A STUDY OF PUNCHED CARD METHODS USED IN ACCOUNTING IN BUSINESSES IN OKLAHOMA

By

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CHAPTER I

AN INTRODUCTION TO PUNCHED CARD METHODS

Industrialization in the Southwest is new, and the growth of large scale enterprise in this region is relatively recent. This means that the use of the punched-card method in accounting systems in this region is so new that little is known about the accounting adaptations in use except by the manufacturers of the equipment and the users themselves.

I. THE PROBLEM

Statement of the Problem. This study was made for the purpose of gathering information concerning the use of punched-card methods in accounting, particularly in Oklahoma, and presenting this information in a non-technical form so that an accountant not trained in punched card methods might understand the functions of punched-card equipment in accounting and some of the accounting and auditing problems involved.

Importance of the Study. Most theses on accounting are read by college teachers and by students of accounting. For this reason, the material presented in this study was written for the purpose of extending the field of knowledge of students of accounting who will tomorrow be the practitioners in public and private accounting. A large percentage of accounting students will someday work for corporations which are so large that a punched-card method of accounting is already in use or will soon be in use. These people must acquire a working knowledge of punched card principles if they are to get the most from their accounting records. Although these people working in private accounting may not be working in the tabulating machine department of the company, a working knowledge of punched-card methods may be a factor in determining their promotion to executive positions.

Students entering the field of public accounting usually work for major

public accounting firms. Among the clients of such firms are numerous companies which use punched-card methods of accounting. The minimum requirements for auditing a company which prepared records by the use of punched card machines includes a careful study of the accounting procedures and system of internal control and audit in effect.[1] When an auditor writes his opinion concerning the financial statements of a business he must include in his opinion a statement that the audit was performed in accordance with generally accepted auditing standards. Auditing standards require an auditor to have adequate technical training and proficiency as an auditor.[2] If an auditor does not have a working knowledge of punched card methods of accounting, there is some doubt as to whether he would be qualified to give his opinion concerning the statements of a company using a punched card method of accounting.[3] It would seem logical that an auditor would not need to know the technical wiring of each machine, but he should know the functions of various machines and how the information flows through them to produce the records and statements being audited.

Every accountant relies upon the use of adding machines, cash registers, and calculators with complete confidence, yet many accountants view punched-card equipment with uncertainty and fear. The speed and simultaneous performance of many simple operations has caused the operations of punched-card machines to seem bewildering to many people. Many old practicing certified public accountants have turned over the audit responsibility of punched-card

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[1] David F. Devine, "Auditing Machine Kept Records," New Developments in Accounting, 1946, pp. 60-63.

[2] The American Institute of Accountants Auditing Research Bulletin Number 24.

[3] Norman V. Bellenoit, "Special Problems in Auditing Records Kept on Accounting Machines," The New York Certified Public Accountant, XVII(Sept.1947) 608.

machine installations to younger men because of the apparent difficulty of learning punched-card operations. An accountant must understand that punched-card equipment, although complicated, is nothing more than a tool of the accountant. The efficiency of such equipment depends upon the intelligent direction of the tabulating machines department by the supervising accountant. A knowledge of the advantages and limitations of punched-card methods is essential to many accountants.

Stella Traweek emphasized the importance of the role of colleges in training accountants and statisticians in the use of punched-card methods:

> Education of executives on the job is a difficult and often impossible job. That fact is a strong argument for training the future executives in modern methods while they are being given their formal educational background. They receive information with little prejudice and they being their career with the knowledge of equipment which can lessen their tasks and those of the workers they may direct and at the same time offer other improvements not possible using all long hand methods.[4]

II. MATERIAL PREVIOUSLY WRITTEN

Instruction manuals explaining the detailed functions of each machine and technical bulletins concerning specific applications of machines to various phases of accounting and statistics are made available to users of punched-card machines by the manufacturers. Short articles have been published in accounting journals concerning various phases of accounting by punched-card methods. An excellent doctoral dissertation was written by Stella Traweek concerning the application of punched-card methods to accounting and statistical problems of businesses in Texas. Several technical books have been written about the uses of punched-card machines in scientific computations and

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[4] Stella Traweek, "Application of the Punched-Card Method to the Statistical and Accounting Problems of Texas Business as Exemplified by Representative Case Studies." An unpublished doctoral dissertation at the University of Texas, Austin, Texas, 1949. p. 272.

statistical analyses. The few books written about the uses of punched-card equipment in accounting have for the greater part become obsolete due to new developments in equipment. For this reason no attempt has been made to present any of the technical aspects of punched card equipment.

