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Mechanized Accounting

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In future years, the present period may be known as the era of mechanized accounting. The business world now has an array of machines to aid in clerical tasks from which to choose a combination to solve almost any data-processing problem. From the simple adding machine to the complex electronic computers, there are offered today a group of machines so versatile as to give hope that monotony in office work is soon to pass. Here is an interesting quotation: "The elimination of human drudgery will be accomplished only by the introduction of automatic tools." Was this spoken by a great modern industrialist? No, it was said by Aristotle over 100 years before the birth of Christ. Today, it could apply to office machines as well as it did then to the potter's wheel.

What is "mechanized accounting?" Broadly, it is any means, other than strictly manual, by which record-keeping systems are maintained. Machine systems unquestionably possess many superiorities over manual systems, such as in their ability to:

Enforce an accurate record of transactions.

Perform various operations simultaneously, such as adding, subtracting, computing balances, and accumulating control totals.

Post transactions on two or more related records at the same time.

Provide mechanical proof of correctness as a by-product of processing operations.

Eliminate operations.

Record a large number of routine transactions faster, more accurately, more legibly, and more economically.

These are only a few of the characteristics which have resulted in the general acceptance of machines in the office today.

REASONS FOR MECHANIZATION

Why do we mechanize? Dr. Howard Aiken of Harvard University

puts it this way: "In the past, engineers have been concerned primarily with four fundamental problems. The first of these has been the production of power, power being that by which men augment their own muscles; the production of tools, these being devices with which men have adapted their hands to their work; the production of instruments, these being devices by which men have adapted their sense of perception to their surroundings; and finally, through the use of power, tools, and instruments, the production of consumer goods. . . . But note that all of these activities have to do with the elimination of the physical drudgery to which our race is heir. Assume, however, as we enter the field of data-processing, that we are now entering upon that activity in which we hope to eliminate the clerical drudgery with which our race is associated. . . ."

This, then, may be one reason for seeking mechanization - a social reason which would have as its foundation the desire to free clerical personnel from low-level, repetitive tasks. Many in turn will be elevated to the responsibility for handling, on a higher level of thought, those exceptions from routine which are not subject to mechanization.

As a matter of business economics, however, mechanization would not be sought unless it were advantageous to do so on a basis of cost reduction or increased efficiency. Machines must be better than humans for the tasks to be done.

To some extent, the acceptance of these machines in the business community probably has been born of necessity. Without the machines, there would have been heavy pressure upon the economic system to provide the personnel to perform the many clerical tasks that are now done mechanically.

DEVELOPMENT OF OFFICE MACHINES

Just when efforts to mechanize accounting routines began has not been established. It is known, however, that the world's oldest and fastest manually operated adding-calculating machine, the abacus, was in use over 750 years ago. It is said, also, that there are more of these devices in use today than all other makes and models of adding and calculating machines combined.

Business machines of a less oriental character had their beginning in the 1880's, both here and abroad. The first comptometer was

developed by Dorr A. Felt in 1884 and in 1886 W. S. Burroughs completed his first models. Herman Hollerith developed the first punched-card equipment about 1890 so that we can say that modern accounting systems and the tools for mechanizing them had their beginnings at approximately the same time.

The development and use of such machines and equipment in this country has kept pace with the growth of American industry itself. As business organizations have become larger and more complex, there has been continuing pressure for improved mechanisms to solve their data-processing problems.

The Early Machines

While the development of each type of machine has moved steadily forward, the uses of the machines have come in waves. The earlier machines, such as adding machines, typewriters, and calculators were designed to improve a single function. The basic clerical functions are:

- Classifying
- Sorting
- Recording
- Calculating
- Summarizing
- Filing

From 1890 on, considerable growth in the use of machines of this type has been evident up to the present day, with improvements being made all the time.

The Advent of Bookkeeping Machines

After the first World War there was a widespread usage in large firms of machines which combined two or more functions such as adding and recording or recording, posting, and summarizing. Foremost among these are the bookkeeping machines which introduced an entirely new concept of accounting.

