

A MANAGEMENT DATA SYSTEM  
FOR SMALL BUSINESS

BY

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## PREFACE

A thorough review of the structure and operation of some twenty one small companies in Oklahoma during the period from 1958 to the present has revealed major problems.

While owners and managers of small businesses are daily confronted with production and operating problems of a minor nature they oftentimes fail to recognize the development of serious major problems. The aid of administrative and staff personnel to maintain surveillance is usually a luxury that most small businesses cannot afford.

The growth of most of the small enterprises was considered from the manufacturing and sales areas. The purpose of this thesis is to provide guidance in obtaining a management data system primarily oriented toward the administration and maintenance of business records and data.

Lack of accurate, timely information encourages procrastination by the small business manager. The failure to make a decision is in effect a wrong decision for it permits the growth of small problems into larger ones.

There is no single best system of maintaining data for all small businesses. Each small business reflects the individuality of its management.

General guidelines and areas of interest are described to enable the particular manager to select according to specific needs and within his capabilities.

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## CHAPTER I

### SMALL BUSINESS

In order to analyze the operations of small businesses it is first necessary to define small business. The U. S. Government, in establishing the Small Business Administration, set a limit of 500 employees, below which a business is small and above which presumably it is big. The concept of size is a relative matter and such definitive limitations require additional clarity. Although any definition is arbitrary, certain typical characteristics can distinguish small business from larger firms.

Small businesses are usually closely owned, and if incorporated, capital stock is seldom available for public purchase. The identification of ownership with management is a common characteristic of a small business in contrast to a large concern where a dichotomy is the usual arrangement.

The firms considered conformed in all respects to these specifications. Their area of operation was generally local or regional. Ownership was held by comparatively few individuals and capital supplied by a small group.

Some of these firms were unsuccessful and others were moderately successful. An unsuccessful company is easily defined. Any firm in bankruptcy or in reorganization under the supervision of the Federal court can be considered a failure. Voluntary liquidation is not

essarily a failure. Paradoxically all failures are not profitable. Many firms go out of business for other reasons than failure.

Impending failure, while quite apparent, could not be used as a factor. One striking characteristic of small businesses is the rapid swing between prosperity and disaster. The fast changes may occur in either direction. There have been frequent instances in which a new management took over a faltering small firm and, within a matter of months, "put it on its feet."

Success is much more difficult to define and again is a relative matter. Obviously the definition "the absence of failure" is not sufficient. Herein success will be defined largely on the basis of reputation and consistent sound earnings over a period of at least five years. Earnings and reputation are not an absolute criteria of success however, and a modicum of judgement has been interjected into each evaluation.



## CHAPTER II

### ORGANIZATION

Like "Topsy" most of our local industries just "grewed." An individual had an idea for a product, developed it, made it, and sold

After working 24 hours a day until exhausted the developer found that he could afford to hire employees to perform some of his activities.

With this brief history we have outlined the embryonic development of the majority of Oklahoma's industries. Also the basis for most of the management problems has been included. The owner-manager, having been in the center of all operations, usually finds it difficult, or impossible, to remove himself from this position.

Obviously, then, the analysis of the individual companies will reflect facets of the developer's capabilities, training, personality, and interests. The management function requires the continual making of decisions. The cumulative accuracy and judgement entering into these decisions results ultimately in the success or failure of the manager and consequently the enterprise.

All of the classic areas of responsibility are present in small business, even though some managers must, of necessity, "wear more than one hat." Responsibility areas are normally considered to be sales, purchasing, engineering, accounting, manufacturing and administration.

Ideally each of the aforementioned functions is performed

hout friction, with the executive exercising overall control. Unfortunately, this situation is rarely found. In the small business executive usually tends to usurp the prerogatives of his subordinate managers.

A small firm with one-man management resembles a professional vice, since the most important asset is the genius of the key man who can compensate, but only temporarily, for basically unsound organization.

Personality and business success may be closely related. Small businesses attract men of strong and colorful personalities; and strength of their personalities tends to influence, in turn, firms which attract them. The mild and unambitious are usually eliminated as the law of survival operates.

A primary executive function is to determine what is to be accomplished; to insure that the subordinates are capable and know what their objectives are; to check periodically on how well they are accomplishing them; and to develop methods by which they will perform more effectively. These are basic elements of management.

To operate a successful business today, management must specify objectives, establish plans and a system of procedure to accomplish them, delegate responsibilities and authorities, set up adequate methods and standards of performance, apply a scientific attitude, and evaluate results.

Management's task of governing, coordinating, and controlling the various functions of a business is not an easy one. Its aim is "to get things done" in a most efficient manner.

An organization chart of some kind must be followed to provide

ability and to prevent conflicts of authority.

It should be apparent that the success of any organization depends upon having an adequate number of human beings in the right place at the right time, producing in accordance with predetermined requirements. No system will obviate the necessity of managing personnel. Management is considered to be the art of getting things done through the efforts of other people. This breaks down basically into planning, organizing, and directing.

Planning should be accomplished by formulating a system of procedures and policies that reflects the basic objectives and goals of management. The system, properly planned and utilized, will aid in attaining the desired results in the best manner with the least expenditure of both time and effort. Policies, once established, designate the aims of the enterprise. They establish the pattern to be followed and the process whereby a top executive reduces the necessity for making routine decisions.

Organization will normally consist of the act or process of defining the lines of authority and responsibility of individuals, and coordinating their individual efforts for harmonious attainment of the predetermined objectives.

Direction usually means to command, coordinate, and control. To command is to issue definite orders, release instructions, or establish rules and regulations under which the operations are to be carried out. To coordinate is to design the structure by which the various units can operate together for the best interests of the enterprise. It is the process of getting all of the different work routines to move along together and smoothly toward a common goal. Control includes the

ctions necessary to insure that objectives are attained. Some of these actions are evaluation, appraisal, examination and investigation. Knowledge of the various aspects of a situation enable the manager to guide the outcome by exercising his managerial abilities.

While absolute control is not always possible, particularly when human beings are factors in the situation, achievement of realistic objectives indicates the existence of managerial control.

## CHAPTER III

### MANAGEMENT OBJECTIVES

Usually we think that businesses exist to make a profit. Few question this motive. Since most businesses begin, as we have noted previously, from the ambition of an individual, the financial success tends to be a scale of accomplishment. Most heads of small businesses are personally "married to their business." For this reason many decisions are emotional rather than coldly logical.

If we analyze the operations based upon the game philosophy wherein emotion and personality play a part we will tend to come closer to reality than through a sterile impersonal approach.

The following check list of management guides and activities will assist in making a comparison of considered businesses. Appendix C includes a detailed accounting data check list.

#### List 1

- I. Simple Adequate Records:
  - a. Records adequate and adapted to purpose.
  - b. Proper filing, accessible and available on time.
  - c. Parallel to line of organization.
- II. Cost and Production Standards:
  - a. Standards and variances shown in reports.
  - b. Overhead costs controlled
  - c. Continuous study for improvement

III. Informed Leadership:

- a. Adequate reports and communications.
- b. Comparison with past performance and standards

IV. Sound Organization:

- a. Clear untangled organizational pattern.
- b. Centralized personnel control.
- c. Trained understudies for key jobs.
- d. Proper sales organization.

V. Balanced Finances:

- a. Adequate liquidity and sensible borrowing
- b. Assets controlled

VI. Sound Labor Relations:

- a. Human recognition of labor.
- b. Wages in line with industry.
- c. Workers interested in production.
- d. Participation in profit by key personnel.

VII. Effective Plant and Equipment:

- a. Modern machinery well maintained.
- b. Production synchronized and standardized.

VIII. Research and Product Development:

- a. Market analysis.
- b. Improvement of product and production.

To insure compliance with policies one must first have a clear understanding of the objectives. Are they completely sound and practicable? What are the limiting and determining factors? The next step is to ascertain whether or not the policies are being followed by those concerned. Are they guiding the organization in the achievement

its objectives?

A poor system or procedure can be costly and may prevent carrying the policy for which it was intended. A system may have outgrown usefulness. A procedure may be confusing, misunderstood, or inadequate to fit the particular need.

Business success is chiefly gained by performing all operations effectively and by consistently striving for improvements. Such accomplishment can result only if there is a keen awareness on the part of management of the necessity for promptly translating good judgement into decisive action. Maintaining good control over operations is management's principal problem.

Evaluation of existing conditions is essential to any program. In consideration of our health we have a periodic physical examination, so should each business periodically have a management audit.

The management audit is a comprehensive and constructive examination of an organizational structure, its plans and policies, its financial controls, its methods of operation and its use of human and physical facilities.

The ground rules must establish the areas to be investigated and the limitations. These should be established and understood prior to initiating the analysis. Actual periodic examination is necessary in order to assure compliance with company policies.

Should the audit reveal deficiencies or weaknesses, such deficiencies must be corrected. Timeliness is as vital to the successful conduct of a business as it is in the conduct of a war.

Large volumes of paperwork tend to obscure pertinent data from the

ger's timely consideration. It is therefore quite necessary that he maintain close control over his paperwork generation.

In terms of volume, the letter is second only to the form. Except the report, the letter is the most expensive document produced. The for communication is revealed in the billions of letters, radios and telegrams that are transmitted each day.

Most letters are the production of management and include the necessary preliminary chore of reading and storing information.

Letters may be considered more than conversation reduced to writing. They should, therefore, convey facts and thoughts in simple, able and understandable language. Ambiguous correspondence only tends to confuse readers, and creates the need for further explanatory costly paperwork. The archaic third person form still used by Government Agencies and some businesses should be "junked." Correspondence should be written in a positive vein; use of the first person helpful in attaining this condition. Nothing is more distressing to receive letters written in the negative fashion, skirting around issues and leaving the addressee wondering what the correspondent has in mind. Some basic instructions for sound, economical reporting systems

1. Be brief and to the point.
2. Submit timely, accurate information.
3. Employ a format to minimize reading and writing time.
4. Include summaries with all voluminous reports.



Even though reports convey information necessary to the conduct of business, they may actually be unnecessary. Many reports convey operating conditions of some sort or other. These usually fall into three broad categories: Normal, above normal and below normal. Why normal conditions are ever reported is one of the unsolved mysteries of business administration. Management should be concerned only with improving satisfactory conditions and taking lessons in application from those that are better than satisfactory. Thus, if written standards are developed to describe normal or satisfactory conditions and departments are instructed to report only when these situations deviate from normal, the absence of a report would indicate the absence of any problems. To assist in the control of excessive paperwork, it is absolutely vital that policy and procedure be developed for the following areas:

1. Creation and use of forms.
2. Creation and use of reports.
3. Creation and use of administrative issuances.
4. Creation and distribution of correspondence.
5. Paperwork simplification.
6. Filing and retrieval documents.
7. Procurement, utilization and maintenance of office equipment.
8. Storage and disposition of inactive record holdings.

9. Protection against destructions and unauthorized disclosure of vital information.

## CHAPTER IV

### MINIMUM DATA REQUIREMENTS

Certain data are required of all employers by virtue of State Federal law. Each business must maintain these data to assure compliance with governmental regulation. The manager in accomplishing responsibilities would be wise to use this data as a nucleus and assume that his enterprise will flourish and grow, thereby requiring additional data.