III. DEVELOPMENT OF PUNCHED-CARD SYSTEMS

International Business Machine Corporation Equipment.[5] In 1885, Julius E. Pitrat invented a computing scale which was the forerunner of all punched-card equipment. This invention was further developed by Herman Hollerith, a statistician in the Bureau of the Census in 1889, in order to classify data of the national census.

His system was fundamentally simple. It consisted of recording in a card in the form of punched holes all the facts of any given situation. A pre-arranged code assigned a definite meaning to each position on the card. A hole punched in that position would then actuate electrically-operated mechanisms which dealt with the particular data which that position represented, functioning as counting or adding devices. The cards were made of a special paper which would not conduct electricity. The passage of the perforated cards under brush contact permitted an electrical circuit to be completed through the card at the position of the punched hole. This closing of an electrical circuit at a definite time and from a fixed position on the card was the basis upon which the machine operated.

Several companies were formed after 1890 for the purpose of manufacturing various types of business machines. There were several consolidations of these companies and as a result of one of them International Business Machines Corporation was formed in 1924. The term "IBM" has been universally accepted

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[5] International Business Machines Corporation Pamphlet AM-1.

as referring to any of the equipment manufactured by this corporation, and the term will be so used throughout the remainder of this study. Engineering research brought many improvements in old machines and invention of new ones. Operations were extended until the corporation now has customers in almost every country in the world, with factories in the principal countries supplying the market.

Remington Rand, Incorporated equipment. In 1907 James Powers, an engineer, developed other punched-card equipment which improved then existing census recording equipment. In 1927, together with seven other large office equipment companies, the Powers Accounting Machine Company was merged into one company, Remington, Inc. The purpose of the merger was to enable business institutions to obtain all their office equipment needs from one source.

IV. THE PUNCHED-CARD PRINCIPLE

The punched card has not changed form since it was first developed and it is still used by Remington Rand, Inc., and International Business Machines Corp. Instead of letting each position on the card represent a separate classification as used when the system was developed, an alphabetic and numeric coding system is presently used by both companies. The principal distinction between the cards used by the two companies is that the hole punched by IBM machines is an oblong hole while the hole punched by Remington Rand machines is a round hole. Fig. 1 illustrates the coding system used by each company to indicate digits and letters. Except in a few cases for special purposes, double punches in a column of an IBM card indicate letters and are so transcribed by the machines. Use of the upper and lower halves of the card separately gives Remington Rand 90-column card capacity as compared with IBM's eighty.