Instead of making the entries by hand on each appropriate ledger page, followed by computation of new balances on an adding machine and entry in turn on the same ledger page, the bookkeeper selects a card from a tub tray, and presses a few keys to enter the amount to be posted. The machine automatically dates the transaction, enters the posted amount, computes the new balance, posts it, and also carries, in an accumulator, the balances of all posted amounts in order to prove the total postings in any batch of documents.

Of particular importance, however, is the fact that through the

use of the machine, a clerk with a few weeks' machine training is able to do the work formerly done manually by the more experienced bookkeeper. By substituting for decision-making functions certain routines of bookkeeping and by establishing machine procedures, it becomes possible to speed the recording function and to absorb increases in the volume of transactions.

Punched Cards Come Into Their Own

About the time of and probably as a result of the depression in the early '30s, the use of punched cards expanded greatly. Punched-card systems have been used most successfully where operations are characterized by a large volume of transactions and where processing routines involve few exceptions requiring human decision. Since these conditions prevail in most medium to large businesses, the use of punched-card systems is widespread today.

Tremendous advances have been made in developing the versatility of this method since the days of the 45-column card, the non-printing tabulator, and the vertical sorter. Cards are now punched on fully automatic key punches no more difficult to operate than an electric typewriter. The punched cards can be arranged in desired combinations and sequences very quickly. The cards can be used to perform various other computations at the rate of 150 cards a minute. New sets of cards can be created from existing sets at the rate of 100 cards a minute.

Tabulating machine procedures have been designed for countless operations formerly accomplished manually on data records. Punched-card files can be merged or separated in accordance with practically any desired plan. Current cards can be used to select items from a permanent file for updating or cancellation. After these high-speed preparatory steps have been completed, reports can be prepared from the cards on machines which will list 150 cards a minute. The machines will print totals from groups of cards and will print either single or multiple lines from each card or from selected cards in the file. All this can be done in a report format complete with punctuation and showing various combinations of special characters.

While the wide usefulness of the punched-card system is derived to a considerable extent from its speed, and, to a lesser degree, from the variety of operations capable of being performed by the machines, its acceptance in the business world has been greatly facilitated by the fact that the basic punched-card record can be interpreted and read by either human beings or machines.

Far less manual control is required under the punched-card method than when bookkeeping machines are used. By storing a program of operations in a control board, the human operator is relieved of all tasks other than feeding the cards into the machine. Such operations as the selection of accounts to post (whether the item is a debit or a credit) and of the groupings which shall be subject to control balancing are predetermined under a punched-card system design, and, once determined, become automatic features of the system.

Punched-card systems have been in use for such a long time it is easy to lose sight of many things which are done within the systems because of the limitations of the systems themselves. In order to make most efficient use of each of the special-purpose machines within the system, it is not possible, as in the manual system, to take individual items, perform on them all operations, and follow through to completion. Instead, in the punched-card approach, all items are bunched and a particular operation, such as sorting, is performed on the entire group of items at one time. Only in this way can the machines be utilized efficiently. For example, it would not be practicable to select John Jones' time record, punch from it a card, place the card in a calculator to obtain gross and net pay, and then place the card in an accounting machine to print the results of the payroll computations - and following this, to take the other employees' time records and perform successively the same operations. The punched-card approach is a deviation from the manual method of accounting.

THE COMMON LANGUAGE APPROACH

One of the hindrances to complete mechanization has been the inability to classify data at the source in such a way that no further transcription would be needed. A further hindrance has been the lack of compatibility of equipment of various manufacturers. Some of the greatest developments by the business machine engineers and some of the most advanced thinking by methods personnel have been directed at this problem. This has led to the development of special types of machines utilizing a common language of perforated tape, which promise to change materially the older concepts of mechanized accounting.

These machines produce perforated tapes or punched cards as a by-product in the preparation of original documents such as material requisitions, payroll checks, invoices to customers, accounts-payable vouchers, purchase orders, and sales memos. By producing perforated

tapes or punched cards simultaneously with the production of these basic documents, a medium is available to serve as the basis for the mechanical summarization of reports and analyses in the accounting and reporting system. This new method is of special interest to smaller businesses because it eliminates the expensive manual card preparation and verification steps necessary to link their system with a service bureau. This means, for example, that as invoices are typed on an electric typewriter, a punched card is automatically produced which is available for delivery to a service bureau for preparation of sales analyses and accounts receivable statistics. Or, if the service bureau is located at some distance, a perforated tape can be produced instead of the cards, and this can be mailed to the bureau where it can be converted into cards automatically.

