Inventory Control and Material Accounting

IBM

Data Processing Application

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Contents

Most business organizations have a substantial part of their assets represented in inventory, and effective inventory control procedures are an important element in their profitable operation. Insufficient or excessive stocks, lost sales, idle machine time and an excess of rush orders are only some of the consequences of inadequate procedures and represent the possibilities for savings resulting from improved ones. This manual shows how IBM machines and systems have been applied to the inventory control functions of different types and sizes of companies and points out some of the advantages that can be gained from their use.

Basic Questions

While there is great diversity in inventory applications, there are some general questions which are common to almost all of them and which must be answered to provide the basis for effective inventory management. We shall cover these questions as an introduction to the more specific material presented in the remainder of the manual.

What is on Hand?

This question is basic to all inventory applications and involves the maintenance of a record showing the actual material on hand. In data processing procedures, this information is kept on a balance record in the form of holes in an IBM card, or as magnetic spots on tape or disk records. Three things must be done to provide this information:

Starting inventory balances must be established, preferably by a physical inventory, but at least by audited figures from previous inventory records. The information is recorded in machine-readable form and is used to set up the on-hand balances in the card, tape or disk inventory records.

Provision must be made to record all inventory transactions in machine-readable form, with appropriate codes to specify the different kinds of transactions. The transactions affecting physical balances can generally be classified as receipts, issues and adjustments; most inventory procedures, however, provide for many breakdowns of these types of transactions. Thus, for example, some of the distinct types of issues in one actual application are planned manufacturing requisitions, planned field requisitions, unplanned manufacturing requisitions, nonproductive requisitions, nonconsumptive requisitions, etc.

All transactions must be processed to update the balance record. The data processing machine or system recognizes the type of transaction by the transaction code and follows the correct routine required to increase or decrease the corresponding inventory balances by the amount of the transaction.

Figure 1 shows an inventory report in which the opening balances have been updated by receipts and issues, to produce current on-hand balances. Many procedures provide for storing additional on-hand information such as balance figures for many inventory locations, detailed balances by various size and color breakdowns, etc.

Furthermore, since all issues must be processed to maintain the on-hand figures, provision is frequently made for accumulating and storing usage data such as monthly usage, number of issues, date of last activity, etc. This information provides the basis for the determination of order points and economical order quantities discussed in the following sections and is also important in controlling obsolete items.

Stock No.	Description	Opening Balance	+ Receipts	− Issues	= On Hand
11398	TRANSFORMER	210			210
11402	MOTOR ASM 50	1205	500		1705
11610	CAM	10341		1423	8918
11682	LEVER	433	3500	1255	2678

Figure 1. A Statement of Items on Hand

What is on Order?

In addition to maintaining records reflecting material on hand, it is necessary to keep track of material on order, for purchased items, or material to be manufactured, for manufactured items. This information is required since any decision to obtain additional inventory must, of course, be based on the knowledge of any open orders.

The illustrative report, Figure 2, now shows the planned available inventory balances obtained by adding on-order to on-hand quantities. In keeping on-order balances it is necessary to reduce on-order quantities when orders are received and also to make adjustments for overshipments and undershipments when they occur, so that the on-order figure reflects actual conditions.

In many applications, provision is made to keep track not only of the total on-order figure, but also of when the various open orders are scheduled to be placed in inventory. This is particularly significant in manufacturing industries having a relatively long production cycle.

Only a portion of any inventory control application is concerned with maintaining records to keep balance figures in agreement with what has occurred as a result of actual transactions such as receipts, issues, placing of purchase orders, etc. These records, of course, must be kept accurate and up to date since

they form the basis for the remainder of the inventory job. Some of the additional questions that must be answered to provide a complete inventory picture are as follows:

What Components Are Required to Meet the Manufacturing Schedule?

Manufactured products of any complexity contain many assemblies, subassemblies and component parts. The purpose of requirements planning is to determine the type and quantity of parts and assemblies which will be needed at future points in the production calendar to produce the required number of finished products. Once gross requirements (i.e., requirements not considering material on hand or on order) are determined, it is then necessary to compare the gross requirements with the actual and planned inventory position and to take action, if needed, to assure that the components will be on hand when they are required. The illustrative inventory report, Figure 3, now shows the combined on-hand and on-order balance of each item reduced by the planned requirements for that item. An excess of planned inventory over requirements is indicated by a plus balance in planned availability; a negative balance calls attention to the need for inventory replenishment.

In many inventory applications, this information (on order, requirements, available for planning) is

Stock No.	Description	Opening Balance	+ Receipts	- Issue	= On Hand	PLANNING	
						+ On Order	= Available
11398	TRANSFORMER	210			210	300	510
11402	MOTOR ASM 50	1205	500		1705	1500	3205
11610	CAM	10341		1423	8918		8918
11682	LEVER	433	3500	1255	2678	500	3178

Figure 2. Items on Hand Plus on Order

Stock No.	Description	Opening Balance	+ Receipts	- Issues	= On Hand	PLANNING		
						- Require.	+ On Order	= Available
11398	TRANSFORMER	210			210	50	300	460
11402	MOTOR ASM 50	1205	500		1705	1855	500	1350
11610	CAM	10341		1423	8918	2133		6785
11682	LEVER	433	3500	1255	2678	920	500	2258

Figure 3. Manufacturing Requirements Are Weighed against on Hand and on Order

maintained in a time series—that is, the information is broken down in time periods—to present a picture of the inventory position at various times in the future. Available stock can then be assigned to the earliest needs, and orders of stock may be scheduled to arrive when available stock will be exhausted. Changes in requirements may be made with ease, and the effect of the changes can be observed in relationship to each time period. For example, a change in requirements in the first period may force a change in a stock order which was due in the fifth period.

How Much Shall We Order When More Material is Required?

Once it has been established that additional inventory is needed, the question remaining is, how much shall we obtain at this time? The choice of this amount is a compromise between two opposing factors—the cost of acquiring inventory and the cost of maintaining it (Figure 4). Certain costs, such as setting up production lines, issuing and controlling purchase orders, etc., increase as the number of lots or orders per year increases. Thus, to fill an annual requirement of 10,000 pieces, one order may be placed for the entire quantity, or orders for a part of the quantity required may be issued at periodic intervals. The lowest manufacturing cost occurs when the entire quantity is produced at one time, since the setup and handling

costs are prorated over a maximum quantity. But the creation of a large inventory by making more parts than are currently needed, and the resulting expense of maintaining this inventory cannot be overlooked. Manufacturing 10,000 pieces at one time and using them at a uniform rate throughout the year means that an average inventory of half of the initial quantity is maintained during the year. Average inventory investment is thus 5,000 times the unit cost per part. The cost of maintaining this investment is found by applying the cost of carrying inventory for one year to the average inventory investment. The carrying (or maintenance) cost varies from plant to plant. One commonly used figure for the metal fabricating industry is an average of 25%, broken down as follows:

Contributing Factor	%
Obsolescence	10.00
Interest or return on capital investment	6.00
Physical deterioration or its prevention	5.00
Handling	2.50
Transportation	.50
Taxes	.50
Insurance	.25
Storage facilities	.25
	25.00%

This, of course, may not be an appropriate figure for a specific plant, but it shows what this tangible
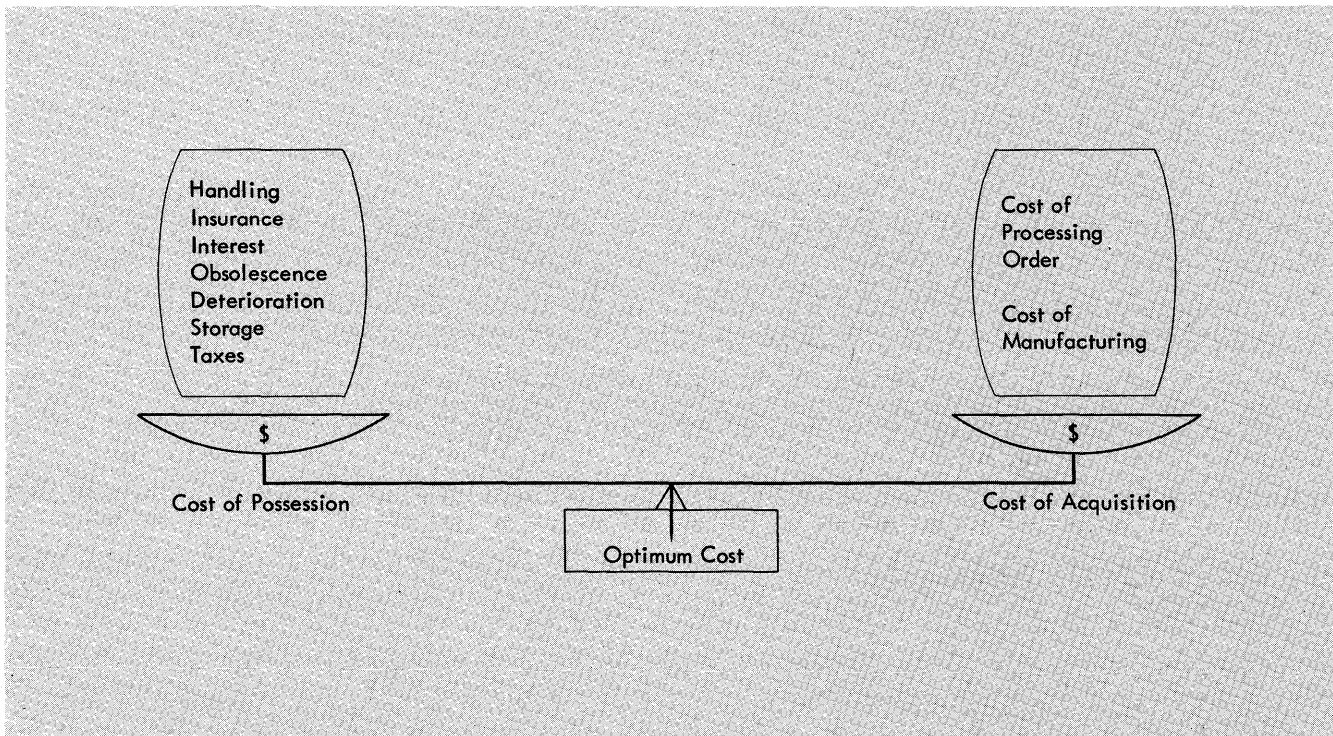

Figure 4. Cost of Possession Versus Cost of Acquisition

and significant value is based on. Naturally, it is best to determine this element for each individual industry or firm, and in some cases even for each class of inventory. Carrying cost percentages ranging from 15 to 30% are quite common.

Thus the savings in acquisition costs obtained by fewer orders per year must be considered in terms of the resulting increased cost of inventory maintenance. For every part there is an order quantity that yields a minimum of inventory maintenance and acquisition costs. The relationship of the factors that determine this optimum quantity can be expressed in graphic terms (Figure 5). The lower curve represents the factors which contribute to a decrease of acquisition cost as the quantity ordered at any given time increases. The diagonal line represents the factors which result in an increase in inventory cost as the quantity of stock increases. The upper curve represents the sum of the costs in the acquisition curve and the inventory curve. The optimum order quantity, from an economic standpoint, is indicated where inventory cost and acquisition cost intersect. A mathematical formula calculating the economical order quantity can be derived by expressing each of the two curves as a formula in terms of the elements that make it up and then equating the two formulas. Derivation of such a formula is discussed in most standard books on inventory control and is commonly expressed as follows:

$$EOQ = \sqrt{\frac{2RS}{KC}}$$

A sample determination of economical order quantity by the formula is as follows:

R = Annual requirements (10,000 pieces)
S = Setup expense ($200 per lot)
C = Unit cost ($5)
K = Carrying charge (25%)

$$EOQ = \sqrt{\frac{2 \times 10,000 \times 200}{.25 \times 5}}$$

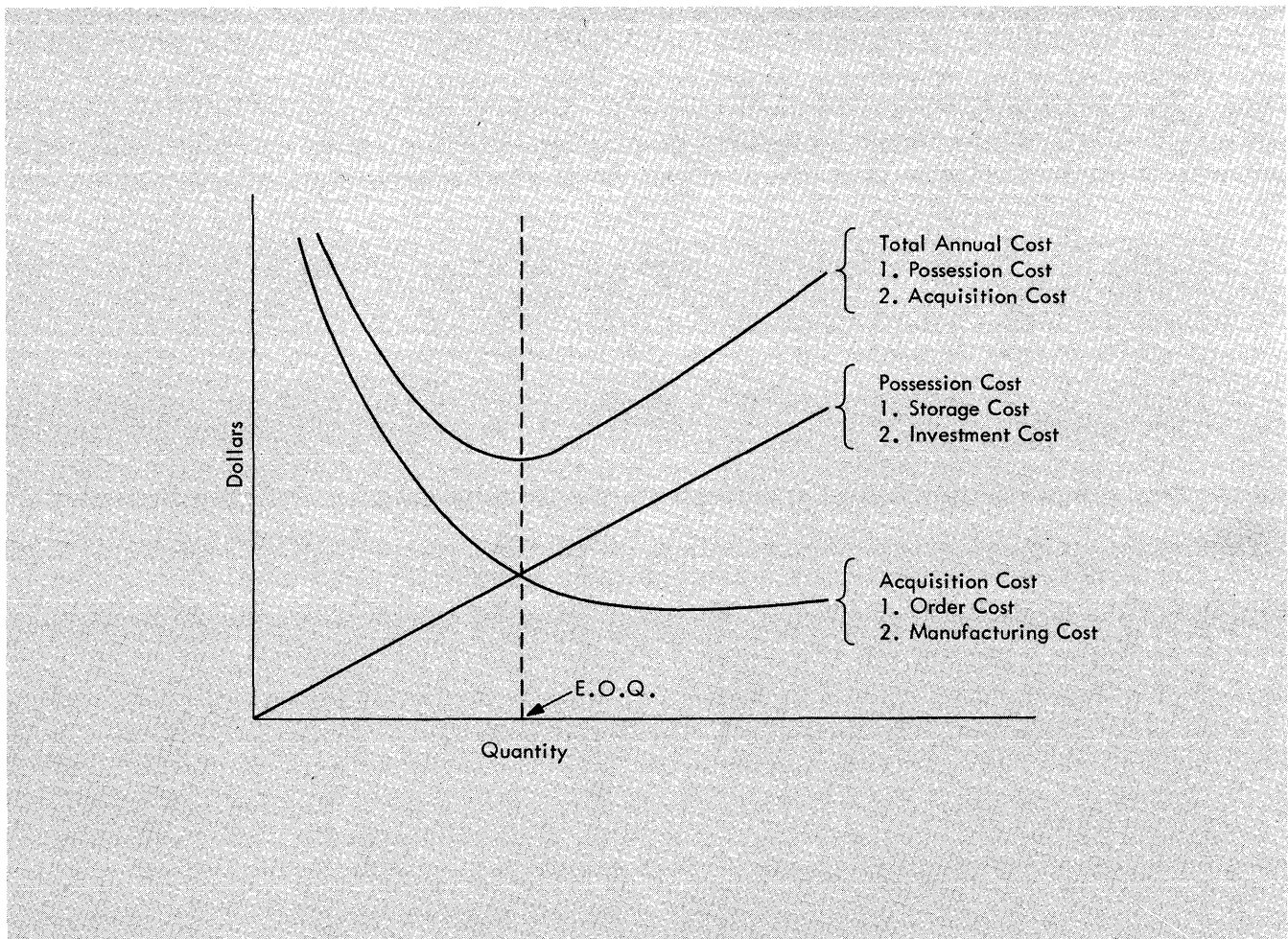$$= \sqrt{3,200,000} = 1,789 \text{ pieces}$$

Figure 5. Graphic Presentation of Economical Order Quantity

This technique is also applicable to purchase items wherein the setup cost becomes the cost of placing and expediting a purchase order. Modifications may be made to consider quantity discounts.

Naturally the strictly mathematical approach does not allow for certain considerations such as physical bulk, limited storage facilities, the possibility of a major change in price, etc., which may affect certain EOQs. For example, if the formula were applied to a large casting and indicated a lot size of 2,000 pieces, it might not be practical to handle so many at one time. In certain instances, therefore, the calculated quantities must be modified because of special circumstances.

The above and similar formulas have been in existence for many years, and in the past usually have been applied manually either by slide rule or desk calculators, or by reference to tables or nomographs. These calculation methods, however, are tedious and time-consuming and in many cases much of the work of optimizing order quantities never was accomplished. Futhermore, the variables—expected consumption over a given period of time, and unit cost—are subject to frequent change, so that to optimize once is not enough; the economical order quantities must be recalculated as the variables change. The use of data processing systems makes this calculation possible on a frequent and realistic basis, since they can provide for the accumulation of data on past consumption, which normally forms the basis for forecasting future consumption, and for the accumulation of the cost factors, in addition to performing the optimizing calculations as frequently as required. Thus, the concept of economical order quantity can be effectively applied as an integrated part of data processing inventory procedures.

What Minimum Order Points Shall be Established?

We shall now concern ourselves with the question of when (or at what stock level) an order shall be placed. From the standpoint of inventory control the timing of an order is as important as its size. The "when" of order placement is usually controlled by an order point system. Ordering action is taken when withdrawals from stock have reduced the available inventory (on hand plus on order) below the order point—or in certain cases where a comparison of planned future requirements against planned future inventory indicates this will be the case. Order points are usually established in terms of the following basic factors:

Order processing time. The period of time required for the activity involved in preparing the purchase or manufacturing order.

Lead time. The period of time required for obtaining delivery of, or for manufacturing, the economical order quantity once an order has been placed. Together, order processing and lead time represent the period between the indication that additional stock is required and its receipt. This interval, multiplied by the planned usage for the period, represents the number of pieces used during the lead time. The protective stock added to this determines the order point.

Protective stock. This factor represents the designated lower limit of stock on hand. It is the bare minimum below which actual stock will ordinarily not be allowed to fall. The establishment of a protective stock represents an effort to insure against sudden, abnormal demands and delays in delivery or production. In this respect, it is an investment that balances the cost of maintaining the protective stock with the costs that might be entailed by delays in production or out-of-stock conditions.

The illustrative inventory report (Figure 6) now shows available inventory compared with the minimum order point. If the quantity in stock, or this quantity plus the quantity already on order, exceeds the order point, no additional order will be placed. On the other hand, if this quantity falls below the order point, it will be the basis for placing a new order.

In some procedures the protective stock level as well as the minimum stock level is included in the inventory record. Thus, whenever the stock quantity has fallen below the protective stock level, an order

| Stock No. | Description | Opening Balance | + Receipts | - Issue | = On Hand | PLANNING | | | OP |
						+ On Order	= Available	Order Point	
11398	TRANSFORMER	210			210	300	510	400	
11402	MOTOR ASM 50	1205	500		1705	1500	3205	2000	
11610	CAM	10341		1423	8918		8918	9000	*
11682	LEVER	433	3500	1255	2678	500	3178	2750	

Figure 6. On Hand Plus on Order, Versus Minimum Order Point

should be expedited. This type of situation is shown in instance V of Figure 7. Similarly, instance VI displays an expedite situation because actual stock has fallen below the protective level. In this case, however, the quantity previously placed on order does not raise the level beyond the order point. Therefore, an additional order will be placed.

A point should be made at this time concerning protective stock and the establishment of minimum order points. The basic purpose of a minimum order point is to assure that enough of each item will be on hand to meet the coming demand for it. Since ordering and production usually precede demand, the minimum order point (as well as the economical order quantity) must be based on an estimate of future demand. Protective stock provides for inaccurate estimates of this demand as well as for variations in lead time and usage. It can thus be seen that better estimates of demand, based on the compilation and analysis of the factors that influence it, can result in reduced protective stock levels.

While there are numerous factors affecting future demand, they can be classified as those that have influenced demand in the past and will probably do so in the future, and those that will appear in the future for the first time. In many industries, most of the factors are in the first class and determination of future demand can be made by the collection and extrapolation of past data. Where future conditions bear little resemblance to the past (in a fashion industry, for example) prediction rather than forecasting must be used. Thus prediction involves primarily the estimate of management, while forecasting involves primarily the use of historical data applied to the future. To forecast future demand, there are three basic requirements:

Accurate measurements and accumulation of past usage.

A means of converting the information into a forecast.

Ability to check the forecast with actual conditions and to make any necessary revisions to the forecasted figures.

When we consider that many companies have thousands of inventory items and that the ability to meet requirements and customer demands is based on the replenishment of one item at a time, we can readily understand the reason for the use of data processing systems—for they provide the ability to automatically perform the above three functions for all inventory items, thus providing a basis for effective EOQ and reorder point determination.
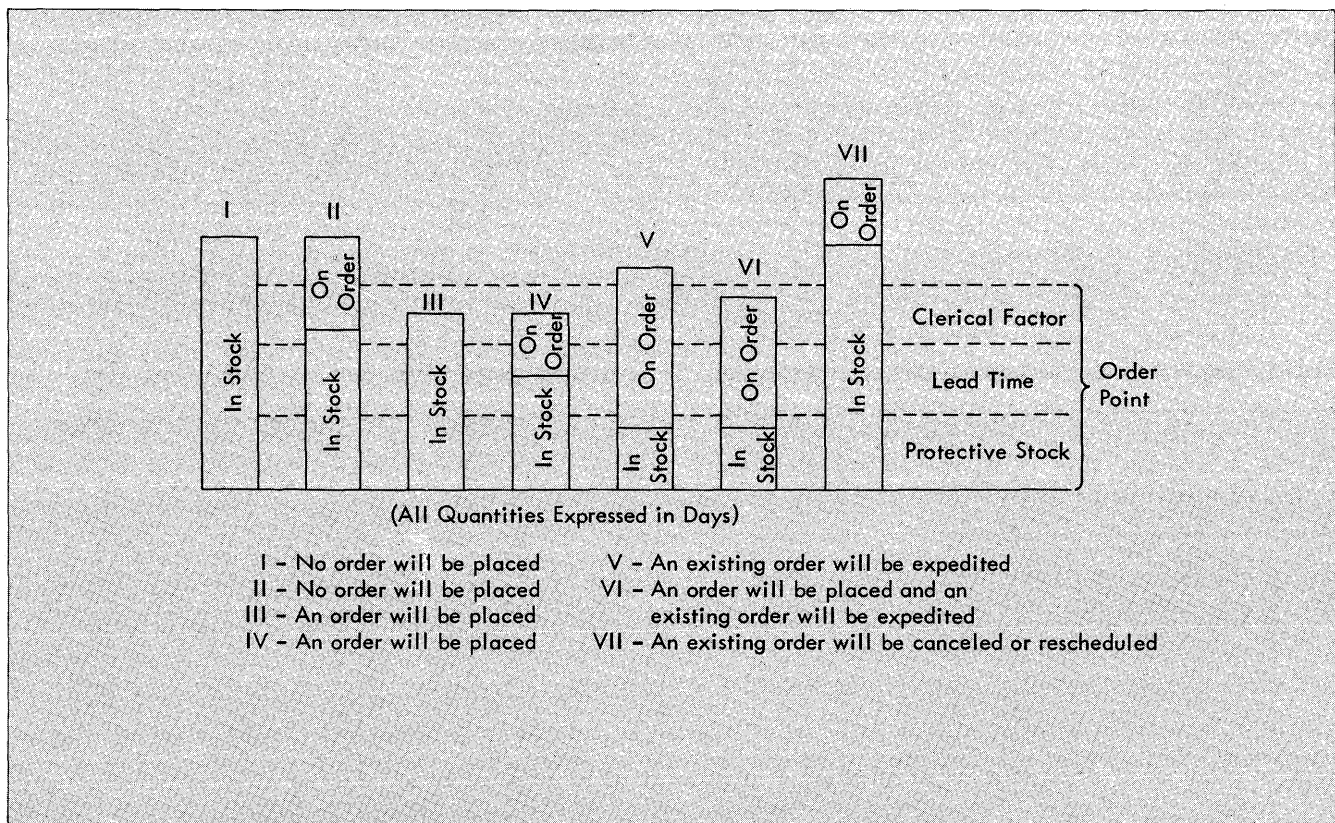

Figure 7. Ordering, Expediting, Canceling and Rescheduling

What Action Must be Taken?

The answer to this question is based on an analysis of all the factors described previously. Besides the quantitative measurements of on-hand, on-order and minimum-order points, etc., covered above, there are, of course, such considerations as pending price increases, quantity discounts, length of life of machine tools, etc. The objective of data processing procedures, however, is to gather as much as possible of the information required to make inventory management decisions, and to analyze the mass of data collected to select those inventory items which require attention.

In one actual application, for example, the supply position of 22,000 different items changes in an average week, but the change is significant for only 700 of them. The data processor picks out these exception items and prints a supply action recommendation. The heart of this report is the detailed recommendation of specific action required to bring the supply position of the items within desirable limits. In addition, the report shows full descriptive, on-hand, on-order, requirements and procurement data for each item. Thus, with this one document, the stock analysts can audit the recommended action and initiate the appropriate action documents.

Some applications go even further and include the automatic preparation of purchase requisitions and shop orders. In one case, for example, provision has been made to print the purchase order, showing the date, purchase order number, vendor name and address, the date for which the item should be shipped, item number and the quantity and description of each item ordered.

We have discussed the functions common to most inventory applications. It is impossible, of course, to cover all of the complex factors involved in any given inventory job. Likewise, the great diversity of inventory applications makes it impossible for any given statement to apply equally to them all. However, this introduction should help to provide an overall perspective of what is required in inventory control.

Before discussing some of the more common procedures used to perform various types of inventory applications, let us consider the degrees of mechanization found in actual inventory applications.

Inventory control can be divided into three basic areas:

The preparation, communication, accumulation and summarization of information concerning a large number of daily occurrences affecting actual and planned inventory balances. Since inventory control procedures are usually performed centrally, and the transactions occur at remote points, provision must be made to record the transactions as they occur, forward them to the central processing point, convert them into machine-readable form, and then sort and accumulate the information they contain.

The maintenance of quantitative, descriptive and procurement data concerning each inventory item. The accumulated data must then be entered on an inventory record. This includes *quantitative data* such as on hand, on order, monthly usage, etc.; *descriptive data* such as unit of measure, noun description, size, etc.; *procurement data* such as lead time, setup cost, initial manufacturing department, etc. (for manufactured items), and shipping time, unit cost, vendor name, etc. (for purchased items); and *action data* such as minimum and economical ordering quantity. In tape and disk storage processing, inventory records containing over 400 characters are not uncommon and records as large as 1,000 or more characters are occasionally used. With punched card processing, multiple card records are frequently used for the storage of additional information.

The manipulation, correlation and review of the above information as the basis for making inventory decisions and taking the required action. This function is the most complex of the three, but is, of course, critical to effective inventory management.

Some presently installed inventory applications provide for performing one or two of the above functions mechanically, and the remainder manually. Others provide for handling practically all phases on an automatic basis. A significant trend in recent years has been toward a complete systems approach encompassing practically all areas of inventory control. Increased processing capability, high speed input and output, large storage capacity, rapid data transmission, etc., have made this possible and have enabled many companies to make significant improvements in their inventory control procedures.

Procedural Approaches—Unit Record (Inventory Control)

There are many approaches to inventory control based on the different requirements of various industries and individual companies. This section outlines the most common unit record procedures used by industry to perform inventory control functions. We will briefly discuss each method in the introduction, before covering it in detail in later pages.

Balance Forward

This is the most common approach used and its basic principle underlies most unit record and data processing procedures. Complete information about the status of each item is maintained in a punched balance card (or on a tape or disk record in data processing systems). All transactions affecting inventory are recorded in transaction cards which are periodically processed with the balance card so that a new, up-to-date balance card can be summary-punched (or tape or disks records updated). The balance cards are then used to prepare stock status and other inventory reports.

Unit Inventory Control

This approach is used primarily in the distribution industry, particularly by grocery chains and whole-salers. A tub file (see Figure 21) is maintained with a prepunched card for each shipping unit of merchandise in the warehouse. Cards are added to the file when merchandise is received, and removed when merchandise is to be shipped. Thus a perpetual inventory is maintained in the unit inventory tub file. The cards removed from the file, representing items to be shipped, are already prepunched and extended, and are used for billing and sales analysis.

Stock Allocation Procedure

This is basically a modification of the balance-forward and unit inventory plans which combines, under certain circumstances, many of the advantages of each approach. While it can be used under many conditions, it has been applied mainly where the number of items in inventory is high and where it is desirable to pre-edit orders to be filled—a combination of factors difficult to satisfy with other unit record approaches

prior to the introduction of the Random Access Method of Accounting and Control (RAMAC®).

Inventory Control with Batch Billing

Batch billing performs the same functions as the unit inventory approach while eliminating tub files and card pulling. Under this procedure cards are punched, rather than pulled from a tub file, for all items to be shipped. When a large batch or group of cards has been punched, it is sorted into item-number sequence and matched with balance cards; the new inventory balance is computed by processing the cards in an electronic calculating punch. At the same time the cards are priced and extended and can then be used for billing and sales analysis. Batch billing is generally used for larger volumes than those handled by unit inventory approaches.

Merchandise Control

This application has become increasingly more important in recent years. The approach followed by most retailers uses punched price tickets and a balance-forward method of updating balance cards representing items sold and, in some cases, inventory balances as well. (Merchandise control is also covered in the section of this manual on data processing systems.)

Automatic Reorder System

This approach is used by distributors of certain consumer goods, such as hosiery and lingerie, and by retail outlets, such as large chain and department stores. It involves inserting or attaching an IBM card into or onto the merchandise. When the merchandise is sold, the card is removed and placed in a convenient container. Periodically the cards are forwarded to the manufacturer or to the retail outlet's office, where they are tabulated to automatically prepare inventory reports and reorder documents.

Service Parts Inventory Control

This is a specialized approach used by manufacturers supplying many branch outlets with service parts.

Balance Forward

In establishing the use of the punched card system for inventory, the first step is recording stock on hand. Obviously, the most desirable approach would be a physical count of stock, balanced against whatever records already exist. In the event of a variation between actual inventory and recorded inventory, all adjustments and corrections should take place before punching the initial inventory cards. A complete agreement between physical inventory and the punched card records at this point is imperative to the accuracy and usefulness of any future inventory reports.

The Balance Card

The quantities thus established are punched into a balance card with the item identification. One balance card should be punched for each stock number (Figure 8).

The balance card will be an up-to-date record. Daily, or perhaps semiweekly or weekly, when the transactions affecting any given item are processed, an updated balance card is summary-punched. When this new balance card is prepared, the total availability can be checked by the accounting machine. When this availability is negative, a credit balance appears. This particular card should be specially punched to identify it for planning purposes. On one pass through the sorter, these credit balance cards can be selected and then reproduced into a purchase or manufacturing authorization card, intended to initiate a purchase or manufacturing order.

When interpreted, these cards can be used by your stock analyst to indicate the quantity required. The cards have a further use: they can become heading cards for the work-in-process file. Material and labor charges can be filed behind these cards and retained until the order has been completed.

Note that the balance card includes a field for opening balance, and a date for the accounting period. The receipts and issues fields will carry cumulative analysis totals from the start of the procedure to some regularly scheduled cutoff date, usually semiannually or quarterly. Each time the semiannual or quarterly report is prepared, new balance cards are reproduced. The cumulative receipts and issues factors are dropped, and the on-hand figure is transferred to appear also as the opening balance in the new card.

Since the unit of issue of materials and products used will inevitably vary, a unit-of-measure field is usually provided to specify the issuing unit of each item: foot, pound, each, barrel, gallon, etc. If issued materials are costed at a standard price, cost-per-unit may be carried in the balance card. A separate routine, however, is frequently provided for costing the issued material.

In the balance-forward plan, each balance card should crossfoot independently to the formula:

Opening Balance + Receipts — Issues = Balance on Hand

The totals of all the balance cards should also crossfoot to this formula. The daily transaction totals, added to the previous balance figures, should agree with the new balance card totals. This gives a completely accurate control on inventory (Figure 9).

Figure 8. A Self-Contained Record of Each Stock Number

9

	REPORT BALANCES			
	Opening Balance	+ Received	− Issued	= On Hand
Previous summary balances	10000	12000	9000	13000
Receiving transaction totals		+ 2000		+ 2000
Issuing transaction totals			+1000	−1000
Revised control balances (computed)	10000	+ 14000	−10000	=14000

Figure 9. Accuracy, and Proof of Accuracy

Figure 10. Materials are Requested on This Form . . . .

Figure 11. . . . . or on a Dual Card

Issue Cards

Many departments will require the use of materials from the stockrooms or warehouses. Finished products will be issued to satisfy sales and shipping orders. Subassemblies or raw materials must be withdrawn during the manufacturing or assembly processes. Repair parts and expendable items will be used by maintenance. The office and clerical staffs will require stationery supplies. Each one of these requests results in the issue of materials or stores, and the consequent reduction of inventory. The greatest number of transactions, then, will originate with issues cards as the source.

As materials are requisitioned, cards may be punched from material requisition sheets (Figure 10) or from sales orders. On the other hand, the requisitions may be in the form of a dual card and serve as both the source and the punched card for recording the data (Figure 11).

In many cases, effective use is made of prepunched cards kept in a tub, or reservoir file. As materials are needed, the appropriate cards are withdrawn from this tub file and used for requisitioning. Quantity and order number, or any other required information, can be written or marked on these cards as part of the transaction, and later card-punched or mark-sense-punched (Figure 12).

On-Order Cards

As the available supply of any given stock item approaches or falls below the minimum requirement, three things must happen: The need for reorder must be recognized; a purchase order must be written and sent to the vendor; and the inventory records must show that (1) the item has been ordered and (2) the on-hand supply must be increased upon receipt of the order.

The need for reorder has been discussed, and the use of this system will make the need immediately recognizable. Daily or periodic appraisal of the balance cards produces a purchase or manufacturing order authorization. The request for a purchase or manufacturing order could also originate in the stockroom, in a variation of the procedure. In this case, the stockroom staff would prepare a purchase or manufacturing order request (Figure 13) as a signal that stock is low.

Figure 12. A Card Is Easy to Find—Easy to Handle

Figure 13. What We Need, When, and Where to Get It

PURCHASE ORDER

NATIONAL ENTERPRISES INC.

PLANT NO.1 BUFFALO, N.Y., U.S.A.

REQ.   DATE 3/4/6-

ORDER No. 13752

TO ARNO SUPPLY CO.
1000 CARROLL STREET
CLEVELAND 14, OHIO

━━━━━ IMPORTANT ━━━━━
SHOW OUR COMPLETE ORDER NO. ON ALL INVOICES, PACKAGES AND SHIPPING PAPERS.
ADDRESS ALL MAIL TO: BUFFALO, N. Y.
ROUTING
OVER 35 LBS. AND L.C.L. AS SPECIFIED, OTHERWISE:
0-20 LBS.—PARCEL POST
21-35 LBS.—EXPRESS
CARLOAD—SEE TERMS AND CONDITIONS ON REVERSE

SHIP TO BUFFALO   VIA BLORE-IF OVER 35#   F.O.B. SHIPPING POINT L 60083

QUANTITY	DESCRIPTION	ITEM	PRICE
1000	3642210 PLASTIC CONTAINERS E. C. 7830 SHIP 6/15/6 -		.147 EA. LESS 15% AND 20% TERMS NET 30 DAYS

BLUE PRINT ATTACHED   MAKE TO ENG. CHANGE OR RELEASE NO._____

ORD. BY	SHOP DATE	ORDER OR REFERENCE NO.	JOB NO.	ACCOUNT NO.	DEPT. CHG.	APPRO. NO.	MAT. CODE	COMMITMENT
539	830	3642210	1200	920-2004			X860	2

Subject to the Terms and Conditions on the back hereof
which are incorporated and made a part hereof.
NATIONAL ENTERPRISES INC.