Where adequate preparations for progressive growth have not been made, the growing company is usually strangled by an antiquated, inflexible, record keeping system. On the other hand ill-advised small companies have been overburdened by an elaborate, gaudy system of records far in excess of their current requirements.

This aspect of planning is therefore most important. First maintain the minimum records required by law. Second insure that the system is economical and is also capable of expansion even to electronic computers if future growth requires.

Keeping these objectives in mind the required records should be delineated and the method of maintaining them determined. The alternative methods of record keeping and their relative costs should be evaluated along with compatibility of systems, labor of maintenance, adaptability and speed of operation.

Much of the required data is financial in nature but is easily

ted for other purposes. Management data should serve two purposes. One purpose is historical records to indicate what was done. The other purpose is to guide decision making.

Since the bulkiness of historical records eliminates or minimizes their use for decision making, certain extractions must be made to provide necessary data. The bulk is principally routine facts and figures. Normal day by day payroll and production figures. The key extraction is the exception principle. Management by exception is practiced by each of us in the performance of our daily existence. Parents constantly filter out all the children's noises and notice distress or alarm signals. On shipboard the most alarming signal is silence felt throughout the ship when the engines stop. All of us usually listen only during a brief interval of our waking hours.

A major task confronting top management is the simplification of paperwork burdens in order to release sorely needed time for creative thinking. Business, government, and social activity depend on accurate records. In this "paper dynasty", man is regulated by documents from conception to death. Records are akin to man's memory and may be considered an extension of his brain. In them is stored knowledge by which decisions are made and plans are formulated. Small enterprises operate with a minimum of records. However, as ventures grow, the need for records multiply. Managers removed from the scene of operations are in desperate need of information on business administration. Without paperwork most communication dies, employees receive no feedback, performance is not reviewed, and management cannot control.

There must, of course, be official records, but the recording procedure is a secondary one. It is the tendency to regard it as

important which makes so many of our large businesses excessively bureaucratic, and it is because some chiefs elevate paperwork to a position of significance which it should not occupy, that they are overworked. Many managers spend too large a proportion of their time poring over documents and too small a proportion cultivating good individual relations with their subordinates. The resulting lack of confidence between people forces them into an elaborate machinery of committees which further restricts their time for personal contacts.

Basic records and reports required to conduct a business are:

1. Social Security and Withholding Tax Account Number.
2. Federal Unemployment Contribution Account Number.
3. Sales Tax Account Number.
4. State Withholding Tax Account Number.
5. Payroll Records Reflecting Hours worked, wages paid, taxes withheld, social security number, tax exemptions, etc.
6. Operating expense records reflecting payments, purpose, dates, etc.
7. Gross receipts or income reflecting dates, quantities, purpose.
8. Copies of the following forms and reports:
  - a. Monthly withholding depository receipts.
  - b. Monthly Sales Tax Receipts.
  - c. Quarterly Income Tax and Social Security Deposits.
  - d. Quarterly State Withholding Tax Receipts.
  - e. Quarterly unemployment contributions receipts.
  - f. Annual withholding tax forms including employee's W-2.
  - g. Annual unemployment contributions form.
  - h. Annual income tax forms as required by form of business.

In many companies, basic weaknesses work, "termite" fashion, for months or even years before their consequences are revealed in their statements. A careful management appraisal might have given forewarning even though the records and balance sheets indicated favorable conditions. Obviously then a favorable appearing set of records should not be accepted only on the basis of appearance.

The minimum basic records provide the nucleus of data for management decisions. The manager must supplement this data with technical data pertaining to the basic processes involved in his respective business. According to some present-day text books, management is a profession in itself and executives need no technical knowledge, since this can be employed. Although the reasoning is valid for big companies it is mainly not valid for small businesses.

The human mind is in reality a computing mechanism. The data input and the output are self regulated. The manager must recognize that the influx of trivia and erratic programs decrease the efficiency of the personal computer. Since it is self programming the major efficiency increase will come from careful selection of input data and optimum utilization.

Unfortunately management is disinclined to follow rational procedures. The manager is overwhelmed with data due to his inclination to want "all the information" that is available. He feels that by having this mass of detail pass over his desk he is keeping in close touch with his business.

Subordinate supervisors and staff employees also tend to "swamp" the manager by furnishing all the trivial data along with the pertinent information. The manager is thereby forced to "wade" through a jungle

ords and figures in an effort to determine the basic trends and variations from normal expectations.

The problem today is the need of management to get operating information in the form that it needs and in time to take effective action.

Judicious use of forms and condensed reports can eliminate superfluous trivia. Careful consideration should be given to design of forms and rigid control must be exercised to insure the form serves its complete purpose, efficiently.

A study beginning with a list of all records and reports prepared by given organization will readily point out duplication of effort and superfluous reporting. There is nothing complicated in the preparation of such a list; however, it very often requires considerable determination to bring about the discontinuance of records and reports. This is primarily due to the attitude that the information might be needed.

There are few management functions that are not recorded on paper. Therefore, an analysis of the paperwork performed offers an excellent opportunity to make a critical analysis of all business activities.

A form is a printed or duplicated piece of paper with "open spaces" to be filled in. This filling-in action is the time-consuming operation that concerns us. The cost of forms is estimated to be about 7 percent of the clerical expense of using them. Therefore, \$100 worth of printing is the authorization for \$930.00 worth of clerical labor.

Before office work entered the era of integrated data processing (D.P.) and electronic computers, the printed form was the very "warp

and wool" of systems design. The only integration of data was through the use of human beings, such as the typist who selected information from a bill of materials for transfer to a purchase requisition, the bookkeeping machine operator who created an invoice on the basis of a shipping ticket.

With the advent of punched paper tapes, tape-to-card and tape-to-tape converters, the storage of data on magnetic tapes and drums, and the use of internally stored programs, the principle of single entry of basic data and automatic transmission and processing without the intervention of human beings has had some effect in changing the role and design of business forms.

Three significant points concerning forms design and controls are:

1. Companies having integrated data processing systems no longer require as many forms, and maintenance of data in stages is unnecessary.
2. Forms for integrated data processing (I.D.P.) and electronic data processing (E.D.P.) are much more complex and, as integral parts of the complete program, can only be designed by one who is familiar with the requirements and limitations of the type of equipment being used.
3. Probably 90 percent of the forms in use will not fall within the purview of the IDP or EDP systems. Herein lies the challenge to efficiently design by being aware of technical developments in printing and reproduction processes and materials.

The printed form on a clerk's desk or in a typewriter is often a more eloquent device for directing the flow of work than the written procedure that is filed away in the bookcase.



Forms control consists primarily of:

1. Ascertaining that each form fulfills a basic requirement of an approved operating procedure.
2. Designing it so that it will perform its purpose efficiently and effectively.
3. Specifying the most economical method of manufacture.
4. Establish a system of stock control and replenishment that will make forms available when needed in economic quantities, at advantageous prices.

There are eighteen generally recognized types of forms. Their purposes are to:

1. Acknowledge
2. Agree
3. Apply
4. Authorize
5. Cancel
6. Certify
7. Claim
8. Estimate
9. Follow-up
10. Identify
11. Instruct
12. Notify
13. Order
14. Record
15. Report
16. Request

17. Route

18. Schedule

The fundamental purpose of the form is to record and convey formation. The form, therefore, should be easy to write and easy to read. Sufficient space is necessary for each entry. Entries should be in sequence of data being transcribed. Captions should readily indicate what is to be entered. As much information as possible should be preprinted on the form to reduce the time required to prepare it.

Lines should be spaced at  $1/4$  inch intervals for most handwritten entries. If a form is prepared optionally by hand or typewriter, 3 inch spacing should be used. If prepared entirely on the typewriter, horizontal lines should be omitted and  $1/6$  inch can be allotted per line.

The form stockroom is similar to the production parts stockroom, with most of the same functions and the same problems. Activities include maintenance of stock records, processing and filling withdrawal requisitions, watching stock balances and replenishing or purging stocks.

Table I provides a coding system for classifying forms while Table II provides a method of coding by function.

CODING SYSTEM FOR CLASSIFYING FORMS

FORMS CLASSIFICATION SYSTEM

Type of Construction (Prefix)	Purpose (Final Digit of 4 Digit Base Code)
A. Outside Purchased (not classified otherwise)	0. General and other
B. Company Printed (up to 8 1/2 X 13)	1. Requests
C. Company Printed (over 8 1/2 X 13)	2. Orders
D. Duplimats	3. Records
E. Hekto Masters	4. Movement or Material
F. Envelopes	5. Notifications
G. Tags	6. Identifications
H. Tab Cards	7. Reports and Analyses
I. Multipart Units	8. Schedules and Tables
J. Continuous Strip	

**ORGANIZATIONAL FUNCTION**

(First 3 Digits of the 4 Digit Base Code)

0100	Executive and General	1000	Sales Department
0200	Accounting Department - Basic Functions		1100 Sales - Product A
			1200 Sales - Product B
0210	General Ledger		1300 Contract and Order Service
0220	Accounts Payable		1400 Market Research
0230	Accounts Receivable		
0240	Payroll	2000	Engineering Department
0250	Timekeeping		
0260	Cost Accounting		2100 Laboratory A
			2200 Laboratory B
0300	Accounting Department - Related Functions		2300 Drafting
			2400 Blueprint
0310	Auditing		
0320	Budget Control	3000	Production Department
0330	Systems and procedures		
0340	Forms Control		3100 Industrial Engineering
0350	Cashier		3200 Production Control
			3300 Purchasing
0600	Industrial Relations		3400 Material Control
			3500 Machine Shop
0610	Personnel		3600 Assembly Shop
0620	Medical		
0630	Labor Relations	4000	Inspection Department

Special types of forms provide for ease of maintenance and reduce clerical costs. Some of these special designs are:

1. Carbonized forms
2. No-carbon-required forms
3. Snap-out forms
4. Continuous carbon interleaved forms
5. Form-feed devices
6. Registers
7. Sales books
8. Window envelopes
9. Translucent paper for diazone copies
10. Spirit carbon forms

Costs may be further reduced by maintaining orderliness and prompt filing of records. Adequate supervision and good training will accomplish a great deal toward an efficient accurate record system. Periodic verification by use of sampling procedures will enable the manager to correct deficiencies promptly and prevent gradual deterioration of the system.

## CHAPTER V

### ADDITIONAL NECESSARY MANAGEMENT DATA

For the small business manager no data is more vital than inventory status. Inventories of merchandise, materials, and supplies (which represent capital investment) may be the company's major asset. Closely following these requirements are production output, sales, production scheduling, quality and inspection, equipment maintenance, building maintenance etc.

Technical data required is dependent upon the product being manufactured or distributed. Sources of this type of data are usually suppliers since they maintain continuous research and development and are alert to customer's needs. Their service should also serve as an example for the small business manager that he must similarly support his sales efforts with service. At present there is no better economical method of handling the bulky suppliers catalogs than simple lockcases and binders or file cabinets and tabbed folders.