Presently there are machines of almost every type equipped with tape perforators. In addition to the electric typewriter, there are adding machines, bookkeeping machines, cash registers and typewriter-computers equipped to produce a perforated paper tape as a by-product of normal machine functions. This suggests that at any place where data originate, it may be possible to produce tapes so that an entire system can be mechanized to a very high degree. Although this possibility is far from realization at the moment, much is being done to overcome the obstacles.

On most of these tape-perforating business machines, there is provision for selection of the items to be entered as well as the code to be used on the tape. This feature makes it possible to limit the entry on the tape to pertinent data only and also, in some cases, permits the entry of special repetitive information stored in the machine or as read from auxiliary equipment. Tapes using teletype code may be used for transmission of data by wire. Transmission by radio link also is possible. The cash register machines are being automatically adapted to read Kimball or Dennison garment tags. This suggests an extension of the use of these machines to mechanized inventory-taking. By wheeling the machine through rows of garments and registering each hand ticket on the tape, a very rapid inventory might be obtained, both as to units and price. A similar method could be employed in the taking of periodic inventories in other types of industries where some form of perforated bin card or hand ticket could be utilized.

AND NOW COMPUTERS

There is now on the horizon a new challenge to those responsible

for the recording functions of their companies - the challenge of electronics. At nearly every technical or professional meeting these past few years, the subject of data processing by electronics has had a prominent place. The pressure is definitely on management to do something about this new approach to accounting mechanization. It has even been said that "The effect of electronic equipment on our economic life is of the same magnitude as the effect of the H-bomb on our military strategy." This seems an extreme view: Instead of a revolution, it is likely that an orderly evolution will occur, with which management must keep pace.

Just as adding machines, bookkeeping machines, and punched-card systems do their particular tasks more rapidly and more efficiently than human beings, so do the electronic computers have their characteristics which suggest that they can pay their way.

The principal feature of electronic data processors which appeals to those who are seeking the optimum in mechanized accounting is the ability of the system to function with a minimum of human intervention. In this equipment is found the highest level of automation for all of the record-keeping functions. Additionally, the system possesses the characteristics of speed, flexibility, and the automatic transmission of data from step to step. Let us consider, then, the nature of this equipment which promises to introduce a new concept in mechanization.

Any of the individual components of an electronic data-processing system could have been developed for use in conjunction with key-driven accounting machines or punched-card systems. It just happens that, in the original development of electronic computers, electronic engineers were attempting to solve a problem involving the processing of strictly mathematical data. Accordingly, they directed their efforts toward a machine using electric pulses operating on electronic circuits to perform arithmetical functions. The development of the central electronic arithmetical and logical unit with its fantastic processing speeds satisfied the scientist and the mathematician. It is taking a period of time, through which we are now passing, to develop the peripheral equipment which will satisfy those persons interested in the processing of business data.

During this period of development, the components of an electronic system may be found in various combinations constituting either special-purpose machines performing relatively few tasks or general-

purpose machines capable of being programmed to accomplish an unlimited number of tasks.

The special-purpose computers now in operation employ, as their principal machine element, a cylindrical drum device for information storage. Access to the drum occurs through inter-connected key-driven recorders or similar mechanisms. Examples of this type of equipment are the Magnefile used by B. Altman & Company department store and the Reservisor used by American Airlines. These are comparatively simple electronic machines earning their way in the business world. Beyond these limited applications, general-purpose machines are required to perform the more involved business data-processing operations.

Components of General-Purpose Computers

General-purpose machine systems to suit almost any fancy are presently offered. These are called machine systems because they comprise many pieces of electronic equipment. Most systems are practically made to order inasmuch as the combination of system components and capacities is a matter of customer specification. The system components of all makes and models fall into three major groups: input equipment, central computer, and output equipment. The central computer, in turn, may be thought of as being a combination of an arithmetical and logical unit, in which computation takes place; a storage unit, in which programs and working data are stored; and a control unit, for directing the sequence of operations.