PURCHASING AGENT

Figure 14. A Typical Purchase Order

Figure 15. This Material Has Been Reserved for Production

If the purchase order is written on the accounting machine, summary punching will automatically provide an on-order card. If the purchase order (Figure 14) is written on the CARDATYPE®, an on-order card can also be produced.

Requirements Cards

Requirements cards are established to provide for smooth-flowing production lines by reserving stock for later issue against planned manufacturing. The requirements cards can be reproduced into issues cards and furnished to the stockroom, where they are held pending production. Thus those materials will be earmarked for use, and when production on a given order is authorized, the issues cards are marked with the quantity delivered (Figure 15). This will result in a realistic condition between stock on hand plus reserved materials, and actual requirements.

Receipt Cards

When stock is delivered to the stockroom, the physical delivery must be checked against the purchase order, and also against the shipping notice accompanying the order. Then inventory records must be increased by the amounts of materials received. This is done by punching receipts cards. Another possibility is to maintain a file of open-purchase commitments by reproducing the on-order cards and removing the open

purchase cards from the file as goods are received. These cards can now be processed as receipt cards, and the on-order file kept up to date—and all of it at machine speeds, and with machine accuracy.

In some cases, individual distribution cards for each stock item ordered are punched for use in accounts payable records. If this is so, these cards can also serve as receipt cards. In most cases, however, it is better to record receipt of shipment and the consequent change in inventory immediately, instead of waiting for the vendor's invoice.

Adjustment Cards

Any unusual transaction that results in a discrepancy between the inventory record and the physical inventory calls for immediate action. An adjustment card is punched and processed with the other transaction cards for that day. Transactions of this kind can take place when material is issued and later returned to stock unused, when an order for material is canceled, when requirements are canceled or altered, when material deteriorates or is condemned, and when material is destroyed by fire or damage, etc.

The Transaction Register

This report (Figure 16) is prepared on the accounting machine. Cards for every type of transaction—issues, receipts, orders, requirements, adjustments—any trans-

PART NUMBER	UNIT OF MEASURE	ORDER OR REFERENCE	DATE	TRANS.	ACTUAL TRANSACTIONS			PLANNED TRANSACTIONS		
					RECEIPTS	WITHDRAWALS	ON HAND	REQUIRED	ON ORDER	AVAILABLE
318117	BX	277-219	11/15/6-	I		7				
318117				□			146□			212□
321548	EA	27-012	11/15/6-	D	500					
321548	EA	274-381	11/15/6-	I		100				
321548	EA	147-888	11/15/6-	R				298		
321548				□			460□			278□
327414	EA	294-320	11/16/6-	I		20				
327414	EA	16-872	11/16/6-	O					144	
327414				□			74□			228□
336593	EA	264-116	11/17/6-	I		4				
336593				□			26□			− 30□*
344544	EA	29-648	11/17/6-	D	75					
344544	EA			□			99□			125□

Figure 16. All Transactions for the Current Period
(in This Example the Previous Balance Card Is Not Printed on the Transaction Register)

actions that can affect the inventory or its requirements in any way—are sorted by stock number and material class. They are then processed in the collator to select and merge with the current balance cards for the corresponding active items.

The report can then be prepared in various ways, depending on the ultimate purpose of the analysis. The cards may be listed in detail or summarized by stock number.

The report may highlight activity by material class such as steel, phosphorus or cotton. Or it may be broken down by form: steel rods, explosives, yard goods. The makeup of the report will be determined by the sequence of the documents to which it is to be posted, or by the significance of the analysis for which it is being prepared.

Factors from the various cards are entered into the counters of the accounting machine by the formula shown in Figure 17.

During the running of this transaction report, new balance cards are summary-punched with revised current information. These new cards are filed back into the balance card file by using the high speed collator.

The transaction register can be printed with a carbon impression on the reverse side of the sheet to make it possible to use the IBM 954 Facsimile Posting Machine for posting historical ledger cards, if required.

Stock Ledgers

It is often found desirable to maintain in the stockroom or in the stock analysis section a ready and current catalog showing the status of any individual stock item. Stock ledger cards (Figure 18) answer this requirement and can be posted and maintained very easily by the use of the IBM 954 Facsimile Posting Machine or the IBM 557 Alphabetic Interpreter.

Facsimile-Posted Ledger Cards

Postings showing either complete detail or summarized information can be entered on these cards at speeds of about 300 to 500 lines per hour. Posting speed is greatest when the ledger cards have been selected before the posting operation is begun.

| Card Type | Opening Balance | TO DATE | | = On Hand | Minimum - Inventory | + On Order | = Available |
		+ Receipts	- Issues				
Previous Balance Card (These items are not printed on Transaction Register)	900	96	786	210	500	200	-90
Receipt Card		+200		+200		-200	
Issue Card			+75	-75			-75
On-Order Card						+750	+750
New Balance Card (summary-punched)	900	296	861	335	500	750	585*

Figure 17. The Information Comes from Various Cards

The facsimile posting machine used in this operation posts an entire line at a time from the transaction register, developed with accounting machine accuracy. Complete identifying data, such as stock number, material class, and order or voucher number, is posted for each transaction at no loss of speed, because an entire printed line of the register is transferred to the ledger card in a single operation. Futhermore, any posting to the wrong card is immediately and easily detectable. Each posting enters the part number of the ledger card, and a difference in number would signal an incorrect posting.

However, if such an error were to pass unnoticed, it would not be perpetuated by a machine-bookkeeping operation, because each new posting machine medium is prepared from the punched card balance file. The next time a posting entry was made to that ledger card, it would be restored to its proper balance.

A space is often provided on the ledger card to manually note a purchase request. In many organizations, a considerable time may pass from the time the request is made until bids are received and a firm purchase order is placed.

Each time a ledger card has been withdrawn from the file for some activity, it can be reviewed and appraised by a stock analyst or buyer before being refiled. He can immediately place a factory order or requisition when the stock is unusually low, or take preventive measures if any other unusual condition appears. A credit figure printed in the "Available" column during the accounting machine operation will point up a low-stock condition. If, as may happen, the transaction register does not have an "Available" column, a double asterisk or another distinctive symbol can be used to indicate a credit condition requiring reorder.

IBM 557 Alphabetic Interpreter

The 557 Alphabetic Interpreter is also used to prepare stock ledger cards, using an IBM card as the ledger. With the Selective Line Printing feature, the interpreter automatically finds the next available line on which to print the latest entry. These ledger cards are usually posted directly from the transaction cards or from new balance cards.

STOCK LEDGER — 321548 / 321548

PART NO.	PART DESCRIPTION	DATE	REFERENCE NO.	AUTHORIZED QUANTITY	STANDARD UNIT COST	ENGINEERING CHANGE NUMBER
	Pinion Gear	1-17-53	16-142	150	2.61	
	Pinion Gear	9-1-54	16-287	500	1.88	#3158

PLANNED TRANS. CODES
R — REQUIREMENTS
O — ON ORDER
I — ISSUE
D — RECEIPT
K — CANC. RQMT.
C — CANC. ON ORDER

UNPLANNED TRANS. CODES
B — BAL. OR SUM.
X — MISC. ISSUE
W — CREDIT ISSUE
A — INV. ADJ. PLUS
Z — INV. ADJ. MINUS
E — MISC. RECEIPT

PART NUMBER	UNIT OF MEASURE	ORDER OR REFERENCE	DATE	TRANS.	ACTUAL TRANSACTIONS RECEIPTS	WITHDRAWALS	ON HAND	PLANNED TRANSACTIONS REQUIRED	ON ORDER	AVAILABLE
321548										
321548	EA	147–863	10/26/6-	R				84		
321548										
321548	EA	16–287	11/01							
321548										
321548	EA	274–346	11/07							
321548										
321548	EA	274–381	11/10							
321548										
321548	EA	27–012	11/15							
321548	EA	274–381	11/15							
321548	EA	147–888	11/15							
321548										

(overlaid IBM card)
5213 | 01 27
PART NO. | U/M | A.C.
CLAMP
DESCRIPTION
400
E.O.Q. | SCRAP
056 | 9929
UNIT COST | ENG. CHG. NO.
ON ORDER STATUS

	DATE	R	AUT	Q
1	8/16	4/4		400
2	8/30	4/4		400

PREPUNCHED
PART NO | U/M

LAST ACTION DATE	RECEIPTS	ISSUED	ON HAND	REQUIRED	ON ORDER	AVAILABLE
101	130		130			130 /
103	130		130	444		314☐ /
105	130		130	444	400	86 /
105	530	172	358	272		86 /

STOCK LEDGER

:: SYMBOL — CREDIT QUANTITY

Figure 18. Samples of Stock Ledger Cards

Stock Status Summary

It many organizations, the transaction register is referred to as the stock status summary. In other cases an overall listing of all the balance cards is used to provide a source for the periodic review of all stock items. Frequently the stock status summary report is used as a purchasing or manufacturing guide, and the historical ledger is not used at all (Figure 19).

Inventory Control Flow Chart

Perhaps the best way to summarize the balance-forward method is to examine a step-by-step flow chart outlining the sequence of operations for this procedure (Figure 20):

1. All transaction cards are sorted by stock number and material classification.

2. In the collator the transaction cards are compared with the balance file cards; those that match are selected and merged together.

3. The transaction register, also used as a posting master, is prepared on the accounting machine.

4. New balance cards, reflecting all changes caused by transactions, are summary-punched while the transaction register is being prepared.

5. The new balance cards are checked for accuracy on the accounting machine.

6. They are then merged by the collator into the file of balance cards that had no activity for the period. This file is used for periodic preparation of stock status reports.

7. Stock ledger cards are posted from the transaction register by the 954 Facsimile Posting Machine.

Ledger cards are reviewed by the stock analyst to determine whether reorder is needed. Ledger cards can also be posted using the 557 Alphabetic Interpreter.

8. Transaction and old balance cards are separated in the sorter. Receipt, issue and adjustment cards are now available for use in the material accounting procedure.

This procedure can be modified to fit individual needs, and various significant reports can be prepared by arranging the cards in the desired sequence and processing them in the accounting machine.

Advantages of the Balance-Forward Plan

Manufacturers and users in other types of industries have pointed out some of the advantages of the balance-forward plan for inventory control:

1. Stock status reports are available for review of all stock items. They are valuable guides to purchasing and production, serving many other needs as well.

2. An up-to-date historical record of stock is very easily obtained by posting the stock ledger daily.

3. It provides a complete record of work in process.

4. It makes possible ordering minimum supplies on an economical basis.

5. It helps insure steady flow of supplies to assembly and production lines.

6. Lower overhead results from maintaining economical but adequate stock, minimizing handling, storage, deterioration and similar costs.

7. Concise and current records make available many analytical and statistical reports as by-products of the inventory control procedure.

					STOCK STATUS SUMMARY						
							ROUTING	ACCOUNTING ☐ ENGINEERING ☐ PURCHASING ☑ PRODUCTION ☐ SALES ☐			
	DATE 2-28-6-										
MATER'L CLASS	STOCK NUMBER	DESCRIPTION		OPENING BALANCE	ACTUAL TRANSACTIONS			PLANNED TRANSACTIONS			
					RECEIVED	ISSUED	ON HAND	ON ORDER	REQUIRED	AVAILABLE	
174	146301	MOTOR ½ HP 60 CYC		49		16	33	50	36	47	
174	146334	MOTOR ½ H P DC		7			7		2	5	
174	146718	MOTOR 1 HP 60 CYC		12		2	10		5	5	
175	32	TERMINAL CLIP		6,750		2,710	4,040	10,000	3,000	11,040	
175	87	TERMINAL CLIP		4,210		1,500	2,710		2,800	90-	
175	119	TERMINAL CLIP		1,250	3,000	1,840	2,410		1,150	1,260	
175	121	TERMINAL CLIP		2,780	3,000	3,675	2,105		3,000	895-	
175	6841	TERMINAL CLIP		975	1,200	1,208	967	10,000	450	10,517	
175	14600	TERMINAL BAR		2,450		1,467	983	1,000	860	1,123	
175	14601	TERMINAL BAR		860	1,000	41	1,819	1,000	2,845	26-	
175	15017	TERMINAL BAR		450	1,000	219	1,231	1,000	210	2,021	

Figure 19. The Current Status of Each Stock Number

Receipts

Issues

On-Order

Requirements

Adjustments

Other

Sort ①

Merge ②

Balance and
Transaction Cards ③

Acct. Mach.

Sum. Punch ④

Old Balance
and Trans.

New Balance

Transaction
Register

Facs.
Post ⑦

Stock
Ledger
Card

Review

Sort ⑧

Receipts

Issues

Adjustments

to
Costing

On Order

Requirements

Old Balance

Other

Acct.
Mach. ⑤

Coll. ⑥

Balance File

Accounting
Machine

Stock
Status

(Prepared
periodically)

Figure 20. A Typical Procedure

Unit Inventory Control

This concept of inventory control uses a prepunched file of IBM cards that is, in effect, a miniature warehouse in which each card represents a shipping unit of merchandise available somewhere in the storage rooms or warehouses of the organization.

The system has found widespread application in many industries and at various distribution levels including wholesalers, jobbers and distributors. The paint, furniture, electric appliance and grocery industries are typical users of this type of inventory control.

A punched card is prepared at high speed, in the reproducer or in the document originating machine, for each shipping unit of each item of stock on hand. These cards are kept in accessible reservoir or tub files (Figure 21). Cards are added to the files as goods are received or made available, and they are removed from the files when merchandise is shipped. Any in-
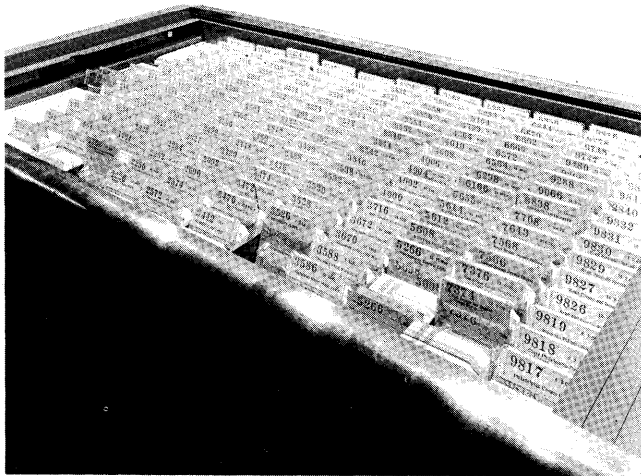
Figure 21. Each Card in This File Represents One Shipping Unit

crease or decrease in the number of units in the warehouse is represented in accurate detail by the corresponding movement of IBM cards into and out of the file.

Each different item of stock in the warehouse is represented in the tub file by a section separated from the others by a guide card which stands higher than the IBM cards. The easily legible divider has printed on it the product code number and the name or description of the item.

In front of each of these guide cards are filed the item cards (Figure 22). Each individual item card is identified by a code and serial number printed across

the left end of the card. The serial number printing and the punching are accomplished simultaneously by the document originating machine. The cards are filed vertically, in sequence by code number, and within each code number the cards are in order by serial number. The serial numbers provide the basis for determining the quantity of each item that is on hand at any given time.

Two methods are used to assign these serial numbers:
1. The high-to-low plan.
2. The low-to-high plan.

High-to-Low Plan

Time and motion studies have established that the most efficient way to remove cards from a file is from the rear of a section. In this plan for filing and pulling inventory cards, the serial numbers are in ascending order, with the highest serial numbers to the rear. As shipping or issue orders are filled, the cards at the rear are pulled from the file; and those are the cards with the highest serial numbers.

Each time stock is received, or whenever the supply of cards is replenished, cards are punched and serial-numbered in the proper quantity starting from the number 1. This is done automatically on the document originating machine with count-controlled punching and numbering device. This group of cards would now be placed in the front of the file section corresponding to the stock-code number, as shown in Figure 23. In this illustration, cards numbered 2347-1 to 2347-150 have been added to the front of the file. A divider card separates the newly added cards from those that had already been in use. In this case, the next card to be used in filling an order would be at the rear of the file, 2347-4.

Now a quick visual check of stock on hand for any given item is possible, by adding the serial number of the card immediately before the divider, to the serial number of the last card in the file, 150 + 4 = 154.

In a majority of cases the greatest number of stock items on hand will have a single group of cards on file. The serial number of the last card in the group will be the actual count of stock available.

You will find a modification of this plan used by organizations having large quantities of shipping units in their warehouses. To avoid having bulky and unmanageable files, they use a setup card on which all receipts of goods are noted. As working cards are replaced in the file, the balance shown on the setup card is reduced. This has an added advantage in industries whose products are subject to price changes,

SEABOARD WAX			24	28	2,29	1,65	1,65	1,58	4	27	1	4
ITEM		SIZE	PACK	% PROFIT	SUGGESTED RESALE PRICE	PRICE	EXTENSION	COST	WEIGHT	CLASS	QUANTITY	CONTAINER

Figure 22. This Represents One Unit of One Item
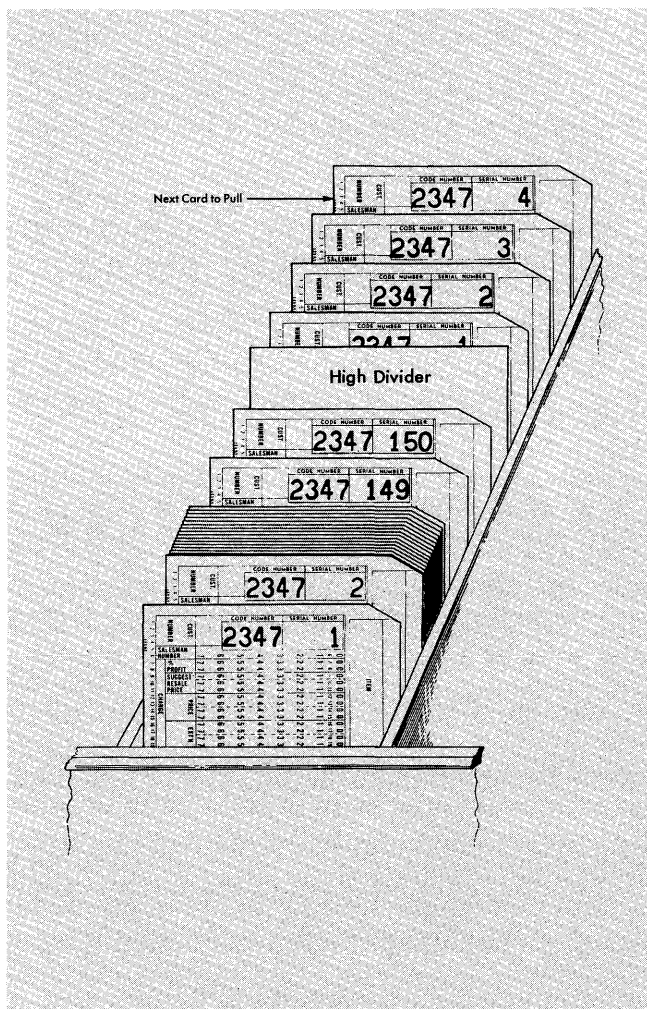
Figure 23. High-to-Low Plan

Next Card to Pull

2347 4
2347 3
2347 2
2347 1

High Divider

2347 150
2347 149

2347 2
2347 1

in that it reduces the number of cards that must be corrected to reflect these changes.

When this variation of the high-to-low plan is used, an inventory check of an item is made by adding the serial number of the last card to the balance shown on the setup card.

Low-to-High Plan

In this plan the serial numbers are in descending sequence, with the lowest number in the rear. The cards are pulled from the rear as shipments are made and orders filled. A setup card (Figure 24) is a basic part of this plan, too; on it are recorded the last serial number assigned, shipments received, and the number of units for which inventory cards have not been prepared. Reproduction of descriptive data from a master card, counting, and serial number printing are accomplished simultaneously by the document originating machine with the count-controlled punching and serial-number printing feature.

In this method, inventory is calculated by subtracting the lowest-numbered card from the highest number recorded on the setup card, and adding one to the difference. This shows the number of units that should be in stock.

In maintaining any stock record system, however, it is important to take periodic physical count of the inventory in order to uncover any discrepancies between actual stock and the card record, and to adjust these differences. At all times, the tub file should be an accurate and true picture of the inventory.

Split Cases

Some firms sell and ship in split cases—i.e., in amounts less than the usual shipping unit—when a customer so requests. Wherever this possibility exists, the smaller shipping unit may be considered an entirely different stock item, on the basis that each code number represents a shipping unit, and that part of a shipping unit should be recognized as a separate shipping item. Another method for handling split cases is to provide, in the sections for those items in which split cases are possible, enough split-case cards to justify the removal of one whole-case card. When these cards have been used, another whole-case card is replaced by an equivalent number of split-case cards. Sometimes only even numbers are used for items shipped as cases, and odd numbers for split cases or parts of a case. This is just another way of providing a different stock number for the split quantity. To go further, a distinctive color-striped card is often used to denote split cases.

Buying Control

When IBM unit inventory control is used, it is an easy matter to provide the buyer with time-to-buy signals for every item he handles. Three different-color cards —minimum, danger and out-of-stock—are inserted into the tub files at predetermined points (Figure 25). These will indicate the various levels of every stock item. If these signal cards are encountered as the clerks pull cards to fill orders, the signal card is pulled from the file as well. Then it can be sent to the buyer, or a time-to-buy report or skeleton purchase order prepared on the accounting machine, to be used by the buyer. Certain considerations are necessary in determining the points at which these cards should be placed in each file section.

Minimum-Stock Card

In determining the minimum amount of stock desirable, the buyer considers (1) the average number of days elapsing between the issuance of a purchase order and the actual delivery of the merchandise, and (2) the average number of sales per day. These figures, of course, vary greatly for different articles of goods, and are further influenced by seasons of the year, weather, price, etc. The actual figures can be secured from analysis reports made from previously used inventory cards. These reports often become source documents for sales analyses.

Once the minimum amount of stock for the particular item has been determined, the signal card is filed at the point where the remaining cards (after the minimum card has been reached) equal the minimum stock necessary before reorder. When the file cards

have been pulled, up to the minimum signal, that card is removed and set aside to be listed on a report indicating items to be ordered.

Danger-Stock Card

The buyer considers the minimum time needed to take corrective measures in the event of a failure to

Figure 24. This Continuous Record Saves File Space

receive a delivery, basing his estimate on the average number of sales per day for each item. This estimate determines the location of the danger-signal card in the file. When the order clerks reach this card, it is sent to the buyer on an emergency basis, representing an imminent shortage. This gives the buying staff enough time to check the delivery date of an order supposedly placed at the time the minimum-stock point was reached. If the checkup shows a probable out-of-stock condition before the expected receipt of the new merchandise, immediate measures can be taken. The item might be obtained either locally, or by special-delivery arrangements, or from another source. At any rate, time is provided so that every possible effort can be made to prevent an out-of-stock condition and its consequent results.

Out-of-Stock Card

This card is filed so that it will be withdrawn with the last unit card. Out-of-stock cards are listed daily, and copies of the list are made available to buyers and warehousemen. Salesmen and sales managers want to be aware of out-of-stock items when accepting orders so that they may keep customer good will by avoiding commitments that cannot be met.
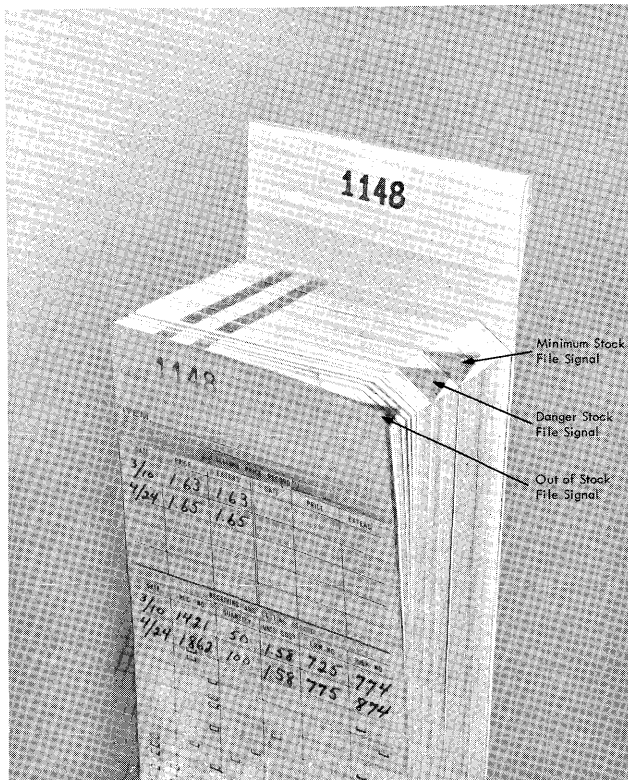
Figure 25. The Colored Cards Stand Out

Through the use of these signal cards, buyers and top management are forewarned of any unusual conditions or trends that affect the continued production, sale and shipment of their products.

Simplified Ordering

Obviously, it would be much easier to fill an order, not only in pulling the cards from the file, but also in the warehouse, if items were ordered by the shipper's customer in the same sequence as the inventory card file.

In many inventory operations, therefore, preprinted order forms are used. These serve as a catalog from which the retailer's order is chosen and, at the same time, as the blank on which the order is submitted. Because the only writing necessary is the posting of the desired quantity next to the printed description, a minimum amount of time is required in writing orders, and descriptions are always complete, accurate and legible.

Many IBM users prepare the mats for printing these forms on the accounting machine, thereby reducing printing expenses. Furthermore, it is possible to prepare the order form in the easiest sequences for the retailer to fill out, and to keep the merchandise in the warehouse in the easiest sequence for filling the order, since the cards selected from the tub file for the items ordered can be automatically sorted into warehouse sequence before shipping documents are prepared.

Batch Identification

In some industries it is difficult to control the manufacturing process to the extent that exact uniformity of all characteristics of the finished product is achieved. They find that some characteristics—color, texture, etc. —will vary from one batch to the next. Furthermore, it is highly desirable that any one customer's shipment include products from only one batch, so that there will be no variation in his salable merchandise.

When the unit inventory plan is used, roll, bolt or batch numbers are punched into the unit stock cards. This will prevent mixing of different batches into a single shipment; it will also provide a means for shipping the oldest goods first, and make it possible to recall shipments that may have proved defective or substandard.

This, of course, requires proper identification tags on the products to be shipped, so that book and physical inventories will agree.

In the textile industry, for example, a piece of cloth is examined by the cloth grader, and he makes out a hang-tag to be attached to the piece. The hang-tag is

a portion of an IBM stub card. Printing is arranged so that the information written on the hang-tag by the grader will be carbon-copied on the card (Figure 26).

Now the piece of material, with the hang-tag and inventory card attached, is ready for storage. The bin or shelf number is recorded on the card and the card detached. The hang-tag remains with the material, and the card goes to the inventory section, where it is punched on a printing punch, verified, and reproduced to create a duplicate file. The inventory card is filed in the tub file by style, and the reproduced card sent to the accounting department for the preparation of production and inventory reports.

When an order is received, cards are pulled from the tub file in the amounts needed to satisfy the order. At this point it is possible to govern selection of material from stock by the batch number, or by lot number, as the case may be.

The stockroom staff can now forward the material and cards to the packing department for packing and shipping. It is practical, at this point, to prepare a packing slip, shipping instructions, and an invoice on the CARDATYPE or the accounting machine. The same cards, with no possibility of error or change, are now available for sales analysis reports and for adjusting the inventory balance.

This application of the IBM punched card method makes it a relatively simple matter to take physical inventory. There is a card in the tub file for each piece of stock, showing its warehouse location. Selection of the cards by any standards—age, batch, lot, size, color—becomes a much simplified procedure.

Unit Inventory Merchandise Control

Frequently, businessmen have found it advantageous to maintain inventory records in unit form, even though the cards are not used for order writing or billing purposes. Figure 27 shows a typical file used to identify merchandise such as furniture, clothing or jewelry. Cards like these are prepared from master cards when merchandise is received. The cards are maintained in a tub file and constitute a permanent inventory.

As sales are made, sales slips are prepared. With these source documents as a basis for selection, clerks remove cards from this file and transcribe the information from the sales slips into them in the form of punched holes. In this mobile form, the cards have a number of advantages.

When they are arranged by delivery date and location, they can be used to prepare selection lists (Figure 28), which facilitate filling of shipping require-

Figure 26. The Tag Stays with the Material; the Card Is Filed

DRUM TABLES

DROP LEAF TABLES

CONSOLE TABLES

COFFEE TABLES

19	54	618	1	2126	END TABLE MAPLE	21MR16	S8	21,50	29,95
DEPT.	CLASS	VENDOR	PCS.	LOCATION	DESCRIPTION	STYLE	SEASON	COST	RETAIL

(Lower card labels): DEPT. / SEASON / CLASS / SERIAL NUMBER (ORDER NO. ITEM) / VENDOR / STYLE / LOCATION (BLDG. FLOOR SECTION) / PIECES / COST / RETAIL / DESCRIPTION / DATE OF SALE (MO DAY) / STORE NO. / STORE OF SALE / SALESMAN NO. / BOOK / CHECK / DATE OF DEL. (MO DAY) / ROUTE / SELLING PRICE

Figure 27. A Compact, Permanent Inventory

HOUSE OF FORRESTE

SELECTION LIST

DELIVERY DATE 6–22–6–   BLDG. 2   FLOOR 1

LOCATION			CL.	SERIAL NO.		DESCRIPTION	ROUTE NUMBER
BLDG.	FLOOR	SECT.		ORDER NUMBER	ITEM		
2	1	2	38	2786	01	LAMP,BRACKET	6
2	1	3	57	3413	07	BOOKCASE,PINE, 18 IN	7
2	1	4	16	1845	84	COFFEE TABLE,MAH.	6
2	1	7	54	3474	31	DESK,STUDENT, MAPLE	17
2	1	11	38	2786	14	LAMP,VANITY	6
2	1	19	16	1845	96	COFFEE TABLE,MAH.	6
2	1	26	54	1403	09	END TABLE,MAPLE	17
2	1	26	54	1403	09	END TABLE,MAPLE	17
2	1	26	54	3413	12	BOOKCASE,MAPLE,36 IN	6
2	1	38	10	2196	47	HASSOCK, PLAS. GR.	2

Figure 28. This Saves Many Steps in the Warehouse

ments. This saves time and keeps warehouse handling expense at a minimum.

Another possible use of these cards, or cards reproduced from them, is to serve as delivery tags. There are many variations of these—as many variations as there are users. Sorted by delivery route sequence, they are used at the loading platform to verify merchandise selection and facilitate truck loading. Still in the same sequence, they can be used to help deliverymen unload the proper items when making their stops. Sometimes the card is given to the consignee of the shipment for his records, and may also serve as a promotional piece (Figure 29).
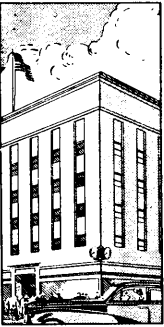
The sales cards perform an additional function in the preparation of commission and sales analysis reports. But the cards remaining in the tub file have significance, too. These represent goods that were unsold. The questions come up again: What is in stock? Is it enough? Is it too much? And a new one: Why wasn't it sold?

These questions are of vital importance to the business. And the answers are available through careful analysis of the reports made possible by the IBM method.

Advantages of the Unit Inventory Approach

1. The same cards used for inventory control and material accounting may be used for other operations: billing, sales accounting, purchasing, etc.

2. A reduction in warehouse investment is made possible by a closer control of stock.

3. Systematic checking of tub files with actual warehouse stock is instrumental in controlling warehouse losses.

4. It is possible to take frequent periodical physical inventories, minimizing inventory adjustments at the end of the fiscal year.

5. FIFO, LIFO or retail pricing methods may be used to calculate dollar value of stock.

6. No time is wasted looking for out-of-stock items, because only items known to be in stock are listed on the invoice form.

7. The use of signal cards focuses management's attention on any abnormal stock conditions at the proper time for taking corrective measures.

8. Detail cards, when reproduced, are a good source for producing picking tags with the warehouse location punched and interpreted. Judicious use of these tags effects a saving in warehouse time and labor.

Figure 29. A Card That Serves Many Purposes

Stock Allocation Procedure

In some industries inventories contain many thousands of stock items, stock-outs occur frequently, shipping quantities vary greatly, and price changes are frequent and unexpected. The unit inventory plan has practical limitations where a combination of these circumstances is encountered.

Actually, where such is the case, it is usually necessary to edit orders before attempting to fill them. This provides a central control over orders, so that partial shipments on many orders can be made, rather than full shipment on only a few, particularly when stock is low, or when the quantities on some of the orders are especially high. The balance-forward plan is not well adapted to pre-editing of orders, and much machine time is required in associating active balance and transaction cards when the balance file is large.

That brings us to a simple and effective method combining certain of the advantages of balance-forward and unit inventory plans: the stock allocation procedure. It has been effectively used on inventories with over 100,000 different line items of stock, as well as inventories with less than 1,000 items.

The Balance File

The basic ingredients are an interpreted IBM card inventory file (the card used is similar in makeup to that maintained in the balance-forward plan) and a stock editor. Each stock-numbered item is represented in the inventory file by a balance card (Figure 30), in which is punched all information necessary to provide a complete picture of the status of that item. The file drawer itself is felt-bottomed and about two inches wider than a conventional card file.

When an order is received, an IBM card with a prepunched invoice number is immediately attached, thereby assigning the invoice number. Another card is punched with all the identifying data about the order: customer number, purchase order number, date, etc. Now the total number of lines, or different stock numbers, is punched into the card. These two cards are the

Figure 30. The Stock Editor Works from These Cards

master cards for a given order, and similar masters are prepared for all other orders received.

Now, in one high speed operation on the document-originating machine equipped with the count-controlled punching and serial-numbering feature, an individual transaction card is punched for each item line on the order, with all the reference data and identifying information. The item line is end-printed on the transaction card, but neither the quantity ordered nor the stock number appears (Figure 31).

The Stock Editor

This set of cards, together with the requisition or order, goes to the stock editor, who has before him the punched inventory balance card file described earlier. He selects item card number 1, and obtains the quantity and stock number from line 1 on the order. Referring to the balance card for that stock number, he decides whether the request is to be filled, partially filled or back-ordered. If the full amount of the ordered item is to be issued, the item card is sense-marked with the quantity and a code indicating that it is to be issued. It is then placed behind the balance card, and both cards are now offset to the left side of the drawer (Figure 32), to denote activity for that item. The felt bottom of the drawer prevents these cards from shifting to the right after they have been offset. And the same procedure is followed for each item line on the order.