Filing may be by subject or alphabetically by trade name, however cross-indexed card file is essential. The local telephone directory's classified section provides an excellent reference index and of course the large metropolitan directories are even better. The local library is another seldom used source of guidance and their system of cross-indexing is an excellent one to follow.

A typical file might include the following broad titles in

dition to certain specialized subjects.

Accounting

Administration

Advertising

Buildings

Collections

Communication

Equipment and Supplies

Furniture and Fixtures

Inspection

Legal

Paperwork

Management

Personnel

Production

Purchasing

Real Estate

Security and Plant Protection

Services

Sales

Shipping

Training

Utilities

Under each broad category additional sub-divisions may be created needed. A convenient numerical file that acts as a cross index to the functional file of available forms may be set up simply by filing a copy of each form according to its control number.

Since data is rarely obtained at the appropriate time of use it must be obtained, stored, and then retrieved as required. Large organizations usually devote special staff effort to these functions but seldom can a small business devote more than a fraction of the manager's time to clerical filing time. The skill of the manager is sorely tried in exploring the various fields affecting his enterprise.

Trade journals, special news articles, government bulletins and subscription services help but do not solve the dilemma.

The most skillful manager can do little with a jungle of unclassified papers. There is genuine need to locate, inventory, classify, and make available the vast amount of important existing records. Failure to accomplish this not only impedes research but offers no real assurance that important research projects are not duplicated.

Development of original data within his own field of endeavor is a creative effort that the small business manager rarely ever finds time to do. A rapid reading course is always a wise investment for the burdened manager. This usually improves the acquisition of information by the manager and provides him with more time.

Product data includes drawings, tracings, blueprints and specifications. These should be identified by title and a consistent numbering system. To eliminate unnecessary handling these should also be indexed by card or by entry on a ledger. The ledger method is inflexible and the 5 X 7 card is much more suitable, for drawing changes can easily be noted on the record card.

Careful consideration must be given to the assignment of part numbers as well as the drawing numbers. If both right and left hand



ts are required the even and odd unit numbers can so designate. Participation of product improvement will require sufficient digits permit identification of changes sequentially.

Manual entries of data on small 3 X 5 or 5 X 7 cards, indexed and arranged in trays are a valuable filing tool. The major transition from this type of system is the coding of the data by perforating the card. The punched card system is described in Chapter VII in more detail and illustrated in Appendix D.

Flat card files with visible tabs which may be coded for various purposes are a useful refinement of the card and tray method mentioned. Some of the widespread uses of this type of filing are inventory control systems, equipment history and repair records, sales records.

The flat card system has been expanded to large size visible tab cards for use in production control scheduling and progress status.

The small business manager must determine his own data requirements and evaluate the benefits in comparison with equipment and clerical costs.

## CHAPTER VI

### DATA ACCUMULATION AND EVALUATION

The accumulation of data is a natural function of the man. The memory capacity of the human mind is not readily understandable however it normally continues to store experience data throughout the lifetime of its owner. This data is readily evaluated by comparing current circumstances with past experiences and decisions made based upon this evaluation.

The ability of the mind to assimilate data is limited by physical capabilities such as the form of the data and the environment. Familiarity with similar data, distracting influence, and capacity of the individual also act as limiting factors.

A primary purpose in accumulating data is to provide sufficient information for consideration in making decisions. Great masses of data are impressive but worthless unless they can be considered. Accumulation must therefore be thorough but judicious. Retrieval of specific data is increasingly difficult the greater the mass of accompanying data.

When filing by subject matter important and unimportant data are usually filed together. Thus unless unimportant records are systematically removed from files, basic decisions may be based on incorrect information or sufficient time for consideration may not be available.

Prior to an "all out" drive to collect data in support of a project, the limits of that project should be clearly defined. Review all pertinent records to insure that effort is not wasted by collecting data which has previously been obtained. Ask for opinions and judgments of specialists and experts. The services of libraries and governmental agencies should not be overlooked.

Accumulation of data can and probably will be from many sources. Much will of course be generated within the organization and will have varying degrees of significance. There are numerous government agencies concerned with supplying all types of information. Much of this is available through the Superintendent of Documents, Government Printing Office, Washington 25, D. C. State agencies, in general, parallel the Federal Agencies but may have more pertinent data applicable to the locality. Various trade associations and professional societies maintain extensive libraries and conduct research studies for benefit of their membership. Universities, educational institutions and various trade journals also provide sources of data for the small business manager.

The basic test of any item, "does it work", is also applicable of data accumulation and storage systems. Lack of use, and lack of trust of the retrieved data are the two greatest marks of failure of a data system. The manager that uses his data system and requires that they be maintained in usable form will be better for it.

Obsolete records and files must be purged regularly. This is best accomplished by scheduling retention periods for each type of record. Consider administrative, legal, fiscal, operating, historical or research value of each series and establish regular schedules for disposition.

Accumulation of data may be a by-product of routine business operations. Specific technical data and evaluation of special or routine data may require capabilities beyond those available to the small business manager. In such instances the services of a consultant should be considered. The manager should investigate local sources of expert help first, since living expenses of out of state consultants are quite burdensome and must be borne by the company being serviced.

Professional services are similar, therefore, after selecting a consultant, the manager should frankly discuss the problem that requires professional help. Both parties should reach a thorough understanding of the desired results, an estimate of cost and an estimated progress schedule.

The small business manager who desires reputable outside assistance should discuss his needs with local professional societies or university staff members.

## CHAPTER VII

### RETRIEVAL, DISSEMINATION AND COMMUNICATION

Data are received from many sources and in many forms. Some are stored as received, such as manufacturers' catalogs, manuals, books and correspondence.

Payroll records and production records may be manual entries or may be recorded on a punched card (Appendix D).

The problem is not the receipt or the generation of the data but the retrieval of the data. The cartoonists and humorists have great sport depicting the manager trying to find information in his office files. More frequently than not the manager cannot conveniently find the desired data in his files. This can be a frustrating experience.

The purpose of cross referencing as recommended for engineering drawings was to simplify retrieving them without delay and to minimize handling.

There are frequent occasions when the solution to a problem requires information to be acquired from previously accumulated data. To meet such needs, extensive archives must be consulted. Accomplishing the searching and correlation of massive files of information is an excessively time-consuming task unless measures are taken to organize collections of graphic records or to provide other aids to identifying items of pertinent interest.

Traditionally, such aids to searching and correlating have been

three kinds:

- a. Classifying documents and records into fixed arrays so that items pertaining to certain areas of subject content are grouped together;
- b. Alphabetized indexing to provide an array of subject-headings as aids to identifying pertinent documents;
- c. Encyclopedic compilations of factual data, as exemplified by the Gmelin and Beigstein handbooks or the International Critical Tables in the field of chemistry.

For many years these traditional methods seemed adequate to meet the information requirements. During the past few years, however, the situation has undergone rapid changes. As the volume and complexity of recorded information expanded at unprecedented rates, the effort and professional skill required to use conventional tools to search for, to locate, and to correlate needed information have likewise increased. As a consequence, the paradoxical situation has developed in which the continuing accumulation of valuable knowledge makes it less accessible, with a consequent loss in practical usefulness.

In considering information retrieval devices and systems, the importance of human memory is sometimes overlooked or underestimated. If it is possible to consult someone who knows what another person may need to find out, it is almost certainly possible to save much time and effort. The well-integrated knowledge of the expert coupled with seasoned judgement and creative imagination is an information source that cannot be equalled by a collection of documents or other records. Rather, such collections must serve as an adjunct to human memory - as a source of knowledge needed in making decisions, but not already in mind because

various human limitations.

There are several methods of cataloging or classifying and filing data. The retrieval efficiency is dependent upon the ability of the system to react to the demand of the user. Books and catalogs are filed in areas of specialization. The Dewey Decimal System and the Library of Congress System are limited to the extent that specific data can be retrieved. Usually reference to such systems places the researcher "in a ball park," so to speak. (12).

At some point in time a halt must be called in the fact finding process. Recognizing that decisions must be made under handicap of time adds urgency to the retrieval process.

Ability to retrieve information is directly dependent upon the coding or assignment of identification to the element of data. The programming of electronic data computers is even more dependent upon this assignment of addresses and position in the operating system than manual information.

Short sentences composed of simple, positive, monosyllabic words are far more effective than highly technical, ornate language. The average executive or manager spends much of his time reading, usually at the rate of less than three hundred words a minute.

This apparent inconsistency in meanings unduly complicates the arrangement of data elements into any storage system. Simplicity and standardization are therefore essential to consistent accurate retrieval. Published guide lines must specify the handling procedures to insure timely consistent retrieval.

Storage of data must likewise provide protection from damage, loss, or disruption of the retrieval system. The standard steel file cabinet

rovides only the minimum protection required.

The following types of records should be considered in a protection program.

Accounts Payable	Licenses
Accounts Receivable	Manufacturing Process Data
Audits	Minutes of Director's Meetings
Bank Deposit Data	Minutes of Stockholders' Meetings
Capital Assets List	Notes Receivable
Charters and Franchises	Patents and Copyrights
Constitutions and By-laws	Payroll and Personnel Data
Contracts	Purchase Orders
Customer Data	Sales Data
Engineering Data	Social Security Receipts
General Ledgers	Special Correspondence
Incorporation Certificates	Statistical and Operating Data
Insurance Policies	Stockholder Lists
Inventory Lists	Stock Receipt Books
Leases	Tax Records

Care must be taken to assure that outstanding information is recorded in the best ink and on the best paper stock. No amount of safeguarding will retain information placed on cheap sulphite stock in ink that is subject to fading. Valuable information placed on low grade paper or written with inferior ink can be protected by microfilming.

Information available from vital records is invaluable to business competitors in the same way that information in secret government documents would materially benefit an unfriendly foreign power. The federal government spends a great deal of time and effort guarding



against unauthorized disclosures of such vital information. Too many businesses ignore the possibility of commercial espionage. Such activity is much more widespread than is commonly realized. Organizations that have discovered such activities have for the most part been reluctant to make the matter public.

It is good business practice to protect the firm's property and to entrust it only to those employees who can be trusted. Most small business managers are prone to welcome new employees into their business "family" with a minimum of reference investigation and usually make all company data available without reservation. This is a most dangerous action. Almost any visitor can observe proprietary data. For example:

During 1952 a company, which shall be called, "Loring Machine Works", was in desperate straits. Ralph Loring was "barely making ends meet" jobbing minor machine shop work for local companies.

A friend in the building business inquired whether or not he could fabricate some metal duct and guttering. Though he had never performed sheet metal work, Ralph visited several local firms engaged in similar work with his friend.

Suffice to say that none of those firms are manufacturing the items mentioned today. Within two years Loring had a complete monopoly within the local market.

This danger of loss of proprietary information should not stifle exchange of information and, probably, the example pointed out the lack of progressive management on the part of the original manufacturers. Even so, much technical data is very valuable and should be protected.

Recording of data on forms manually and filing in original form

is still the very body of data storage. The more efficient but less generally understood storage of data in electro-magnetic "memories" is viewed with suspicion since such data is not visible nor of physical nature. The small business man usually cannot afford the initial cost of the large computers nor the overhead costs necessary to maintain such systems. However cooperative efforts of several small businesses are capable of supporting a computer installation for the benefit of the participants. Also large computer manufacturers are producing smaller computers and are establishing computer centers to sell computer time as a service.