Among all of these components, there is only one which appears to be entirely different from other conventional equipment developed in the past. We can understand a machine that calculates; we can understand a machine that reads prepared data; we can understand automatic print-out from processed data; but the concept of a complex, but flexible, stored program of operations is new. It is this which seems to be the new horizon. It is this which challenges the imagination in the promise of potential for use. It is this which transfers to the machine an almost perfect equivalent of human supervisory control.

The principle of the stored program is basically simple. It involves recording precise instructions in a specific section of the system where they will be available in any desired sequence to meet the contingencies of the application. This is analogous to some extent to the detailed instructions a mother might give her son the first time she sends him to the supermarket. The only difference might be that

the machine will do exactly as it is told.

Coupled with the supervisory capacity of a stored program are processing abilities resulting from very high speed, and accuracy, as effected by self-checking features incorporated in the machine design.

It would appear that electronics has provided the most versatile and powerful tool yet devised to mechanize accounting. In the search for better ways to do the task of record keeping, the various steps from manual methods to electronic data processing have provided tools of ever-increasing capabilities. The adding machine and calculator group performed the two functions of summarizing and recording. The book-keeping machines performed the three functions of summarizing, posting, and recording. In punched-card equipment, there were many pieces of machinery performing various functions, but since the machines were made compatible through the punched card, the entire system was integrated. All of the elements of data processing were performed on punched-card equipment: classification, sorting, calculating, summarizing, and recording. Continuous processing was not possible, however, because of the limited communication between functions. It was necessary to have people to move cards from one machine to another. In the electronic data processor, inter-connected units operating under direction of a stored program offer possibilities for a complete processing cycle without manual interference.

THE USE OF OFFICE MACHINES

The office equipment industry is a giant today. In addition to the larger companies, there are many smaller firms who build and sell office equipment. The variety of office equipment available is difficult to catalogue and new approaches are being developed constantly. In countless business establishments, we can see simple and complex machines performing their daily tasks.

In the department store, the conventional cash register protects the funds of the owner and provides him with a printed bookkeeping record of every transaction. The newly developed point-of-sale recorder will, in addition, provide a perforated paper tape from which punched cards can be prepared for automatic record keeping. Soon, it will be possible to feed this tape into an electronic data-processing system to provide even faster results for the guidance of management.

In the savings bank, the window-posting machines perform on-the-spot bookkeeping, simultaneously posting the passbook and the

depositor's ledger. More recently these window machines also have been cutting paper tapes with a record of the transaction so that a by-product of punched cards is obtained.

In the public utility, customers' bills are produced by bookkeeping machines or by punched-card equipment depending on the size of the company. Premium billings are performed, similarly, by insurance companies.

In the brokerage house, where for many years the purchase and sale tickets have been prepared on a computing bookkeeping machine, there is a noticeable trend to punched cards and small electronic computers.

In the aircraft and numerous other industries, there are vast arrays of punched-card equipment for the production of payroll checks for thousands of employees and for the maintenance of complicated cost and inventory records. In some of these installations, portions of the more complex records are now assigned to magnetic-drum calculators because these machines do some of the jobs better than the conventional equipment.

THE ADVANCE OF MECHANIZATION IN FASTGRO CORPORATION: AN ANALOGY

The impact of mechanical and electronic equipment on modern office procedures becomes evident upon reviewing the multiplicity of devices available today and the variety of jobs to which they have been adapted. To lend perhaps more specific meaning to such a review, it may be useful to indulge in analogy, imagining the evolution of a small business and the application of successive steps in the mechanization of its accounting routines as the business expands and grows.

Fastgro Corporation is a small machine shop employing ten metal craftsmen and a bookkeeper. Mechanical office equipment consists of an adding machine, a calculator, and a typewriter. All records, including the payroll, are prepared manually. Invoices to customers are prepared on the typewriter. The bookkeeper's salary is \$300 a month.