When the editor's examination of the balance card makes him decide to back-order the item, the same procedure is followed: the quantity required is sense-

marked with the code indicating back order, and the transaction card is filed behind the balance card and offset.

If his decision is to fill the request partially, he marks the transaction card with the amount to be issued and codes it as an issue. Then, on a blank transaction card, he sense-marks all the reference data, the quantity to be back-ordered, and the proper back-order code. Both cards, in this instance, are filed behind the balance card and offset.

Emergency Orders

Occasionally the order department will be called on to supply an emergency order. Blank transaction cards

Figure 32. The Cards Remain Offset until Collected

Figure 31. All Transactions Are Handled This Way

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can be prepared by the clerk receiving the order, with all reference data sense-marked on them. Bypassing the initial machine operations, these cards and the order are rushed to the stock editor, who files them behind the balance cards, offsets them, and sends the order itself directly to the stockroom, where it is filled and shipped immediately.

Processing

During all these editing operations, merchandise is being received, purchase requisitions placed, requirements from manufacturing control expressed, inventory adjustments made, and other transactions normal to a stock control operation are occurring.

All these transactions are punched or sense-marked on transaction cards having appropriate color stripes, and appropriate transaction codes entered on them. Then these cards are filed in the same manner as described for items issued.

Either on a predetermined schedule or whenever the stock editor finds it desirable, the offset cards—balance and transaction cards—are removed from the file, and distinctive marker-signal cards substituted. The cards thus removed are ready to be sent to machine accounting for processing—easily, efficiently and at machine speeds. The following are the processing steps in the typical stock allocation procedure shown in Figure 33.

1. When an order is received, a prepunched invoice number card is attached.

2. The order master card is punched with reference data from the order, such as customer number, purchase order number, date, and total number of line items on the order.

3. An individual item transaction card for each line on the order is prepared and end-printed on the document originating machine equipped with a count-controlled and serial-numbering feature.

4. The stock editor performs allocation functions, sense-marks quantities and codes, and offsets the item requisition cards in the inventory balance file with the balance cards.

5. Blank cards are chosen, sense-marked, and offset with proper balance cards for receipts, returns and miscellaneous transactions.

6. The appropriate balance cards, item requisition cards, receipts, returns, inventory adjustments, and miscellaneous transaction cards are now offset from the inactive balance cards in the inventory balance file.

7. All cards offset are removed from the file, signal cards substituted for each balance card taken, and description, class, number, price and location gang-punched. Transaction codes and quantities are mark-sense-punched. In organizations where second-shift

operation is used, these cards are machine-processed during the second shift. Thus, new inventory balances are available for use at the beginning of each day.

8. The transaction register is prepared and new balance cards summary-punched. The register may be used for posting to historical ledger cards.

9. The revised inventory balance cards are processed in the accounting machine for proving, and filed back into the inventory balance file.

10. The transaction cards are sorted to separate charges and credits from all other transactions. The charges and credits are then sorted into customer-number sequence.

11. Quantity times unit price is calculated.

12. Shipping document header cards are filed, and shipping papers and invoices prepared. Reproduced and interpreted, the item cards may be used to prepare picking tags.

13. Cards are summary-punched during preparation of shipping documents.

14. The item requisition cards go into the material accounting procedure.

15. Summary-punched cards are collated with order master cards for control of the shipping and billing operation.

The results of the steps in this procedure are:

    a. Up-to-date inventory balance file.
    b. Order master cards available for control of operations.
    c. Shipping documents and invoices.
    d. Source material for material accounting procedures.
    e. Preparation of picking tags for warehousemen.
    f. Transaction ledger and historical stock ledger kept current.

Advantages of the Stock Allocation Procedure

Businessmen whose requirements have led them to install this method have pointed out some of the more desirable features:

1. The responsibility for keeping stocks current and for controlling accuracy is placed directly in the hands of the stock editor.

2. Up-to-date stock balance information is available at all times. Corrected balance cards are furnished daily, or even more frequently. The exact stock status between processing cycles is readily obtained from the cards filed behind each stock balance card.

3. In large operations where it may be a problem, machine time is reduced.

4. Personnel requirements in punching, verifying and tub file picking are reduced.

5. There is sufficient flexibility to allow for expan-
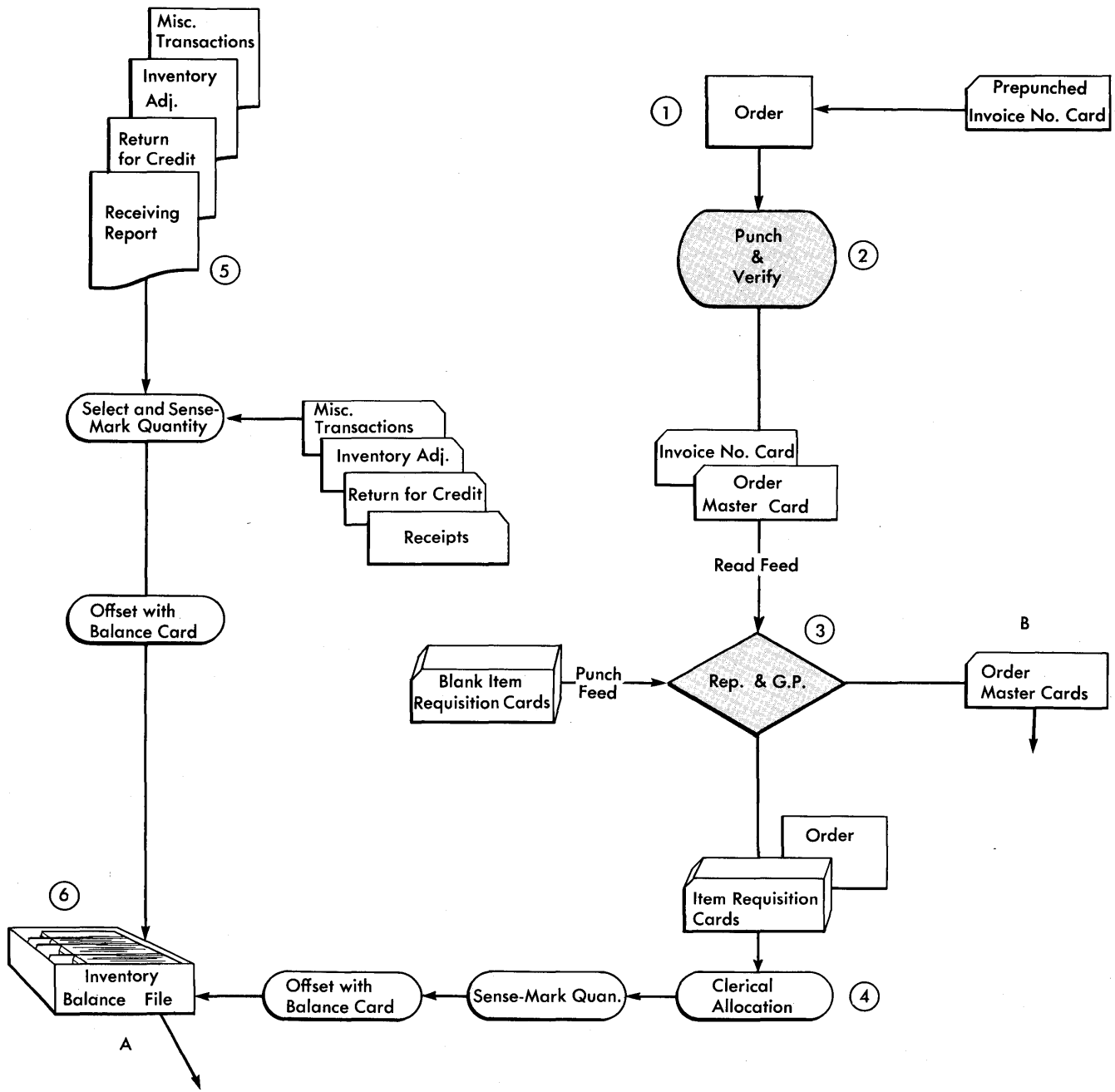
Figure 33. Typical Stock Allocation Procedure

sion or reduction in activity and in the number of inventory items.

6. Varied consolidated reports can be made available to top management whenever requested, by reproducing the balance cards, arranging them in the required order, and then listing and accumulating the information.

7. Coding and pricing are automatically achieved without any additional operations, and price changes are easily handled.

8. Basic data for physical inventory can be reproduced from the balance cards, to mechanize physical inventory taking and processing.

9. Complete and detailed analysis reports can be prepared regarding obsolescence, turnover, and on-hand supply of each item stocked.

Clerical Filing

Inventory Balance File

Inter.

Hand-Select Offset Cards

Acct. Mach. ⑨

M. S. & G. P. ⑦

Revised Inventory Card

Sum. Punch

Acct. Mach. List ⑧

Transaction Register

Facs. Post

Historical Stock Ledger

F

Misc. Transactions
Inventory Adj.
Receipts

Sort ⑩

Returned for Credit
Item Requisition Cards

Shipping Document Header Cards

Calc. ⑪

Order Master Cards

Hand File

⑫

Rep. & Int.

Acct. Mach.

Sum. Punch ⑬

Accounts Receivable Cards

Coll. ⑮

Picking Tags

Shipping Documents

Item Requisition Cards

Material Accounting Procedure

Control

E

C

⑭

D

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Inventory Control with Batch Billing

The development of electronic calculators made possible a new approach to inventory control and material accounting. It is true that the unit inventory tub file is simple and quick for billing purposes, but when the volume of transactions is high, or where a large inventory is involved, it is somewhat cumbersome.

Batch billing is used, essentially, to eliminate tub files. It provides many of the advantages of the unit record plan, but does not retain the possibility of pre-edit, which is a feature of the stock allocation system. Orders and receipts are processed on the machine in groups or batches, daily or twice daily. Batch billing is, therefore, a medium between unit records and stock allocation. The file of balance cards should not be so large as to make daily or twice-daily collating with transaction cards impractical, rush orders should be at a minimum, and orders should be scheduled in an even flow if the best advantages of this procedure are to be realized.

Batch billing, like the stock allocation plan, uses an inventory balance card for each stock item. The inventory balance card doubles as a master card by showing the noun description and other information such as pack, size, cost, etc. This information can, in normal procedure, be gang-punched into the order cards that will be used for billing purposes.

Typical Procedure

The flow chart shown in Figure 34 outlines one of the many variations of the procedure used in batch billing:

1. As orders are received, a commodity or order card is punched for each stock item ordered. This card contains customer number (which is mechanically duplicated into each succeeding card of the order), stock number and quantity ordered. These cards are retained for combined machine operations, usually twice a day.

2. Receipt cards are punched for merchandise received since the last machine processing of the inventory.

3. The receipt cards are placed in front of the order cards and the cards sorted, so that they will be in order by stock number with the receipts preceding the corresponding order cards for each item.

4. In the collator, the receipt and order cards from step 3 are match-merged against the stock balance cards.

5. A blank card is filed behind each stock-number group. This card will become the new balance card.

6. The electronic calculator is programmed to:

Gang-punch product name and any other descriptive information required.

Calculate new inventory value—
Old Value + Value of Receipts = New Inventory Value

Calculate new unit cost—
$$\frac{\text{New Inventory Value}}{\text{Total Quantity}} = \text{New Unit Cost}$$

Calculate and punch extended cost and retail price.

Identify item cards for incomplete shipments and line items which cannot be shipped because of out-of-stock conditions.

Gang-punch descriptive data and balance factors into the blank trailer card, which becomes the new balance summary card.

7. Cards are sorted by separate card types—old balance, new balance, receipts and commodity.

8. The new balance summary card is merged with the inactive stock balance file.

9. Commodity cards are sorted into customer-number sequence.

10. Name and address cards are merged with the commodity cards.

11. Invoices are prepared on the accounting machine.

Advantages of the Batch Billing Procedure

As stated earlier, there are many other variations to the billing procedure besides the one shown in the flow chart. Advantages over the unit tub file procedure, however, are common to all:

1. Less manual filing—the prepunched unit file consists of single inventory cards, one for each item ordered.

2. Lower card cost—the card volume is reduced to a single card for each item ordered plus the new balance summary cards punched during the processing of each batch.

3. Economy of floor space—elimination of the prepunched inventory file decreases the amount of floor space required.

4. Simplification of price changes—a change in price requires that only one card (the inventory master) be changed, instead of hand-pulling and reproducing whole groups of cards from prepunched file.

5. Daily inventory reports—inventory status reports on a daily or twice-daily basis can be prepared quickly and simply from the new inventory items. Reordering of out-of-stock items is controlled directly.

6. Fast merchandise handling—a minimum of time elapses between the receipt and issue of goods.

7. Current maintenance of unit costs—average unit costs are computed automatically on a daily basis.
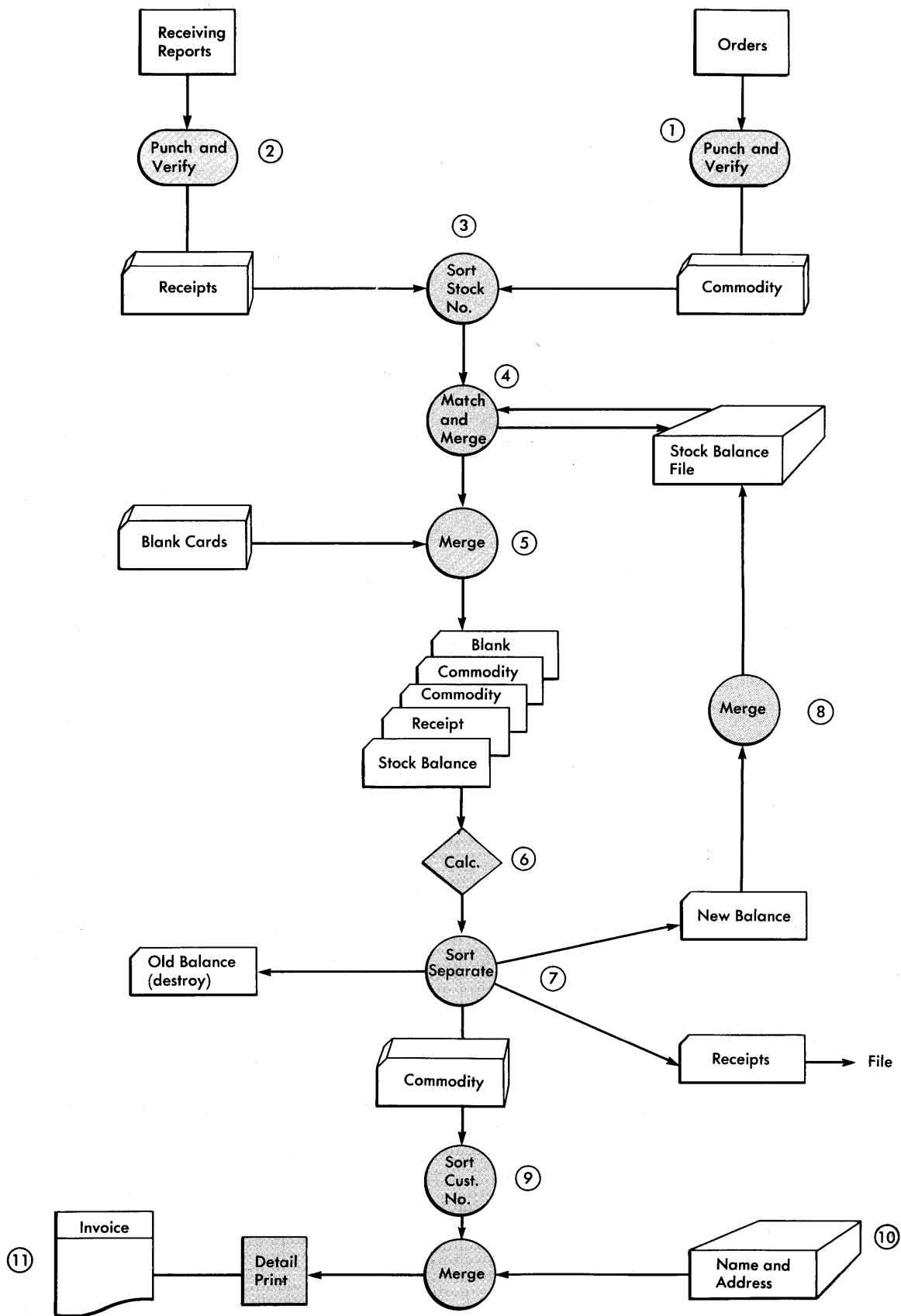
Figure 34. Operational Steps in a Typical Batch-Billing Procedure

Merchandise Control

Detailed information concerning inventory and movement of merchandise is required by department stores, retail chains and similar organizations to enable them to manage their business effectively. The development of branch stores, the large number of items stocked, the heavy volume of transactions, and the increase in fashion items are some of the many factors that have made it impossible to effectively control the merchandising functions of a large retailing organization without accurate and timely records. IBM procedures utilizing either unit record machines or data processing systems are providing this vitally important information for many retailers. This section of the manual covers a commonly used approach to merchandise control based on punched price tickets and unit record equipment. The use of RAMAC systems and other data processing systems for this application is covered later in the manual.

Print Punch Price Tickets

Print punch price tickets fulfill the functions of normal price tickets and, in addition, contain punched information which enables them to be used as an automatic means of entry into data processing procedures. Samples of two commonly used print punch price tickets are shown in Figure 35.
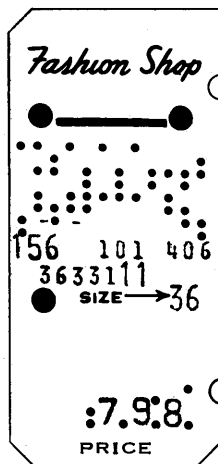

Figure 35. Print Punch Price Tickets

These tickets are usually prepared with from two to five stubs and generally contain either 20 or 25 positions of punched information and up to 47 positions of printed data. They are prepared and attached to the merchandise in a manner similar to that of ordinary price tickets, since the ticket manufacturers have provided printing and punching machines which operate with the same ease and speed as their non-punching equipment. Thus a source record, providing inexpensive and automatic input, can be prepared with little additional effort in the marking department.

The number of stubs used and the information punched vary from store to store and department to department. One store, for example, prepares a five-part ticket for its ready-to-wear departments, as follows:

Part 1. Transfer ticket—for mechanical processing of interstore transfers.

Part 2. First sale ticket—removed from merchandise when the first sale is made and then forwarded to the data processing department for processing.

Part 3. Customer return ticket—removed if the customer returns the garment and forwarded to the data processing department for processing.

Part 4. Second sales ticket—used when a sold garment has been returned to stock and resold.

Part 5. Garment ticket—not used for merchandise control accounting purposes (kept by customer).

The above is only one of the many variations in use; three-stub tickets are probably the most common.

Print punch tickets have proved to be extremely functional and can be used in most departments—including coat, suit, dress, blouse, lingerie and sportswear; infants', children's and men's wear; handbags, neckwear, millinery, etc.

After the merchandise is ticketed, it is forwarded to the selling floor. When a sale is made, one portion of the price ticket is removed and placed in a specially designed receptacle. At the end of the day, or periodically throughout the day, the tickets are collected and forwarded to the data processing department, where they are separated into groups of markdown, mutilated and regular tickets. The regular tickets are processed through an IBM 549 Ticket Converter or through a tag reader attached to an IBM summary punch. All information stored in the price ticket, plus additional information of a fixed nature, such as store number, type of transaction and date, is punched into IBM cards. Markdowns are also processed by the converter and all fields are punched with the exception of sales price, which is manually punched after the ticket-converting operation. Cards are also manually punched for any mutilated tickets. A sample sales card is shown below (Figure 36). In most cases,

tumble cards (cards which are used once, turned over and used a second time) are used, since the information required is generally less than 40 columns.

After the sales cards are punched, they are used for the preparation of merchandise control reports by sorting and summarizing them at high machine speeds. Although the frequency and content of these reports vary with different stores and departments within a store, the following illustrations indicate the types of reports that can be obtained.

Unit Control Reports

These reports commonly show sales, and sometimes inventory, of an item of merchandise identified by its individual characteristics such as size, color, style number, manufacturer, etc. Figure 37 represents a portion of a typical report showing the sales of a dress department, broken down into size within color, within style, within manufacturer, within merchandise classification, within department. This type of report is usually prepared daily, or two or three times per week, depending on the requirements of the individual store or department. A copy of the report is sent to the buyer, and the tabulated information is, in some cases, posted by the unit control department to a "black book" from another copy of the report. In other cases, the stock record is maintained by posting an IBM stock ledger card on the 557 Alphabetic Interpreter.

Figure 36. Typical Merchandise Sales Card

Figure 37. Unit Sales Report

Figure 38, below, shows a report prepared by a somewhat different approach in that both sales and inventory are shown and the information is broken down only to style level. Color and size data is not accumulated but is obtained from color and size classification reports and other sources.

To prepare an inventory-type report, cards are punched for orders placed, for miscellaneous transactions such as interstore transfers and customer returns, and for receipts of merchandise. One way of punching receipt cards, for example, is to have the ticketing machine operator prepare one additional ticket for each lot of merchandise received and mark the quantity received on the extra ticket. These tickets are forwarded to the data processing department, where they are processed in a manner similar to that of sales, except that after converting the stubs to cards, the quantity received is manually punched. This method is used in departments where the number of units received in a given lot is usually large. In departments where relatively small quantities of any one style are generally received, an extra ticket can be prepared when each garment is ticketed and then used as the source for creating the receipt cards. In other approaches, receipt cards are manually punched from copies of the receiving report, or they are mark-sense-punched from cards removed from an on-order tub file.

Interstore transfers and customer return cards are either converted from price tickets when an extra stub has been provided for these purposes, or punched directly from source documents as are the cards for orders placed and merchandise returned to vendors.

The transaction cards, representing orders, transfers, returns and receipts, are combined with the cards representing sales and are then merged with the last period's summary cards containing inventory and on-order balances and the preceding period's sales figures. The cards are then placed in the accounting machine, the sales and inventory report is prepared, and a new balance card is summary-punched.

Naturally, there are many variations to the above procedures among different stores and even within a given store. For example, some stores prepare unit control reports showing color and size for departments that most need this information, color for other departments, and no color or size for the remainder. This reduces cost since less time and effort are required to ticket the merchandise and less sorting, tabulating and posting are needed to maintain the records. Similarly, reports for one group of departments may be prepared daily, and for others twice weekly or even weekly. In addition, reports may be tabulated on sales only, or combined sales and inventory reports may be prepared. The flexibility of the punched card method enables users to vary the information and the timing of the reports obtained according to individual stores' and departments' requirements.

Classification Control

Classification control is a type of merchandise control that provides for maintaining sales and inventory records on a units-and-dollar-value basis for a similar group of items within a department. The most commonly prepared report of this type is the class price line report, which shows sales broken down by price line within merchandise classification (Figure 39). This report provides an overall picture of the merchandise status of a given department and is the basis for the compilation of the open-to-buy report, which

					Unit Sales							
Dept.	Class.	Mfr. Number	Style	Price	3rd Wk. Prior	2nd Wk. Prior	1st Wk. Prior	Last Week	Accum. Sales	On Hand	On Order	Retail Amount
4 2	1 0	5 2	1 0 7 4	1 6 9 5	1	2	2	3	1 9	2 1		5 0 8 5
	1 0	5 2	1 1 4 5	1 2 9 5		1	3	5	9	3 0		6 4 7 5
								8				1 1 5 6 0 *
	2 0	1 2	3 3 0	2 2 9 5							1 2	
	2 0	5 2 6	7 0 1	3 5 0 0	1		1		2 7	1 2		
	2 0	5 2 6	7 1 9	3 5 0 0		2	1	2	1 1	1	1 5	7 0 0 0
	2 0	5 2 6	7 3 4	3 5 0 0	3	3	2	1	1 5	3	1 2	3 5 0 0
	2 0	5 2 6	9 1 1	2 9 9 5	1		2	2	9	9		5 9 9 0
								5				1 6 4 9 0 *

SALES AND INVENTORY REPORT

Figure 38. Unit Sales and Inventory Report

shows the money available for the purchase of merchandise within a given classification, and which is used by the buyer and merchandise manager as a means of exercising control over merchandising activity.

Another type of report commonly used is the color-class report. This report shows sales for a given department broken down by color within a given classification, and occasionally within a given price line. Similar reports showing size, material, etc., within merchandise classification can also be prepared. Figure 40 shows typical color and size analysis reports.

The reports described here are illustrative of what can be done. Many variations are in use, since punched card procedures can be readily adapted to meet individual requirements. In some cases, the required information is punched from regular price tickets or from sales slips, rather than converted from print punch tickets as described previously. Sometimes a punched paper tape is prepared when a sale is entered on the cash register and the tape converted to punched cards. Some stores prepare a given report daily, others weekly. And so on. Figure 41 is a flow chart of one of the more common approaches used.

CLASS PRICE LINE REPORT

Dept.	Class	Price	On Order Units	On Order Dollars	On Hand Units	On Hand Dollars	Sales Units	Sales Dollars
4 2	1	1 7 95			1 0	1 7 9 50	7	1 2 5 65
	1	1 8 00			1 4	2 5 2 00		
	1	1 9 95	7 0	1 3 6 9 50	2 3	4 5 8 85	3 5	6 9 8 25
	1	2 2 95	3 0	6 8 8 50	1 8	4 1 3 10	1 3	2 9 8 35
	1	2 5 00	1 8	4 5 0 00	2 7	6 7 5 00	3 4	8 5 0 00
	1	2 9 95	2 9	8 6 8 55	4 5	1 3 4 7 75	2 7	8 0 8 65
	1	3 5 00			1 6	5 6 0 00	1 1	3 8 5 00
	1	3 9 95	4	1 5 9 80	6	2 3 9 70	5	1 9 9 75
	1	4 5 00	4	1 8 0 00	6	2 7 0 00	1	4 5 00
	1	4 9 95	4	1 9 9 80	1 0	4 9 9 50	1 2	5 9 9 40
	1	5 9 95					2	1 1 9 90
	1	6 9 95			9	6 2 9 55		
			1 5 9 ✻	3 9 4 3 15	1 8 4 ✻	5 5 2 4 95	1 4 7 ✻	4 1 2 9 95
4 2	2	1 7 95					3	5 3 85
	2	2 2 95	1 8	4 1 3 10	3	6 8 85	6 2	1 4 2 2 90
	2	2 5 00	1 8	4 5 0 00	1 7	4 2 5 00	1 2	3 0 0 00
	2	2 9 95	6	1 7 9 70	1 9	5 6 9 05	2	5 9 90
	2	3 5 00			4	1 4 0 00	1	3 5 00
	2	3 9 95	1 7	6 7 9 15	2	7 9 90	1 4	5 5 9 30

Figure 39. Class Price Line Report

COLOR ANALYSIS Dept. 1 5 9 Mo. 8 | Day 1 | Yr.

Class	Price Line	Color	Size	Unit Sales Season To Date	% to Total	Unit Sales For Period	% to Total	Stock On Hand	Stock On Order	% O.H.&O.O. to Total
0 2		0 1		5 9	1 4 7	1 2	1 5 6	2 1	1 5	1 7 1
		0 2		1 2 1	3 0 2	3 1	4 0 3	8 3		3 9 5
		0 3		6 3	1 5 7	8	1 0 4	4 1		1 9 5
		0 7		1 5 8	3 9 4	2 6	3 3 8	5 0		2 3 8
				4 0 1	✻	7 7	✻	1 9 5 ✻	1 5	✻
0 3		0 1		5 1	1 5 2	9	1 5 3	1 5	1 2	2 5 5
		0 3								
		0 4								
		0 8								
		1 1								

SIZE ANALYSIS Dept. 1 5 9 Mo. 8 | Day 1 | Yr.

Class	Price Line	Color	Size	Unit Sales Season To Date	% to Total	Unit Sales For Period	% to Total	Stock On Hand	Stock On Order	% O.H.&O.O. to Total
0 2			7	3 6	1 4 0	9	1 5 2	1 5		1 5 5
			9	5 4	2 1 0	1 2	2 9 3	1 0	1 0	2 0 6
			1 1	7 1	2 7 6	1 5	2 5 4	1 9		1 9 6
			1 3	4 9	1 9 1	1 0	1 6 9	2 1		2 1 6
			1 5	3 2	1 2 5	8	1 3 6	1 2		1 2 4
			1 7	1 5	5 8	5	8 4	1 0		1 0 3
				2 5 7	✻	5 9	✻	8 7	✻ 1 0	✻
0 3			1 0	2 1	1 8 6	6	1 9 4	4		9 1
			1 2	3 4	3 0 1	8	2 5 8	1 7		3 8 6
			1 4	4 0	3 5 4	1 0	3 2 3	5	1 0	3 4 1
			1 6	1 8	1 5 9	7	2 2 6	8		1 8 2
				1 1 3	✻	3 1	✻	3 4	✻ 1 0	✻

Figure 40. Color and Size Reports

RECEIPTS   SALES   ORDERS, MFR. RETURNS   TRANSFERS
                                                        AND ADJUSTMENTS

```
  ┌─────────┐          ┌──────────────────┐      ┌──────────────┐          ┌──────────────┐
  │         │          │ Remove ticket when│     │Miscellaneous │          │Remove Ticket │
  │ Receipts│          │merchandise is sold│     │Transactions  │          └──────────────┘
  │         │          └──────────────────┘     └──────────────┘                 │
  └─────────┘                   │                       │                         │
       │         ┌──────────┐   │                       │                   ┌──────────┐
       │         │Open Order│  Tickets                   │                   │ Tickets  │
       │         │   File   │   │                        │                   └──────────┘
       │         └──────────┘   │                        │                         │
       │              │   To Data Processing Department  │                         │
       │              │         │              To Data Processing Department  To Data Processing Department
 ┌───────────────┐    │   ┌──────────────┐               │                         │
 │ — Order Check —│◄──┘   │Separate Tickets│              │                         │
 │  Mark Sense    │       └──────────────┘               │                   ┌──────────┐
 │Quantity Received│            │                        │                   │ Convert  │
 └───────────────┘    ┌─────────┼─────────┐              │                   │   and    │
       │              │         │         │              │                   │Reproduce │
       │         ┌─────────┐┌─────────┐┌─────────┐       │                   └──────────┘
    ┌──────┐     │Mutilated││ Regular ││Markdowns│  ┌──────────┐                  │
    │ Mark │     └─────────┘└─────────┘└─────────┘  │Card Punch│                  │
    │Sense │          │         │         │         └──────────┘           ┌──────────────┐
    │Punch │     ┌─────────┐┌─────────┐┌─────────┐       │                 │Transfers Out │
    └──────┘     │Card Punch││ Ticket  ││ Ticket  │       │             ┌──────────────┐│
       │         └─────────┘│Converter││Converter│       │             │Transfers In  ││
       │              │     └─────────┘└─────────┘  ┌──────────────┐    └──────────────┘
    ┌──────┐          │         │    ┌─────────┐    │Miscellaneous │          │
    │Receipts│        │         │    │Card Punch│   │Transactions  │          │
    └──────┘          │         │    └─────────┘    └──────────────┘          │
       │              └─────────┼─────────┘               │                   │
       │                   ┌──────────┐                   │                   │
       │                   │Sales Cards│                  │                   │
       │                   └──────────┘                   │                   │
       │                        │                         │                   │
       │                   ┌─────────┐                     │                  │
       │                   │ Sort by │Department, Class, Manufacturer and Style│
       │                   └─────────┘                     │                  │
       │              ┌──────────┐                         │                  │
       │    ┌───────┐ │Accounting│   ┌──────┐              │                  │
       │    │Summary│◄│ Machine  │---│Sales │              │                  │
       │    │ Punch │ └──────────┘   │Report│              │                  │
       │    └───────┘                └──────┘              │                  │
       │        │                                          │                  │
       │   ┌──────────┐                                    │                  │
       │   │Sales Summary│                                 │                  │
       │   │   Card   │                                    │                  │
       │   └──────────┘                                    │                  │
       │        │          ┌─────────┐                     │                  │
       └────────┴─────────►│ Sort &  │◄────────────────────┴──────────────────┘
                           │ Merge   │
                           └─────────┘
                                │
  ┌───────┐  ┌──────────┐  ┌─────────┐
  │Collate│──│Balance File│─►│ Merge  │
  └───────┘  └──────────┘  └─────────┘
       │          ▲             │
       │          │        ┌──────────┐  ┌──────────┐
  ┌──────────┐┌───────┐   │Accounting│--│Sales &   │
  │New Balance││Summary│◄─│ Machine  │  │Inventory │
  │  Cards   ││ Punch │   └──────────┘  │Report    │
  └──────────┘└───────┘        │        └──────────┘
                          ┌─────────┐
                          │ Sort by │Class and Price Line
                          └─────────┘
                               │
  ┌──────────┐  ┌───────┐ ┌──────────┐
  │Class Price││Summary│◄│Accounting│
  │Line       ││ Punch │ │ Machine  │
  │Summary Cards└───────┘ └──────────┘
  └──────────┘
       │
   ┌───────┐
   │ Merge │
   └───────┘       At Month End
       │                      ┌──────────┐  ┌──────────┐
  ┌──────────┐                │Accounting│--│Class     │
  │Class Price│──────────────►│ Machine  │  │Price Line│
  │Line       │               └──────────┘  │Report    │
  │Summary File│                             └──────────┘
  └──────────┘
```
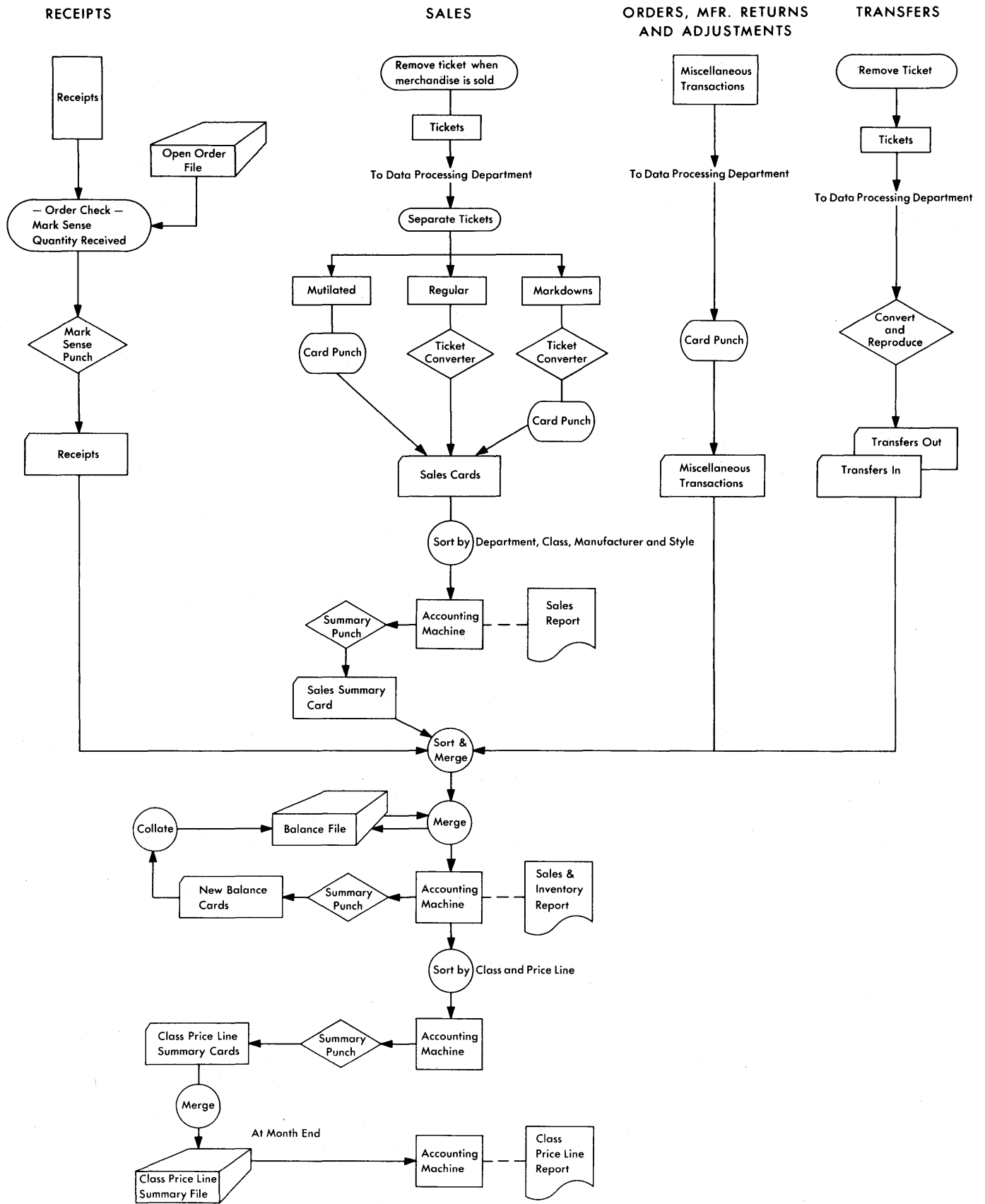
Figure 41. Typical Merchandise Control Procedure

The Three-Part Card

In some cases, generally where a larger ticket is desirable, a three-part IBM card (Figure 42) is used rather than a print punch ticket or a conventional price tag. The IBM card price ticket is usually prepared as follows: When merchandise is received, a master card is punched for each lot of garments that differs in style, size and color. From these master cards three-part tickets for each garment are reproduced in the document originating machine and end-printed for greater readability by store personnel. Additional information, such as manufacturer, style, department, etc., is printed on top of the ticket by the interpreter.