The first step in punched-card operations is to punch information in

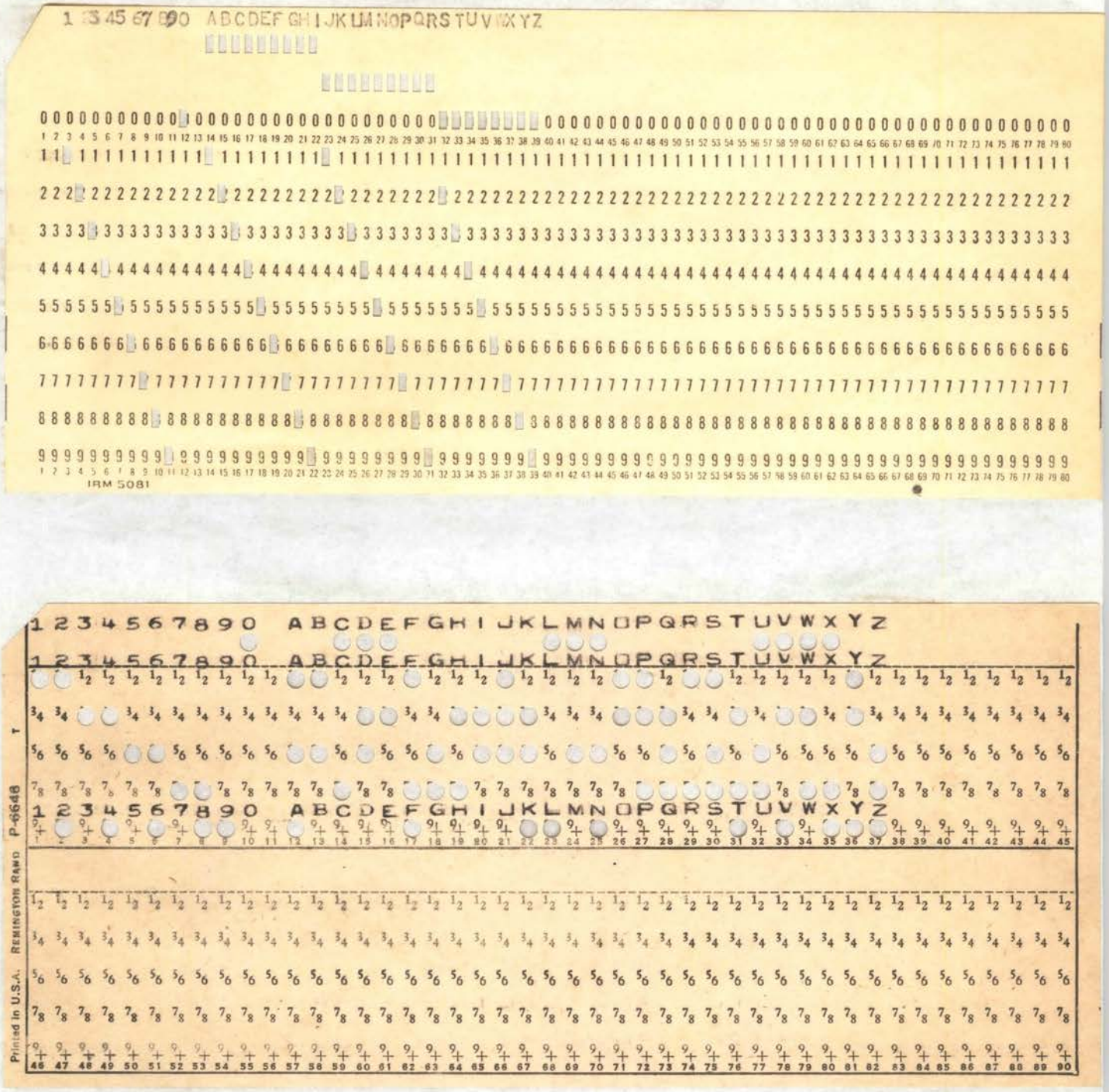

Fig. 1. An illustration of the cards and coding system used by International Business Machines Corporation (above) and Remington Rand, Inc. (below).

blank cards. All information of similar type must be punched in the same columns of the cards. The group of columns for each classification of information is known as a "card field." Once prepared, a card can be used repeatedly to produce all sorts of documents, records or reports involving the transaction recorded on the card. A card can be reproduced, or amounts on cards can be added to, subtracted from, or multiplied or divided by another amount either in another card or in the same card. The resulting figure can be punched in the same card, a different card, or the total printed in a report. The number and variety of accounting applications of punched-card machines includes almost every conceivable operation or report.

V. ORGANIZATION OF THE REMAINDER OF THE THESIS

The purpose of Chapter III is to explain in general terms the functions of various types of punched-card machines presently used. Although most of the punched-card accounting in Oklahoma is done on IBM equipment, there are enough uses of Remington Rand equipment to justify a description in this chapter. Although hundreds of models of punched-card machines are presently used, most of these machines are variations of about eight basic types of machines. These basic types of machines have been described by explaining the functions of one model of each group.

In Chapter IV the application of these machines to certain accounting problems common to most businesses has been described. Although no two businesses keep their records in exactly the same way, there are certain similarities so that an understanding of one method of preparing payrolls, or accounts receivable ledgers, for example, will enable an accountant to understand readily the methods used by other businesses. In each of these general accounting procedures the flow of information through the tabulating department has been described from the time information from source documents

is punched in tabulating cards until final reports are printed.