Very few managers in small business are familiar with electronic computers. The tendency of college graduates, familiar with computers to go into large businesses retards the mechanization of small business record keeping.

The punched card and the machine accounting systems are more easily understood and a physical product is available. The manager can even learn to read or decode the punched card or the punched tape. Cost of such equipment is quite variable. The selection of data processing equipment must be made on the basis of an over-all plan rather than haphazardly. Care must be exercised to insure that improved units of equipment may be substituted for obsolete ones without seriously affecting the basic plan. The equipment components should be capable of interconnection and machine language must be common between components. Retranscription of data must be minimized and clerical transcription should occur only once. (4).

A familiar characteristic of punched card (tabulating) systems is that once data are punched into a card, that card may be used for a

umber of different purposes. It may be sorted, collated, interpreted and tabulated without further transcription or manual copying of data.

The most common language or code form utilized for business data handling is "card" code. Card code refers to the manner in which data are represented by holes punched in a card. Appendix D illustrates a punched card furnished for use with the equipment of International Business Machines Corporation. As can be seen, the card consists of 80 vertical columns. Each vertical column can represent one digit, letter, or other symbol. The digit, letter, or other symbol is determined by the position at which a hole (or holes) are located in the vertical column. A similar, but not identical card code is available on cards furnished by Remington Rand Division of Sperry-Rand Corporation.

The principal alternative machine code employed in business systems is known as "channel code." This is used with punched tape (Appendix E) and magnetic tape and will activate common language machines and automatic computers.

## CHAPTER VIII

### DECISION AND POLICY MAKING

The right to make decisions is eagerly sought by almost every individual. It carries with it all of the prestige of leadership. Unfortunately it cannot be given nor can it be achieved easily.

The failure to utilize available data or to even realize that needed data is even available results in defective decisions. Ultimately the responsibility for a decision must always rest with some individual. Nevertheless even a poor decision is better than no decision.

"One of the most widely followed rules of action is to make the decision by default."

#### MAJOR INFLUENCES ON PERSONAL DECISIONS (2).

- . Situational limits over individual choice.
  - (a) Ability of the individual to cope with and solve problems.
  - (b) Limited physical, functional or financial means.
  - (c) Actions taken by others which force or guide.
- . Factors of logical decision-making.
  - (a) Recognition of an actual problem.
  - (b) Understanding of one's operating environment and its impact.
  - (c) A set of identifiable personal values and goals.
  - (d) Knowledge and understanding of the pertinent facts.

(e) Recognition of the consequences of action.

Nonlogical influences on decision making.

(a) Fear and avoidance of the unknown (Don't Rock The Boat).

(b) Decision by indecision or default.

(c) Emulation, conformism, and submission.

(d) Conditions of acute personal stress.

(e) Emotionally feeling one's way between pleasure and pain.

(f) Wishing that something were so and rationalizing its actuality.

Much more subtle constraints are those which are imposed upon the executive by his subordinates. In a purely legalistic sense they do not control; they merely follow orders. In a practical sense they determine the way orders will be carried out. The mature executive knows this and plans his actions accordingly, even though he cannot know the necessity of doing so. (2).

The implication of this, it follows, is that you do not take actions which are foredoomed to being frustrated or nullified by the actions and inactions of your subordinates. (2).

The manager can do much to overcome undue influences. He must keep abreast of technical and social changes. Being well informed, he can then take action to overcome subtle obstacles. He must examine information critically and evaluate its source as well as its content. The manager should insure that the decisions made must be consistent with the objectives to be attained.

After proper consideration a tentative decision should be made and then a check made to see if the facts support it. The manager should go no more deeply into the facts than is profitable. Seek the few elements that account for the greatest portion of the situation.

rank known facts in order from the greatest importance to the most trivial. Then, on these bases, a tentative decision is made firm.

Original research and exploration into new fields can be the highest category of "intelligence." Care must be exercised to insure that such pursuits are not mere duplications of the work of others.

Results of a questionnaire directed to top level research managements of one hundred metal companies indicated a high positive correlation between earnings and the degree of ability to use recorded information.

During World War II, a defense plant maintained a costly staff of 100 engineers for original research on a multitude of projects. A management expert, wondering about the necessity for this outlay, investigated 50 sample research projects. To the amazement of the top officers, he demonstrated that half the cases he could have obtained the same, or better, information by going to the library. (12).

When using the services of technical assistance whether they be employees, consultants or suppliers, goals must be established both by cost and by accomplishment. The accomplishments should be compared to costs regularly. Be assured that the advice is good by reviewing past accomplishments and thoroughly checking references. Good advice could be used, poor advice is too expensive even if it is free.

The art of decision making has been thoroughly explored by many experts. Surprising findings were revealed in an 18-month study conducted jointly by the Catholic University, Washington, D. C. and R.F. Industries. (14).

These findings were:

1. "Snap" decisions are usually bad decisions. Subjects who

consistently made good decisions were those who used all the time available to them before signifying their choice.

2. Intelligent people make better decisions.
3. Degree of masculinity in men is unrelated to decision-making abilities.
4. Vocational interests are unrelated to decision-making ability. Within a group of persons with varying occupational interests, no relationship was found to exist between their interests and their ability to make decisions.
5. "Drive," or energy, does not indicate good decision-making. The study showed that the degree of excitability, impatience, energy of the individual had no bearing on decision-making behavior.
6. Mildly maladjusted individuals are fully as capable of making sound, fast decisions as those who fit well into their environment. The adjustment or maladjustment of individuals is not related to the goodness of their decisions, speed of their decisions or other aspects of their decision-making behavior.
7. Adventurous individuals will risk higher stakes than stay-at-homes. But the adventurers do not always bet on "long-shots," as might be expected. They will risk, or bet more, but they will bet on "favorites" as often as their less restless associates.

## CHAPTER IX

### SYSTEMS DESIGN

Systematic operation is not a new thing, it is a "way of life." Daily routine is a system performed to a great extent by force of habit. Disruption of the daily routine is strongly opposed by everyone even though easier, labor savings methods are intended. "Much like a turtle, man crawls only so far out of his habit shell as is necessary to live."

For most small business, manual systems are the initial answer to recording and retrieving data. The first business machine and sometimes the last is the typewriter. Forms then become the plasma of management communications and carry the data from origin-to storage-action point-to storage.

Various equipment salesmen are eager to assist in the design of a system. The purpose is obviously to sell their equipment. Even so, most of the reputable manufacturers have good products and their systems are much better than can be designed without costly, expert help.

To prepare for outside assistance, carefully analyze the operations in the area to be considered. List the objectives of this component. Outline the organizational structure affected. Where data flows between this and other departments, insure that forms design and records maintenance is compatible.



A typical system for equipment maintenance was patterned for use with the Remington Rand Kardex system, (Appendix B). All major items of equipment in the plant were inventoried and arranged in these files by building designation.

Two parallel processes were in use and the equipment was therefore identified as in Mill A or in Mill B. At the same time company serial numbers were assigned and tags affixed to the items of equipment.

Initially maintenance tasks were assigned, based on past experience, manufacturer's recommendations, operator's observations and breakdown. Each service action was authorized by a work order (Appendix A), usually filled out by the supervisor and completed by the mechanic after completion of the assigned action.

The supervisor collected the completed orders from the box assigned to the particular mechanic. The job assignments were arranged in order of priority.

The data from the completed work orders was entered on the equipment history card. Review of history cards then provided the supervisor with data to justify equipment replacement, installation of standby equipment, modification of equipment, inventory requirements for spare parts and preventive maintenance scheduling.

The use of various colored tabs keyed the various data against time intervals. This permitted the proper balancing of available labor to accomplish emergency repairs, capital improvements, and preventive maintenance. Such control is even more important in a small business than the larger industries since there is less flexibility and usually every piece of equipment is of critical importance.

The work order as illustrated in Appendix A was designed to

give a multiplicity of purposes:

1. Orderly assembling of various items of work to be performed.
2. Planning and scheduling of necessary work.
3. File of workload for ensuing period.
4. Authorization for performing work.
5. Accounting distribution or control indication.
6. Individual work assignments.
7. Completed work report.

Similar stock systems are available for inventory control, sales cards and control, and accounts receivable. Other fields of company formation are easily adapted to such methods of transcribing and filing.

Much management information is available with a minimum of counting work. (9).

<u>INFORMATION</u>	<u>SOURCE</u>
• Merchandise on order - - -	File copies of unfilled orders
• Accounts payable - - - - -	Unpaid invoices and expense bills
• Purchases - - - - -	Copies of purchase orders
• Expenses including wages -	Copies of check vouchers
• Cash disbursements - - - -	Copies of check vouchers
• Accounts receivable - - -	Copies of sales invoices
• Sales - - - - -	Copies of sales invoices
• Merchandise on hand - - -	Copies of purchase and sales invoices
• Other revenues - - - - -	Copies of receipts
• Cash receipts - - - - -	Copies of advices and deposit slips
• Cash balance - - - - -	Cash in the till plus bank balance

Such a system is practical only in a very small business for which

the proprietor and the members of his family perform all of the work, including the accounting. In principle, however, it is the system used by establishments of all sizes. It is important in setting up a system to make it sufficient unto itself. If journals and ledgers are used, it is merely because the number of papers handled is so large that it becomes expedient to list them for storage of data. When punched card equipment and automatic computers are used they become merely mechanical devices for the more rapid and accurate processing of unit data. (9).

Description of equipment available and reproduction methods in the following chapter illustrate the wide range of data processing and systems design. The well designed data processing system provides for the substitution of new equipment or improved systems for obsolete ones without disrupting the basic plan. Also the retranscription of data is minimized. A familiar characteristic of punched card systems is that once data are punched into a card, that card may be used for a number of different purposes. It may be sorted, collated, interpreted, and tabulated without further transcription or manual copying of data.

A useful analysis check list for accounting data systems is included as (Appendix C).

## CHAPTER X

### OFFICE EQUIPMENT

The proper use of office equipment increases productivity and quality, and reduces paperwork costs. Improper application of office equipment complicates record making and increases costs. The annual sales of office equipment and supplies is a multi-billion dollar figure.

The lack of mechanization in the office is partially due to a management attitude requiring quick amortization entirely out of proportion to the amortization requirement for machine tools. The daily saving of twenty minutes is equivalent to the ten-year amortization charge on a one thousand dollar office machine. (6).

Some small office tools and methods not found in most offices are:

Copyholder - It advances one line at a time on the copy, enabling the person typing, posting, or billing, to align a single line at a time. It is economical and saves time while increasing accuracy.

Collator - Permits the gathering of many sheets in sets. It is particularly adaptable to the preparation of catalogs, brochures, specification sets and such sequential sets. Mechanical collators are also available economically.

Uniticket Recorder - A manifest sheet combining journal sheet and single line record. Particularly adaptable to Accounts Receivable,

terial Requisitions, Scrap Material Control, Sales Analysis, Time and Job Tickets, etc.

Correction Tape - A self adhesive tape to eliminate messy erasures. Available for regular typing and spirit carbon masters.