After the tickets are prepared they are attached to the garment with a string or tamper-proof seal. When the merchandise is sold, the sales portion of the tag is removed and returned to the accounting department. Sales statistics and inventory reports are then prepared as described previously, except that the stub ticket is either read by an IBM reproducer with a stub card device, or used to select the corresponding card from an inventory file.

Advantages

Some of the advantages that can be obtained from the use of IBM unit record machines for merchandise control are as follows:

1. Only one recording of facts in IBM cards is necessary for the fast, automatic preparation of complete merchandise control reports. These reports are pre-pared essentially by automatically summarizing the same punched cards over and over again at high machine speeds.

2. Complete and timely sales data, which would be too costly or too slow to obtain manually, enables buyers to make decisions based on up-to-date and detailed information and to react quickly and more effectively to sales trends. Sales of one day, for example, can be on the buyers' desks the next morning.

3. A high degree of accuracy can be obtained since most sorting, accumulating and posting operations are performed automatically.

4. Peak loads can be handled with a minimum of additional time and effort.

5. Increased legibility and better format of tabulated, as compared with handwritten, reports help the buyer in analyzing and using the information presented.

6. Flexibility of machines and methods permits the timing and the preparation of records and reports to meet individual requirements and changing conditions. For example, the frequency of reports prepared for the various departments and the order in which they are processed can be varied from season to season.

7. Markdowns and out-of-stock conditions can be reduced as a result of timely, accurate and comprehensive merchandise control information.

8. Increases in volume can be handled with a minimum of additional personnel and expense. Furthermore, repetitive and laborious manual functions, for which it is difficult to obtain and keep personnel, can be eliminated.

Figure 42. Three-Part IBM Card Sales Ticket

The Automatic Reorder System

Automatic reordering is an interesting application of inventory control. It results in the control of the stock level of goods in a retail outlet by the accounting department in the manufacturer's, distributor's or retailer's headquarters.

The plan has achieved widespread popularity in the ready-to-wear industry for such items as hosiery and lingerie, but the principle is applicable in most organizations manufacturing or distributing products which are packaged and which could include a prepunched reorder card. It is also being used by department stores and retail chains for their own internal control of basic stocks.

The operation begins when the manufacturer's representative and the retail buyer establish the basic stock for the retail store. The initial order is entered. From that point on, stock control and automatic reorder are performed through the flexibility of the IBM accounting machine.

In the manufacturer's order department, a tub file of unit record cards is maintained.

When the initial order is received, cards are pulled from unit tub files for each item on the order. Both the cards and the orders are sent to the card punch section. There a master name and address card and a miscellaneous data card are punched (Figure 43).

From these cards — the master name and address card, the miscellaneous data card and the various unit cards — the accounting machine prepares invoice, packing slips, shipping notice, salesman's copy and the accounting department's copy simultaneously and at high speed. As quickly as that, the shipping department is ready to take stock off the shelf and ship to the store.

The master name and address cards are returned to the master files to be used again on subsequent orders, and the unit cards are used for sales analyses and for salesmen's commission statements.

The Reorder Card

The retailer now has the basic stock in his store, ready to sell. Each box or package of merchandise contains the prepunched reorder card (Figure 44) that was put there by the manufacturer. As the last unit of goods is sold from the package or in some cases when the merchandise is transferred from the reserve to the

Figure 43. These Cards Are Punched from the Order

Figure 44. Every Package Shipped to the Retailer Contains a Card Like This

counter stock, the clerk removes the reorder card. At the end of each day, or perhaps weekly or biweekly, all reorder cards that have accumulated as the result of the period's sales are placed in a preaddressed envelope and mailed.

The manufacturer's order department maintains a central order-control desk where these unit reorder cards are checked for price changes and obsolescence as soon as they arrive in the mail. The control desk clerk has a supply of cards for any items on which a price change has occurred, and he can quickly substitute these for the original reorder cards. In the cases where an item has been obsoleted, one of two things has happened: either the item has been discontinued or a substitution has been made. The order clerk can pull the obsolete card, and, if there is a substitution, include the new card for the item replacing the one which is obsolete.

Processing the Card

He now sends all the cards—reorders, price changes and substitutions—to the machine accounting department, where they are merged with the customer master cards. Acknowledgment, invoice, packing slips, shipping notices, salesman's copy and accounting department copies are prepared in one transaction, and at high speed (Figure 45).

Figure 45. One Processing Step in the Accounting Machine Produces Them All

Further, the cards are reproduced into sales and production cards, available for weekly reorder summary reports, and for numerous analyses and reports for all branches of top management.

Usually, when merchandise is received from vendors or from the manufacturing process, automatic reorder cards are placed in the packages. When these cards are returned by the retailer for reorder, necessary customer information is gang-punched from the master card.

Some firms use a variation of this procedure. They do not include the reorder cards in their shelf stock, but have them accompany packing slips, prepunched with customer information. The reorder cards are then placed in the packages as the merchandise is prepared for shipping.

Both the retailer and the manufacturer or distributor supplying him find it desirable to check the basic stock in the store at frequent intervals. About once a month, when the salesman in the territory calls, basic stock is re-evaluated, to consider any adjustments that should be made.

One can readily see that it would be difficult to obtain an accurate, comprehensive and timely analysis of stock movement and inventory with manually posted methods. Cross-indexing colors, materials, styles, sizes and various proportions would lead to hundreds of possible combinations. Obviously then, this automatic reorder and sales analysis method saves the retailer considerable time and effort, and makes for more efficient and profitable operation.

Automatic Reorder Control by Retail and Chain Stores

Automatic reorder procedures, originally developed by the manufacturers, have been adopted by the retail outlets themselves and are being used by more and more retailers to control their basic stocks. Some shoe chains, for example, have set up carefully determined basic stocks for each store and control each store's inventory on a central basis. An IBM card is placed in each shoe box. The card is removed when a sale is made, and the cards representing a day's sales are returned to the main office. Each store's stock is then automatically replenished on the basis of the store's sales and the individual item's reorder point. Similar procedures are used by variety stores, except that a print punch price ticket is used rather than prepunched cards.

Department stores also use automatic replenishment procedures for basic stock of merchandise such as men's shirts, sheets and pillow cases, women's hosiery, etc. Both the shipping of merchandise from the warehouse and the reordering of merchandise are controlled automatically. All types of machines, including punched card and large data processing systems, are being used to process the reorder cards, depending on the individual retailer's requirements.

Advantages of the Automatic Reorder System

Vendors, manufacturers, distributors and jobbers using this system have pointed out advantages both from their own point of view and from the retailer's position as well:

1. Retailers participating in the plan report substantial increases in sales. They attribute this to having the right quantities of the right stock on their shelves, fewer stock-outs, faster turnover, and rapid service from the mill or distributor.

2. Simplified reordering saves time and work for retail store personnel.

3. Errors in orders and shipments are greatly reduced — equally advantageous to manufacturer and retailer.

4. Changes in colors, styles and models can be handled quickly, with minimum confusion to the retailer.

5. It is a fundamental of the system that the retailer secures the assistance of the manufacturer in planning a new basic stock each season; national advertising is correlated with spot promotions, and better results are achieved.

6. Production planning and control, billing, shipping and accounts receivable are simplified and stabilized for the manufacturer.

7. The reorder card serves as an effective advertising medium. It can be designed to promote the manufacturer's products, and it reaches the retail operator at a time when the products are needed.

8. Periodic order analyses are supplied to the retailer by the vendor.

9. The systematic and frequent reorder has a twofold advantage: fewer customers are lost to competitors; and sales and deliveries tend to be constant rather than to have infrequent peaks.

Service Parts Inventory Control

Most companies producing machines or mechanical devices have to provide spare parts for repairing and maintaining this equipment. Many supply these parts directly from the factory to the service outlets, either company-operated or under independent management. Others supply a wholesale distributor, who in turn supplies the retail service outlets. In most cases these service activities are small, and simplicity in the parts inventory control system is highly desirable. In many cases, stocking and identifying parts is only a part-time job, and it does not justify an intricate system.

There are many plans used by manufacturers with the problem of supplying many branch outlets with a practical and readily accessible parts supply. The plan described here combines the most common basic features of the many variations. Shipments to implement this plan can be made directly from the factory, or from a wholesale distributor level.

The Stock Control Card

The factory prepares a file of parts stock control cards (Figure 46). One card is provided for each item to be stocked by the branch outlet. These cards have the part name and part number punched into them. Further, for convenience in filing, the part number is end-printed. Three different card forms are used for this purpose. One is used for parts disbursed in units of one, with maximum stocking of 35; another for parts disbursed in units of 5, with maximum stocking of 175; and the third for items disbursed in units of 10, with 350 as the maximum stocked.

At the branch office, the opening balance is posted as soon as the cards are received. It is determined by taking a physical count of the parts on hand, and adding the amount on order.

The manager of the branch outlet must now establish ordering points for each part. Planning lists furnished by the factory or by his supplier, in addition to his own experience in issuing parts at his outlet, will help him determine this ordering point. The ordering quantity is then established on the basis of one-half the quantity shown as the ordering point.

The stockroom staff can now fill in the spaces reserved for quantity to be ordered, and stock location. An X is written on each card in the column entitled "Ordering Point," opposite the quantity established as the ordering level of that part. Using the first column of numbers on the card to the right of "Ordering Point," the opening balance, as determined by the

Figure 46. Basic Units in Service Parts Control

physical inventory, should now be indicated by crossing out the number that is one higher than the opening balance. If the opening count were 27, the number 28 would be crossed out (28). The same procedure would be followed for the cards for parts disbursed in group 5 or 10.

Operating Procedure

When the stockroom clerk is given a requisition for a part, he locates the parts stock control card in the tub file and crosses out the highest remaining number. For example, if he is issuing one part, and the number 28 was previously crossed out, he will draw a line through the 27. If he is issuing two parts, he will cross out both the 27 and 26.

Remember that an X was marked in the first column of the card to indicate the ordering point. As the parts on hand are reduced by satisfying requisitions, the stockroom clerk will indicate a card that has reached the ordering point by attaching a metal clip to the upper right corner of the parts stock control card. It is now a simple matter to remove these flagged cards from the files, use them as the source records for ordering parts, and indicate the date ordered.

When this order is delivered, the clerk can move one column to the right on the card and show the new balance — the quantity received plus the amount remaining in stock. The old quantity in the column previously used can be struck out. When all columns on the cards have been used and new cards have been provided, the old cards still have a value for historical and analytical purposes, and are usually kept for some time.

Parts Substitution List and Cards

It is typical of business of this kind that parts are being improved constantly, that new developments, engineering changes, or new processes make parts obsolete or unnecessary for restocking. A complete listing of such parts is sent to each branch parts supply room periodically, usually quarterly. In addition, a supplement can be sent monthly, and thus the outlet's records are kept current, even though the local organization may not have the staff needed to make these changes by some other method. Usually, too, because the parts substitution list and the supplements are made from punched cards on IBM machines, the same information is provided on distinctively colored cards and sent to the stockroom to be placed in the file for convenient cross reference.

Factory Order-Filling Operation

The same ease of operation is found in filling the orders at the factory. A conventional tub file application has a clerk selecting cards prepunched with part number, part name, unit cost and storage location. Factory order number, branch office number, and quantity are punched into the cards by one of several methods, and the cards are reproduced into stub cards (Figure 47). There are now two sets of cards: the original can be filed by factory number to serve as an open-order file; the stub cards should be sent to the warehouse for filling the order. As each item is selected for shipment, the stub can serve as identification. The remaining section of the card is ready for use in preparing packing slips, in selecting the on-order card from the file (serving as a finder card), in originating issues cards for use in the inventory account, and in billing.

Figure 47. The Stub Identifies the Part, the Card Has Several Uses

We have examined the various aspects of inventory control and their effect on the operations of a business. Material accounting is the dollars-and-cents aspect of inventory. We have pointed out that raw materials, stock on hand, finished products, and unfinished products, alike are related to the business organization in a manner similar to that of cash. This means that there must be entries to account for these assets, just as there are entries to account for dollars and cents.

The primary requirements of material accounting are to:

1. Record the receipt of material.

2. Record the issue of material to production orders, plant maintenance and operation.

3. Record completed production and transfers to finished stock.

4. Reduce finished stock for sales made.

You will probably find that while entries recording the value of materials received are normally obtained from the payables distribution function, these values affect both accounts payable and material accounts (Figure 48).

Material issues fall generally into two types: direct and indirect. Parts or raw materials to be used on factory or production orders are called direct material and are charged to specific orders. Stock to be used for maintenance or supervisory purposes is indirect material and is charged to expense accounts (Figure 49).

Credits to Inventory

As materials are issued from inventory, the material account must be reduced. Processing the issues cards will develop the credit entries. It is true that these cards, at this point, contain only quantities and must be priced or costed with the proper unit-issue cost. There are, however, so many procedures and variations of costing and pricing that the subject will merely be mentioned here and discussed fully in a later section.

Figure 50 shows how issues transactions, arranged by material class and stock-number sequence, produce the credits to inventory report.

Figure 48. Compensating Entries
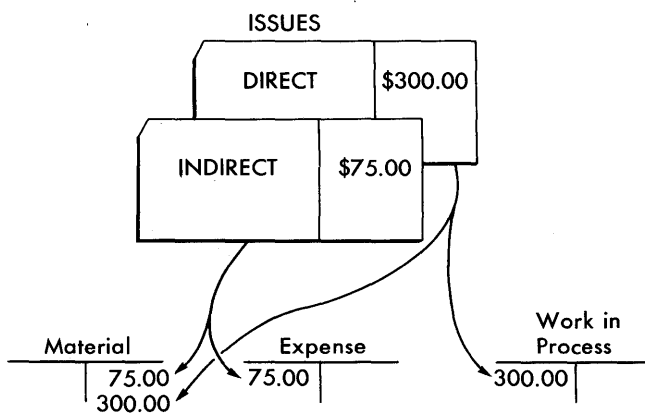
Figure 49. Both Types of Issues Properly Charged

CREDITS TO INVENTORY				
DATE 6-30-6-				
MAT'L CLASS	STOCK NUMBER	QUANTITY	AMOUNT	MATERIAL CLASS TOTAL
310	10300	967	234.11	
310	20400	786	1,083.18	
310	29648	13	76.58	
310	30623	66	2,640.00	
310	38942	500	2,574.60	
310	40732	30	1,055.11	
310	41693	212	1,598.14	
310	50800	180	1,524.20	
310	52634	210	1,393.50	
310	60900	347	2,114.75	
				14,294.17*
320	10005	60	1.74	
320	20012	710	365.79	
320	20023	373	739.66	
320	30023	15	29.75	
320	30064	902	298.08	
320	32341	25	88.25	
320	36521	16	120.96	
320	38753	29	223.01	
320	43910	102	102.00	
320	43960	23	46.00	
320	52306	96	1,068.36	
320	56072	180	112.60	
320	60999	22	66.66	
320	71288	168	290.28	

Figure 50. The Inventory Account Is Credited

MATERIAL CHARGES

☒ PRODUCTION ORDERS — W.I.P. DEBIT
☐ EXPENSE ACCOUNTS — DEBIT   DATE 7-15-6-

PRODUC. ORDER / EXPENSE ACC. #	DEPT. CHGD.	MATL. CLASS	STOCK NO.	QUANTITY	AMOUNT	TOTAL
12248		310	20400	786	$ 1,033.18	
12248		310	38942	500	2,574.60	
12248		340	53814	526	2,540.58	$ 6,198.36 *
12253		320	10005	60	$ 1.74	
12253		320	20001	54	20.20	
12253		340	30730	85	96.41	
12253		410	27804	60	143.50	$ 261.85 *
12315		310	41693	212	$	
12315		310	52634	210		
12315		320	61056	216		
12315		360	14702	220		
12331		310	20400	786	$	
12331		320	20012	710		
12331		480	36840	790		

Figure 51. Direct Issues Are Charged to a Work in Process

MATERIAL CHARGES

☐ PRODUCTION ORDERS — W.I.P. DEBIT
☒ EXPENSE ACCOUNTS — DEBIT   DATE 7-15-6-

PRODUC. ORDER / EXPENSE ACC. #	DEPT. CHGD.	MATL. CLASS	STOCK NO.	QUANTITY	AMOUNT	TOTAL
800010	1	410	59135	21	$ 26.25	
800010	1	410	86284	17	18.70	
800010	1	425	65139	5	70.93	$ 115.88 *
800010	5	300	62135	500	$ 625.00	$ 625.00 *
						$ 740.88 □
800015	3	200	17200	100	250.00	
800015	3	305	25070	50	112.50	$ 362.50 *
800015	25	450	17680	12	$ 421.20	
800015	25	700	67500	1,000	500.00	
800015	25	825	43750	15	19.50	

Figure 52. Indirect Issues Are Charged to Expense Accounts

FACTORY EXPENSE BUDGET STATEMENT

DEPT. NAME BUILDINGS & GROUNDS | DEPT. MANAGER W C GUTHRIE | PROJECT MANAGER A B MCCALLOM | PROJECT NO. 184 | DEPT. NO. 550 | MONTH ENDING APR 30,196-

ACCOUNT NAME	ACCT. NO.	DEPT. NO.	CURRENT MONTH WORKING DAYS 21 / DIRECT HOURS			YEAR TO DATE WORKING DAYS TO DATE 83 / WORKING DAYS REMAINING 171 / DIRECT HOURS				
			BUDGET AMOUNT	(-) ACTUAL EXPENSE	(=) OVER OR UNDER (-) EXPENSE	ORIGINAL BUDGET AMOUNT	(+ OR -) AUTHORIZED CHANGES	(-) ACTUAL EXPENSE	(=) OVER OR UNDER (-) EXPENSE	PERCENT
SERVICE SALARIES & WAGE										
ADMIN & TECHNICAL ASST	204	550		24	24-			53	53-	□-
ARCHITECT & PLANT DES	221	550	11	14	3-	19		123	104-	547.4-
BLDG & OTHER MAINTENAN	259	550	692	355	337	1211		681	530	43.8
CLEANER & GARDNER	260	550	23		23	40		12	28	70.0
TRUCKER & POWER VEH OP	267	550		18	18-			20	20-	□-
OTHER REMUNERATION										
OVERTIME PREMIUM	302	550	8	18	10-	14		26	12-	85.7-
SHIFT PREMIUM	304	550	14		14	25			25	100.0
MATERIAL & SUPPLIES										
ACIDS & CHEMICALS	401	550		68	68-			68	68-	□-
CLEANING SUPPLIES	406	550						11	11-	□-
OTHER SUPPLIES	409	550						19	19-	□-
BUILDING & OTHER MAINT	459	550	115	27	88	202		33	169	83.7

Figure 54. Efficiency: Budget Vs. Actual Expense

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Material Charges

Aside from other information, each issues card is usually also punched with an expense account number or with a production order number, depending on whether the charge is to be made to indirect material or direct. The charge codes used should be so constructed that one sorting operation will separate direct from indirect charges. Now the two reports shown in Figures 51 and 52—a material-charges-to-production-orders report, and a material-charges-to-expense-account report—can be run on a high speed accounting machine. These analyses, and summary cards simultaneously obtained, can provide entries to the work-in-process account, and for general ledger accounting as well.

Cost Accounting

If a business is to be conducted on a profitable basis, certain things must be known:

How much did it cost to produce a unit?

How can this production cost be controlled?

Three essential factors enter into the answers to these questions: material, labor and overhead.

With the IBM method of punched card accounting the answers can be found quickly and efficiently. The direct material-issues cards, reproduced at an early stage in the preparation of these reports, were immediately filed into the open-item work-in-process file. Similar cards representing labor performed and overhead charges, usually computed on a labor-hour basis, were also prepared and filed. Here, then, are the elements needed to complete the cost accounting requirements.

Eventually manufacturing will have completed all the operations of a given production order. Then the staff can make the necessary accounting entries to transfer the costs of manufacture from the work-in-process account to finished goods (Figure 53).

Budget Reports

Just as direct material-issues cards carried a charge against some specific department, so it is with the indirect material issues. These cards are merged, monthly, with departmental budget and year-to-date cards. Reports with any amount of detail desired can be prepared from this file to provide the basis for analysis of departmental efficiency, and for controlling expense, whether on a departmental level or by top management (Figure 54).

Reducing Inventories by Sales

As sales orders were received, the finished goods inventory cards provided the basis for filling the orders, shipping the goods, and billing the customer. There is even more utility in these cards, in that they can be used to prepare informative sales reports. Cards reproduced from these cards were previously costed for charges to sales. Now these cards, properly costed, provide the source for entries to reduce the finished goods account (Figure 55).
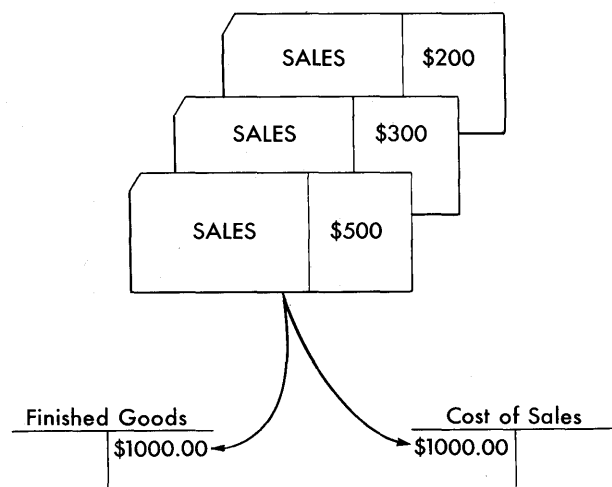

Figure 53. Accounting Entries When Production Is Completed

Figure 55. Accounting Entries When Goods Are Sold

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Costing the Issues Cards

There are many variations of procedures for costing the issues cards, each of them developed, because of some problem or advantage, to suit the peculiar requirements of a given industry or business. We can reduce most of these variations, however, to a few basic concepts:

> Standard cost
> Average cost
> First in first out
> Last in first out
> Last purchase price

Standard Cost

The cost accountant for an organization using this system compiles data about each job or operation. He considers wage rates, usage of equipment, indirect costs and services, time-and-motion studies, and material requirements and costs. Analytical reports derived from this information are used in establishing standards that indicate how much the finished product should cost. Every effort is made to accomplish production at or below this standard. Any trend or deviation is carefully studied for cause and correction. Periodically, or when a special trend is observed, these prices are revised.

The standard price so established can be punched either into the corresponding balance cards or into a separate file of costing cards. At any rate, this factor serves as a group multiplier, or a gang-punching source to cost the materials issued for a job in process.

For finished stock, similarly, the standard price may be prepunched into the tub file cards used to invoice the customers, or the unit price may be gang-punched from a separate cost file. Whatever method is used, the figures derived are used to reduce the finished-stock account.

There are a number of advantages in this costing procedure that have made it popular:

Simplicity—it requires minimum clerical and accounting time.

Responsibility—by making deviation from standard immediately noticeable, it focuses attention on the production or distribution point responsible for excessive expense.

Incentive—it provides a definite goal for all elements of production to approach.

Timeliness—it makes recognition of trends and consequent production and sales forecasts possible at the right time.

Average Cost

In this system, the average unit cost of an item in stock is determined by dividing the total value of the item by the quantity in stock. Some firms make this calculation only once a month, and use the computed average price to cost all issues until a revised calculation is made the succeeding month. Others will allow their costing average to remain unchanged until labor or raw material reports indicate a definitely changing trend, at which time they calculate a new average.

Commonly, at the end of an accounting period, a balance-forward card is summary-punched with the

Figure 56. Automatic Calculations Produce the New Unit Price

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quantity and value figures accumulated by the accounting machine. The new average unit price is then computed on a calculating punch:

$$\frac{\text{Value}}{\text{Quantity}} = \text{Unit Price (Figure 56)}$$

An alternate method would be to process receipts, issues and previous balance cards in a calculating punch:

$$\frac{\text{Old Dollar Value} + \text{Dollar Value of New Receipts}}{\text{Total Quantity}} = \text{Average Unit Cost}$$

Each issue card is now extended by the computed average unit cost, while the new balance figures are summary-punched into a trailer card. The flow chart in Figure 57 shows this approach.

Flow Chart Steps for Average Costing

1. Receipt cards are obtained from the accounts payable distribution, issues cards from the inventory control application.

2. These cards, sorted by stock number, are used to select and merge with the corresponding balance cards from the cost balance file.

3. A blank card is merged in behind each stock-number group.

4. The calculating punch:
   a. computes average cost.
   b. punches average unit cost into each issue card.
   c. computes and punches quantity X unit cost into each issue card.
   d. accumulates quantitative balance data and value and punches these figures into the blank trailer card, making it the new balance card.

5. The new balance cards are returned to the file.

This method can be used to good advantage under special circumstances. Where market prices are subject to constant fluctuation, or where a large variety of small items is issued in small quantities, average costing will reduce clerical detail and give a reasonably accurate basis where extremes of cost might exist. Furthermore, the effect of unusually high or low prices will be counterbalanced, facilitating production and sales forecasts.
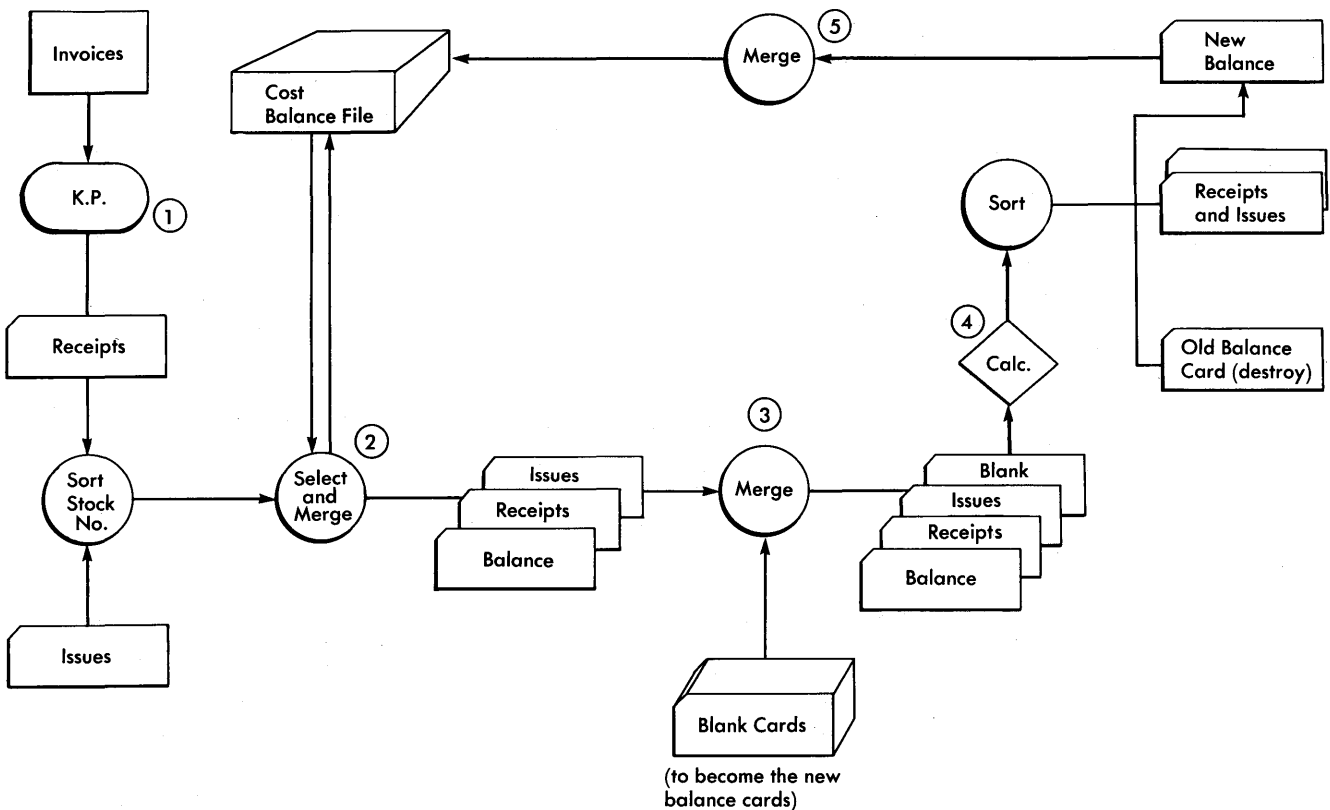
Figure 57. A Typical Procedure
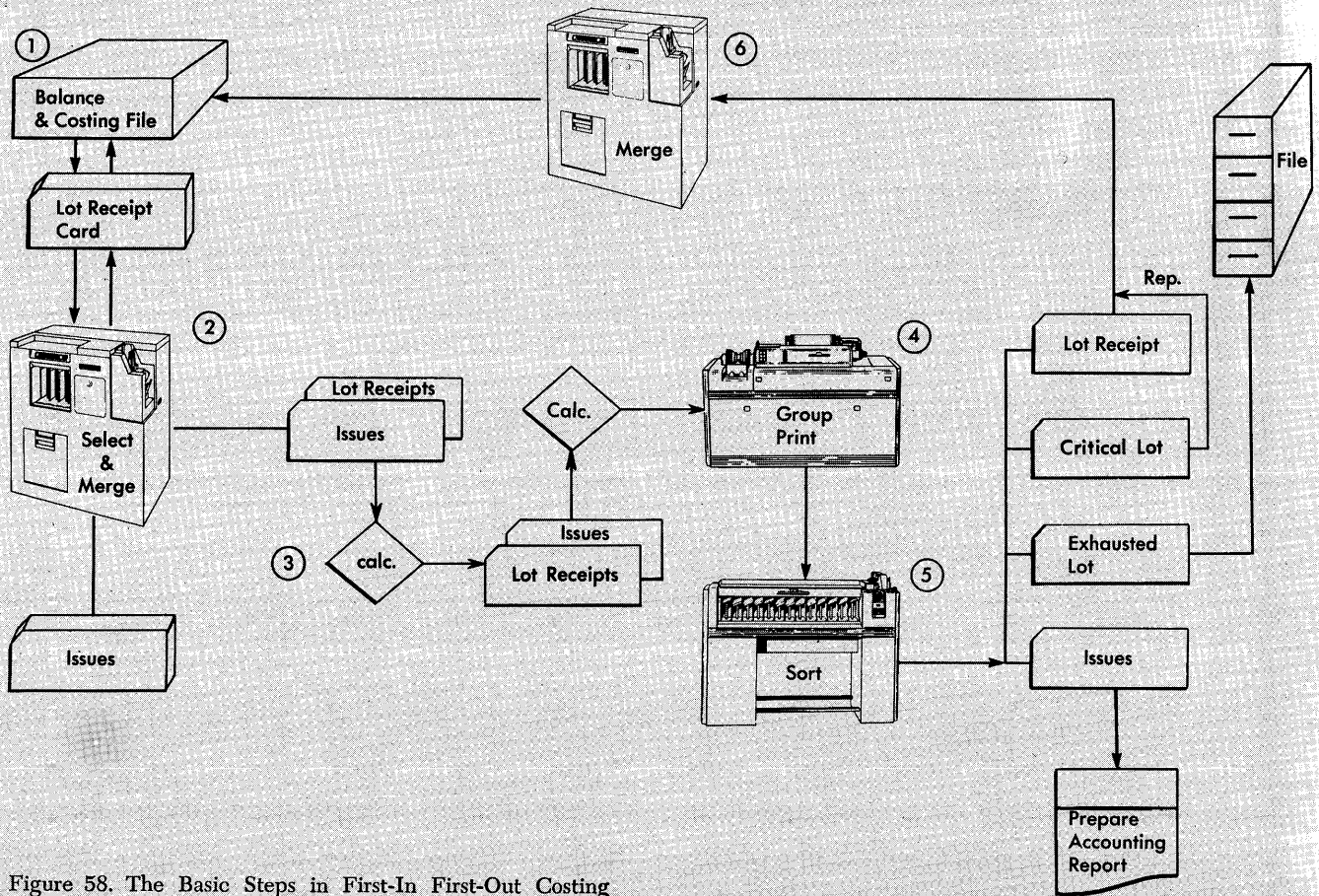
Figure 58. The Basic Steps in First-In First-Out Costing

First In First Out

This method is especially applicable in industries where receipts are in relatively large quantities and have a high unit cost. This is because it is necessary to identify material drawn from a given lot. It is also desirable that not more than two or three different lots be on hand at any given time.

The assumption is that material first acquired is used first, and is priced accordingly.