There are some accounting problems peculiar to certain types of business which are solved by punched-card methods. For this reason the users of punched-card equipment have been classified by industries. The accounting uses of punched-card equipment by one of the leading companies in each classification has been discussed in detail. The uses by most companies within each classification are very similar, and an understanding of the uses made of punched-card machines by one business in each classification will do much toward understanding the punched-card operations of any business in that same classification.

The last chapter is a discussion of the factors determining the situations where it is advisable to use punched-card equipment. These factors may be considered to be conclusions drawn from the study. No adequate summary could be devised since the body of the thesis is itself a summary of a great amount of detailed information.

CHAPTER II

PUNCHED-CARD EQUIPMENT PRESENTLY USED

An auditor should understand at least the fundamental operating principles of the equipment used to produce the records under review.[1] There are numerous types of machines which have special functions, and there are several models of each type, also there are many special attachments. These models and types of machines have been developed by continual research to meet the varying requirements of different types of businesses. New models of machinery supersedes much of the older equipment which is no longer manufactured but is still in use. There is no need for an accountant to know the details of each of the various models of equipment available. A knowledge of the operating functions of a few representative types of punched-card machines will enable an accountant to understand the functions of presently existing equipment and models which will be developed in the future.

I. NECESSITY FOR NUMEROUS TYPES OF MACHINES

The functions of various types of punched-card machinery may, perhaps, be more easily understood if each machine is thought of as a component part of a large multi-purpose accounting machine. It is conceivable that a single punched-card machine could be manufactured which could perform every accounting operation from the time original documents are received until the final reports are printed. An operator of such machines could transcribe information from original documents into tabulating cards in the machine, and the holes punched in these cards could actuate various mechanisms within the machine so that

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[1] Norman V. Bellenoit, "Special Problems in Auditing Records Kept on Accounting Machines," The New York Certified Public Accountant, XVII, (September, 1947), pp. 609.

cards would be sorted automatically, information accumulated, amounts added, subtracted, multiplied, or divided as necessary, and the reports printed automatically. All these functions are presently performed almost entirely automatically by the combined operations of various punched-card machines.

A single machine to perform these functions would not be practical because the speed of operation of electric and electronic machines far exceeds the human speed of transcribing information from source documents to blank tabulating cards. Most parts of the machine would remain idle while the operator was transcribing information into the machine, thus the reason for having separate machines known as key punches to transcribe original information into tabulating cards is obvious.

Cards, in which several types of information has been punched, must be sorted so that all cards containing similar information may be grouped together for further tabulation. Cards may be sorted as fast as 650 cards a minute, thus a separate machine known as a sorter is justified on the basis of speed alone.

The simultaneous preparation of numerous reports, each of which requires several steps, requires maximum utilization of various tabulating functions. These steps can be performed more efficiently if done by several different machines, thus utilizing the potential of each machine as effectively as possible.

The functions of several types of punched-card machines are over-lapping, and this is often advantageous, since two or more operations can often be performed by running the cards through a machine at one time. If the work performed by a machine of one type becomes excessive, it may be possible to use a machine designed for a different purpose to perform the function of the overloaded machine.

II. DESCRIPTION AND COMPARISON OF PUNCHED-CARD EQUIPMENT

The punched-card machines invented and manufactured by the two principal manufacturers, Remington Rand, Inc., and International Business Machines, Corp. are meant to serve the same purpose. Although there are other manufacturers, a description of the types of punched-card machines manufactured by these companies should serve the purpose of illustrating the functions of various models of equipment.

A. IBM MACHINES

Key Punches. International Business Machines, Inc. manufactures several models of key punches. The Type 31 Alphabetical Duplicating Key Punch is a representative model.[2] This machine is used to transcribe both alphabetic and numeric information in tabulating cards. Similar type information is punched in designated columns of the card, known as a "card field." One of the two keyboards used to control the machine is very similar to that of a typewriter. The other keyboard is used when only numeric information is to be punched, and is similar to the ten-key keyboards used in certain adding machines. The only difference is that there are two additional keys for punching the upper two positions on the card known as the "11" and "12" zones of the card. As a key is depressed a hole is punched and the card advances automatically to the next position. Cards are fed into the key punch and are ejected automatically. Information common to more than one card may be reproduced automatically by placing a "Master" card, in which this information has been punched, in the duplicating rack of the machine.