Shelf-Filing - A method of alphabetical breakdown by date on terminal digit filing. Does not permit an elaborate system of indexing, but is normally acceptable because accumulation of data referring to one special subject is rare.

Numbering Machines - Relatively rare device that is a great aid in cross reference indexing or identification.

Addressing Stencil - May be attached to a ledger card permitting a variety of uses eliminating additional typing or duplication of address or description.

Spirit Writer - A duplicating device for addresses or short text messages.

Special Staplers - Such as the long arm stapler that permits stapling in the center of a sheet. Electric staplers that permit fast stapling of a quantity of papers without physical effort.

Hanging Folders - Suspended from guide bars extending along both sides of the file drawer eliminate bulging and out of shape files.

Tally Counter - Provides the simplest method for counting and recording vital facts in single units. When the cover is depressed, the dials register the recording. It may be grouped in banks up to a total of 72 units.

Folding Machine - For quantity circular letters, invoices, statements, catalog sheets, and announcements. It is small, portable, adjustable and electrically powered.

There are many other specialized items of a less general nature at offer even greater savings for their particular use.

Too frequently the manager falsely assumes that the secretary is miliar with all of the "tools of the trade" and will ask for equipment at is needed. This is a gross error. Even production workers tend to reluctant to ask for additional tools.

CHART OF TYPICAL OFFICE OPERATIONS AND RELATED MANUAL DEVICES

Operations

Devices

1. Writing and Transcribing: . . . . .

This is the most common office operation and is generally the most fruitful field for study.

1. Pencils (black, colored, mechanical, etc.)

2. Pens (ball, fountain, drawing, etc.)

3. Typewriters (regular, electric, special.)

4. Checkwriters, endorsers, signers, etc.

5. Key punches

6. Telauthograph (and other remote writing devices).

2. Sorting: . . . . .

Putting similar items together for listing, summarization, or distribution.

Under certain fairly common conditions, the manual methods employed with these devices sort faster and more economically than the best mechanical devices.

1. Box sorter

2. Leaf sorter

3. Vertical sorter

4. Needle sorter (marginal punched cards)

5. Table top sorting

6. Files

7. Basket

8. Sorting and filing aids i.e. cut outs, colors

3. Reproducing: . . . . .

The recording of repetitive data without re-writing.

- 1. Carbon paper in various forms.
- 2. Spirit duplicators.
- 3. Stencil duplicators.
- 4. Offset duplicators.
- 5. Embossed plate duplicators.
- 6. Rubber stamps.

4. Listing: . . . . .

The recording of significant facts in lists can frequently be eliminated by filing copies of the media which are to be listed. This technique is often described as bookless bookkeeping.

- 1. Journals written from media.
- 2. Accounting board which produces records.
- 3. Adding machines.
- 4. Typewriters.
- 5. Posting machines.
- 6. Addressograph with lister.

5. Calculating or Computing: . . . . .

Although electronic devices have successfully handled many mass computing situations, a great deal of calculating remains to be done by manual methods.

- 1. Mental calculation.
- 2. Abacus (widely used in the Orient).
- 3. Adding and bookkeeping machines.
- 4. Calculators - Rotary and Key driven.
- 5. Slide rule.
- 6. Precalculated charts.



6. Posting: . . . . . 1. Pen and Ink.  
The transferring of data from one record to  
another, as from journals to ledgers. 2. Typewriters.  
3. Bookkeeping and posting machines.  
4. Accounting boards.  
5. Systematic filing of original media.
7. Classifying: . . . . . 1. Sorting devices for unit media.  
The recording or filing of similar items 2. Columnar journals or worksheets.  
together in one place. 3. Distribution ledgers.  
4. Conversion of multiple item media to unit media.
8. Coding: . . . . . 1. Same as writing.  
The conversion of data to a symbolic form.
9. Transportation: . . . . . 1. Carrying devices such as folders, envelopes,  
The movement of documents from one place to 2. Conveyors,  
another. 3. Chutes.
10. Inspection: . . . . . 1. Does not involve any devices, but is facilitated  
The examination or review of a document by proper work place and good working conditions.

11. Storage: . . . . . 1. Sorting devices for temporary storage.  
Media may be kept temporarily pending further 2. Vertical files (blind)  
operations or may be filed permanently. 3. Vertical files (visible)  
4. Horizontal files (visible)  
5. Horizontal files (trays, baskets, etc.)  
6. Rotary files (blind)

In small business, with limited resources, equipment is generally limited to typewriter, keysort, mimeograph, and other devices, none of which, except keysort, are adapted to coding.

The most common form of coding media utilized by businesses is the punched card, (Appendix D). The punched card is almost synonymous with International Business Machines Inc., I.B.M. However Remington Rand Division of Sperry Rand Corporation and other companies use similar methods.

As can be seen, the card consists of 80 vertical columns. Each vertical column can represent one digit, letter, or other symbol. The principal alternative machine code is channel code. The name stems from the fact that impressions are made in imaginary or real channels which run continuously the length of the tape either paper or magnetic. A section of punched paper tape, with channels identified is illustrated in Appendix E. The columns are perpendicular to the channels. Each column represents one letter, digit, or symbol.

Cards, punched tape, and magnetic tape may all be converted from their basic codes to the codes of the several other media. Common language thus makes compatible any machine that will read or produce five, six, seven or eight channel punched tapes.

Figure I shows the performance of the operation of the tape machines in the preparation of check vouchers on a tape-creating typewriter, (Appendix E). This consists of the following operations:

1. Type voucher-check in duplicate, producing by-product punched tape, with selected data only.
2. Prepared distribution cards from tape, using tape-to-card converter.

3. Run by-product tape through Flexowriter (Appendix E) to obtain a check register.
4. Run punched cards through a punched card tabulator to obtain distribution.

Note that three end-products result from these operations. First voucher-check is produced. Second the punched cards for a distribution of debits are automatically prepared. Finally, a check register machine is created. The only manual process involved is the typing of the original voucher-checks.

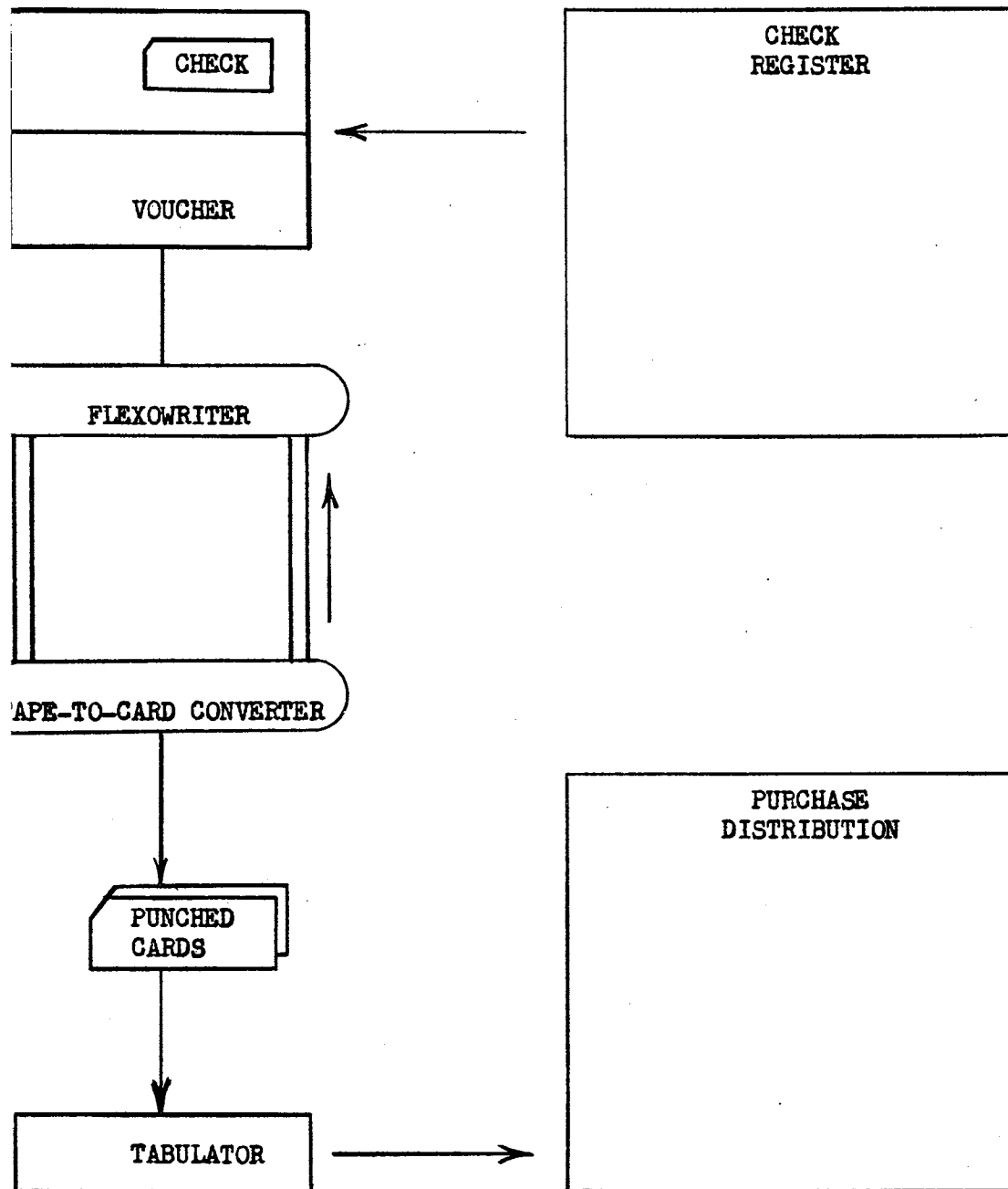


Figure 1. Performance of Operation of Tape Machine in Preparation of Check Voucher

## CHAPTER XI

### SUMMARY AND CONCLUSIONS

The operation of a business, even small business, is much too terse and too complex to consider all aspects in so brief a treatise. In so each manager of a small organization whether it be independent or a component of a large industry can profit from the guidance included herein.

No better philosophy of management in a "nutshell" can be found than the six principles expressed by Mr. J. C. Penny. (8).

"1. I believe in preparation. A man must know everything possible about his business. He must know more than any other man knows. His achievement depends largely on preparation.

2. I believe in hard work. The only kind of luck any man is justified in counting on is hard work. This means sacrifice, persistent effort, and dogged determination. Growth is never by chance; it is the result of a combination of forces.

3. I believe in honesty. There is a kind of honesty that keeps a man from taking something which belongs to someone else, but there is also that finer honesty that will not allow a man to give less than his best. That makes him count, not his hours, but his duties and his opportunities, that constantly urges him to enlarge his information and to increase his efficiency.

4. I believe in having confidence in men. I have found my most valuable associates by giving men responsibility, by making them feel that I relied on them. And those who have proved unworthy have only caused the others, who far outnumber them, to stand in a clearer light.

5. I believe in appealing to the spirit of men. One of the wisest of men said, "For the letter killeth, but the spirit giveth life." Every enterprise in which I have been interested demonstrates this fact.