It is necessary, then, that the records for each purchase lot be identified and accounted for separately. The unit inventory tub file system utilizes this pricing principle. In the unit inventory plan, unit cards were priced as they were prepared. In plans other than unit inventory, the procedure is basically as outlined in the flow chart (Figure 58):

1. The balance and costing file consists of one lot receipt card for each shipment received of each stock-numbered item. In addition to reference data, these factors are punched in the cards:

> date of receipt
> quantity received
> unit of measure
> unit cost
> total cost
> card identification

Each stock-numbered group of lot receipt cards is sorted by date, with the oldest dates in front.

2. At the end of the accounting period, the issues cards are sorted into stock-number sequence and merged in front of the corresponding active lot receipt cards, while the inactive are rejected.

3. The cards are processed in a calculating punch, in the order shown in Figure 59.

> a. The amount issued is accumulated from the issues cards and stored as a credit figure. Then the quantity of the first lot card is tested against the amount issued. If this lot is sufficient to satisfy all the issues, then total quantity issued, revised lot quantity, revised lot value, average unit cost of issues, and total value issued are calculated and punched. This card is also identified as the *critical lot card* by an X-punch.

> b. If the quantity on the first lot card was insufficient to satisfy the total issues, the unit cost and quantity are stored; an X is punched to identify the lot card as exhausted; the total issues quantity is reduced by the amount of the first lot; the remaining quantity of issues is tested
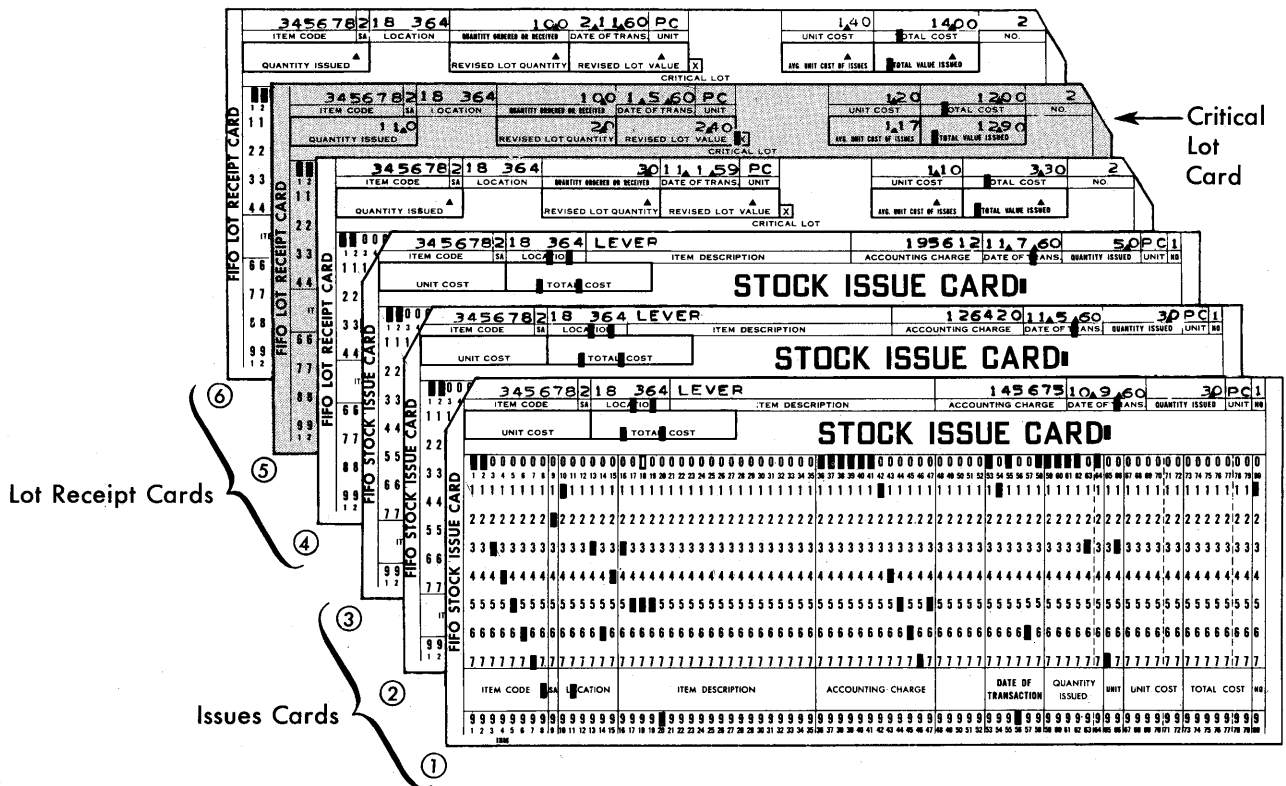
Figure 59. Sequence of Cards in the First Run through the Calculator

against the quantity of the second lot card; and this card is now identified as the critical lot card by an X-punch.

c. Now this critical lot card is calculated for the same factors, total quantity issued, revised lot quantity, revised lot value, average unit cost of issues, and total value issued.

d. All remaining lot cards are ignored by the calculator.

e. When all these calculations have been completed, a second processing in the calculator is necessary. The average unit cost of issues becomes the multiplier, and all the issues cards are extended, quantity times average unit cost. (To accomplish this without sorting the cards, they are placed in the calculator face up, twelve-edge first, and the control panel is wired accordingly.) The issues cards are punched with the extended cost and the unit price; the lot receipt cards are rechecked against the issues cards for zero-balance proof. Figure 60 shows the sequence of the cards in the

second calculator run.

4. This step is intended to prove the calculating operations by tabulating lot receipt and issues cards for the calculation balancing report. The new values established are proved visually by adding and subtracting the various factors and accepting zero balance as proof. It must be recognized, however, that small variances can result from $.005 pickup in division and multiplication. Proofs and variations are shown in the report in Figure 61.

5. The cards are sorted to separate lot cards, exhausted lot cards and issues cards. In the same operation, the issues cards are sorted to the sequence necessary to produce required accounting reports.

6. The critical lot cards are reproduced, transferring revised quantity and revised value to the normal location on the card, and, together with unused lot receipt cards, are returned to the balance-and-costing file. Exhausted lot cards are placed in an historical file for future use.

A detailed description of this procedure is given in the IBM publication, *Inventory Accounting, First In, First Out Method* (F20-0055).
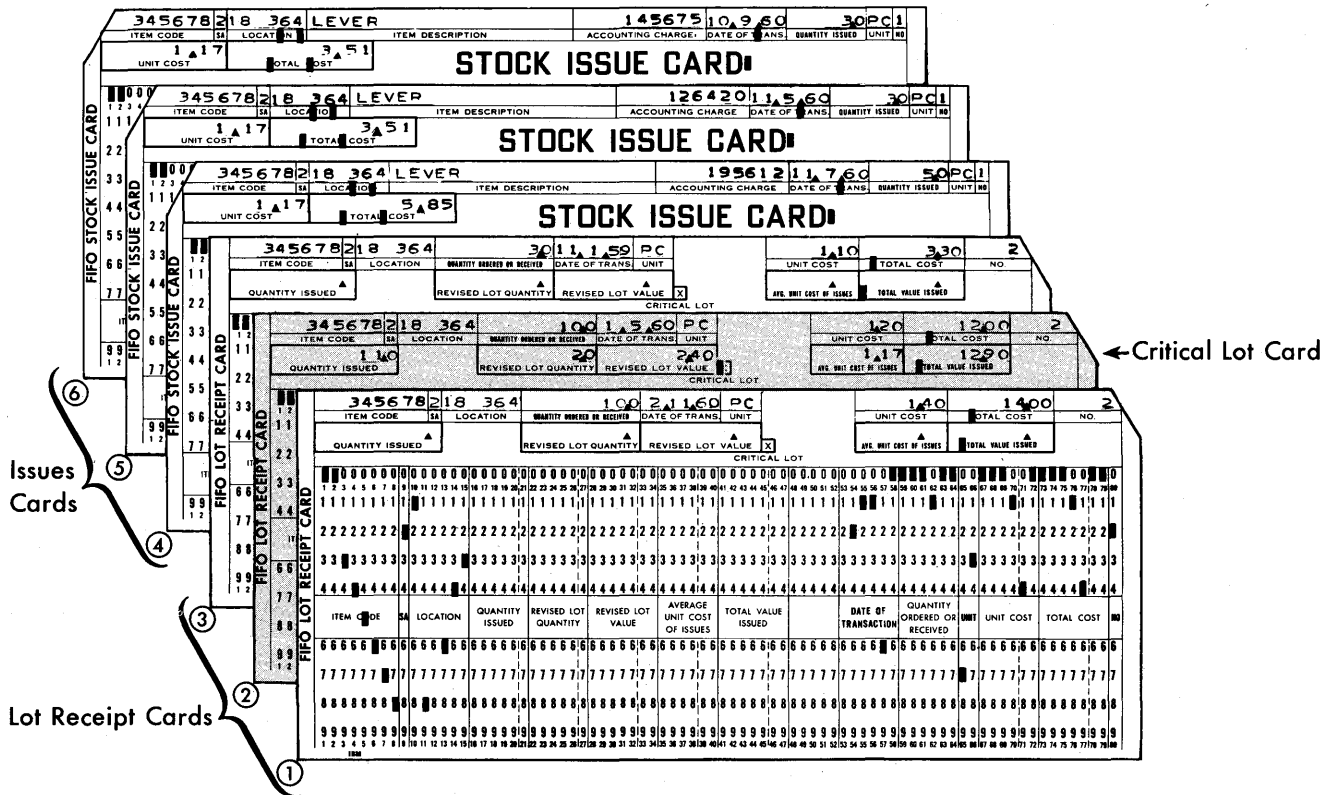
Figure 60. Feeding the Cards Face Up, Twelve-Edge First, Results in This Sequence

FIRST - IN FIRST - OUT CALCULATION BALANCING REPORT

ITEM CODE	DATE OF LAST LOT USED	AVERAGE UNIT COST	INVENTORY QUANTITY / INVENTORY VALUE	REVISED FIFO LOT QUANTITY	REVISED FIFO LOT VALUE	TOTAL ISSUES QUANTITY	TOTAL ISSUES VALUE	SIG.
3 4 5 6 7 7	3 5 6 -	2 1 0 0			1 5 0 0 0 0	7 5 0	7 5 0 0	✱
					1 5 0 0 0 0	7 5 0 CR	1 5 7 5 0 0	
							1 5 0 0 0 0 CR	
3 4 5 6 7 8	3 5 6 -	1 1 7	1 2 0 0	2 0	2 4 0	1 1 0	1 2 9 0	✱
			1 6 4 0	2 0 CR	2 4 3	1 1 0 CR	1 2 8 7	
					3 CR		3	
3 4 5 6 7 9				1 5 0	1 5 0	9 0 0		
				1 5 0	1 5 0 CR	9 0 0 CR	CR ✱	

Callout (345677): An illustration of an item deck prepared in error. Machine calculations are correct, but a digit 2 was incorrectly punched in the field reserved for average unit cost in the critical lot card.

Callout (345678): A valid test deck showing correct results. $.03 variances normal from half pickup in division.

Callout (345679): Illustrating the absence of a critical lot card (no asterisk). Total quantity issued exceeded quantity available from lot cards. Issue cards were not extended.

Group Indicate — Line 1				← List critical lot card →			
Line 2 / Minor	4A - 4B Add Revised critical lot quantity and all succeeding lot quantities.	2C - 6C Subtract all issues. Add critical and all preceding lot quantities.	2A - 6A Same pattern for values	8A Add all issue quantities	8B Add all issue values		
Line 3 / Intermediate	4C - 4D Add revised critical lot value and all succeeding lot values.	2D - 6D Add revised critical lot quantity. Transfer 2C & 6C to 2D & 6D	2B - 6B Same pattern for values	8C Add critical total issued quantity. Transfer 8A to 8C	8D Add critical total issued value. Transfer 8B to 8D		

Figure 61. Visual Proof of the Calculations

Last In First Out

As the name implies, material issued is priced at the cost of the lot most recently received. When that lot is exhausted, the price of the next oldest is used. If the inventory has been replaced, the price of the most recent acquisition is used. This, of course, requires that each incoming shipment be maintained as a distinct lot in record keeping.

From the procedural standpoint, it is the same as the method described for FIFO. However, in LIFO the lot receipt cards are filed in stock-number sequence with the latest shipment at the front of each group (Figure 62).

This method was developed for tax purposes in those industries subject to periods of increasing or declining prices. It tends to equalize taxes over several periods, though not necessarily resulting in a saving. The general theory is that financial statements based on this method of costing will be more accurately related to actual operations, and not affected by profit and loss due to changing prices.

Last Purchase Price

This plan is in common use in those businesses where raw materials are standardized and where prices are more or less rigidly fixed by market prices such as the commodity exchange quotations. Examples would be beef, corn, cotton, tobacco and wheat. Actually, the use of this plan results in costing on a replacement basis.

Where the plan is used, a master cost card file is maintained, with a single card for each stock item. It usually contains the factors:

> material class
> stock number
> date
> description
> unit price

Each time there is a significant change in price on an invoice for new material, or if there must be a revision because of changed labor costs or technological change, the appropriate master card is removed from the file and replaced by one revised.

Whenever transactions are to be costed, the master cards for the active items are selected and merged with the transaction cards in a single machine operation. The masters are used as group multipliers, or as a source for gang punching (Figure 63). When physical inventory is taken, the stock is valued by using these cards to establish the unit price for each item.
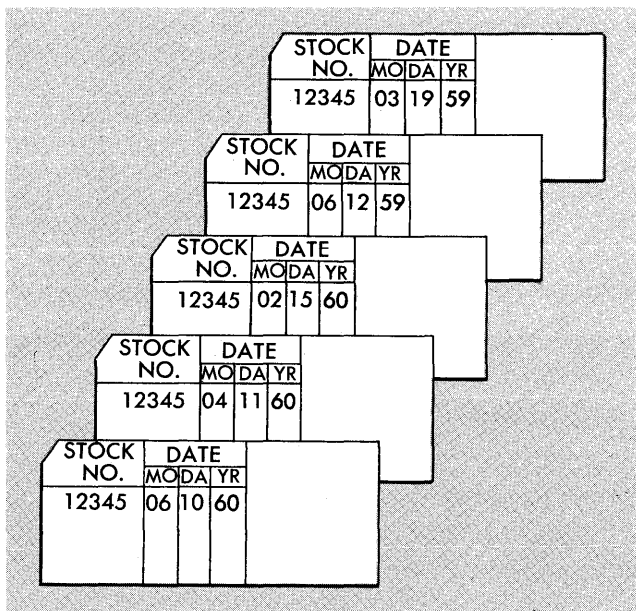
Figure 62. In LIFO, the Newest Cards Are in Front
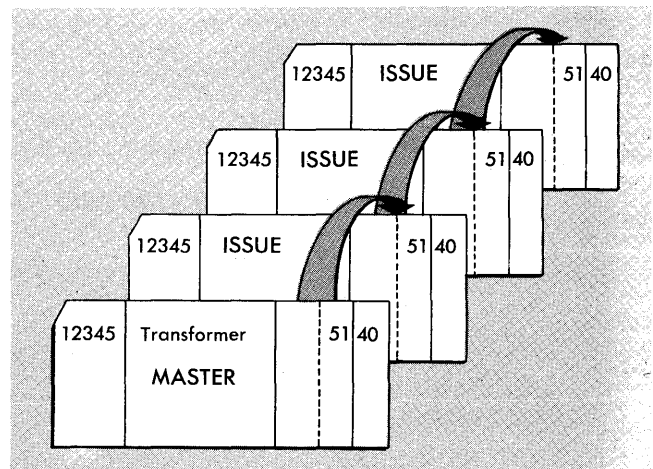
Figure 63. The Master Cost Card Is the Source

52

Producing Accounting Entries

When the issues cards have been costed, there are many uses for them. The uses and reports that may be derived vary with the needs of the business being considered. There are many variations of the procedure shown here (Figure 64), but they are fundamentally similar:

1. A credits-to-inventory report is prepared on the accounting machine to reduce each material class account. Summary cards are produced during this operation, and are used to develop the general ledger summary report.

2. The issues cards are sorted into two groups with the direct charges in sequence by production order number, and the indirect charges in sequence by department and account number.

3. Accounting machine operations on these two groups of cards make possible material charges to the expense accounts report and to the work-in-process report. A by-product of this step is the summary card, for the general ledger.

4. Direct material issues cards now go into the work-in-process file, where charges for labor, material and overhead are accumulated until the order is completed. Cost accounting reports originate from this file.

5. Indirect material charges are merged with budget and history cards and departmental expense reports are prepared on the accounting machine.
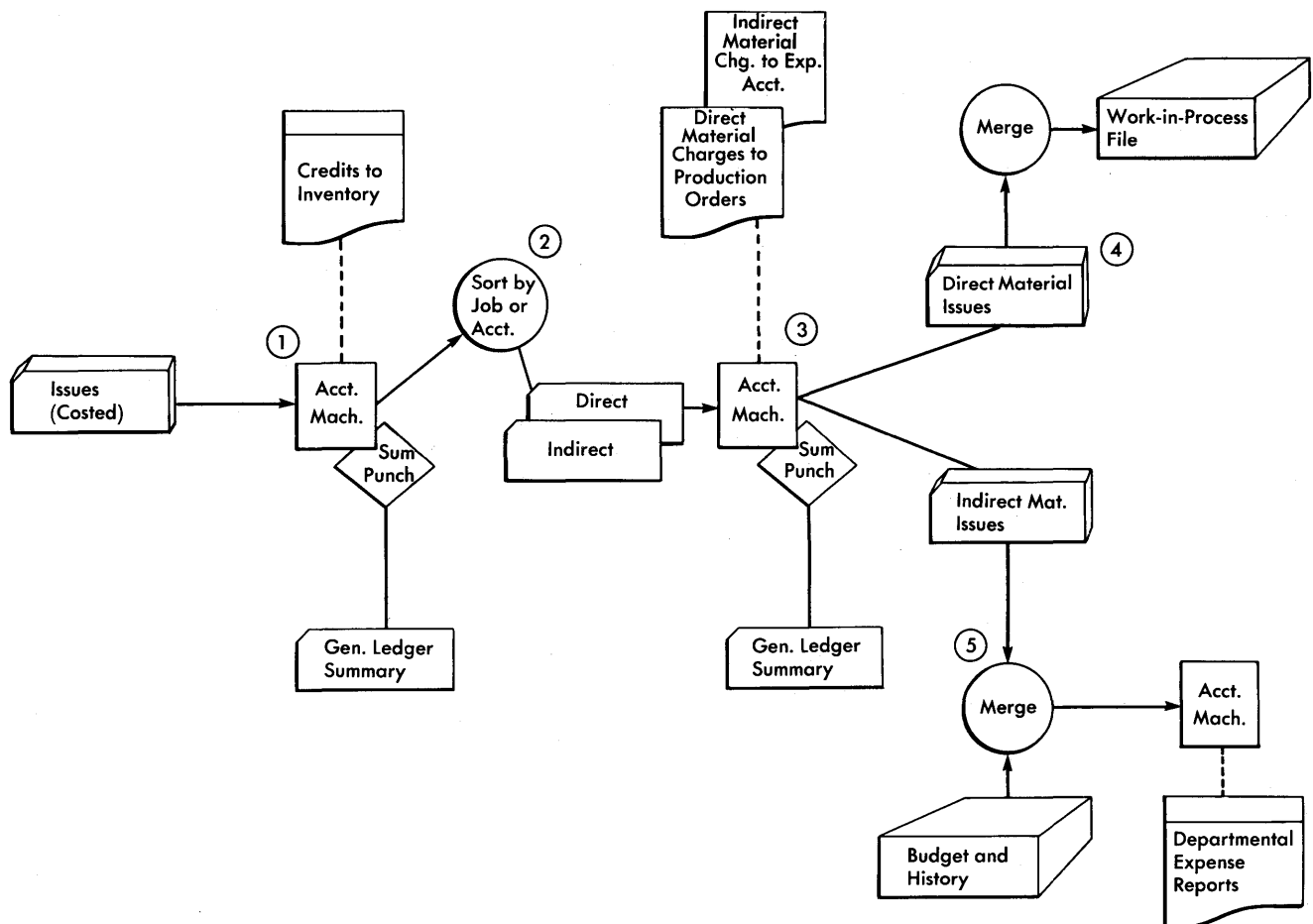
Figure 64. Producing Accounting Entries After the Issues Have Been Costed

Analysis Reports

The most obvious benefit derived from the punched card method of accounting is the saving in clerical costs while achieving greater speed and a higher degree of accuracy. However, the reports available for analysis, study and planning may be the keys to far greater benefits.

This is especially true in inventory and material accounting operations. For many years, retailers and wholesalers have placed great significance on turnover as a focal point in profitable operation. Likewise, industrial organizations have become increasingly aware of the importance of turnover in controlling their inventories.

Among the leaders in this trend is the automobile industry, where remarkable records have been achieved by supplying assembly plants with parts and subassemblies only days in advance of their planned usage. Parts dispatched from the manufacturing centers to the local assembly plants are fed directly from freight cars to the assembly lines. Obviously, this has resulted in tremendous savings in warehouse and handling costs. And these savings—dollars that would have been expended on burden costs, facilities, and inventory investment—are available for use in activities that will show a more profitable return.

The IBM system of punched card inventory accounting makes such operations possible because accurate reports, based on information from widely divergent sources, but now shown in their true relationship to each other, provide the basis for foreseeing needs and problems. Production and deliveries can be scheduled, and the schedules can be kept.

High-Priced Items

Much of the inventory dollar value in most businesses is represented by a relatively few high-priced items. In such cases an analysis of turnover can do a great service, and can be done efficiently by examining reports of the high-priced items only.

If the balance cards for these special-consideration items are identified by a special punch, a turnover study can be quickly and easily printed (Figure 65), and well based conclusions reached.

At the end of each month, balance cards identified as high-priced or special-consideration items are reproduced, and the new cards are filed until such time as the analysis is required. The file, in sequence by stock-number groups, is processed in a calculator to arrive at average inventory:

$$\frac{\text{Total of Month-End Balances}}{\text{Number of Months in Study}} = \text{Average Inventory}$$

During the period to be analyzed, usage figures have been carried forward in each balance card. Now turnover for this period can be computed:

$$\frac{\text{Usage}}{\text{Average Inventory}} = \text{Turnover}$$

In the retail and wholesale fields, these usage figures are derived from sales rather than from issues. The velocity report (Figure 66) is typical of the analysis found to be of great value in enterprises of this kind. In the report illustrated, sales are summarized quarterly. The weekly average quantity sold can be computed:

$$\frac{\text{Quarterly Sales}}{\text{Number of Weeks}} = \text{Weekly Average}$$

Furthermore, the weekly average, divided into the on-hand quantity, will determine the number of weeks' supply available.

In sorting the cards for this report, the high-velocity or rapidly moving items are placed in the front of the file in weekly sales volume groups. The cards are listed on the accounting machine to provide meaningful turnover information and to show which items are overstocked.

In a selling organization, management expects each item stocked to justify its investment in money and space. Furthermore, to be profitable, most wholesale operations must show a high level of tons handled per man-hour. Anything which improves the tons-per-man-hour condition reduces overhead and increases profit.

Analyzing Turnover

By analyzing turnover and presenting it in its most significant form, the velocity report can help in working out the proper location of goods in the warehouse. By proper interpretation of this report, it is possible to reduce the handling of merchandise from receiving to shipping. For instance, some items are sold in small lots, and should be stacked or shelved. Others, fast moving and in large quantities, should be palletized, stored on flats, and loaded in quantity by lift trucks.

Everyone is aware of the importance of obsolescence as a cost in inventory maintenance. But this too can be controlled if it is recognized at an early date. We have already seen how it is possible to compute the average number of issues per week or per month from the accumulation of issues carried in the balance cards.

Low issues activity and high months' supply on hand are clear-cut danger signals. Timely recognition of these signals will lead to a careful examination of the factors which have produced this condition. Then proper steps can be taken to avoid obsolescence loss. A good example is the analysis of inventory activity (Figure 67).

INVENTORY ANALYSIS

DATE 6-1-6-

INVT. CLASS	PART NUMBER	DESCRIPTION	12 MONTH USAGE	AVERAGE INVENTORY	TURN-OVER	UNIT COST
140	2345	BASE CASTING 203	1,235	325	3.8	$ 45.50
140	2988	BASE CASTING 308	540	230	2.3	37.75
140	3075	FRAME	1,235	164	7.5	28.80
140	3146	DRIVE SHAFT	753	80	9.4	32.40
140	3234	CAM	3,705	208	17.8	12.20
140	3289	GEAR	4,994	305	16.4	3.38

Figure 65. A Study of How Fast These Items Move

VELOCITY REPORT

DATE 6-15-6-

STOCK NO.	PACK	SIZE	DESCRIPTION	UNIT COST	INVENTORY		QUANTITY SOLD			WEEKS STOCK
					QUANTITY	VALUE	3 MONTHS	WEEKLY AVG.		
4436	48	1/2	OCEAN DELIGHT TUNA	13.68	504	$ 6,894.72	1,384	100 and Over	106.6	4.8
4564	2	25LB	BEST SEAL FLOUR	3.57	299	1,067.43	1,931		148.7	2.0
11878	6	10LB	SUGAR PAPER	5.38	264	1,420.32	3,485		268.3	1.0
14624	12	46OZ	FLORIDA ORANGE JUICE	4.01	68	272.68	1,406		108.3	.6
				4*		$ 9,655.15*				
1924	12	2LB	ACE CAKE FLOUR	3.90	170	$ 663.00	727	50 to 99	56.0	3.0
3334	48	1LB	BEST BUY DOG FOOD	3.26	305	994.30	760		58.5	5.2
4487		25LB	ACME BLEND FLOUR	1.77	48	84.96	1,229		94.6	.5
10320	48		KLENZO CLEANER	4.41	603	2,659.23	814		62.7	9.7
16422	24	2	COLUMBIA TOMATOES	2.61	58	151.38	879		67.7	.8
				5*		$ 4,552.87*				
1696	12	8OZ	ZENITH BABY FOOD	2.00	62	$ 124.00	4	Less than 1	.3	6.6
1898	50	IND	TOASTIES	.65	4	2.60	3		.2	20.0
3335	48	1	BE SURE CAT FOOD	5.20	96	499.20	4		.3	20.0
9506	6	10	STANDARD BRAND CATSUP	4.07	243	989.01	7		.5	86.0
				4*		$ 1,614.81*				

Figure 66. Supply on Hand, Based on Current Sales

NORTHWESTERN SUPPLY CO.
ANALYSIS OF INVENTORY ACTIVITY

12 MONTH PERIOD ENDING 7-1-6-

STOCK LOCATION	STOCK NUMBER	DESCRIPTION	UNIT	DATE OF LAST ACTIVITY	NET ISSUES FOR PERIOD			BALANCE ON HAND		
					NUMBER OF TRANSCTNS.	QUANTITY	AVERAGE PER MONTH	QUANTITY	MONTHS' SUPPLY	VALUE
2715-237	127205	LIGHT RECEPTACLE	EA	7/54	2	4	.3	16	53.3	$ 4.32
2715-420	247389	SOLENOID, HEATER	EA	7/54	1	1	.1	7	70.0	4.48
2715-267	111462	SWITCH,STARTER	EA	8/54	1	4	.3	4	13.3	8.64
2715-601	896124	PINION STUD	EA	9/54	4	16	1.3	84	64.6	9.24
2716-234	59827	GASKET, MANIFOLD	EA	11/54	2	12	1.0	16	16.0	7.52
2716-320	614	WASHER, RUBBER	DZ	12/54	1	3	.2	14	70.0	2.52
2717-086	6213	BOLT, CARRIAGE	DZ	12/54	1	2	.2	27	135.0	32.40
2717-742	1032	BEARING,CLUTCH	EA	1/55	1	1	.1	9	90.0	34.83
2717-748	148722	AXLE	EA	3/55	1	1	.1	3	30.0	24.60
2719-147	2642	BRUSH,GENERATOR	EA	3/55	3	9	.7	42	60.0	7.14
2719-382	222649	REGULATOR	EA	3/55	4	4	.3	3	10.0	3.78
2720-41	421	VALVE	EA	3/55	6	38	3.0	51	17.0	125.97

Figure 67. These Items Had Very Little Activity during the Last Twelve Months

Branch Locations

Many organizations maintain several different warehouse or branch store locations. Wherever this is true, it is highly desirable to maintain separate inventory records for each location. Where the size of the operation warrants it, each location has its own accounting machine installation, and the balance cards are reproduced periodically and forwarded to the machine accounting department of the home office to be combined with similar cards from all the other locations. There they are used for the preparation of comprehensive overall reports similar to those shown in Figure 68.

If, as in the case of the firm with numerous branch store outlets, it is impractical to maintain a machine installation at each location, transaction data is forwarded from the branch locations to the central office and processed there.

The compilation of master records offers obvious advantages. For instance, slow-moving stock in one geographical area may move fast in another. The stock of high-cost items at each location can be reduced to a minimum, because requirements of one location can be met from the stock of another. A truer picture of velocity or obsolescence can be obtained by comparing trends in difficult areas. And so on.

Sales Analysis

Figure 69 is an illustration of a summarized report showing the status of each product class with comparative figures. This is the type of report that will provide top management with a clear perspective of the overall status of the inventory. The rapid transmission of this data is facilitated by card-to-tape, tape-to-card, and transceiver machines. And the scope, accuracy and efficient use of this information is made possible by the great flexibility of the IBM method.

An example of this flexibility is the condensed picture of the relation between sales activity and stock status on a basis of dollars to units (Figure 70). This type of comparison is particularly significant to buyers and purchasing agents. Similar reports are widely used by retail firms.

CONSOLIDATED STOCK STATUS REPORT

DATE 7-1-6-

DESCRIPTION	UNIT	1	2	3	4	5	6	TOTAL QUANTITY	UNIT PRICE	TOTAL VALUE	STOCK SYMBOL
LACQUER BLACK	PT	137	75	20	46	32	76	386	$ .550	$ 212.30	35 06 004
LACQUER BRSHG WHITE	PT	174	49	72	73	25	85	478	.450	215.10	35 06 005
LACQUER CLEAR	PT	167	25	90	85	19	25	411	.405	166.46	35 06 008
LACQUER CRIMSON											
LACQUER CHINESE RED											
LACQUER MAROON											
LACQUER PINK											
LACQUER SKY BLUE											
LACQUER MISTY BLUE											
LACQUER ROYAL BLUE											
LACQUER SEAFOAM GREE											
LACQUER FORREST GREE											
LACQUER MODERN GREEN											
LACQUER SUNBURST YEL											
LACQUER LEMON YELLOW											

CONSOLIDATED STOCK STATUS REPORT

DATE 7-1-6-

DESCRIPTION	UNIT	UNIT PRICE	VALUE	NET ISSUES MONTHLY AV.	NET ISSUES CURRENT MO.	BALANCE ON HAND MO. SUPPLY	BALANCE ON HAND QUANTITY	STR. RM.	STOCK SYMBOL
LACQUER BLACK	PT	$ .550	$ 75.35	58.4	52	2.3	137	1	
		.550	41.25	21.6	24	3.5	75	2	
		.550	11.00	5.1	3	3.9	20	3	
		.550	25.30	25.0	18	1.8	46	4	
		.550	17.60	20.0	26	1.6	32	5	
		.550	41.80	39.5	34	1.9	76	6	
			$212.30*	169.6*	157*		386*		35 06 004
LACQUER BRSHG WHITE	PT	.450	78.30	117.0	102	1.5	174	1	
		.450	22.05	28.1	24	1.7	49	2	
		.450	32.40	46.0	52	1.6	72	3	
		.450	32.85	38.1	39	1.9	73	4	
		.450	11.25	15.6	16	1.6	25	5	
		.450	38.25	40.3	43	2.1	85	6	
			$215.10*	285.1*	276*		478*		35 06 005

Figure 68. Master Reports Covering All Branches

INVENTORY BY CLASS OF MATERIAL

DATE   7-1-6-

CL.	DESCRIPTION	BALANCE ON HAND END OF CURRENT MONTH	END OF SAME MONTH LAST YEAR	INCREASE* OR DECREASE	NET ISSUES CURRENT MONTH	SAME MONTH LAST YEAR	INCREASE OR DECREASE
1	ABRASIVES	$ 9,900.46	$ 10,521.04	$ 620.58	$ 3,316.24	$ 2,720.10	$ 596.14*
2	ACIDS AND CHEMICALS	3,138.83	3,851.11	712.28	1,319.15	1,216.35	102.80*
3	BRASS	16,341.47	16,137.14	204.33*	6,192.15	6,220.12	27.97
4	CASTINGS ALUMINUM	13,066.94	13,760.93	693.99	5,971.66	5,837.72	133.94*
5	CASTINGS BRASS	47,991.45	57,556.83	9,565.38	22,319.41	21,136.88	1,182.53*
6	CASTINGS BRONZE	11,376.08	12,618.80	1,242.72	4,349.73	3,310.20	1,039.53*
7	CASTINGS IRON	21,365.66	20,185.59	1,180.07*	10,224.39	11,160.15	935.76
8	ELECTRICAL SUPPLIES	20,218.85	34,525.08	14,306.23	8,716.26	7,976.33	739.93*
9	HARDWARE AND SCREWS	25,554.59	37,136.40	11,581.81	11,435.85	10,114.95	1,320.90*
10	INSULATING MATERIALS	1,244.34	1,879.50	635.16	202.18	175.74	26.44*
		$170,198.67¤	$208,172.42¤	$ 37,973.75¤	$ 74,047.02¤	$ 69,868.54¤	$ 4,178.48*

Figure 69. Comparative Reports Often Prove Helpful

NOVASKEIN FASHIONS, INC.
COMPARISON OF SALES AND INVENTORY

DEPT. SPORTSWEAR   DATE 7-1-6-

CLASS NO.	MERCHANDISE CLASS	STOCK POSITION ON HAND LAST WEEK	RECEIPTS THIS WEEK	MARK- DOWNS	SALES THIS WEEK	ON HAND THIS WEEK	ON ORDER	SALES SAME WEEK LAST YEAR	YEAR-TO-DATE THIS YEAR	YEAR-TO-DATE LAST YEAR	MARKDOWNS YEAR-TO-DATE
2	BLOUSES	$ 305.26	$ 109.45	$	$ 116.12	$ 298.59	$ 825.32	$ 98.04	$ 1,510.12	$ 1,412.38	$
3	SKIRTS	310.16	145.60		130.25	325.51	1,024.15	110.16	1,987.34	1,827.36	
4	SWEATERS	175.25	50.25		62.24	163.26	406.35	72.36	184.16	182.04	60.00
5	JACKETS	325.24	98.16		108.20	315.20	982.60	94.25	1,225.06	1,114.38	
6	RAINCOATS	789.25	275.10		250.25	814.10	625.30	210.36	3,356.18	3,026.85	
7	COATS	3,116.12	1,213.04	155.25	12.90	4,161.01	245.15	1,104.28	19,725.04	19,068.72	210.45
8	DRESSES	3,524.86	1,729.30		620.00	4,634.16	7,216.25	1,406.35	20,926.30	18,235.46	266.04
9	SUITS	3,028.45	1,206.45		308.72	3,926.18	526.38	1,008.16	16,825.16	16,436.16	
10	BELTS	110.25	45.12		36.27	119.10	321.60	42.25	467.06	504.32	
11	SCARVES	97.16	50.18		36.19	111.15	350.00	31.05	440.24	396.12	
12	PLAYSHOES	245.21	72.26	32.45	75.16	209.86	612.16	62.16	962.38	894.08	32.45
13	SWIMSUITS	204.26	69.30								16
14	SLACKS	398.16	110.45								45
15	SHORTS	204.25	50.25								12	59.10
16	SHIRTS	187.12	65.30								18
		$13,021.00	$ 5,290.21	$						00	$ 628.04

NOVASKEIN FASHIONS, INC.
MERCHANDISE CONTROL
UNITS AND DOLLARS CLASSIFICATION SUMMARY

DATE 7-1-6-

DEPT NO.	DEPARTMENT AND CLASSIFICATION	MONTH'S SALES UNITS	RETAIL AMOUNT	ON HAND UNITS	RETAIL AMOUNT	ON ORDER UNITS	RETAIL AMOUNT
18	COLLEGE WEAR						
	BLOUSES	435	$ 2,070.50	355	$ 1,566.02	95	$ 308.58
	SKIRTS	150	1,075.28	155	1,275.70	84	748.56
	SWEATERS	204	1,059.65	229	1,102.99	108	496.32
	JACKETS	117	1,839.64	125	2,010.40	36	609.36
	DRESSES	427	12,703.25	296	8,806.00	365	10,858.75
	COATS	285	17,784.00	148	9,235.20	207	12,916.80
	BELTS LEATHER	134	502.50	102	382.50	96	360.00
		1752	$37,034.82	1410	$24,378.81	991	$26,298.37
24	SPORTSWEAR						
	BLOUSES	216	$ 1,028.16	134	637.84	225	1,071.00
	SKIRTS	473	4,337.41	246	2,255.82	450	4,126.50

Figure 70. Comparisons Can Be Made on a Different Basis

Further refinements of the information are often necessary or desirable. When considering the purchase of merchandise, buyers must face the problem of color and size distribution. Their tasks can be made easier if they are provided with reports similar to the one shown in Figure 71.