Variations of the Model 31 Key Punch presently used include models which record numeric information only, and the duplication feature may be optional.

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[2] Notes Concerning Production Control at International Business Machines Corporation Endicott Factor. pp. not numbered.

One machine which has the same features as the Model 31 prints across the top of the card the alphabetic and numeric information which is punched in the card.

A small portable card punching machine can be carried easily from place to place, but has none of the automatic features.

In old models a pressure of several pounds was required to punch cards manually, but present day machines require a pressure of only a few ounces. In each successive model developed, fatigue-reducing, automatic features have been added, but the general principles and purpose of the key punch remain unchanged.

Interpreters. The IBM Type 552 Alphabetical Interpreter translates the holes punched in tabulating cards by printing along the top edge of the card the alphabetical and numerical information which the holes represent. This information may also be printed between the eleven and twelve zones of the card. The speed of operation of this machine is sixty cards per minute.

Verifiers. The IBM Type 52 Electric Punched Hole Verifier verifies accuracy of both alphabetical and numerical key punching. The manual operation of the verifier is the same as that of the key punch. After cards have been punched by one operator on a key punch another operator places the punched cards in the verifier and repeats the process of the key punch operator. Instead of punching a hole as a key is depressed, the verifier simply advances the carriage to the next position on the card if the key depressed corresponds to the hole already punched in the card. If the key depressed does not correspond to the hole punched in the card, the carriage does not advance, thus indicating to the operator an error which may be in the card, or an error made in verifying by depressing the wrong key. Some verifiers automatically cut a small notch in the top edge of cards which have been verified satisfactorily.

Sorters. The process of grouping cards of similar classification and at

the same time arranging the groups in numerical sequence is known as sorting. This term is also applied when all cards containing a common digit punching are segregated from the remaining cards. The Type 80 Electric Punched Card Sorting Machine is one of the machines used for this process.[3] After cards have been punched and verified, sorting is usually the next process. The operator places the cards in the feed hopper, sets the sorting brush on the column to be sorted, and presses the starting key. There are thirteen pockets into which cards may fall, one for each position of the card, and a reject pocket in which cards will fall which have no punch in the column being sorted. The sorting operation is accomplished at a speed of 450 cards per minute, per column sorted. A new electronic sorting machine will sort cards at the rate of 650 cards per minute.

Collators. A Type 77 Electric Punched Card Collator may be used for several types of operations. The principal use of this machine is to merge or interfile cards in sequence, and to match cards with identical punching, and selecting desired cards. This operation is performed automatically at the rate of 240 cards per minute. The machine will verify information punched in master and detail cards, or in two fields in one card, simultaneously with a merging or selecting process, or a combination of these processes. An Electric Punched Card Collator with Alphabetic Feature enables cards punched with alphabetic information to be merged, filed or selected automatically by one run through the machine. Accounting applications of this machine include such operations as filing current transaction cards with previous transaction cards; pulling account receivable debit cards and combining them with cash received credit cards; combining master cards, such as name and address and

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[3] International Business Machines Corp. Pamphlet 22-4100.

and rate cards with transaction cards and separating them again for use in accounting machine operations.

Calculating Punches. The Type 602-A Calculating Punch multiplies, divides, cross-adds, and cross-subtracts in any combination during the same operation automatically, punching the result in a designated field of the card.[4] This machine is one of the few punched card machines which can add or subtract amounts punched in two fields of the same card. The result can be used as a factor in further calculations. The sequence of the operating functions of addition, subtraction, multiplication and division are completely flexible and can be performed in any desired sequence. Any of the results may be used as a factor in further calculation. The machine may be used to perform many of the functions of a reproducing punch. This machine can multiply a 22-digit multiplicand by an 8-digit multiplier to obtain a 30-digit product. A 15-digit dividend can be divided by an 8-digit divisor to obtain and punch an 8-digit quotent. It is possible to expand both the multiplier and the quotent beyond the eight digits by additional calculations.

Factors used in computation may be read from different columns of the same card, or from card fields of different cards, or from the result of a previous calculations. In addition, fixed factors not punched in cards may be read from a "digit emitter." Factors, intermediate and final results may be entered in "Storage Units" which retain the information until it is to be used in further calculations or to be punched. This machine will start computations on one card while punching the result of the previous card. The speed of this machine varies from 9 to 50 cards per minute, depending upon the number of operations being performed.