Fastgro prospers and soon, with a shop payroll of twenty-five, the recording work load has increased to a point where the bookkeeper is given a salary increase and an assistant. Problems of costing the product and controlling the inventory begin to appear. The situation is reviewed. The Company is still too small for mechanization but a few improvements are made in the present system, including the installation

of a write-it-once method for the payroll. At this stage, the office expense is now \$575 a month, the salaries of the two office employees. Of this amount, about \$300 is allocable to the payroll function. This is equivalent to a cost of approximately \$3.00 per payroll check.

Fastgro Buys A Bookkeeping Machine

Later, as a result of a merger with a neighboring welding shop, Fastgro boasts a work force of 160, consisting of 150 shop workers and 10 office employees. It now becomes apparent that some form of mechanization is desirable. A bookkeeping machine is purchased and it is decided to centralize all record keeping on this one machine. One of the clerks, supervised by the bookkeeper, will post the general ledger, maintain accounts receivable and accounts payable ledgers, prepare payrolls, and also keep subsidiary records pertaining to cash, fixed assets, securities, and the like.

The portion of the clerical and machine cost allocated to payroll preparation now amounts to \$1,700 a month, or about \$2.75 a check. This first step in mechanization probably will be the easiest ever made. Meanwhile, as the volume of transactions continues to grow and the employees increase to 300 in the shop and to 28 in the office, there are an increasing number of alternative methods to consider for absorbing the new work load. Should a new model of the present equipment be purchased? Should another piece of equipment be added? Is this the time to go to an entirely different mechanical method, such as punched cards? Or possibly to a small-scale computer?

After due consideration, it is decided that, since the present system has the desired elements of simplicity, the purchase of one more machine similar to the first will be the best solution in the circumstances. However, the management has been requesting various sales statistics and it is found that utilizing an edge-punched card in conjunction with the billing operation will produce a sales analysis more rapidly than was possible by the manual methods followed in the past. For a monthly cost of \$60 it is now possible to save 3 clerical hours each day in the sales analysis work. The total clerical and machine expense for the payroll function has now increased to \$3,100 a month, or a cost of approximately \$2.50 per check. This lower cost per check reflects the ability of the machine to absorb volume increases without proportionate cost increases. At this point, about 1-1/4 hours of clerical time per check issued is required to keep all records for each employee.

Fastgro Uses a Service Bureau

By hard work and alertness, Fastgro continues to forge ahead. It is not long until there are 500 employees in the shop and the clerical staff has increased to 30 persons. It now appears that the analysis work is beginning to bog down because of the daily volume. The edge-punched card has required sorting by means of a needle device and summarization of the recorded amounts by use of key-driven adding machines. While the machine cost has been low, the clerical cost seems to be unduly high.

Other complexities also have entered the picture. The functions of the accounting group gradually have been broadened. Management has been making increasing demands for statements, reports, and statistics. The situation calls for a complete survey of the accounting system.

In reviewing the system, it quickly becomes apparent that any consideration of improvements must include a study of the possible integration of the entire recording and reporting system. There should be a recognition of the relationships of the original data from transactions to all of the ultimate uses.

After analyzing the economics of the matter, it is decided that it will be preferable at the present stage to use a service bureau for punched-card processing in conjunction with the new system. Accordingly, two card-punching machines are ordered and installed, together with an adapter to the present bookkeeping machines. This permits punched cards to be obtained as a by-product of the bookkeeping operation. These additional machines add \$150 to the monthly machine cost. Card costs are estimated to be approximately \$80 a month. Four of the clerical employees formerly doing analysis work are transferred to other duties. The clerical plus machine cost for the payroll operation is reduced from \$3,660 to \$3,250 a month. In terms of cost per check, the reduction is from \$1.80 to \$1.60. Clerical time per check is now 40 minutes.

Fastgro Installs Punched Cards

This system proves to be so flexible that it serves adequately through a considerable period of further expansion in the Corporation's business. Ultimately, however, it is realized that the Corporation has outgrown the service bureau arrangement. Accordingly, Fastgro proceeds to install its own punched-card processing equipment.

As Fastgro continues to expand, it makes maximum use of its equipment and when the point is reached where there are 2,000 shop

workers and 180 clerical workers, its machine and clerical cost for payroll work aggregate \$8,300 a month, or \$1.03 per payroll check. Increased mechanization through maximum use of punched cards has driven the clerical time down to 13 minutes per check.