Another common device used by retail sales organizations is the price markdown to stimulate quick sale. Management is guided, in the selection of items to be marked down, by inventory reports based on season and price line (Figure 72).

COLOR ANALYSIS

DATE 7-1-6-

DEPT. NO.	DEPARTMENT AND CLASSIFICATION	PRICE LINE	COLOR	SOLD THIS MONTH	ON HAND	ON ORDER
67	COLLEGE WEAR BLOUSES	$ 3.98	WHITE	62	75	25
			BLUE	17	20	
			NAVY BLUE	18	25	10

SIZE ANALYSIS

DATE 7-1-6-

DEPT. NO.	DEPARTMENT AND CLASSIFICATION	PRICE LINE	SIZE	SOLD THIS MONTH	ON HAND	ON ORDER
67	COLLEGE WEAR BLOUSES	$ 2.98	10	18	25	5
			12	32	37	10
			14	21	16	10
			16	13	29	5
			18	13	13	5
		3.98	10	20	23	12
			12	35	42	12
			14	17	16	6
			16	8	7	6
			18	10	6	
SKIRTS		4.98	10	20	14	12

Figure 71. Information to Help Buyers

INVENTORY BY SEASON CONSOLIDATED REPORT

DATE 7-1-6-

DEPT.	CL	DESCRIPTION	QUANTITY	PRICE	VALUE	VALUE BY SEASON			
						1ST	2ND	3RD	4TH
17	1	FLOOR LAMPS	7	$ 14.95	$ 104.65	$ 44.85	$	$ 59.80	$
			5	15.00	75.00		45.00		30.00

UNIT INVENTORY BY SEASON

DATE 7-1-6-

DEPT.	CL	DESCRIPTION	QUANTITY	PRICE	VALUE	QUANTITY BY SEASON			
						1ST	2ND	3RD	4TH
17	1	FLOOR LAMPS	7	$ 14.95	$ 104.65	3		4	
			5	15.00	75.00		3		2
			1	15.25	15.25	1			
			4	15.50	62.00	4			
			1	16.98	16.98	1			
			1	17.75	17.75	1			
			7	17.95	125.65	5	2		
			9	21.00	189.00	9			
17	2	LAMPS PIN	12	21.25	255.00	6	4	2	
			13	22.25	289.25	5		5	3
			1	23.00	23.00	1			
			2	23.95	47.90	2			
			6	24.95	149.70	6			
			3	26.50	79.50	3			
			2	27.00	54.00		2		
17	3	PARCHMENT	74*		1,504.63*	47*	11*	11*	5*
17	2	LAMPS PIN UP	26	3.25	84.50	20	6		
			12	4.25	51.00	6	3	3	
			10	4.50	45.00	8			2
			2	5.25	10.50	2			
			50*		191.00*	36*	9*	3*	2*

Figure 72. Deciding Where to Use Markdowns

The benefits that can be gained through the use of data processing systems are particularly great in the field of inventory control. Most concerns have a significant part of their assets represented by inventory, and even a small reduction in inventory coupled with a decrease in stock-outs can do much to justify the use of these computers.

It is significant to note that when primarily clerical applications such as billing are mechanized, the savings possible are to a great extent based on the economies that can be made in the clerical and administrative procedures themselves. Improvements in inventory and the related production control area, however, are generally broader and not only affect clerical operations but have a great impact on the manufacturing and selling functions as well. Insufficient or excessive stock, idle time, excessive rush orders, lost sales are only some of the consequences of inadequate procedures and represent the possibilities of savings resulting from improved ones.

Naturally, the scope and volume of the individual application determines whether RAMAC, intermediate, or large data processing systems are used. In any case, their use can result in significant advantages over manual or unit record approaches, because of the additional speed, logic and storage provided.

Inventory control processing can be divided into three broad areas—information accumulation, maintenance, and analysis. Punched card procedures play the most important role in information accumulation, while data processing systems not only provide for greater speed in this function, but also, through their storage and processing ability, can effectively perform the information maintenance and information analysis functions. Thus the old system of manually reviewing machine-posted records on a cyclical basis can be replaced by constant machine review of inventory—review which considers many factors that could not be effectively included in a manual analysis.

Through the use of data processing systems, action documents can be produced showing the specific inventory items which require attention. Purchase policies can be based and administered on machine summarization and analysis rather than on voluminous manual compilation. The time required for starting procurement action can be reduced. The number of stock-outs caused by incorrect or late information can be minimized at the same time inventory investment is lowered.

Because of the number of different systems available it is impossible to discuss the use of all of them in a manual of this scope. We have therefore chosen four different applications, as performed on RAMAC systems, to illustrate how data processing procedures have been applied to inventory applications. The applications described could, of course, depending on volume and other considerations, be performed on many IBM systems including the 305, 1401, 1410, 7070, etc.

ABCs of IBM Data Processing

A Data is recorded into punched cards... and can be converted to magnetic tape or can serve as direct input to...
B data processing machines or systems which calculate, rearrange, do table look-up and process current data with master data and historical data stored on magnetic tapes, drums, disks or cores...
C to produce updated master files and finished results which are recorded into punched cards, magnetic tape, magnetic disk files or printed reports.

By a card punch:

Original Documents
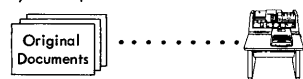
Automatically from radio, telephone, telegraph and from digitalized recording instruments:
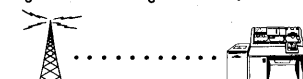
Automatically as documents are typed:

Original Documents

Punched Cards

Processing Unit

Core Plane

Disk

Drum

Tape

Tapes

Punched Cards

Printed Reports

Updated Disks
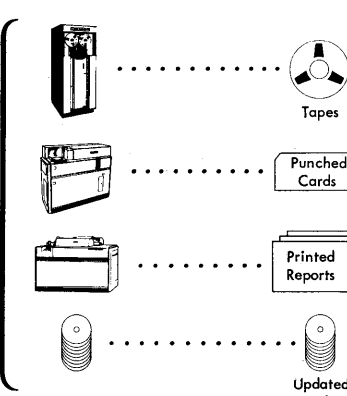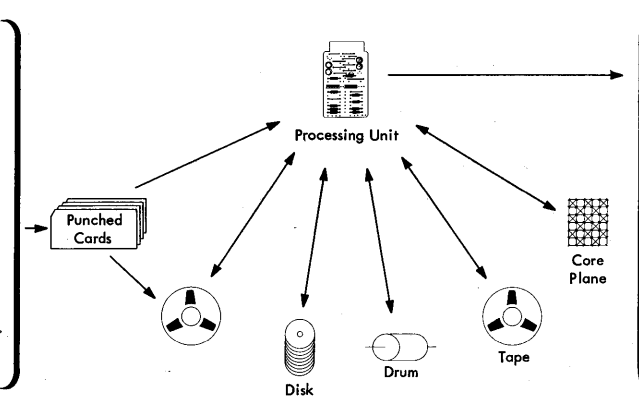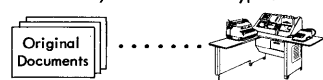
ABC's of IBM Data Processing

RAMAC Systems

In-Line Data Processing

The advent of machine accounting revolutionized the approach to many record-keeping procedures. Until the availability of machines capable of processing accounting data economically and at high speed, records were kept manually in a series of ledgers. Staffs of clerks posted business transactions from paper to paper, and from book to book. Transactions were posted to the proper accounts as they occurred. Therefore, within the limits of the clerical staff's ability to keep up with the volume of business, records were continually up to date and the accounts were constantly maintained in balance. This was in-line data processing. Soon, however, the increased volume resulting from the rapid growth of business, in many cases, made manual methods uneconomical, time-consuming and unreliable. The cost of accounting and record keeping grew far out of proportion to production. Mechanization of procedures became a necessity. Machine accounting grew rapidly because it overcame many of the weaknesses of the manual method. It proved to be economical, reliable and fast.

Machine accounting utilized a new accounting approach—batch processing. Instead of taking each transaction through all of its logical steps and then tackling the next transaction, records were processed in batches. Transactions were permitted to accumulate to practical quantities and were then taken through each step of the procedure in large groups. The disadvantages of the obsolete manual method had been overcome, but something still remained to be learned from the old way, for the principle of in-line data processing had a great inherent advantage. That is, accounts are constantly maintained in balance and up to date, and these up-to-date records are available at once—without waiting for a whole batch of transactions to accumulate and be processed for each step in the procedure. If this feature could also be incorporated into machine accounting, the cycle would be complete: the advantages of speed, accuracy and economy would be coupled with those of instant and continual accessibility to up-to-the-minute records. This has now been achieved. It is called the random access method of accounting and control (RAMAC), and utilizes a new form of storage which permits mechanized in-line data processing.

Information is stored on a series of rotating disks. The basic unit used with the RAMAC 305, for example, has 50 disks, 100 circular tracks on every disk, with ten 100-character records on every track—adding up to 5,000,000 storage positions. With double-capacity disk storage, twice as much storage is available, and, with two disk storage units, 20,000,000 storage positions can be obtained. Thus, when a 100-character record is used, the RAMAC 305 system can store up to 200,000 individually addressable records. On the side of the stack of disks there is an access arm that moves under electronic control to any desired track on any of the disks. This allows random access—the ability of the machine to obtain any record without scanning through intervening records (Figure 73).

Detail information is usually entered into disk storage from IBM cards. The machine then performs a series of steps resulting in the posting of an individual transaction to the proper accounts and records. Since the large storage capacity allows the machine to store many different types of accounts, most or all of the records affected by a transaction can be updated on the same processing run.

In-line data processing eliminates the need for transactions to accumulate before a processing run; transactions can be posted as they occur. This means a continuous flow of work, resulting in much smoother
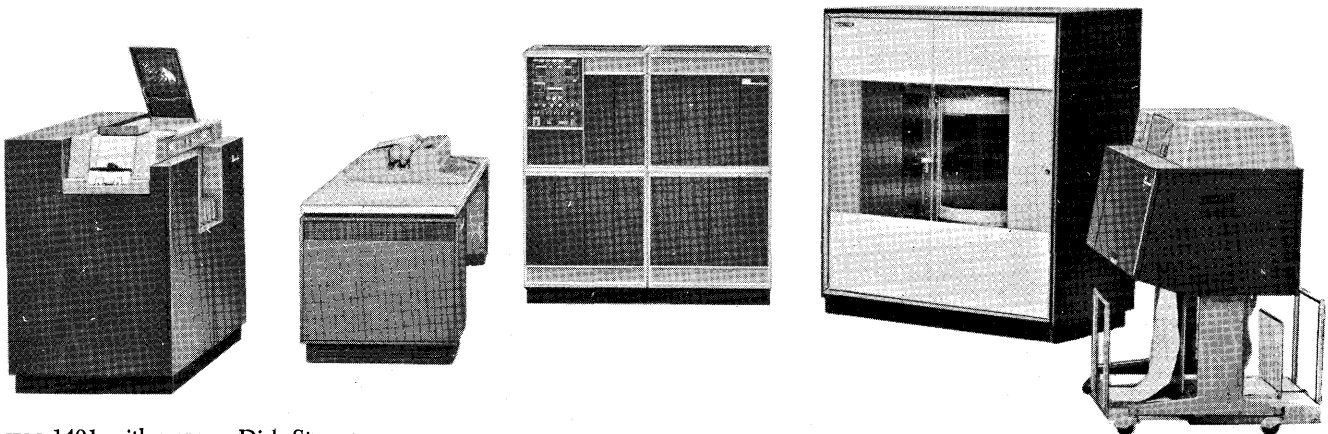
IBM 1401 with RAMAC Disk Storage

operation and better service. In many cases, the in-line procedure eliminates the need for many steps of sorting, collating, and multiple processing runs. A truly current balance is instantaneously available by inquiry to any part of the stored record. Instead of reviewing a history of what once happened, management has access to up-to-the-minute reports of what is happening.

Other important advantages of in-line processing are earlier preparation of management reports and reduction in peak loads. Often, during the month, current transaction data stays inactive in file drawers. Then, at the end of the month, a peak load is processed to produce management information as quickly as possible. An in-line procedure utilizes the time during the month to completely process the current transactions and keep the management information continually up to date. At the end of the month the management report is simply read out of storage. The following pages show how the in-line concept has been applied to inventory control and material accounting through use of RAMAC systems.

Figure 73. RAMAC Disk Storage (access arm travels up and down, and in and out, to reach desired track on desired disk.)

Figure 74. Batch Vs. In-Line Processing

RAMAC Systems for Inventory, Billing and Sales Analysis

One of the commonest uses of RAMAC systems is for a combined inventory, billing and sales analysis application. Food, drug, hardware and other wholesalers, as well as many manufacturers with widespread distribution, have found that these systems are an excellent answer for many of their data processing problems. While there are many approaches being followed, the illustrative procedure given below is typical of what can be done. It is based, for the most part, on the work being performed by a replacement parts dealer who stocks about 30,000 items and has about 4,000 customers. One 100-character record is used to store the name and address of each customer and another 100 characters are used for maintaining their sales records. Provision has also been made to store the billing, inventory and usage data pertaining to each item on a 100-character record. How the records are addressed and how they are used is discussed below.

Addressing

The manner in which the computer uses the identifying part of an input card, such as a part number, to locate a record in disk storage is called addressing. Several different methods of addressing have been developed. Each of these methods has certain advantages and disadvantages which vary in importance according to the nature of the data composing the file. The methods may be divided into two general categories, direct addressing and indirect addressing. In the direct addressing method, certain information in each record is used, either directly or by a simple conversion process, to provide the disk storage address. This information is usually the control data of the record (i.e., an identifying part of the record, such as employee number, part number or account number).

In some applications, it is not practical to use direct addressing. These situations usually arise because no part of the records will directly be, or easily convert to, disk storage addresses. Also, there will be some instances in which direct addressing will not be possible because the available addresses, if used, will result in an excessive amount of wasted storage space. In either case, it will be necessary to use indirect addressing methods, unless it is found more desirable to renumber the records.

In the job chosen for illustration, catalog listings, pricing material, etc., were in the hands of customers and dealers, and the cost of reassignment of part numbers and of the consequent redistribution of this material was prohibitive. It was therefore decided to use indirect addressing. Two weeks of experimentation with various conversion methods resulted in the decision to use the indexing method, which provides for the location of a record by the use of indexes in disk storage. The approach adopted converts part number to a disk storage address by rearrangement, extraction, placement, and by prefix digits specifically

Figure 75. Billing and Inventory Input Card

related to disk storage locations and results in spreading the 30,000 inventory items over 40 disks.

Daily Order Processing

As orders arrive, they are forwarded to the control desk, where the customer number, type of order, order number and shipping instructions are entered on the order. The control clerk also checks that there are part numbers for all items ordered; if any are missing, she consults the catalog and enters the correct part number. The orders are then sent to the card punch operator, who punches the information into a spread input card (Figure 75). She first punches the customer and order numbers, then the part number and quantity of each item on the order. When more than six items are ordered, a second card is punched. (Naturally, the number of items that can be entered in one 80-column card depends on the size of the part number and the maximum quantities ordered.) In addition, if the order is nonstandard, it is necessary to punch ship-to and/or special data cards. As soon as the cards for an order are punched, they can be placed in the machine for processing.

The computer searches for the customer record (Figure 76) of the account that is to receive the order and punches the information into a name and address card which will be used to write the invoice. Then for each item ordered, the system:

1. Converts the part number to a disk storage address and locates the part record.

2. Checks the catalog number for valid, obsolete or superseded numbers.

3. Edits the quantity ordered for a standard pack or for excessive quantity.

4. Determines whether total quantity ordered can be shipped, or whether allocation must be made to protect low stock position.

5. Determines allocation quantity if stock balance is less than a 30-day supply.

6. Updates the item record (Figure 77) for:
   a. Inventory balance
   b. Number of times ordered
   c. Current quarter usage
   d. Current year usage
   e. Back-order quantity (when applicable)

7. Calculates monthly usage (the volume of an item which has been sold in the 30 days just previous to the current day).

8. Edits for reorder point (less than 90-day supply), follow-up (30- to 60-day supply), or expedite (less than 30-day supply). Punches signal cards where any of these conditions exist.

9. Punches back-order cards for out-of-stock items or a balance due as a result of allocation action.

10. Prices and extends quantity to be shipped.

11. Punches extended item card.

After all the line items on one order have been processed, the invoice total, including any applicable allowances and taxes, is added to the accounts receivable balance maintained for each customer. This amount is checked against the customer's credit limit

Customer Number	Type	Name	Address	City & State	Accounts Receivable Control				Credit Limit Code	Salesman Number
					90 Day	60 Day	30 Day	Total		

Figure 76. Customer Record

Supplier	Catalog Number	Type	Description	Package	List Price	Unit	Whse. Location	Discount	Unit Cost	Status	Class	Yr. of Mfg	Number of Times Ordered	Product	Sequence or Index	Inventory	Last Quarter Use	Current Quarter Use	Last Year Use	This Yr. To Date Use	Commit- ment	Lead Time	Allocated Balance

Figure 77. Item Record

(predetermined by the credit manager and held in disk storage). If it exceeds the limit, a signal card is punched and the invoice referred to the credit manager. In addition to punching name and address cards, line item cards, and inventory signal cards, the computer also punches special data cards, tax and allowance cards, C.O.D. cards, etc., when required. All output cards are then sort-separated. The cards required for invoicing are sorted by warehouse location and used to prepare the invoice. The inventory signal cards are used in the daily inventory analysis run discussed below. Figure 78 shows the daily processing just described.

Daily Inventory Analysis

At the end of the daily billing cycle, all receiving reports, credits for returned parts, and inventory adjustments are punched and sorted with the signal cards produced during the processing of parts orders. These then serve as the input for the inventory analysis run, during which the system:

1. Converts part number to disk address and locates the item record.

2. Updates all balances required for each transaction.

3. Computes and updates new unit price where necessary.
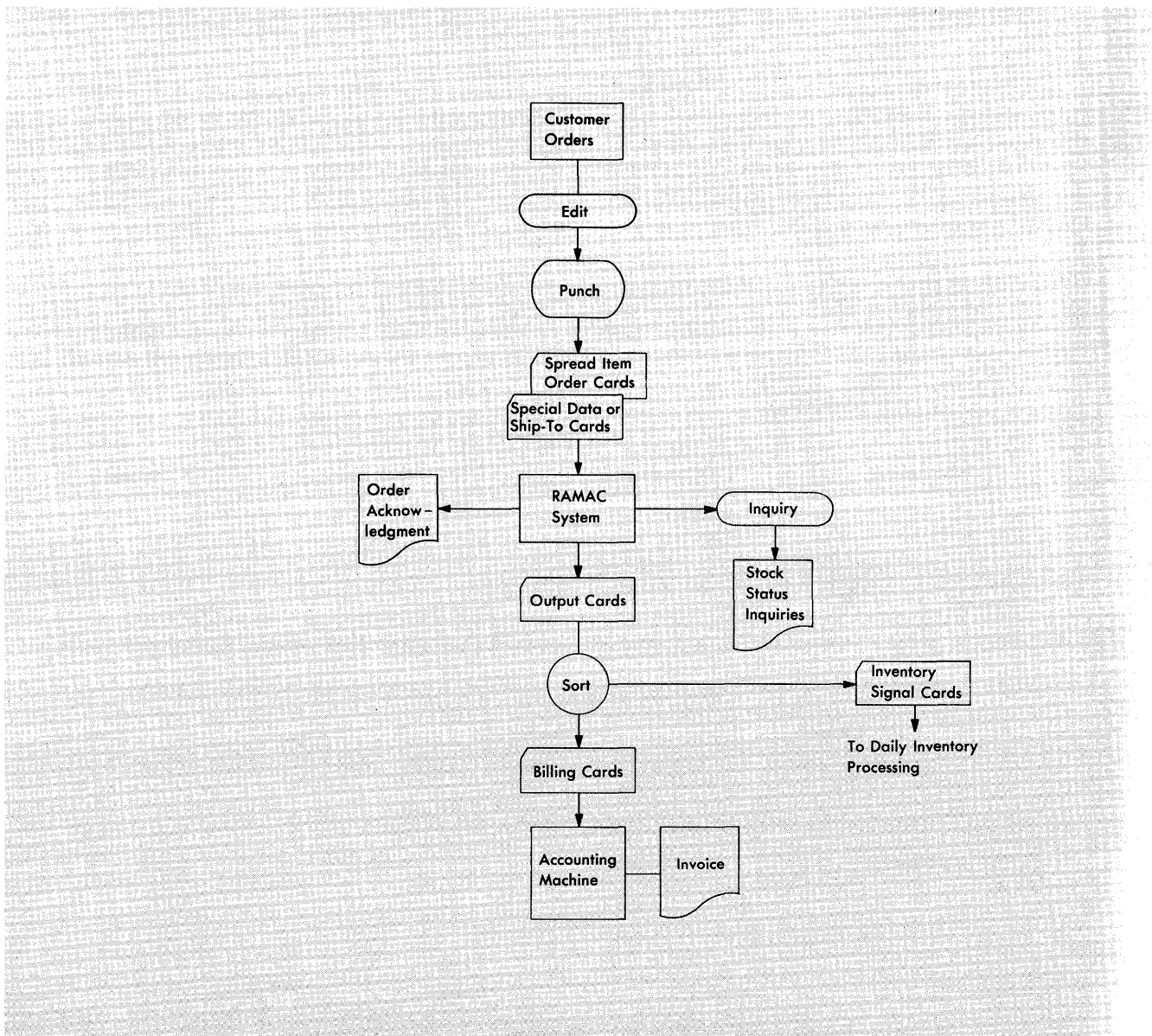
Figure 78. Daily Order Processing

4. Revises warehouse location where necessary.

5. Punches back-order release signal card where receipts to stock re-establish sufficient balances.

6. Computes inventory coverage in terms of months of stock on hand, based upon previous usage figures.

7. Calculates suggested order quantity for items requiring procurement action.

8. Prints an action report for all items with less than a 30-day supply remaining (Figure 80).

Inquiries

The data processing department is connected with related departments, such as the purchasing and order departments, by an interoffice communication system. When requested, the machine operator makes inquiries concerning the status of individual items by keying the item number on the inquiry keyboard. The typewriter then prints out the status of the requested part number, as indicated in Figure 81. The information thus provided constantly reflects the status of each inventory item requested—as current as the last transaction processed.

Figure 79. Daily Inventory Analysis

Supp.	Catalog Number	Description		List Price	Unit Cost	Dis.	Whse. Loc.	Status	Yr. Mfg.	Cl.	No. of times Ordered	REMARKS:			
W	DW3X 330 F	ADAPTER		90	35	50	A10	1	54	7	1				
W	DW3X 330 F	3	335 6	6	114	139	114		440		21	300			
Supp.	Catalog Number	Lead Time	Inv.	No. of Mo. Cov.	On Order	No. of Mo. Cov. Inc. On O.	Yr. to Date Use	Last Qtr. Use	Qtr. to Date Use	Last Year Use	Allotted B/O Qty.	Qty. Received	Stock Adj.	Pieces to Order	
Supp.	Catalog Number	Description		List Price	Unit Cost	Dis.	Whse. Loc.	Status	Yr. Mfg.	Cl.	No. of times Ordered	REMARKS:			
X	WD5X 110	FUSE		835	186	50	33	1	51	11	30				
X	WD5X 110	3	7 —	50	—	250	59	52	300				2	125	
Supp.	Catalog Number	Lead Time	Inv.	No. of Mo. Cov.	On Order	No. of Mo. Cov. Inc. On O.	Yr. to Date Use	Last Qtr. Use	Qtr. to Date Use	Last Year Use	Allotted B/O Qty.	Qty. Received	Stock Adj.	Pieces to Order	

Figure 80. Stock Analysis and Procurement Action Report

Address	Supplier	Catalog Number	Description	Superseded Address	Pkg.	List Price	Unit	Whse. Loc.	Da	Unit Cost	S	Cl. Cd	Yr. Mfg.	Times Ordered	Prod. Cd.	Sequence Code	Inventory	Last Qtr. Use	This Qtr. Use	Last Yr. Use	This yr. to Date Use	Commitment	Lead Time	Allocated Balance
14201	1	WX 34X105F	GASKET		6	120		404	50	41	1	7	56	6	2	20018	239	652	535	2071	1205	400	3	20
03073	X	AX 01X552	SOCKET	46003	12	165		601H		30	1	1	49	12	21	120130	74	172	196	530	422		3	

Figure 81. Inquiry Typeout

Advantages

We have briefly described the use of RAMAC systems for combined billing, inventory control and sales analysis applications. Large random access memory, logical ability, interrogation feature and in-line processing capacity of these systems make them ideal for these distribution and inventory accounting functions. Some of the advantages that can be gained are as follows:

1. Inventory control is improved: out-of-stock conditions are minimized while inventory capital requirements are reduced.

2. Number of items carried is decreased through analysis of item movement.

3. Accurate stock control records are maintained on an up-to-date basis, with a reduced volume of paper-work.

4. Pre-editing for availability minimizes warehouse back orders.

5. Purchasing by exception, from machine-prepared stock analysis and procurement reports, helps expedite orders on manufacturing plants and suppliers, and minimizes stock analysis work. This represents a true application of the management-by-exception technique.

6. Order processing and shipments can be completed sooner, allowing customers to carry smaller parts inventories.

7. Reduction in overall operating expenses can be obtained in most cases.

RAMAC Systems for Merchandise Control

As pointed out previously, detailed, accurate and timely merchandise control records are required to efficiently manage a large retailing organization. An earlier portion of this manual discusses a commonly used approach to merchandise control based on punched price tickets and unit record equipment. This section will show how RAMAC systems make possible a more complete and effective approach by performing three important functions—accumulating merchandise control information, updating the required records, and then analyzing the records automatically. Only the first of these—or the first two—are generally provided for by unit record approaches.

An illustrative procedure, showing some of the merchandise control functions that can be performed on these systems, is given below. We shall first discuss the records that are kept in disk storage and then cover the processing runs and reports prepared. The procedures outlined would, of course, have to be modified somewhat to meet specific needs.

File Organization and Layout

Each department is assigned a particular disk or disks, within which its records are stored—classification and price line, style, color and size. Classification records are addressed by using the department number and the classification number. The style record is addressed by using the vendor number and the style number from the detail cards, and certain factors in the master card, and converting these into a disk storage address. The address of color and size records is obtained from the style record.

Description of Records

The merchandise classification record (Figure 82) contains information concerning a particular classification of merchandise within a department. For instance, in men's furnishings, one classification might be socks, another shirts, another pajamas, and so on. Since the number of prices in any classification is variable, the class record could consist of several disk records. The classification records are maintained by store for the purpose of responding to the individual requirements of each store.

The style record (Figure 83) contains information concerning a particular style purchased from a specific manufacturer. Totals are maintained for sales and on-hand in each store as well as for all stores combined. The style record also contains the disk address of the detail color and size record maintained for each style.

The color and size record (Figure 84) contains the sales and on-hand for each individual size and color carried in a given style. It is a variable length record depending on the number of colors and sizes carried for each style. Individual color and size records are kept for each store.

Figure 82. Merchandise Classification Record

Figure 83. Style Record

Figure 84. Color and Size Record

Processing

This approach uses three primary processing runs, as follows:

Daily updating of the portion of the records affected by sales and returns.

Daily updating of the portion of the records affected by receipts and orders.

Periodic analysis for slow-moving, age of stock, and classification reporting.

Daily Sales & Returns Processing

The sales run is designed to handle the large volume of sales transactions at maximum speed. It is performed daily and provides for the updating of the style, the color and size, and the classification records, and for the determination of the best-selling items.

Sales transactions, usually in the form of punched price tickets, are converted into IBM cards by the ticket converter. Markdowns and any mutilated tickets are manually punched. All cards representing a day's transactions are sorted by department, by classification and by style, and are collated with master cards whose primary purpose is to provide a flexible means of addressing the style record. The cards are then processed by the computer, which reduces inventory and accumulates sales information by merchandise classification and price, by style, and by color and size within style. At the same time, the computer reviews the sales-to-stock ratio of each active style, taking into consideration different merchandising requirements which were previously determined by the buyers, and punches a card for each best-selling item. These cards are then sorted into the proper sequence and listed on the accounting machine to prepare the best seller report. This report is produced daily and serves as a guide for the buyer and merchandise manager in taking action on best-selling items.

For example, in the best seller report (Figure 85) it can be determined that style 1159 (A), @ \$2.95, was received this week (week number 15) and has been

---

4 | 30 | 58 Weds. Week 15 BEST SELLER REPORT

DEPT.	CLASS	PRICE	MFG.	STYLE	WEEK IN STOCK 1st	WEEK IN STOCK Last	SALES PAST 2 WEEK PERIODS 2	PAST 2 WEEK PERIODS 1	THIS 2 WKS TO DATE	THIS WEEK TO DATE	TODAY	On Hand	On Order	STORE 1 Sea. Sales	1 On Hand	2 Sea. Sales	2 On Hand	3 Sea. Sales	3 On Hand	4 Sea. Sales	4 On Hand	5 Sea. Sales	5 On Hand	COMMENTS
120	01	1.95	012	0100	5	13	25	10	31	22	12	94		77	(9)	23	17	17	13	28	(30)	32	25	*Redistribute*
120	01	2.95	012	0101	7	7	9	5	26	19	15	65		29	(9)	6	12	4	8	10	(24)	6	12	*Reorder & Watch Distribution*
120	01	3.95	196	8001	2	9	58	61	36	23	11	82		62	12	32	16	18	14	20	21	30	19	
120	01	1.95	200	0002	9	9	15	10	22	20	12	79		24	24	8	16	3	9	6	18	7	12	
120	02	2.95	152	1159	15	15			18	18	10	12		14	4	2	4			2	4			*"Hot Item"*
120	02	3.95	022	1200	12	14		28	46	35	20	145		38	36	12	38	12	24	6	(23)	6	(21)	*Watch Distribution*
120	02	4.95	061	1280	13	13		16	33	25	13	77		31	21	6	18	4	20	3	15	5	3	
125	03	7.95	211	1260	10	13	26	31	20	16	8	15	36	43	5	19	5			16	5			*Expedite Reorder*
125	03	9.95	311	1100	1	14	15	16	19	11	6	32		27	6	9	6	10	6	7	8	13	6	
125	03	12.95	419	0010	5	8	28	23	22	17	10	51		86	13	23	12	27	9	16	8	21	9	*Reorder*
128	01	.99	010	0201	4	13	165	180	140	108	74	453	360	250	130	160	89	101	63	203	100	135	71	
128	01	1.99	100	1600	7	14	82	81	113	81	23	220	120	178	73	73	26	71	15	59	56	46	51	
128	01	2.99	103	8000	10	10	31	60	83	62	20	150	120	73	71	28	21	22	18	21	19	29	21	
128	01	3.99	300	0100	15	15			29	29	15	91		15	45	4	14	3	9	3	9	4	14	

Date first brought into stock

Date of last receipt

Weeks are numbered 1 to 52

Week-to-date ending May 3

This is the current 2 week period to date ending May 3.

Each of these are 2 week periods of past history.

Figure 85. Best Seller Report

subject to two days' sales. For this period, 18 out of 30 received have been sold and only 12 remain. This is therefore a "hot item" and, with most of the selling season ahead, should be promptly reordered.

For those best sellers which have been in stock, such as style 8001 (B), @$3.95, or style 10 (C), @$12.95, the report is a constant reminder to the buyer of the day-to-day best sellers. These items merit continued review to maintain proper distribution by store and an assortment of desirable colors by size. For merchandising management, this concise exception report means that follow-up with the buyer may be specific—based upon the action to be taken on each best-selling style. Figure 86 presents an overall picture of the sales and returns procedure.

Receipts and Order Processing

One card is punched for each item ordered. The buyer indicates the type of control required (i.e., by style, color and size) and this and the other data concerning the order are punched into the order card. The card is punched with type of control, department, class, price, manufacturer, style number (color and size, if required), date, order number, date due and quantity. The order card is used in the daily processing to record the order and is then filed in the open order file.

When merchandise is received, it is "listed" by the receiving clerk and the receipt is checked with the order for terms and price. The quantities received are then sense-marked on the corresponding open order cards selected from the open order file. The cards are also marked to indicate whether they represent a complete or partial shipment. These cards are then automatically mark-sense-punched and are then utilized in the daily processing.

Each transaction is read by the computer and all levels of inventory affected by the transaction are updated to reflect the current inventory position. The system prints out the totals of the units posted, which is balanced to an adding machine control total previously established. Obvious errors, such as receipts at the wrong price, markdowns from the wrong price, etc., are rejected for investigation.