Reproducing Punches. The Type 513 Electric Card Reproducing Punch is a

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4 "Principles of Operation, Calculating Punch, Type 602-A."

very flexible machine which can perform several types of operations simultaneously.[5] One of the functions of this machine is to reproduce cards. This is done by placing the cards to be reproduced in one of the feed hoppers and the blank cards in the other feed hopper. Information may be reproduced in exact or altered sequence at the rate of 100 cards per minute. This operation is known as "gang punching." A comparing device in the machine will prove the accuracy of the punching of the cards.

One of the most important uses of this machine is to prepare summary cards. For this operation the machine is attached to an electric accounting machine by means of a flexible cable. For all other operations the machine is used independently. Information to be punched in summary cards may come from three sources; amounts from counters of the accounting machine, information from master cards in the other feed hopper, and digits from the digit emitter. The speed of this operation is somewhat slower than ordinary gang punching because amounts must be first accumulated in the accounting machine before being punched in the summary cards.

A mark sensing device, which is optional equipment, may be used to cause pencil marks on the cards to be interpreted in the form of punched holes. The single section manual control panel enables any desired arrangement of data to be obtained from the punched cards.

Variations of this model include ones which will print on the left end of the card certain information punched in the card.

Accounting Machines. The Type 405 Alphabetic Accounting Machine may be used to produce complete printed reports including alphabetic and numerical information. The number and type of reports and documents which can be prepared

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[5] International Business Machines Corp. Pamphlet 22-4100.

through the use of this and auxiliary machines is almost unlimited. As cards are run through the machine information punched in the cards may be printed in almost any desired position on a report. Amounts punched in the cards may be subtracted or added in various counters, totals being accumulated in separate counters for each classification of information. Any required multiplication or division must be completed before the cards are run through the accounting machine because this machine is limited to the functions of addition and subtraction. The Type 495 Alphabetic Accounting Machine can list 80 cards a minute, while the numeric accounting machine can list at the rate of 150 cards per minute.

There are several devices used on an accounting machine whereby certain information may be selected for use in calculations and reports. One of these devices is known as an "X" Selector". This device is actuated by a distinguishing punch in a pre-designated column of the card in an eleven zone position. For example, an "X punch" in column 39 may be used to distinguish sales from sales return transaction cards. Another device known as a "class selector" allows certain information to be added or subtracted or printed only when cards having a certain control punch pass under the reading brushes of the machine. Another device which controls the use of certain columns of information is called a "comparing relay." This device allows certain information punched in a card to be used or not used until a change is detected in a certain column or columns of subsequent cards. The number of X selectors, comparing relays, and counters may be varied according to the needs of customers.

The machine is equipped with major, intermediate, and minor controls which provide for the printing of group totals when classifications change. The operation of the machine continues automatically as long as cards are fed into the machine.

Later models of this machine include many improved features such as the ability to print three lines from one card, and cross-footing of amounts punched in the same card. The models which operate more rapidly usually have less flexibility.

Electronic Calculating Punch. The Type 604 Electronic Calculating Punch performs all four basic mathematical processes - addition, subtraction, multiplication, and division - successively, in any order, during a single run of the cards through the machine. The calculations are made in the electronic unit and the results are punched in the cards at the rate of 100 cards a minute.

An Automatic Sequence Controlled Calculator installed at Harvard University in 1944 contains 2,204 counter positions including 72 storage counters of 24 column capacity. It was the first of a series of rapid calculating devices completed or now under construction intended for use in the field of scientific computation.

B. REMINGTON RAND MACHINES

Key Punches. The Automatic 90-column Type 305 Alphabetic Punch will perform the same functions of an IBM Model 31 key punch machine. Information read from original documents by the operator is punched in designated fields of the card at one time instead of punching a hole as each key is depressed. Information to be punched is first set up for the entire card, and any errors detected by the operator may be corrected before the card is perforated, therefore wastage due to spoilage is reduced to a minimum. Any number of cards can be punched from one set up. If certain information is common to more than one card, a partial repeat punching set up is made, and additional information can be punched into each card. Repeat information is punched into subsequent cards without effort or attention by the operator.