6. I believe in a practical application of the Golden Rule as taught by the Master nearly two thousand years ago - one of the most fundamental laws that can be expressed in words, specifically stated in the literature of eleven known religions."

There are many sources of assistance to the small business manager. of them are dependent upon the willingness of the manager to seek p and to use the assistance provided.

The officials of a small firm risk failure if they do not know technical processes involved in their own businesses.

Small business attracts independent personalities and those who vive are strong.

Many of the small business group feel that their most pressing d is to be left alone by regulatory governmental agencies. (13).

By allowing the inept to fall quickly, small business serves a refining process separating the efficient from the inefficient. ll business enables able men to climb to success and attain ognition.

Equipment and methods are available at economical prices to enable efficient small business man to more than hold his own in competi- on with big business. The small business man cannot afford to do less n his best and efficient informative data resources will enable him do it.

The general guidelines and areas of data accumulation, storage l retrieval described herein should enable the particular manager select those items which will benefit his specific enterprise.

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## APPENDIX A

## THE DESIGN OF A WORK ORDER FORM

The design of the mechanical department work order (Figure 2) was a portion of the installation of a formal maintenance system in the Oklahoma City Plant of General Mills, Inc.

Prior to the installation of this system, the millwright crew was assigned to the Plant Superintendent but work assignments were made by each departmental superintendent or by the millwrights themselves. As a consequence work was initiated and performed haphazardly.

The purpose of the work order was to schedule or assign work to the individual millwright. Where more than one millwright was necessary the individual assignments were planned and reflected on the work order.

Accumulation of the completed work orders provided historical information on equipment maintenance costs, departmental requirements and provided a means of measuring the effectiveness of the preventive maintenance program.

All of the information desired by management was listed. Size of the form was limited to that which would fit in overalls or pants pockets. The form was stiff cardboard to permit filling out on the rough work benches. Simplicity was essential inasmuch as the millwrights were not clerical minded employees and resented "paperwork".

After six months use the form and associated procedures were evaluated. No changes were made. Meanwhile production had doubled. The millwrights appreciated written assignments and scheduled work from

single source. Departmental superintendents appreciated equitable distribution of manpower and priority work assignments. Better budget justification was available and systematic equipment renovation and replacement became possible.

MECHANICAL DEPARTMENT WORK ORDER												
DATE OF ORDER			LOCATION & EQUIPMENT DESIGNATION						ORDER NO.			
CHARGE -		ACCT.	CLASS		JOB STARTS:							
WORK TO BE DONE:												
LIST MATERIALS USED ON OTHER SIDE THIS CARD												
← AUTHORIZATION REQ.			LABOR HOURS			LABOR COST			MATERIAL COST			
ESTIMATED COST →												
ISSUED BY:				ASSIGNED TO:				WORK COMPLETED			INITIAL	DATE
HOURS	M	T	W	Th	F	S	S	TOTAL	RATE	MECHANICAL SUPT. APP.		
										DEPARTMENT HEAD APP.		
REQUESTED BY _____							AUTHORIZED BY _____					

Figure 2. Work Order Form (General Mills, Inc.)

## APPENDIX B

## VISIBLE CARD FILES

There are several manufacturers and distributors of visible card file systems. The best known supplier at present is Remington Rand Division of Sperry Rand Corporation. Their original product sells by the trade name of "Kardex."

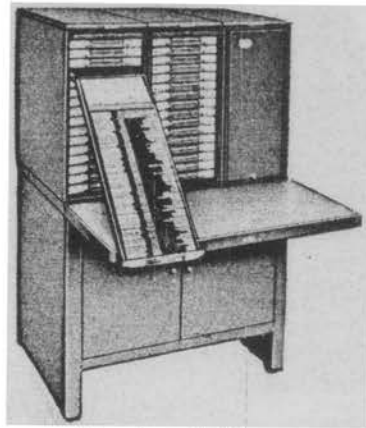
"Kardex" type records are extensively used for inventory, sales, accounts receivable and for cross referencing all types of data accumulation.

Normal method of storage is in sliding trays, hinged about a retaining guidepiece housed in steel cabinets. Other applications use reference frames which hang on a central axis and turn like the leaves of a book. The system is also adaptable to portable carts and to chart type wall display.

The key to efficient use of the visible card system is the condensed coding and indexing system. Basic identifying data and pertinent facts must be apparent within the space of the visible card edge. Once the item is identified the entire card is exposed and more detailed information becomes readily available.

While the system cannot be mechanized, since visual recognition is essential, it is efficient and is a transition between manual ledger type systems and the various coded card systems (Appendix D).

Edge coding consists of pertinent language description and colored plastic markers. The illustration of the Kardex Inventory Control is a typical example of the versatility of this type of system.



Kardex Cabinet

Record of  
orders,  
receipts &  
costs

Large  
record

Record of  
rent  
activity &  
balance

3041 V Belts										3041 V Belts No 0 31 IN										
ORDERED					RECEIVED					MONTHLY TOTAL										
DATE	QTY	ORDER NO.	QUAN.	COST	DISC.	YEAR	DATE	QUAN.	DATE	QUAN.	1956	1957	1958	1959	1960	1961	1962	1963	1964	
1/5	1	P112	350	168.	5%	C	1/26	175	1/26	175										
1/11	2	P432	350	157.	5%	C	3/15	350												
1/18	2	P791	350	157.	5%	C	4/3	100	4/10	350										
										JAN	185	187	173							
										FEB	196	211	168							
										MAR	192	216	166							
										APR	187	173	160							
										MAY	211	235	190							
										JUNE	216	236								
										JULY	232	213								
										AUG	260	143								
										SEPT	212	152								
										OCT	226	190								
										NOV	190	199								
										DEC	173	187								
										TOTAL	2530	2920								
										MEMO	Order Point 180									

3041 V Belts No 0 31 IN									
IN-OUT AND BALANCE RECORD					IN-OUT AND BALANCE RECORD				
DATE RECEIVED	QTY	TOTAL MONTHLY	BALANCE	DATE RECEIVED	QTY	TOTAL MONTHLY	BALANCE	DATE RECEIVED	QTY
3/7	33	33	323	4/7	100	191			
3/10	43	76	279	4/10	250	414			
3/22	42	124	231	5/14	43	398			
3/28	44	168	187	5/21		305			
3/27	21	21	166						
3/29	49	85	103						
3/15	360		452						
3/21	39	129	413						
3/28	42	166	371						
4/9	30	30	341						
4/11	47	77	294						
4/18	20	17	274						
4/25	35	132	239						
4/28	18	150	221						
4/27	21	21	200						
5/2	59	75	196						
5/12	36	111	110						
5/21	19	130	91						

Figure 3. Kardex Tray With Inventory Cards

APPENDIX C

ACCOUNTING SYSTEMS DATA CHECK LIST

DATE . . . . .

Name of Company . . . . .

Address . . . . .

Nature of Business . . . . .

Location of Plant . . . . .

Average Number of Employees in 19\_\_:

a. Manufacturing - Direct . . . . .

Indirect . . . . .

Total . . . . .

b. Administrative and Clerical . . . . .

c. Selling and Distribution . . . . .

d. Other . . . . .

e. Total . . . . .

Copy of Income Statement . . . . .

Copy of Balance Sheet . . . . .

Organization:

a. Copy of Organization Chart . . . . .

b. Are lines of Authority Clearly Defined? . . . . .

c. Names and Titles of Executives supplying Data . . . . .

. . . . .  
. . . . .  
. . . . .

Reports to Management:

Nature of Report

To Whom Supplied

How Often

a. . . . .

b. . . . .

c. . . . .



Copy of Account Classification . . . . .

Sets of Important Forms: (Copies of each obtained ) . . . . .

a. Sales Order . . . . . d. Purchase Order . . . . .

b. Factory Order . . . . . e. Receiving Report . . . . .

c. Sales Invoice . . . . . f. Disbursement Voucher . . . . .

Books and Records:

a. Journals

	<u>Sample Obtained</u>	<u>Bookkeeping Time Per Month</u>	<u>Kept by Whom</u>
(1) Sales Journal . . . . .	. . . . .	. . . . .	. . . . .
(2) Sales returns & allowances . . . . .	. . . . .	. . . . .	. . . . .
(3) Purchase Journals . . . . .	. . . . .	. . . . .	. . . . .
(4) Purchase returns & allowances . . . . .	. . . . .	. . . . .	. . . . .
(5) Cash Receipts . . . . .	. . . . .	. . . . .	. . . . .
(6) Cash Disbursements . . . . .	. . . . .	. . . . .	. . . . .
(7) Voucher Register . . . . .	. . . . .	. . . . .	. . . . .
(8) General Ledger . . . . .	. . . . .	. . . . .	. . . . .
(9) Other . . . . .	. . . . .	. . . . .	. . . . .
	. . . . .	. . . . .	. . . . .
	. . . . .	. . . . .	. . . . .

b. Ledgers

(1) General . . . . .	. . . . .	. . . . .	. . . . .
	. . . . .	. . . . .	. . . . .
(2) Private . . . . .	. . . . .	. . . . .	. . . . .
(3) Accounts Rec. . . . .	. . . . .	. . . . .	. . . . .
(4) Accounts Pay. . . . .	. . . . .	. . . . .	. . . . .
	. . . . .	. . . . .	. . . . .

b. (continued)	<u>Sample Obtained</u>	<u>Bookkeeping Time Per Month</u>	<u>Kept by Whom</u>
(5) Raw Materials . . . . .	. . . . .	. . . . .	. . . . .
(6) Work in Progress . . . . .	. . . . .	. . . . .	. . . . .
	. . . . .	. . . . .	. . . . .
(7) Finished Goods . . . . .	. . . . .	. . . . .	. . . . .
(8) Consignment Inv. . . . .	. . . . .	. . . . .	. . . . .
(9) Factory . . . . .	. . . . .	. . . . .	. . . . .
(10) Factory Expense . . . . .	. . . . .	. . . . .	. . . . .
(11) Property . . . . .	. . . . .	. . . . .	. . . . .
(12) Merchandise Inv. . . . .	. . . . .	. . . . .	. . . . .
(13) Supplies . . . . .	. . . . .	. . . . .	. . . . .
(14) Other . . . . .	. . . . .	. . . . .	. . . . .
	. . . . .	. . . . .	. . . . .

c. Other Records

(1) Employee Earning Records . . . . .	. . . . .	. . . . .	. . . . .
	. . . . .	. . . . .	. . . . .
(2) Insurance Records . . . . .	. . . . .	. . . . .	. . . . .
(3) Tax Records . . . . .	. . . . .	. . . . .	. . . . .
(4) Minute Book . . . . .	. . . . .	. . . . .	. . . . .
(5) Record of Production Standards . . . . .	. . . . .	. . . . .	. . . . .
	. . . . .	. . . . .	. . . . .
(6) Other . . . . .	. . . . .	. . . . .	. . . . .

Procedures:

a. Brief description and/or flow chart of the procedures under each of the following headings:

- (1) Sales, Accounts Receivable, and Cash Receipts . . . . .
- (2) Purchases, Accounts Payable, and Cash Disbursements . . . . .