Slow-Moving, Age-of-Stock, and Classification Reporting

Every day a different group of styles is reviewed. Most items are on a two-week cycle. This is equivalent to the buyer's studying the movement of each item and preparing a list of slow-moving items for the merchandise manager. There is no input involved other than signal cards which direct the system to review the merchandise of specific departments. The
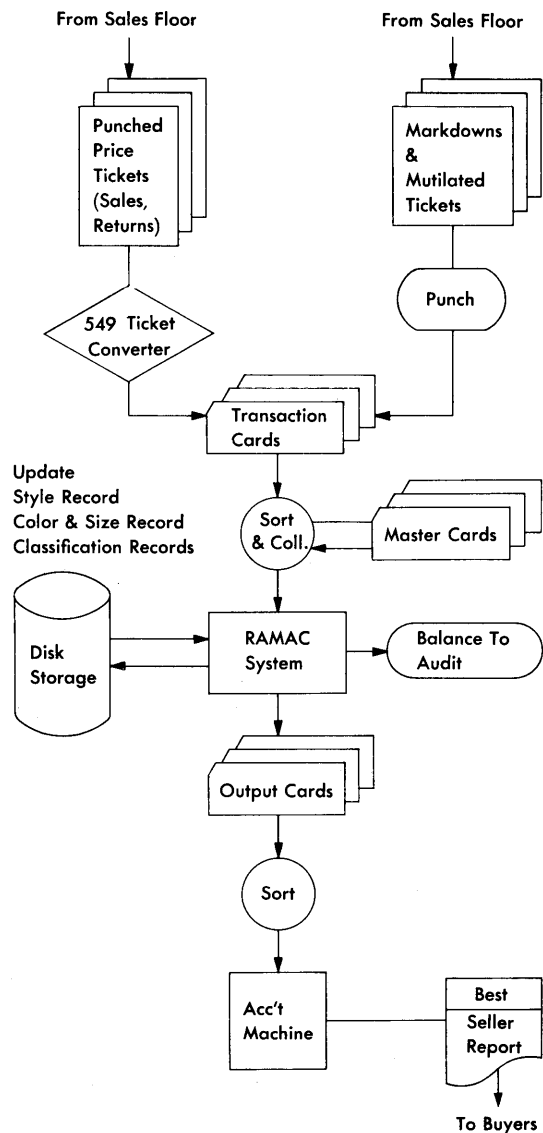
Figure 86. Daily Sales and Returns Processing, Including Best Seller Report

computer punches a card for each style, indicating those that are slow-moving and punching the age of stock in each card. The style cards are sorted into the proper sequence and used to prepare the slow-moving report and the age-of-stock report.

At the end of each month, the comparative sales of the previous year and the stock plan for the month are entered into the computer. These figures are combined with the current figures and are punched into output cards. These cards are then used to prepare the classification open-to-buy report. The contents of the three reports are discussed on the next page and an overall flow chart showing how they are prepared is shown in Figure 88.

THE SLOW-MOVING REPORT

The computer reviews each item by a sales-to-stock ratio and punches a card for each slow-moving item. The cards are sorted and listed on the accounting machine to prepare the slow-moving report. This is an action report used to protect profit and prevent unnecessary markdowns. It is also a precise periodic report of problem items that a merchandise manager may quickly review with each buyer, such as buying mistakes and remnants that deplete the open-to-buy.

For example, in the slow-moving report (Figure 87), the first item, style 293 (A), @ $3.98, was received last week (receiving week number 17, reporting week 18). The item was properly displayed, the timing was right, but it did not meet customer acceptance. Fast action is needed. The open order is canceled and, since the action is taken quickly, the vendor is willing to accept the return. Style 693 (B), also @ $3.98, was found poorly displayed. In fact, on occasion, a slow-moving item may still be in the receiving room, in a corner, or under the counter. The computer constantly alerts the buyer to these potential markdowns. Two items for vendor 103 (C) were marked down to clear. Style 159 (D), @ $6.98, was marked down to $5.00 while still in season.

One by one, each item is reviewed so that the market know-how of each buyer may be brought to bear on each specific slow-moving item. The computer consistently follows each item so that all problem items may be noted.

THE CLASSIFICATION OPEN-TO-BUY REPORT

This report enables the buyer to maintain an overall balance of stock. Cutoff problems and delays in office paperwork are eliminated, as a prompt, accurate classification report is available immediately after the close of each period. The classification report, which includes open-to-buy, is based upon all merchandise received, orders placed, and goods sold as of the previous working day. This report assists the retailer in eliminating costly overbought conditions, by raising such questions as:

Should we buy up or down?
Is demand changing by classification?
Should commitments be canceled or extended?
Are we overstocked or are better displays required?
Is special promotion necessary?

SLOW—MOVING REPORT

5-31-
Week 18

	DEPT.	CLASS	PRICE	MFG	STYLE	WKS IN STOCK		SALES PAST 2-WK 1	SALES PAST 2-WK 2	2 WKS TO DATE	WEEK TO DATE	TODAY	ON HAND	ON ORDER	STORE 1		STORE 2		STORE 3		STORE 4		STORE 5 ON HAND	COMMENTS
(A)	125	01	3.98	63	293	17	17			2			19	12	1	5		6	1	5		3		CANCEL ON ORDER RETURN TO VENDOR
	125	01	3.98	149	3530	03	12	5	2				1	24	12			6		6	5	1	7	GOOD ITEM OUT OF STOCK CONDITION
	125	01	3.98	149	3233	16	16						12			6			6					RETURN TO VENDOR
	125	02	5.98	314	1047	08	13	2	8				1	1	12	11	1	6		6		6		PAST SEASON—MARK DOWN FOR CLEARANCE
(B)	125	03	3.98	9	693	15	15						11	1	5					6				REDISPLAY
	125	03	3.98	9	698	15	15			3			32	2	14		2	1	5	1	11			TIMING BAD — BROUGHT IN STOCK EARLY
	125	05	6.98	27	7001	15	15						12	6						3			3	RETURN TO VENDOR
(C)	125	06	4.98	103	2031	11	11	1					19	1	11					4		4		MARK # DOWN TO CLEAR
	125	06	4.98	103	2035	08	14		4	1	1	1	13	2	4		3	3	3				3	MARK # DOWN TO CLEAR
(D)	125	06	6.98	18	159	15	15			3	1	1	6		2	2			1	2	3		3	MARK # DOWN TO CLEAR

Date of Last Receipt ↑   ↑   ↑ ↑ Week-to-date ending May 31

This is the current 2-week period to date
ending May 31.

Weeks are numbered from 1 to 52.   Each of these is a 2-week period of past history.

SPEAK TO VENDOR

Figure 87. Slow-Moving Report

THE AGE-OF-STOCK REPORT

This management report is used to evaluate quickly the age of the merchandise assortments presented by the buyers. It reveals at a glance the soundness of stock investment and provides an insight into the operation of each department.

Basic Stocks

There are naturally many variations of the above procedures in use, depending on the requirements of an individual store or department. For example, some stores maintain inventory control of basic stock items, such as men's shirts, sheets and pillow cases, women's hosiery, etc., on RAMAC systems. The computers issue replenishment orders to be sent to the warehouse when items fall below the minimum level and also prepare reorder cards when the warehouse stock reaches the order point. The primary objective of this type of approach is to assist the retailer in presenting a complete, balanced merchandise assortment for customers while maintaining the lowest possible level of inventory.

Advantages

We have shown the use of RAMAC systems for merchandise control by outlining one typical approach. Large random access memory, logical ability, the inquiry feature, and in-line processing ability make these systems capable of performing a complete and efficient merchandise control job. Some of the advantages that can be gained are as follows:

1. Manual posting to unit stock ledgers and style and price line cards is eliminated.

2. Accuracy is increased, since all arithmetic and posting functions are performed by machine.

3. Fast moving styles are rapidly brought to the attention of the buyer, so that desirable items may be quickly reordered.

4. Slow-moving stock is pinpointed so that corrective action may be taken without delay.

5. Items below minimum stock limits are brought to the attention of the buyer immediately, so that sales will not be lost, and adequate assortments can be maintained.

6. Reduction in overall cost can usually be obtained in addition to improved turnover of profitable items and reductions in markdowns.

Figure 88. Slow-Moving, Age-of-Stock and Classification Reporting

RAMAC Systems for Maintenance and Stores Material Accounting

Public utilities, railroads, airlines, large manufacturing plants are some of the organizations that must stock a large variety of maintenance and stores material. This includes construction material, factory and office supplies, replacement parts for machinery and equipment, and similar types of inventory. The items stocked may vary in size from small parts to units which can be handled only by power equipment, and they may be worth a fraction of a cent or hundreds of dollars. Some have a large volume and rapid turnover while others lie on storeroom shelves for months or years without the need for being repurchased or perhaps without even being used. In some cases the nature of the material is so critical that it must always be kept in stock, while in other cases material can be out of stock for weeks without any major consequences.

These factors and many others result in a complex inventory and material accounting job, for which RAMAC systems with their large random access storage and logical ability, have proved to be an excellent

answer. We will first discuss the functions that must be performed in this application and then show how random access procedures can be used to perform them.

Functions To Be Performed

• Maintain records of physical balances. This usually requires that individual balances be kept for many storage locations.

• Determine when and how much to order.

• Maintain records of what is on order.

• Price the material issued and charge it to a general stock account.

• Charge the issue to a specific job and/or a particular department.

• Provide access to inventory records so that personnel at all locations can obtain the information they require to perform their functions properly.

• Provide for periodic inventory taking, for rapid means of inventory evaluation, and for the reconciling of book and physical balances.

The following pages outline a typical approach to handling these functions, showing how computer pro-

Figure 89. Stores Ticket

cedures can be used to perform them. The approach is based, for the most part, on the work being performed by a large manufacturing plant stocking about 30,000 miscellaneous store items and spare parts.

Disbursements Processing

Store tickets are filled out on a dual IBM card (Figure 89) by the person desiring the material. The card is sent to the central storehouse or to one of the local storehouses, where the part is pulled and sent to the requisitioner and the part number entered on the card. Any adjustment in quantity is made at this point so that the card always reflects the amount of material disbursed. The cards are then sent to the data processing section, where the information entered on the cards (cost code, work order, material code, quantity and unit of issue) is punched into them. After the cards are verified they are processed through the computer, which determines the disk address of the item, decreases the quantity on hand by the quantity disbursed, multiplies the quantity issued by the average unit price, and decreases the item inventory value. During the same operation one of the material classification control accounts is decreased by the value of the parts disbursed and a cost account record is increased by a like amount. If the material was removed from one of the area stores, the area store control record is updated to show the through-put of the local store. In this manner, all records affected are updated in one pass of the card.

The order point is also checked automatically on the same run, and if the quantity on hand plus the quantity on order has fallen below the order point as a result of a disbursement, an order card is punched. In the event a below-minimum balance resulted on a previous disbursement, the quantity on hand is checked against 25% of the minimum, and if the quantity is less than 25% of the minimum, the machine prints a notice to the purchasing department to expedite this material. For each stores ticket processed, the system punches a card containing all the information in the original stores ticket plus the material description, date processed and extended cost.

In other words, with one pass of a stores ticket through the computer, the item record, material classification control account, the cost account and, if necessary, the area store records are updated, a cost distribution card is punched, and, if the material drops below the minimum level, an on-order card is punched to denote this fact. If supply of the item is very short, an expedite report is produced for the purchasing department. Figures 90 and 91 show the flow of work and the record layout of the four records discussed above.
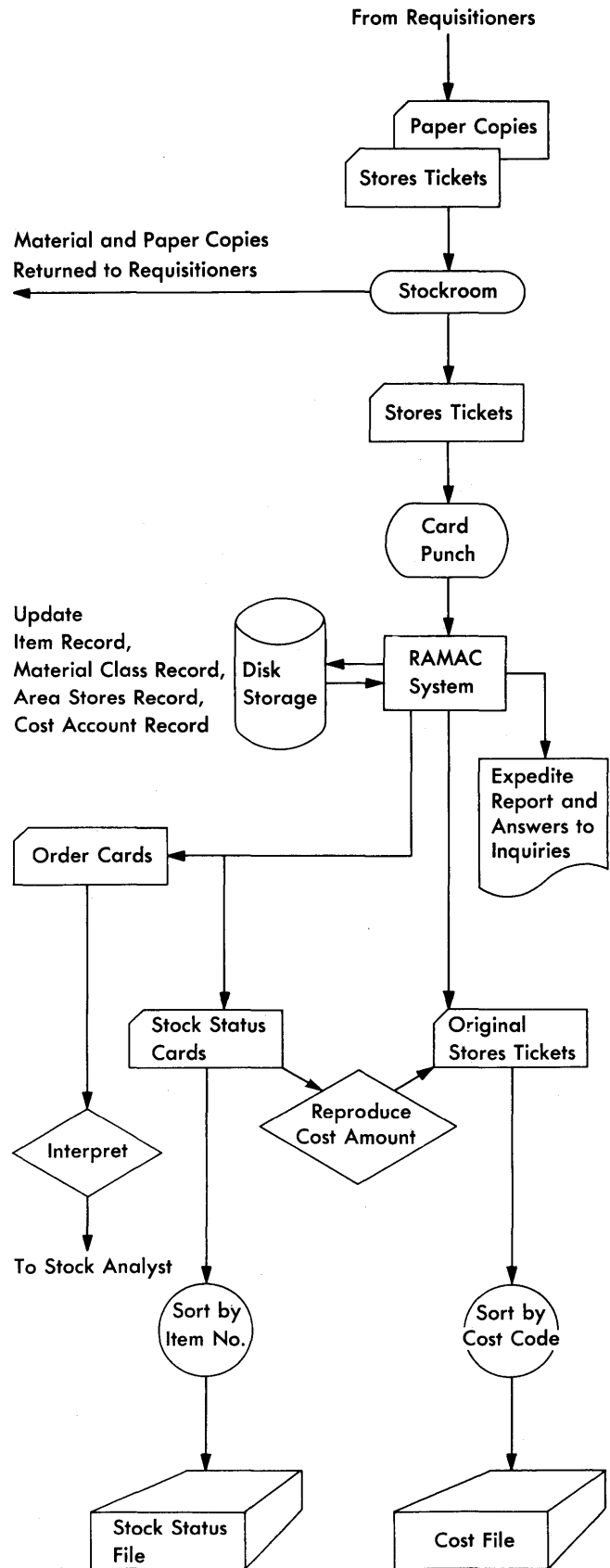
Figure 90. Disbursements Processing

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Item Record

Disk Address	Material Code	Unit of Issue	Material Description	Item Inventory Value	Average Unit | Price	Quantity Not Priced	Balance on Hand	On-Order Balance	Order Point	Quarterly Usage	Year-to-Date Usage	Date of Last Issue Mo. Day Yr	Stock Analyst

Item Record

Material Classification

Disk Address	Material Class	Material Classification Title		Beginning $ Balance	$ Received During Month	$ Disbursed During Month	Ending $ Balance	

Material Classification

Area Stores Control Record

Disk Address	Area Number	Area Name		Beginning $ Balance	$ Received During Month	$ Disbursed During Month	Ending $ Balance	

Area Stores Control Record

Cost Account Record

Disk Address	Cost Account	Cost Account Title		Engineering $	Operating $	Total $	

Cost Account Record

Figure 91. Basic Records

Figure 92. Orders, Receipts, and Pricing Card

Circled letters in box indicate department entering information

Stock Analyst

Purchasing Department

RD   Receiving Department

AP   Accounts Payable Department

Order Procedure

The order card (Figure 92), punched by the computer the first time the total of the quantity on hand and on order fell below the order point, is interpreted and forwarded to the stock analyst. The analyst decides the quantity to order on the basis of the information interpreted on the card (balance on hand, open-order balance, order point, quarterly usage, yearly usage) and on the basis of an item reference card containing complete description, name of vendor supplying the material, ordering history, etc. The analyst enters the quantity to order, the purchase unit, and the delivery point, then forwards the cards to the purchasing department.

The purchasing department then prepares the purchase order, posts the purchasing information to both cards, and returns the reference card to the stock analyst and the order card to the data processing department. The quantity ordered and the purchase order number are punched into the order card and it is processed through the computer to update the on-order balance.

Receipts Procedure

While the computer is processing the order card, it punches a receiving card which is interpreted and forwarded to the purchasing department. When the material is delivered, the quantity received is noted on the order card, as well as an indication as to whether or not this shipment completes the order. After this the cards are returned to the data processing department. They are then punched with quantity received and processed through the computer to decrease the on-order balance and to increase the on-hand balance and the quantity received not priced. If the shipment does not complete the order, an additional receiving card is punched for the remaining balance due. If the order has been marked as complete, the on-order balance is reduced by the original quantity of the order, to adjust for instances where a shipment considered complete is slightly over or under the original quantity ordered.

Pricing Procedure

When the receiving card is processed, a pricing card is automatically punched. This card is interpreted and sent to the accounts payable section, where it is held until the vendor's invoice is received. After the invoice is checked, the cost of the material and the accounts payable voucher number are entered on the pricing card and it is returned to the data processing department, where the information is punched and verified.

Then, as the card is passed through the computer, the quantity received not priced is decreased, the item inventory value increased, and the new average unit price calculated. The formula for determining the new average price is inventory value divided by the quantity on hand, less any remaining quantity received not priced. This card, at the same time, increases the material classification control account covering the item received. Figure 93, on the following page, is a flow chart of the orders, receipts, and pricing procedure.

Inquiries

A telephone is located on the console. Any department requiring information calls the console operator. He types the disk address of the item in question and the entire item record is read from storage and printed by the console typewriter. Processing is held up for less than a second while the inquiry is made. The console operator then gives the caller the requested information.

Month-End Procedure

As each transaction is processed, the extended price is accumulated in the computer, and the various types of transaction totals—receipts, disbursements and adjustments—are read out at the end of each day. These figures are posted to the control book and added to the month-to-date totals. Next the machine adds together all the material classification control accounts and the total is balanced to the control book totals just updated. Control accounts are thus balanced daily. At the end of the month one card is punched for each item record in disk storage. An inventory trial balance is then listed and subtotals are taken for all the items in each material control account. These figures are then balanced to the control book totals.

One card is then punched for every material classification control record, cost account record, and area stores control record. The cards are used to prepare:

1. The material classification report, showing the opening dollar balance, the value of all receipts and disbursements, and the closing balance, for each stock account. The dollar differences between the opening and closing balance are also shown.

2. The cost account summary report, showing the dollar amount of the material expended in each cost account and department, broken down into engineering and operating expense. A detail report is also prepared from the store tickets for certain accounts.

3. The monthly area stores transactions value report, showing the opening dollar balance, the value

From Disbursements
Procedure

Order Cards

Stock analyst notes quantity to be ordered;
forwards cards to purchasing department,
where quantity ordered and purchase order
number are entered.

To Purchasing Department

Filled-In
Order Cards

To Data Processing Dept.

Punch
and
Verify

Quantity ordered and purchase order number
are punched and verified.

RAMAC System
On-Order
Processing

Receiving Card

Increase quantity on order.
Punch receiving card.

Interpret

Ordered
Not Received

Receiving Card

When the material is received the purchasing
department selects the proper receiving card
and enters quantity received and whether
order is complete.

Select

Punch
and
Verify

Quantity received and complete order code
are punched and verified.

Receiving Card
Partial Shipm'nt

RAMAC System
Receipts
Processing

Increase quantity on hand, decrease quantity
on order, increase quantity received not
billed.
Punch pricing card and,
if partial shipment, receiving card.

Pricing Card

Interpret

Received Not
Priced

Pricing Card

When the invoice is received the accounts
payable clerk selects pricing card and enters
voucher number and cost.

Select

Punch
and
Verify

Voucher number and cost are punched and
verified.

RAMAC System
Pricing Run

Decrease quantity received not billed, increased
item inventory value, calculate new average
price, and increase material classification
account.

Figure 93. Orders, Receipts, and Pricing Procedure

of all receipts and disbursements, and the closing balance, for each local storehouse. The differences between the opening and closing balances are also shown.

Physical Inventory

A portion of the material is inventoried every month. A permanent staff counts the material and enters the count on a prepunched inventory card. All stores tickets and receipts prior to the inventory cutoff are processed and the machine punches out one balance card for each item inventoried. Thus, during the interval when the inventory cards are being collected and punched, the computer can continue processing all post-inventory transactions on an up-to-date basis.

The inventory cards are then punched, verified and collated with the balance card. Both cards are entered into the system, which proceeds to check for inventory differences, extends the inventory and the inventory differences, and punches an inventory valuation card for each item. These cards are then listed on the accounting machine and any inventory differences reconciled. The inventory valuation cards representing balances which must be changed are then punched with the quantities to be added or subtracted from the balance, and reintroduced into the computer.

We have described one typical approach to stores and material control. Other procedures used are somewhat more sophisticated and complete, and include automatic reordering and order point determination; still others are even simpler than the one described. The flexibility of RAMAC systems and related procedures allows for approaches to be designed to meet individual requirements.

Advantages

Some of the advantages that can be gained by use of the RAMAC systems for maintenance and stores material accounting are as follows:

1. Reduced inventory by decreasing minimum stock balances through daily reorder control. The order point is reviewed as every transaction is processed, rather than periodically, as under many other inventory procedures. Procurement action can thus be taken sooner, and the order point can therefore be reduced.

2. Reduced inventory by periodic analysis of all items. Activity figures and the last transaction date can be maintained in the inventory balance record and the computer used to select low-activity items for management action. Obsolete items can be readily discovered in this manner.

3. Reduced inventory by the use of statistically based order points and order quantities. The machine can maintain actual usage figures and apply them and other quantitative factors to determine the best reorder quantities.

4. Increased accuracy and timeliness of information, since each transaction is automatically extended and posted to all affected records on the same processing run. Month-end reports are available soon after the last transactions are posted, and information is available soon enough to be of use.

5. Ability to recompute the average price of each inventory item when each change in price is received, rather than periodically, as under most manual systems.

6. Efficient handling of both relatively large and small inventories, in terms of items stocked, because of the various capacities of disk storage available.

7. Maximum timeliness, accuracy and availability of inventory control information.

RAMAC Systems for Inventory Control and Related Applications in Manufacturing Industries

Perhaps the most common use of RAMAC systems is in manufacturing industries for inventory control and related manufacturing control functions. Undoubtedly, there are more approaches being followed in this area than in any of the three others mentioned previously. This is due to the great variation in manufacturing organizations: not only are there major differences in the types of manufacturing processes, but there are also significant differences in volumes, physical facilities, manufacturing control techniques used, etc. It is therefore beyond the scope of this manual to cover all the approaches used, or to discuss fully the broader overall area of manufacturing control, which encompasses inventory control. We have, however, selected one approach, which illustrates many of the functions that can be performed by RAMAC systems in manufacturing industries.

The procedure discussed is based on the job performed by a manufacturer of diesel fuel injection equipment and hydraulic cranking systems. The company markets over 1,000 end products and 6,000 service or after-market parts through four regional sales warehouses, 50 distributors, and through direct contact with customers.

Requirements of the System

Before the computer was placed on order the company made a complete study of the factors affecting the manufacturing control application. They first determined that their system should be able to process effectively, with little outside intervention, varying types of input including all material transactions, engineering changes, service requirements and production schedules by time period. Second, these input documents must be processed against internally stored records to:

1. Convert product schedules to requirements by time period.

2. Measure requirements against on-hand, on-order and reorder points for each inventory item, to determine the time period when shop orders and purchase orders must be prepared.

3. Revise economical order quantities and reorder points by constant evaluation of the factors involved in their calculation.

4. Cancel and/or reschedule unreleased manufacturing or purchase orders.

Finally, the system must rapidly select from storage the data required to prepare:

1. Status reports for all released manufacturing orders.

2. Shop orders to manufacture in economical size lots by time period, indicating standard costs for all components.

3. Stock planning status for any part on request.

4. Evaluation of optimum inventory based on economical order quantities and reorder points.

5. Immediate answers to questions concerning any part in inventory.

When the study was completed, the application requirements were compared against available equipment. On the basis of this analysis, an IBM RAMAC 305 was ordered. Many features of the 305 made it ideal for the application in question. For example, the storage capacity of the system was more than adequate to maintain the inventory records for the 15,000 finished goods, assemblies and parts, a bill of material for every manufactured item, and the quantities of each part needed to satisfy orders and forecasts by time period. The random access storage principle would allow the updating of inventory records on a current basis and would also provide the most direct method of exploding the production schedule down to its individual requirements. This would be accomplished in a single pass through the system. Through the inquiry feature, up-to-date facts on any part would be available as needed. In addition the cost of the 305 could be justified by the potential savings.

An outline of this customer's procedures is as follows:

Material Transactions

There are 34 different types of material transactions processed through the RAMAC 305. These can be generally classified as receipts, adjustments and issues. The 305 recognizes the type of transaction by a code in the card (Figure 94) being read and selects the correct records.

For each of the 15,000 items (1,000 end products, 9,000 manufactured parts, 5,000 purchased parts) used, there are five 100-character records (Figure 95). The first two records are used for storing inventory and cost data.

As each type of material card is read, the inventory record for that item is selected and the on-hand balance, usage to date, or last activity date is updated.

Located next to these two 100-character inventory and cost records is a requirements record which indicates the number of pieces actually required for each of twenty 10-day periods.

Figure 94. Material Transactions

Inventory Record

Cost Record

Requirements Record (for either purchased or manufactured items)

Open Orders

Bill of Material Record (for manufactured items)

Figure 95. Basic Records

The fourth record stores commitments by time period. These reflect the quantity to be ordered to cover requirements. Since these commitments are for the manufacture of economical lot quantities, they will differ from requirement amounts.

The last record of 100 characters is either a bill of material (if the product is manufactured) or released orders to a vendor (if the item is purchased). These records will be more fully covered under "Level-by-Level Net Requirements Planning."

Level-by-Level Net Requirements Planning

Orders are received and sales forecasts are prepared by the sales department. The sales department and the production control department working together determine the production schedule changes (increases or decreases) by time period, indicating what end products are now currently required to satisfy the forecast and customer orders. In addition, they also indicate those items which are required to satisfy the after-market business. This schedule is then introduced into the RAMAC 305 in the form of schedule change cards (plus or minus). It is important to note here that this is a changed schedule of end products and does not indicate those parts and assemblies which are required to build these products.

As each change card is read, the 305 internally finds the inventory record for the required end item. The on-hand and on-order portion of the record is checked to determine whether there is enough stock to satisfy the requirement. If there is not sufficient inventory, the computer determines the lead time, stores the order in the requirements record for release at the proper time, and examines the bill of material record for the item to determine the quantities of each part required to build the item. This 100-character record will accommodate up to eight different component parts. If more than eight items are required in an assembly, the 305 stores this information in an unused portion of disk storage.

The 305 then posts the quantity required of each component part or subassembly to the requirements record of the part or subassembly by time period, taking into account the lead time required to assemble the components into the end product. The operation to this point is called gross requirements planning. As the last production schedule card enters the 305 and is processed, the system automatically begins what is termed level-by-level net requirements planning. This involves the consideration of each item against which gross requirements or changes in gross requirements have been posted, in order to determine whether these items have sufficient inventory on hand or on order. If there is not sufficient inventory, an order is placed in the economical lot quantity by the correct time period and stored within the system for later release. The inventory record for the component part or subassembly is examined to determine whether there is sufficient inventory of its component parts or whether an order is required. The process continues for each part that makes up the end products, until sufficient inventory is found or a purchase requirement for raw materials is posted.

By using level-by-level planning and low-level coding (where each item in the file is coded for the lowest level in which it appears in any product), the RAMAC 305 actually produces net requirements for each item at one time and one time only during its processing. To save time, it looks only at items in the file which have activity.

As a by-product of this routine, various types of cards are created by the 323 Card Punch. The first of these, rush shop order cards, are punched if a given part should have been started before the current manufacturing day. (The manufacturing day, commonly called M-day, is a reference to a manufacturing calendar which assigns a numerical value to each working day.) Whenever there is a requirement to order common parts, a common part order card is punched. Because common parts are relatively inexpensive and are used in large numbers, they are planned by the production control department and not by the RAMAC 305. Record keeping on these items is at an absolute minimum. A purchase planning card is punched at the completion of the level-by-level routine to initiate the planning of purchased items. Also, exception cards for certain types of activity not planned by the 305 are created. These include:

a. Special engineering parts.
b. Parts with EOQ but no reorder point (this indicates usage last year but none this year).
c. Parts with reorder point but no EOQ (this indicates usage this year but none last year).
d. Parts with no reorder point and no EOQ (this indicates no usage this year or last year).

After this run, the 305 has a complete new production schedule by time periods and orders and requirements by manufacturing day for all end products, subassemblies and manufactured parts. Figure 96 is a flow chart of the procedure just described.

Purchase Planning

The single purchase planning card produced from the level-by-level routine is introduced into the 305. This card indicates one end of a chain which the computer has established within its file, linking together all purchased items that have had any activity due to the explosion of the production schedule.

Customer
Orders

Sales Department

Production
Control Dept.

Production
Schedule

Sales
Forecast

Schedule Change
Card + or —

323 Card Punch

Console
Typewriter

Console
Inquiry

407 Accounting Machine

IBM RAMAC 305

Rush Shop
Order Cards

Common
Parts Cards

Exception
Cards

Purchase
Planning Card

To Shop Order Issue

To Purchase Planning

To Purchase and Manufacturing
Status Reporting

Figure 96. Level-by-Level Net Requirements Planning

The 305 proceeds to each item in this chain to determine whether sufficient inventory is on hand or on order to satisfy the requirement. If sufficient inventory is not on hand, a purchase requisition is stored within the computer after considering the time required to obtain this item (lead time). If, however, the date of the purchase requisition is prior to the current M-Day, a rush purchase requisition card is created. The 305 proceeds in this fashion from one item to the next, through the whole chain. As a result of a reduction or a change in the production schedule due to changing customer requirements, previously established purchase requisitions may be canceled. In this case a purchase cancellation card is punched. The computer now contains the completed new manufacturing and purchase schedule in disk storage by M-Day (Figure 97).

Shop Order Issue

The system is now prepared to issue production orders to the shop for the current time period. In order to do this, two types of cards are introduced into the system: (1) rush shop order cards, which are produced from the level-by-level net requirements run, and which are processed daily, instead of being held for ten days awaiting the issue of regular shop orders; (2) the single shop order dating card, which indicates to the system the time period within which orders are now being issued.

The computer then searches the open-order portion of each record in disk storage for the time period indicated. When it finds a quantity, the following functions are performed:

1. If the part is manufactured, a complete ma-
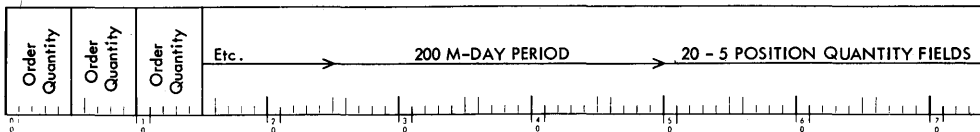
Figure 97. Released Orders
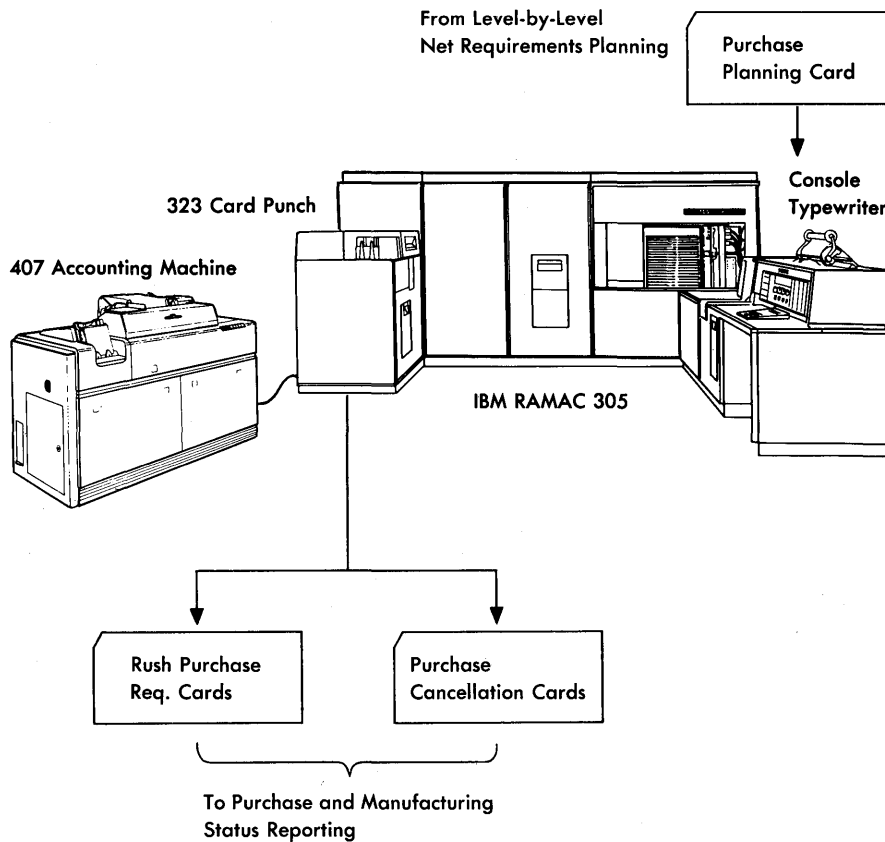
Figure 98. Purchase Planning

terial requisition or a shop order is printed indicating the part and quantity to be made, its components, parts and quantities, standard costs, and the start and finish M-Days. A commitment card is punched for each shop order and is placed in an off-line open-order file. On completion of manufacturing it is reintro-duced into the 305 to reduce the open-order quantity. Shortage cards are punched for any component parts which are not in stock at the present time.

2. If the part is purchased, purchase requisition cards are punched which become the authority for a purchase order. The released order record is updated.

Figure 99. Shop Order Issue

Purchase and Manufacturing Status Reporting

Using the indicated source information as input to the RAMAC 305, a status report is printed every ten days for each active purchased and manufactured part (Figure 100). This report indicates the heading information, requirements, unreleased orders by M-Day and released orders by M-Day (purchased parts only).

File Maintenance

Changes to disk storage are entered in the form of file change cards. As each card is read, the 305 seeks the record to be changed, altered, deleted or added, and performs the proper functions. Simultaneously a visual record of all changes is printed.

Economical Order Quantities

A large portion of the savings in the manufacturing control system described is based on the ability to reduce not only the number of orders issued to the plant but also the setup costs associated with these orders. The key to reducing order and setup costs is establishment of realistic economical order quantities and reorder points in the light of certain base factors and accumulative statistics.