Fastgro Records Data at Source

It is evident, however, that expansion has again brought its attendant problems. The punched cards have allowed ample capacity for handling sales transactions but have not been utilized fully in all areas of payroll and labor distribution. The increase in shop personnel has occurred slowly and a growing number of employees are engaged in the recording function, especially in the determination of departmental costs.

In order to break the existing bottleneck and as a step in further accounting mechanization in the field of costs, an improved system is designed for use in the shop.

Twenty point-of-transaction recorders, costing \$1,000 each, are installed at each time-recording station. The employees are provided with identification badges containing removable inserts with their number, rate and job classification coded thereon. Job identification and time will be entered in the recorder by manual depression of the keyboard and employee data will be transferred from the plate.

Perforated tapes from the point-of-transaction recorders will be collected each day and converted into punched cards for daily processing. This system will provide for rapid recording of cost data at the point of origin. The automatic processing from there on will take place with a minimum of manual handling. The increase of machine costs amounts to approximately \$165 a month but has eliminated the requirement for manually punching and verifying 160,000 cards. The time-recording staff will be materially reduced.

After installation of the recorders, two of the eight operators processing time cards are retained in the tabulating department to process the paper tapes. The cost allocation to the payroll system is reduced to \$6,065 a month, which includes both clerical and machine cost. This is equivalent to 74 cents per check and reflects a reduction of clerical time to approximately 5 minutes per check.

Fastgro Looks Ahead

Soon the Corporation decides to build another new plant to construct components for jet airliners and, as a result, 1,000 more persons are added to the payroll. It is estimated that in three more years there

will be 9,000 shop workers and over 600 clerical workers in the organization. This projection poses a serious problem inasmuch as it has been very difficult in the past to obtain the new hirings necessary to maintain the clerical staff. The present monthly clerical payroll aggregates \$88,000 and the tabulating machines carry a monthly rental of \$4,600. It appears that both of these amounts will increase materially under the expansion program. Since the principal problem will be to obtain personnel, a study program is authorized for the purpose of mechanizing the accounting to the greatest possible extent.

The problem facing this mythical corporation is typical for many of the rapidly growing businesses of today. Let us see if a practicable solution is in sight. In one recent study, where the present cost of a highly mechanized (but non-electronic) payroll system amounted to \$1.20 per check, it was estimated that the machine plus human cost would be 21-1/2 cents per check under an electronic system, or a cost reduction of almost one dollar for each payroll check issued.

As a practical matter, however, all such cost and savings figures should be viewed with caution. At this stage of development, it is very difficult to appraise the reliability and completeness of estimates. Cost reductions will result principally from displacement of personnel, elimination of punched-card and other office machines, and reductions in space and related requirements. Experience to this time has shown that, on a company-wide basis, personnel savings are slow to materialize. Usually, policies of personnel relocation are adopted so that normal attrition and retirement are relied upon to solve the problem of reduced personnel costs. In many cases, tangible savings from the adoption of electronic equipment may be somewhat slow to materialize. Beyond this, however, the intangible benefits from improvements in management efficiencies may well prove to be the greatest contribution of the electronic system. As examples of the latter, the electronic data processors may have great impact in the field of production and sales planning.

GENERAL MANAGEMENT TAKES A HAND

Electronic data-processing machines are both complex and expensive. It is a very difficult and time-consuming job to convert all, or even a portion, of a company's data processing to these machines. For these reasons, a wholly new approach to accounting-system design has

evolved. Consideration of these system designs has penetrated further into the higher levels of management than ever before.

There seem to be two areas of decision relating to electronic systems which should be reserved for general management. One is the area in which a management committee is appointed for the purpose of keeping informed on electronic data processors, selecting applications within the business structure, and considering final system proposals. The other area deals with the necessity for crossing organizational lines in order to utilize the full capacities of this equipment. In this respect, some departments dealing with the gathering and preparation of financial and other business data may be partially or completely eliminated.