- a. (continued)
  - (3) Timekeeping and Payroll . . . . .
  - (4) Production Control, Inventories, and Cost Accounting . . .
  - (5) Summarizing and Closing . . . . .
- b. Procedures Manual . . . . .
- c. Work Measure or overall cost of each procedure . . . . .

Office Machines and Equipment: Make    No. Used    Use and Department

- a. Bookkeeping . . . . .
- b. Tabulating . . . . .
- c. Duplicating . . . . .
- d. Adding . . . . .
- e. Calculating . . . . .
- f. Billing . . . . .
- g. Cash Register . . . . .
- h. Time Clock . . . . .
- i. Filing Equipment . . . . .
- j. Visible Index Files . . . . .
- k. IDP, ADP, Punched Card, Etc. . . . .

General:

- a. Brief description of products, sales prices, unit costs, and manufacturing processes . . . . .
- b. Statement of important management policies, accounting, finance, sales, production, etc. . . . .
- c. Brief description and/or chart of plant layout, management, and flow of production . . . . .
- d. Brief description of type of cost system. . . . .
- e. Brief description of budget system. . . . .
- f. Brief description of deficiencies in accounting system. . . . .
- . . . . .

## APPENDIX D

## PUNCHED CARD DATA SYSTEMS

The use of perforated or "punched" cards to record data is very old and several companies manufacture and sell equipment dependent upon such data source. The International Business Machines Corporation (IBM) is a major supplier of such equipment. The system described is basically one developed and distributed by IBM.

For almost three quarters of a century the punched card has been utilized to solve record-keeping problems. Since the first governmental application of punched cards, their use has extended into virtually every type of commercial and scientific enterprise. Equipment used to process these cards are referred to as Data Processing Machines or as Punched Card Accounting Machines (PCAM). Their primary function is to process business, scientific or commercial information in such a fashion as to give desired results. Results may take the form of a pay check, a purchase order, a sales report, or an inventory report. All these tasks, and many others, may be performed on the same set of equipment.

The Census Bureau required seven years to compile the collected facts of the 1880 census into useful and meaningful form. Since the future compilations would even take longer, Doctor Herman Hollerith, a statistician with the Census Bureau, developed a mechanical system of recording, compiling and tabulating census facts. His system consisted of recording the census data crosswise on a long strip of paper. The facts were recorded by punching holes in the strip in a planned pattern so that each hole in a specific location meant a specific thing. A special machine was able to examine the holes and electrically perform

tabulation as the long strip was passed over a sensing device. For ease of handling and for durability the paper strips soon were replaced by cards of a standard size and shape. These cards were the forerunners of today's punched cards.

In the early 1900s, market areas were widened and manufacturers were adopting mass production techniques. Commercial enterprises were growing. Their record keeping and accounting functions required more and more personnel. Accounting results were often received so late by management that they were of an historical rather than operational nature. The solution to many such problems was the use of Data Processing Machines, which were employed to reduce the mountains of paperwork, to effect standardization of methods, to speed up results and to reduce the cost of record keeping.

The use of the punched card has spread to almost every area of commerce, science and industry, and to almost every size of enterprise within each area. The punched card meets the record-keeping requirements of small businessmen as easily as those of the largest. The success of the punched card in meeting these requirements is expressed through its widespread use in the world today.

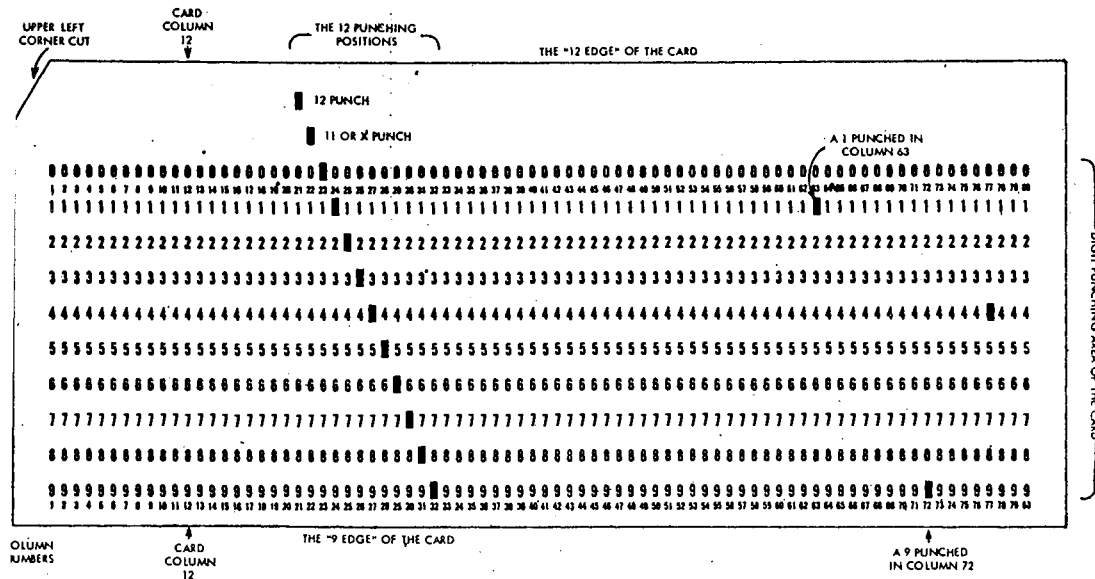


Figure 4. The IBM Card

The IBM card measures  $7 \frac{3}{8}$  inches by  $3 \frac{1}{4}$  inches and is .007 inches in thickness. The card stock is of controlled quality to insure strength and long life.

The card is divided into eighty vertical areas called "columns". They are numbered one to eighty from the left side of the card to the right. Each column is then divided into twelve punching positions. Thus in the IBM card there are 960 punching positions altogether. The horizontal lines of punching positions are designated from the top to the bottom of the card by 12, 11, or X, 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9.

Each column of the card is able to accommodate a digit, a letter or special character. Thus the card may contain up to eighty individual pieces of information. Digits are recorded by holes punched in the digit punching area of the card from 0 to 9. For example, in the card in Figure 4, there is a 1 punched in column 63, a 9 in column 72 and a 4 in column 77.

The top three punching positions of the card (12, 11, or X, and 0) are known as the zone punching area of the card. In order to accommodate any of the 26 letters in one column, a combination of a zone punch and a digit punch is used. The various combinations of punches which represent the alphabet are based upon a logical structure (or code).

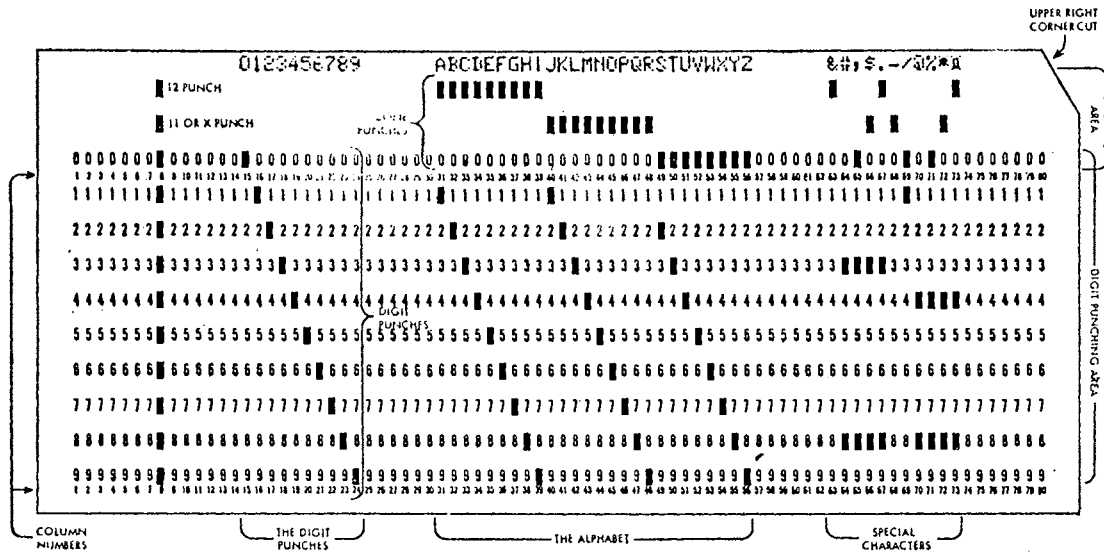


Figure 5. Punching

The first nine letters of the alphabet, A to I, are coded by the combination of a 12 punch and the digit punches 1 to 9. Letters J through R are coded by an 11 or X punch and the digits 1 through 9. S through Z, the last eight letters, are the combination of the 0 zone punch and the digit punches Z through 9. This alphabetic coding is illustrated in Figure 5.

The eleven special characters are recorded by one, two or three

aches. Their function is to provide printed symbols as required, to use certain machine operations to occur, or to identify various cards.

One purpose in assigning codes to data is to enable presentation of the data in the most meaningful, orderly and useful fashion, taking into account the relationship of each item of data with other items of the same or similar nature.

Prior to the selection of the type of code used and the assignment of the code to the data, the identity and nature of the data must be analyzed. The informational needs and desires of management are also considered in the analysis.

A code may be alphabetic, numerical, or both, although numerical codes predominate. The simplest type of coding is the assignment of the numbers in sequence to items on a list. Another type is the assignment of numbers in sequence to data in alphabetic order, such as a listing of names or firms.

The use of a coding structure usually permits faster machine processing in classifying or arranging. This results from the ability to act upon the code number rather than the longer designation of the data. By coding there is often a saving in the number of card columns utilized, this reducing the amount of card punching.



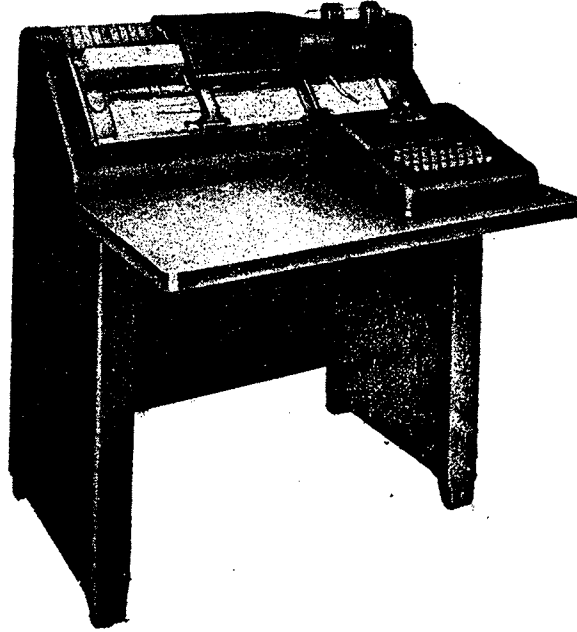


Figure 6. The IBM Printing  
Card Punch

Data is recorded in the form of punched holes by means of a card punch such as Figure 6. A keyboard on the punch, similar to that of a typewriter, is activated by key depression to cause punching of the proper letter, digit or special character in a card column. Data being punched may be printed at the top of the column depending upon the type of punch used. The punch operates serially; one column at a time is punched. After one column is punched the card is automatically repositioned for punching the next.