Before deciding which items should be reordered on an EOQ basis, all 15,000 units and subassemblies were

Common Parts Cards

Purchase Cancellation Cards

Exception Cards

Purchase Requisition Cards

Console Typewriter

323 Card Punch

407 Accounting Machine

IBM RAMAC 305

STATUS	PART NUMBER				ACCT.	PART CODE	TYPE	U/M	LEAD TIME	ON HAND	NON-STD. ON ORDER		DELIVERY QUANTITY	EOQ	REORDER POINT		CLASS OF ITEM	RAMAC ADDRESS		STATUS REPORT
STATUS	PK	795			079	023616	PUR.	1	60	6362			6700	6700	2950		2	37350		STATUS REPORT
MANUFACTURING DAY	820	830	840	850	860	870	880	890	900	910	920	930	940	950	960	970	980	990	000	010
REQUIREMENTS			200							3000				5000					6000		2500
RELEASED COMMITMENTS														6700						
UNRELEASED COMMITMENTS																			6700		6700
STATUS	BC	76312-4A			089	891552	MAN.	1	20	8100				8000	1000		2	96710		
MANUFACTURING DAY	820	830	840	850	860	870	880	890	900	910	920	930	940	950	960	970	980	990	000	010
REQUIREMENTS										1600	730	830	800	800	800	800	700	500		
RELEASED COMMITMENTS														8000						
UNRELEASED COMMITMENTS																				
STATUS	FF42XR2				079		MAN.	FT	20											

Figure 100. Purchase and Manufacturing Status Reporting

analyzed and divided into three categories. The first category consisted of 1,900 items which were either expensive or were produced for irregular sales volumes. The company did not wish to stock these items and so established no reorder point or EOQ here. One thousand common parts were inexpensive enough and in sufficient demand to decontrol to a minimum-maximum bin card basis. The remaining items, of which there were 12,100, could be practically controlled on an EOQ and reorder point basis.

Using historical data, the company then studied all elements of cost which affect the manufacture and warehousing of inventory items. The results of their study can best be indicated by a chart as shown in Figure 101.

The line labeled "Working Stock Carrying Charges" indicates the cost of carrying inventory, which of course increases at a constant rate as the amount in inventory increases. The line labeled "Order and Setup Costs" indicates the order and setup costs involved in issuing and producing orders. This of course decreases as the size of the order increases (i.e., fewer orders

and less setup). The line labeled "Total Cost" is the combined cost or total of order cost, setup cost and inventory carrying charges. As indicated, there is a high total cost involved in issuing many orders and carrying a small inventory. This cost decreases if more inventory is carried and fewer orders in larger quantities are issued—but it decreases only to a point; then the cost climbs again because too much inventory is being carried.

The "Previous Practice" line indicates the company's practice before ordering RAMAC 305. Lacking historical and usage data that could be constantly and currently reviewed, the company had been issuing many orders and carrying relatively small inventory. The "Ideal Practice" line, drawn through to the point of intersection of carrying charges and order costs, indicates what the constantly reviewed EOQ within the system is approximating. In other words, there has been a controlled buildup of inventories by producing larger lot sizes (i.e., less order and setup cost) based on constantly reviewed usage and historical data. The "Potential Savings" area is bracketed and indicates the difference between ideal and previous practice.
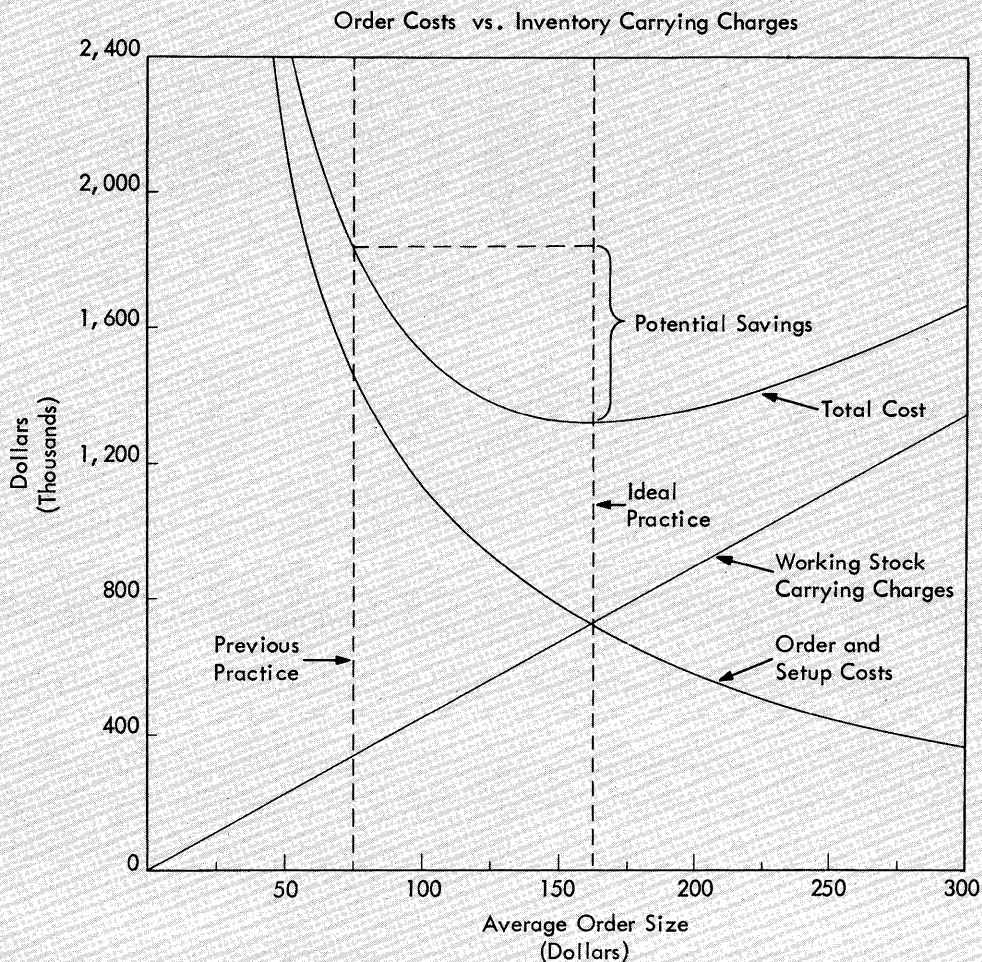
Figure 101. Order Costs Vs. Inventory Carrying Charges

Advantages Gained

The company's management evaluated the performance of the RAMAC 305 against previously determined requirements and found that the following results and benefits were derived from the system:

1. Reduction of the number of shop and purchase orders processed.

2. Reduction of inspection, ordering and setup costs by cutting the number of manufacturing lots processed through the shop.

3. Leveling of production through the use of economical order quantities, with consequent reduction in unemployment insurance payments.

4. Reduction of paperwork handling, resulting in a corresponding reduction in clerical costs.

5. Indications of inventory shortages in time to take corrective action.

6. Increased accessibility to accurate, up-to-date production control records.

7. Balanced inventories through the use of historical and usage data, by investing inventory dollars in active, salable items.

8. Isolation of inactive or obsolete items to reduce record keeping and inventory handling.

9. Restandardization of costs, done quickly at comparatively low expense.

Clearly there is a need for accurate identification of each part or raw material when the inventory is established. The identification must be positive. It must be possible to classify like items. And it is very likely that an accurate description would involve a lengthy written explanation.

The executive who is responsible for inventory and its movements would find it a colossal task to review a detailed inventory. But he would find a summary report of similar items, associated with each other by an orderly method of classification, a workable and valuable tool.

For these considerations, the use of codes has evolved as the simplest way of describing inventory items.

It has become common practice to identify the item first by material classification; this serves as the prefix of the stock number and identifies the major division over which financial accounting control is maintained. This factor, together with the stock number, gives complete identification for each item.

Symbols develop as convenient abbreviations of the terms used in identifying materials, concise in description and uniform in interpretation. The symbol should describe, rather than arbitrarily designate, and should positively identify a given material.

These are the three most common ways symbol codes are constructed:

1. By numerical codes, where each item is designated by a combination of numbers.

2. By alphabetic symbols, where each item is designated by a combination of letters.

3 By combinations of letters and numbers (PWD-3 to indicate plywood, 3 ply).

The numerical systems are the most commonly used, probably because they are simplest and yet have the greatest flexibility. They are easy to use, and have fewer opportunities for confusion.

Coding Systems

There are two basic systems of assigning numerical codes for the identification of materials:

The Block Code

Groups of numbers are assigned to specific kinds of materials, such as 400 to 499 aluminum-base materials, 500 to 599 copper-base materials. This system provides more groups with fewer numbers than any other sys-

tem, but its expansion is limited, and inaccurate appraisal of the capacity required for each group may lead to the awkward use of several blocks for the same type of item.

Significant Digit Code

Each field denotes some definite attribute, and each entry in the field denotes some definition of that attribute. It is often possible and desirable to use a combination of this system and the block code system in establishing a code.

Illustrative Coding System

Let us examine an illustrative eight-digit code, bearing in mind that there are infinite variations in codes, and that different industries and different parts of the same industry must develop codes to fit their own individual requirements. This code is used for raw materials and is subdivided as follows:

1	2	3	4
Basic		Physical	
Material	Alloy	Form	Size
XX	XX	X	XXX

1. Basic material—the primary element or general classification of the item (carbon, silver, steel, etc.).

2. Alloy of chemical composition—any variables of the basic materials represented by their mixture with

3. Physical form or shape.
other materials.

4. Physical size—key dimensions and tolerances.

It is immediately apparent that basic classifications for the steel industry would be quite different from basics for groceries, or paints, or electronic supplies. But it is also apparent that basic designations can be made in any line of products or materials.

Basic Material.—The basic material may be identified by a two-digit code. The items actually included will depend on the nature of the business, but it is usual to arrange them in alphabetic order and assign serial numbers, leaving gaps in the code for the insertion of new materials:

01	Abrasives	51	Mica
02		52	
03	Acids	53	Misc. animal products
04		54	Misc. inorganic products
05	Adhesives	55	Misc. organic products
06		56	Misc. vegetable products

07	Alcohols	57	Molybdenum
08		58	
09	Aluminum	59	Nickel
10		60	
	etc.		etc.

Alloy.—The specific alloy, or variation of the basic material, may also be coded by a two-digit number. To make this possible, we may have to divide a basic material into several basic material classifications (copper, brass, bronze, etc.). A typical alloy code can be formed by arranging the materials in inverse order of the purity of the basic element:

01	Pure copper SAE71	37	Red brass SAE79
02		38	
03	Pure copper SAE75	39	Brass SAE80
		40	
04		41	Brass SAE82
05	Annealed copper SAE83	42	
06		49	Bronze SAE67
13	White nickel brass SAE42	50	
14		51	Phosphor bronze SAE64
15	Brazing brass SAE44		

Here the block-code principle has been used in grouping the items into classes, less broad than the general class, yet more comprehensive than the detailed items.

Physical Form or Shape.—The physical form of the material is usually recorded with one digit. But two digits can just as easily be used in those applications where necessary or desirable. Here is the form section of the illustrative code:

0	Strip	5	Plate
1	Sheet	6	Tubing
2	Wire	7	Forging
3	Rod	8	Casting
4	Bar	9	Structural and other forms

This category brings up the question of definitions. Since the meanings of such common terms as "sheet" and "strip" are by no means standard, even among suppliers of raw materials, the master code sheet should include a careful definition of each one, together with the measurements and tolerances to be used. Regardless of dictionary definition, this must be the authority when code numbers are assigned.

Physical Size.—In coding for size, the block-code system is most commonly used, with specific groups of numbers being reserved for each principal size range. Of course, this grouping will vary greatly in different industries. The manufacturer of watches will have many more materials under ¼" in key dimensions than the builder of locomotives.

The size grouping is usually applied to the thickness or outside diameter of the material, and three digits are usually sufficient. Since coding of variations of temper, edge, finish, etc., would require a long and unwieldy symbol, it is better to provide for these variations within the size or item code.

Three digits are left in the eight-digit illustrative code, allowing numbers from 1 to 999 to be used for various sizes. If 015 is the code for ¼" in outside diameter of a round object, it follows that a round rod, ¼" in diameter, of a nickel base but a white-nickel bronze alloy, would be coded 59 for nickel, 13 for white-nickel brass SAE42, 3 for rod, and 015 for ¼" round. This would be 59-13-3-015—or simply 59133015.

This is not necessarily the order in which the symbols must be put together. Every phase of the symbol identification is determined by the explicit use for which the code is intended. Sections of the code can be expanded or reduced.

Unit of Measure

Unit of measure is an important part of the identification of any inventory item. Care must be taken to insure that the quantities indicated on any transaction use the same unit of measure carried on the inventory balance record. An illustrative code is given below:

Miscellaneous		*Liquid Measures*	
01	Piece - Each	41	Pint
02	Pair	42	Quart
03	Set	43	Gallon
04	Roll - Spool - Ball	44	Half Gallon
05	Sheet		*Linear—Area Measurements*
06	(c) or 100 pieces		
07	Gross	51	Inch
08	Ream	52	Foot
09	Bale	53	Yard
10	Dozen	54	
11	Pad	55	Board Foot
		56	Square Inch
	Containers	57	Square Foot
		58	Cubic Foot
21	Box - Package	59	100 Feet
22	Carton		*Weight Measurements*
23	Tube		
24	Barrel	61	Ounce - Avoirdupois
25	Drum	62	Pound
26	Tank	63	
27	Can - Jar Bottle	64	Ton (Net)
28	Carboy	65	Ounce - Troy
29	Keg	66	
		67	Dram

Materials Catalog

Where interpretation of the material code is required, an up-to-date and readable materials catalog is usually provided. This is a listing of all the items required for the operation of the plant, cross-indexed for easy reference. Here again, when the writing of specifications is under the control of the flexible IBM punched card system, the preparation of new sheets, or of an entire catalog, is not a major problem but a simple and accurate routine.

Figure 102 is a sheet from a materials catalog listed by an IBM accounting machine. Comprehensive data is listed in this catalog, but notifications could be made for individual requirements.

Note the orderly arrangement of materials by the characteristics of classification, when they are in numerical order of the code symbol. This encourages standardization, because the complete range of available materials is present. Standard materials, or those easily or economically available, can be spotlighted by an asterisk or some other special symbol at the right of the catalog page, as shown.

A similar catalog can be prepared from the same IBM cards used in this one. It would detail chemical and physical descriptions of the materials made for inspection, testing and purchasing. These may be indexed by the first four digits of the illustrative code (basic material and alloy), and placed on file for quick and easy reference.

Purchase Specifications

Following the same line of thought in regard to purchase specifications, the various attributes of purchased parts may be recorded and presented in similar form. The specifications agreed upon and cataloged can then be used to prepare purchase requisitions and purchase orders, with the entire operation conducted at machine speeds and with machine accuracy.

FEDERAL FACTORS INC.

RAW MATERIAL CATALOG

REVISED AS OF 2-28-6-   PREFERRED SIZE INDICATED BY SYMBOL ⟶ *

MATERIAL DESCRIPTION	MATERIAL CODE		SPECIFICA-TION	FORM	FINISH	TEMPER			EDGE	THICKNESS OR OUTSIDE DIAM.	TOLERANCE ($\frac{\times}{10,000}$)		WIDTH OR INSIDE DIAM.	TOLERANCE ($\frac{\times}{10,000}$)		L'NGTH IN FEET		STORES UNIT CODE
	PREFIX	SYMBOL				SCLE	MIN	MAX			+	−		+	−	MIN	MAX	
CARBON STEEL	171	100100	S 1010	STRIP	CF	RB	50	66	SQ	.0312	10	10	.5000	40	40	8.0	10.0	9	*
CARBON STEEL	171	100100	S 1010	STRIP	CF	RB	50	66	SQ	.0625	10	10	2.2500	30	30	8.0	10.0	9	*
CARBON STEEL	171	100104	S 1010	STRIP	CF	RB	50	66	SQ	.0937	10	10	4.750	40	40	8.0	10.0	9	
CARBON STEEL	171	100107	S 1010	STRIP	CF	RB	75	90	SQ	.1250	10	10	3.3125	40	40	8.0	10.0	9	
CARBON STEEL	171	100109	S 1010	STRIP	CF	RB	90	105	SQ	.1562	10	10	5.3750	40	40	8.0	10.0	9	
CARBON STEEL	171	101112	S 1010	SHEET	CF	RB	50	66	SQ	.0250	10	10	24.0000	50	50	8.0	10.0	9	*
CARBON STEEL	171	101115	S 1010	SHEET	CF	RB	75	90	SQ	.0781	10	10	32.0000	50	50	8.0	10.0	9	*

Figure 102. An Up-to-Date Catalog at all Times

Physical Inventory

One of the most important items on the balance sheet of an organization is cash—cash on hand and in the bank. Every precaution is taken to protect cash, to account for its acquisition and disbursement. Every cash transaction is checked and rechecked.

A good part of this money has been, or will be, converted into materials, but this conversion is merely a change of form. It is still money, still an important item on the balance sheet. This concept of materials makes desirable the same extreme caution, the same accurate record of transactions involving acquisition and disbursement of materials.

But no matter how complete and comprehensive the inventory book records may be, they must be verified against the actual quantity of material on hand. So a periodic check is made to actual quantity and value with the book record of quantity and value. This periodic check is called physical inventory.

To be of any value, physical inventory must include every item of material, counted, checked and evaluated. The count must cover raw material, work in process, and finished stock. When this actual physical count has been compiled and checked, and its value computed, it must be accepted as correct, and book value must be adjusted if there is any difference.

What about this difference between the physical inventory and the book value — a difference that is usually downward if it exists at all? Differences have the same effect on the balance sheet, and consequently on profits, that a cash shortage would have. The physical inventory, then, must reflect the true value of the material on hand. It must be accurate.

This urgent need for accuracy makes speed of inventory taking a matter of importance. The original count must be verified by a check-count. A recheck may prove necessary. Materials, whether in process or in stock, must not be moved about or disposed of during or between these counts. So, speed is vital.

Many manufacturing plants suspend operations during the period of inventory taking. Some wholesale and retail establishments, finding it impossible to close during a business day, take inventory at night, or on a weekend. In many cases, practically every employee is relieved of regular duties and pressed into service, assisting in the taking of physical inventory. Most of these people, obviously, are unfamiliar with the duties and practices of inventory taking, and yet they must be used.

Check and Counterchecks

The above facts make it essential that a careful system of checks and counterchecks be established in advance.

But the full purpose of physical inventory has not been fulfilled when inventory has been valued and the book record adjusted. Progressive management finds this information valuable to effective controls of business operation.

Consider some of the phases of a business that are affected by the inventory value. Inventory value is an important item on the balance sheet and the profit and loss statement. These financial reports are among the principal considerations by which a company is rated for credit and investment by banks, trade creditors, stockholders and potential investors. As a matter of fact, the inventory item is so important in these reports that an audit of the inventory is a prerequisite to the certification of financial statements by auditors and public accountants. The books cannot be closed until the inventory value has been accurately established.

When planning operating and cost policies, management must know the exact quantity of product units and production materials available.

With the concept of inventory as cash, it becomes obvious that inventory adjustments are to be avoided. Why were adjustments necessary? What caused the differences? The reasons must be investigated, and recurrence avoided or greatly reduced. It follows that these reasons should be known, in detail, by classifications of material, accounts, locations, or other pertinent subdivisions.

Planning of Inventory Taking

The element of time is so critical in physical inventory taking that it is of great advantage to plan every step of the procedure in advance, in detail. Delays can best be avoided by planning the sequence and coordination of the operations, and by considering all the specific conditions existing in an organization. In addition, the available man-hour and machine-hour capacities of the staff must be carefully evaluated. This calculated available time will make it possible to avoid peak loads on machines or personnel, with their resulting problems.

The process of planning should include the selection of the personnel to be used in the inventory counting. These people can be informed of their specific duties in advance, and problems posed, questions answered. Legible handwriting can be stressed, specimen items and procedures completed under supervision. Many companies, even after repeated inventories, find it desirable to hold a short inventory-taking rehearsal shortly before the task is actually begun. Sample situations can be outlined, and various methods of meeting these situations discussed. Competent supervision for the actual inventory work should be provided, and round-table planning sessions held. Many companies have even found it practical to issue a printed or mimeographed plan of procedure. At any rate, careful planning of details will pay big dividends in the inventory-taking operation.

An accountant is usually in charge of the inventory-taking operation, with department and section managers heading teams of personnel.

Prenumbered inventory tags are issued, with a tag-issue record kept showing the block of numbers assigned to each person who is to count inventory. An ample number of tags should be provided, and they should be prepared to the greatest practical extent. Tags for certain items can be prewritten, priced and punched. It is possible, in cases of slow-moving items, to take the official count in advance of the inventory day, leaving only the check-count for that day. At any rate, it is desirable to reduce to a minimum the amount of information to be entered on the tag by the inventory-taker. There will probably be certain items of information, not pertinent to the actual count, that can be entered on the tags at a later time. (Price, an example of such information, will be discussed later.) It may be necessary to arrange special access, during the inventory period, to official records that are needed by inventory personnel.

Auditing the Inventory

The audit of the inventory is usually performed by spot check—with special attention to the high-cost items. In the punched card method, cards sorted by unit price, or a detailed listing, can be presented to the auditor for his verification. Analysis has shown that as much as 80% of the inventory value may be represented by as little as 20% of the total number of stock items. The auditor might very well use some other factors in determining items to be spot-checked. These factors appearing in the balance cards can be used to select, list and tabulate records of the items so requested.

When the physical inventory has been counted, checked and audited, the results must be posted to the detail book-records of stock. These figures must substantiate the records or indicate adjustments.

Physical inventory-taking is an excellent time to begin keeping stock control records by punched card methods. The actual stock on hand is known precisely, and balance-forward cards can be produced by machine methods to initiate the stock control system.

Physical Inventory Made Easier

While many of the advantages of punched card inventory control have already been pointed out, it is well to underscore some of the points pertaining to physical inventory:

1. Automatic recording of all transactions throughout the year increases accuracy, and so reduces greatly the necessity for inventory adjustments.

2. The year-end stock control balance cards may be automatically compared with the physical inventory cards, at machine speeds, and the differences and detail adjustments quickly and conspicuously printed by the accounting machine.

3. Items may be segregated for a more exacting audit, by cost, or by any other factor of data punched in the card.

4. Prenumbered and prepunched tags make the search for missing tags a fast and simple machine operation.

5. The ease with which punched cards can be sorted and tabulated makes it possible to provide department management and top-level executives with analysis reports by any source classification desired . . . stock number, department, class of material, velocity, price, etc.

Inventory Counting and Recording

The inventory cards must contain all the data pertinent to the evaluating of the inventory. The inventory taker, as stated, should be required to enter on this card only a minimum of information—the count and, in some cases, the identification and location of the article. All other information can and should be secured and entered by other means, before the counting operation, or after it. For many items of a descriptive and classifying nature, the stock balance cards can be used as a source, and the greatest part of the required information gang-punched into the inventory cards. This greatly reduces manual effort and speeds up the entire operation.

The extent of the information to be recorded varies considerably according to the particular needs of each

organization and the type of analyses planned. These are typical useful items:

Part number	Quantity
Part name	Unit of measure
Kind or class of material	Size classification
Description	Unit labor cost
In-stock or in-process	Unit material cost
Account number	Unit burden cost
Location: plant, stockroom, floor, aisle, bin, depart-ment, last operation	Total unit cost
	Unit markup amount
	Rate of markup
Condition: rough, semifin-ished, finished	Unit selling price
	Unit profit amount
Active, slow, obsolete	Extensions

The actual cards and tags used in inventory taking vary considerably, since they are usually designed according to the method selected for counting, verifying and reporting.

Single Stub Card Plan

The simplest tabulating-inventory tag is the stub card (Figure 103). A card is written by the inventory counter, and the entire tag is attached to the inventoried item by its stub—tied on, stapled or pasted. The inventory checker follows in the tracks of the counter, charged with the responsibility of making a recount of each item, thus checking with the original count. Both portions of the tag are printed with a serial number, and the checker can now remove the main portion and send it to the machine accounting department. The stub remains attached to the stock item, as a visual indication to the inventory supervisor that this item has not been omitted. Any apparent error in the count, detected by the accounting machine as a difference, is immediately checked back to the stock item itself by reference to the corresponding serial number on the stub.

Figure 103. Stubs Are Commonly Used in Inventory Taking

Figure 104. Mark Sensing Saves Time

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Mark-Sense Plan

This plan has been gaining in popularity and usage because it lends itself very well to mechanization and is fast and accurate.

Tickets are used singly, or in pairs, or with a detachable stub (Figure 104). The inventory counters are provided with blocks of prenumbered tickets to account for. As they make their counts, it is necessary only to sense-mark part number and quantity, note the location, and initial the card. This information can then be automatically mark-sense-punched at high speed.

If auditing is required as part of the operation, duplicate cards are provided and filled out by inventory checkers. The use of mark sensing is flexible, applicable to many different situations, and is very effective where the inventory takers are properly trained and supervised.

Card Envelope Plan

This is an unusual plan involving the use of a card, a window envelope with a gummed flap, and a stub (also gummed) attached to the envelope—all three units serially numbered (Figure 105).

The original count is made on the card, and the card is sealed in the envelope, the window of which allows only identifying information to be visible. The checking count is made and recorded on the face of the envelope, and the stub is attached to the inventoried item. When the sealed envelopes are opened in the machine accounting department, a visual comparison is made, and any discrepancy is checked immediately.

This approach provides an excellent method for auditing and checking inventory taking, and eliminates the need for preparing duplicate cards for this purpose.
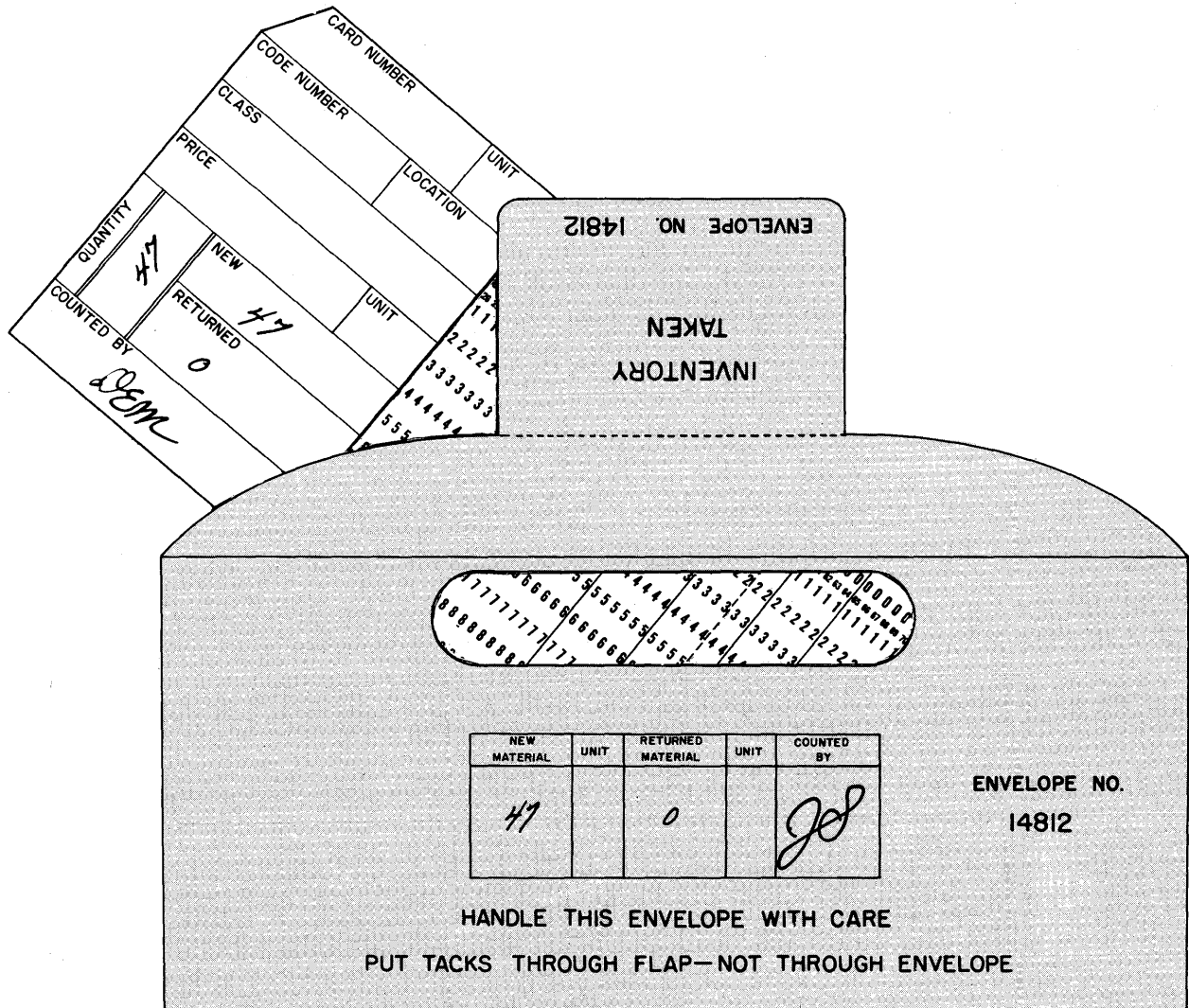
Figure 105. The Count on the Envelope Must Balance with the Count on the Card

Special Stub Cards

Figures 106 and 107 illustrate some of the numerous types of stub cards that are available. In some cases, the stubs and the cards are intended for comparison in the machine accounting department. Some tags have nontabulating multiple stubs. These are used, generally, where verification of counts is regarded as having secondary importance, but where original records are required simultaneously by various departments—accounting, stores, purchasing or others.

Figure 106. There Are Many Types of Stub Cards

Figure 107. Standard Cards Used for Inventory-Taking Purposes

There are so many variations of the uses of special stubs that these are offered for illustration only.

Prepunching

Prepunching techniques are applicable to most systems. Whenever this is possible, it reduces the amount of time needed by inventory clerks. For example, if warehouse locations were recorded in the cards and the cards sorted into this sequence, the job would be considerably simplified.

Mark sensing can be applied to many phases of the inventory-taking operation. This tends to eliminate peak loads in card punching and has the further advantage of reducing the problem of illegible handwriting (Figure 108).

Rotating or Cycle Inventory

Some organizations count their stock quarterly or semiannually, but this is unusual. In the majority of cases, a physical inventory count is performed once a year, at the end of each fiscal period.

In recent years, however, there has been an increasing trend toward the use of a rotating or cycle inventory, in which a permanent staff counts a section of the inventory each day. This method has a number of advantages:

- Peak loads are avoided.
- It is not necessary to shut down an entire plant or store; in many cases no shutdown of any kind is necessary.
- Thoroughly trained personnel are used.

- Counts can be taken at a time when stock is low. In general, cycle inventory offers a high degree of convenience and accuracy.

A problem to be overcome in this type of audit is the difficulty of achieving uniform record-closing at the time of counting stock. One simple solution is the use of colored, printed envelopes placed in the stock bin by the count clerk when he has established the quantity. All clerks are instructed that records of further issues or receipts must be put in the envelopes instead of with current transactions.

Each morning the audit clerk picks up the envelopes from the bins involved and removes the transaction cards. These cards are included in that day's transmittal of records and are so dated.

Remember that only a small section of the inventory will be counted each day. Furthermore, the purpose of the physical inventory is to corroborate the book-record or adjust it, and determine the reason for any needed adjustment. The inventory summary as of the date of the physical count will include all transactions up to the time of the actual counting, and the objectives of physical inventory taking will have been fulfilled.

Check for Missing Tags

During the inventory taking, every bin, shelf, carton or container had a stub attached to it to indicate that it had been included in the count. Supervisors could very quickly check to see that there was no stock without a stub, and consequently, that nothing had been overlooked.

Figure 108. Mark-Sense Processing Speeds Up the Job

Each one of these stubs is serial-numbered—every inventory taker had been issued tags, and the numbers of his block of tags had been recorded in the tag-issue record. By accounting for all the serial numbers, the accuracy of this phase of the counting effort can be assured. Each clerk was instructed that unused tags, whether blank, mutilated, or voided, were to be returned and reconciled with the tag-issue record. Balancing the tags that had been issued is the authentic inventory record. In order to verify that every item has been inventoried, and that every inventory card has been received by the machine accounting department, a missing-tag check is applied, either on the collator, or on the accounting machine with the consecutive number control device.

Pricing the Inventory

The greatest speed in the processing of inventory record cards can be achieved when preliminary planning provides for a minimum of manual punching. Item identification and the count must be manually punched or mark-sense-punched, but all other information should be entered mechanically at machine speeds.

This is easily accomplished by merging the inventory cards with the stock balance cards. The stock balance cards will serve as masters for gang-punching the desired data. The proper unit price will be included in the gang-punched information and will serve as the multiplier when the calculating punch extends the value for each inventory card. After the cards have been extended they can be sorted in the desired sequence, placed in the accounting machine, listed and accumulated to produce the inventory report.

Analyzing the Inventory

With the establishment of the inventory value, the accounting requirements have been satisfied. The books can be closed. But the inventory record cards can now provide high-level management with analyses and studies that are extremely valuable—sometimes indispensable—for proper control of business operations.

These record cards can be sorted for listing or group-printing by any desired classification. The cards can be placed in sequence by tag number and listed in full detail. This could be valuable as a reference during the audit, and also as a permanent record.

Another listing usually found desirable is by part number. This report shows all the available stock with breakdowns of quantity by location in different plants, warehouses, stockrooms or departments. Comparisons could be made with previous inventories, and

planning, production and logistics men would find this report significant.

Awareness of stock-by-location is an important aid to planning. Unsatisfactory distribution of total stock among various locations is immediately detected, and apparent overages or shortages corrected by transfer of stock from one location to another.

For work in process, similar reports can be prepared by department and last operation; for raw materials and finished stock, they will be significant if listed by plant, warehouse, storeroom and section. The inventory at each point can be evaluated against the requirements of that location. It may be found that decisions resulting from these and other studies will bring about inventory reductions without interfering with the manufacturing, sales and service programs.

Many concerns, particularly retail and wholesale distributors, find it important to have an analysis of inventory by vendors (Figure 109). These are most useful in such items as ready-to-wear, furniture, and large or costly items for which a unit-control plan is maintained.

The purchasing department wants to know whether materials have been purchased in the right quantities, at the right prices.

The engineering department is vitally interested in an analysis of the stock condition, suitable to their purposes. New products may be developed to utilize obsolete parts or subassemblies; slow-moving products may be reworked into products of a different nature; or planning for technical changes may be predicated upon the stock condition.

The planning department relies upon having exact knowledge of quantities on hand, in order to plan future production efficiently.

For the sales department, knowledge of quantities, rate of turnover, months' supplies, and other factors will be important in planning sales campaigns and fixing commission rates.

These are some of the many places where accurate and well planned inventory reports can form an integral part of the management picture. Data processing procedures make it possible to provide management with the information they require to control their inventory more effectively.

STOCK ANALYSIS (BY VENDORS) DATE 7-15-6-						
VENDOR	CODE	ITEM NO.	CLASS	QUANTITY	UNIT COST	TOTAL
A R BROWN CO.	1001	1056	1	6	24.00	$ 144.00
T K BOWMAN CO.	1050	1056	1	12	10.00	120.00
BURTON AND WILSON LTD	1175	1056	1	4	31.50	126.00
JONES AND SMITH INC	1540	1056	1	16	6.25	100.00

Figure 109. A Study of Suppliers, by Unit and by Dollar

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