The participation of general management people in planning the electronics program will be one of the most important contributions to the rapid evolution of this field of mechanization. Here is equipment which seems to have an amazing potential in supplying answers in management areas where estimates based on experience have been the only guides in the past. Cost reductions appear to be possible through better interpretation of the accounting functions; through decreased demands for low-level clerical help; through alleviating financial requirements by better control of inventories, faster billing to customers, and improvement in control of product costs; and through determination of the most profitable use of production facilities and materials. Further, management cannot afford for long to ignore such equipment if this equipment has already started to assist an enlightened competitor.

FORMATION OF STUDY GROUPS

New things also are happening within the sphere of the accounting function. There is now a realization that the discovery of applications for electronic data processors and the development of these applications require the full time of personnel with special knowledge and skills. Based on this realization, there has been a trend towards the creation of groups assigned to the tasks of system analysis and design. Personnel of the groups are principally accountants. The analytic ability of the trained accountant, coupled with his intimate knowledge of his company's operations, makes him well qualified for this work. Where a company has a systems and procedures group already in existence, this group can take over the electronic assignment provided they have sufficient groundwork in basic accounting principles.

In either case, there has been the necessity for the group to acquire a basic knowledge of what an electronic data processor can do. There usually follows an evaluation of potential applications, then a detailed study of selected applications. It is during this period that many possibilities are discovered for cost reduction through more efficient operation, regardless of whether or not a computer is installed. The activities of the electronics group usually include preparation of the system proposal for management decision and the conversion of the system designed into the language of the computer.

Just as accounting records changed in appearance through use of tub-file ledgers with mechanical bookkeeping machines and the use of punched cards with tabulating equipment, so does the electronic system bring forth a new record form. This is the magnetic tape. There is nothing unusual about the tape used in computers. It is the same tape on which sound has been recorded and stored in a manner familiar to most everyone. Now, instead of recording music on the tape in the form of a fluctuating magnetic field, tiny magnetic areas are placed on the tape in coded form which can be read by the electronic equipment as pulses. Magnetic tape has proven to be highly reliable. It provided great storage capacity, as well as high-speed readability.

There has been a period of delayed acceptance of these electronic data processors but that period is rapidly passing. On the list of present and prospective users are found many of the famous American industrial and financial institutions that have achieved greatness through their constant search for new ideas and methods.

REALIGNMENT OF THE ACCOUNTING FUNCTION

The readjustment necessary within an accounting system upon the adoption of any of the predecessor mechanical aids to accounting is multiplied many-fold upon the adoption of an electronic system. In a way, this readjustment may be said to be one of simplification. The electronic system reverts to the approach of recording used in manual bookkeeping. Each item is processed in turn through the system, rather than being bunched with other items for specialized operations. The system is simpler because of the high capacity for storage of needed data. Files of rate schedules, prices, inventories, and the like can be maintained within the system so that raw data can be entered with relatively little preprocessing.

To accomplish such a high degree of automation requires a broader range of planning than has been found necessary in the past. That was the reason for the first wild scramble by prospective users for mathematicians, electrical engineers, radar technicians, and others having a knowledge of the computers. Now we know that the same sound principles of system design apply in this field as have been used in past system analysis. A company's own employees should make the installation. They can be trained in electronic data processors and they can be advised in systems analysis procedures. Consultants can be of real value when used in appropriate capacities. Their broad experience will aid the company team in many ways, especially in directing their efforts in a sound plan and in keeping them informed of new developments.

Looking back upon the fable of Fastgro Corporation, many of the fundamental rules of mechanization in accounting are illustrated.

These might be summarized as follows:

The machines used must fit the situations which exist at the various stages of a company's development.

The number and type of transactions to be processed usually limit the choice of machines.

The cost equation for mechanization is: the clerical cost plus the machine cost constitute the application cost.

Increased mechanization with sufficient volume usually results in decreased unit costs.

Just as industrial mechanization led to achievements far beyond anything man dreamed of before he had power, tools, and instruments, so will mechanized accounting develop methods of data processing limited only by man's powers of creative imagination. In the present era, there exists a great potential for tremendous change in the methods of recording and processing business data so as to produce both accounting and management reports with less human effort. Business may now have any type of data-processing machine it wants. By determining needs and making them known, machine users and their accountants can make a valuable contribution as we move forward in this new area of progress.