After cards have been punched, the data in them is usually checked for punching accuracy. The two most common methods are visual and machine verification. Visual verification involves reading the data printed at the top of the card during punching and comparing what is read with the data on the source document. Machine verification is performed on a machine similar in appearance to the card punch. The

First station of the verifier is called the verifying station rather than the punching station.

The IBM card with data punched in it serves two major functions. The card is the means by which the data is stored; information in the card is available over long periods of time for use as needed. The card also serves as the conveyor of the data, as it is the means by which the data is introduced into the machines for processing.

The process of converting the punched holes in a card into electrical impulses is known as "reading". Reading is done by the completion of an electrical circuit through the hole punched in a card column.

As a card passes into the machine each column goes under a separate wire brush. If there is a hole in a column, the brush makes contact with a source of electricity through the hole, creating an electrical impulse which the machine is able to process. Thus the punched hole is actually converted into a "timed" electrical impulse.

Once data has been converted into electrical impulses, the impulses are processed by the machine. The type of processing which the data undergoes depends upon the type of machine used and the results desired.

Prior to the preparation of data in report form, the data is arranged in an orderly fashion for easy use and ready reference. The process of arranging data in a sequence which will meet a specific requirement is known as sorting, or classifying. Data arrangement is performed by a machine called a sorter. The three basic types of classification performed on the sorter are sequencing, grouping and selecting.

Sequencing is the process of arranging data in alphabetic or

merical order, either ascending or descending.

Grouping is the process of arranging like items together.

Selecting is the process of extracting a desired item or items of data from a larger file of data.

There are a number of different IBM sorters which may be used for data arrangement. They range in speed from 450 cards per minute to 1000 cards per minute.

The basic purpose of the accounting machine is twofold: To print alphabetic and numerical data from punched cards in an orderly, meaningful and desired fashion, and to total data by proper classifications. The type and capacity of the machine used depends upon the requirements of the individual task.

The accounting machine is instructed to process data by means of a control panel, placed in a rack on the machine. A few of the functions of the control panel are to tell the machine what data to print from cards, where to print it, what to accumulate and by what groups, and when to print the totals. The control panel gives the accounting machine its flexibility, because by changing control panels a new set of instructions for processing data is given to the machine.

A basic installation of IBM machines normally consists of a card punch, a sorter and an accounting machine. In addition to the three basic types, machines in other categories were developed to meet various data processing needs. Each category includes more than one machine of different speed and capacity.

Collators are machines designed to match (compare) fields of data on two card groups for equality, to merge two groups of cards on the basis of data in them, to select cards punched with specific data, and

sequence-check a file of cards to insure correct ascending or descending order. A combination of these functions may be performed at the same time. Cards enter the collator from two separate feeds. Each feed operates at rates of speed from 120 cards per minute to 60 cards per minute.

Calculators are machines able to perform addition, subtraction, multiplication and division. Information punched in a card is read into the calculator where computations are made. A series of mathematical steps may be performed in one processing and the results punched into the same card. For example, an employee's payroll information may be read from the card into the machine, all taxes calculated and the net pay determined. All taxes and the net pay may then be punched into the card. Processing takes place at speeds up to 200 cards per minute.

Interpreters print on a card data punched in it. Either alphabetic or numerical data may be printed in any desired sequence. One line at a time is printed at speeds up to 100 lines per minute.

Reproducers are machines designed to perform three basic functions: reproducing, gang punching and summary punching. Reproducing is the process in which data in one set of cards is machine-read and punched into another set of cards. Reproducers have two separate feeds, one called the read feed and the other the punch feed. Reproducing is done at speeds up to 100 cards per minute.

Gang punching is the process of duplicating data from one card in a group to the next. Data in a card is read, punched in the card behind it, which in turn is read and the data punched in the next card and so on. Either entire cards or parts of them may be gang-punched at rates of speed up to 100 cards per minute.

Summary punch machines are able only to summary punch and gang-  
ch and are unable to reproduce cards.

In addition to the categories of machines mentioned, there are  
iers which are composed of machines designed for more specialized  
), such as: Statistical Machines, Paper Tape Machines, Card  
msmission Equipment etc.

## APPENDIX E

## PUNCHED PAPER TAPE

Punched paper tape serves much the same purpose as punched cards. Developed for transmitting telegraph messages over wires between two machines, paper tape is now used for communication with other machines as well. For long distance transmission of data, machines convert data from cards to paper tape, send the information over telephone or telegraph wires to produce a duplicate paper tape at the other end of the wire, and reconvert the information to punched cards.

Data are recorded as a special arrangement of punched holes, precisely arranged along the length of a paper tape (Figure 7). Paper tape is a continuous recording medium, as compared to cards which are fixed in length. Thus, paper tape can be used to record data in records of any length, limited only by the capacity of the storage medium into which the data are to be placed or from which data are received.

Data punched in paper tape are read or interpreted by a paper tape reader and recorded by a paper tape punch. Data are transcribed from source documents to paper tape by manually operated tape punching devices. The Friden "Flexowriter" is one of the better known such devices (Figure 8). The "Flexowriter" produces an original document and

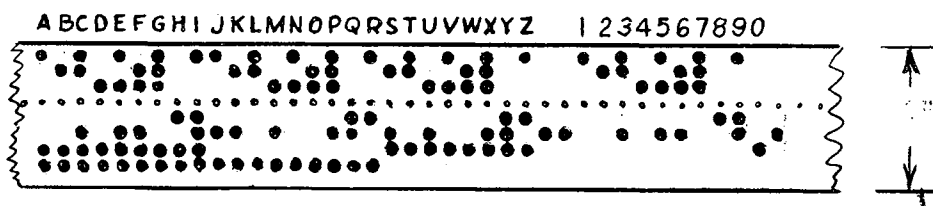


Figure 7. Channel Tape

ncurrently punches tape or cards as an automatic by-product. The tape  
: cards, in turn, automatically create other records. Input may be  
om punched cards, punched paper tape, edge-punched cards or from the  
yboard. The keyboard is used only for entering new data that has  
t previously been recorded. The "Flexowriter" writes all other data  
tomatically.

Output is in the form of a multi-copy printed document and a by-  
oduct punched tape, edge punched cards, or tabulating cards. With the  
dition of auxiliary output units, second documents, tapes, or cards  
ntaining complete or selected information may be automatically and  
ultaneously produced.

Because of the versatility of the tape operated equipment, the  
lexowriter" can meet the basic data processing requirements of any  
se or type of business. By producing purchase orders, sales orders,  
voices, shipping papers or by providing input-output for electronic  
puters the "Flexowriter" is a Keystone of automation.

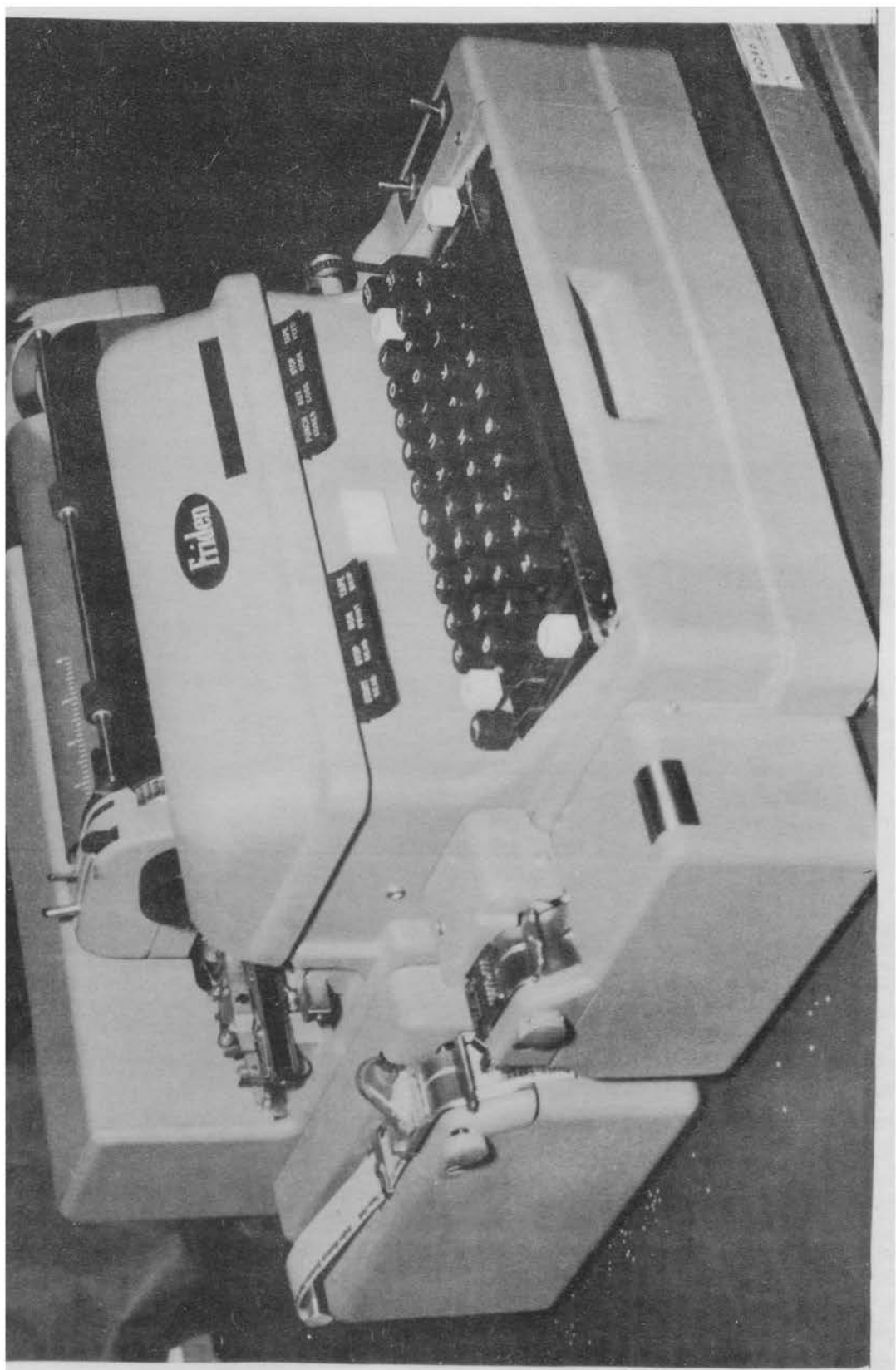


Figure 8. Flexowriter



VITA

William H. Richardson

Candidate for the Degree of

Master of Science

Thesis: A MANAGEMENT DATA SYSTEM FOR SMALL BUSINESS

Major Field: Industrial Engineering and Management

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completed the requirements for Master of Science in  
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City Plant in 1947; entered employ of Tinker Air Force Base  
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Mechanical Contractors as engineer-estimator in 1953;  
entered employ of William J. Collins, Jr. Consulting Engineer,  
as mechanical engineer in 1954; returned to Tinker Air Force  
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Engineers; Member American Society of Heating Refrigerating  
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Oklahoma Society of Safety Engineers; and member of board of  
directors of Tinker Society of Professional Engineers and  
Scientists.