Variations of this model include machines which will punch only 45-column cards, and machines which will punch only numerical information. Portable mechanical and electric punches weighing 16 and 26 pounds respectively may be used for either alphabetical or numerical punching.

Summary Punch. A Type 211 Summary Card Punch attached to a tabulator performs the function of automatically punching summary cards, or group total cards, for amounts summarized in the tabulator. This machine becomes a permanent part of the tabulator and can not be used independently.

Synchro-Matic Punches. Through the synchronization of the Automatic Electric Punch and the Remington Rand Bookkeeping Machine, punched cards are automatically puoduced as a by-product of the bookkeeping operation. The punch perforates the tabulating cards with any or all of the alphabetical and numerical information that is printed by the bookkeeping machine.

Multiplying Punch. The Type 309 Printing Multiplying Punch can be used to multiply factors in two fields of the same card, or to multiply a factor in a field of each card by another factor introduced manually by means of a keyboard, or the machine may be operated as a calculator without the use of any cards.

Reproducing Punch. The Type 310 Multi-Control Reproducing Punch is used to feed two files of cards from two feeding magazines in order to compare the files, punch cards fed by one magazine subject to comparison established, and to segregate the cards in each of the two fields subject to this comparison.

The Type 214 Numerical Reproducing Punch will reproduce a new set of tabulating cards from an original set of tabulating cards in exact form, or modified as required. A variation of this machine will interfile selected cards from both files while segregating certain of the cards according to the comparison established. This machine will reproduce either alphabetic or

numerical information in either 45-column or 90-column cards. All operations are performed automatically at the rate of 125 cards per minute.

Attachments for Punches. There are numerous attachments for Remington Rand punches including a verifying attachment, card counters, a repeat punching mechanism, a numbering attachment, marginal stops, special character key tops, control hole punching attachment, selective group feeding control and a dual card receiving magazine.

The Verifying Attachment is used to mechanically verify cards punched by the Automatic Punch, Visible Punch and Alphabetical Punches. After a set of cards have been punched, another operator re-punches the entire set of cards again. The verifying hole punches are slightly below the regular hole punches, thus making an oblong hole instead of a round hole. After the operator has re-punched the cards, the set of cards is then run through an automatic verifying machine which detects round holes from oblong holes, thus segregating cards which have an incorrect punching.

Sorters. The Model 20 Sorter, utilizing the principle of mechanical selection, sorts punched cards into any desired order or sequence. The appearance and function of this machine is much like IBM sorters, having one feeding magazine in which cards to be sorted are placed. As cards are sorted on each column, each card will fall into one of the 13 receiving magazines. Machines are available which will sort either 45- or 90-column cards at a speed varying from 250 to 450 cards per minute. Attachments are available which will count each classification of cards sorted.

Interpreter. A Type 212 Punched Card Interpreter interprets automatically the punched holes in a tabulating card and visibly registers this interpretation by printing it on the face of the card in any of several different positions. Complete interpretation of both alphabetic and numerical information on either

45- or 90- column cards may be obtained in one operation at a speed of 50 or 100 cards per minute.

Tabulators. The purpose of the Model Three 90-column Tabulator is to translate and print in any statement form desired, the numerical and alphabetical information punched in tabulating cards, at a rate of 100 cards per minute. There is a fixed control panel for each type of operation performed by the machine. In the control panel of the machine which is wired at the factory there are several types of controls and selecting devices much like those of IBM Accounting Machines.

C. PUNCHED-CARD EQUIPMENT COMPARED

The punched card machines invented and manufactured by these two producers are meant to serve the same purpose. The use of the upper half and lower half of the card separately gives Remington Rand 90-column card capacity as compared with IBM's 80.

Remington Rand equipment is designed for mechanical operation and adjustment, while electrical principles control operation of the IBM machines. Changes are made in the operating units at the factory only for the Remington Rand Machines. IBM machine operations are regulated and determined by electical plug-in wiring similar to telephone switchboard operation except that the wires are left in the control boards during any entire machine operation. Minor adjustments can be made in report form on the Remington Rand machines by lever manipulation and designing of card fields. IBM flexibility is secured by rewiring of control panels, digit selection, unlimited class and field selection, and other wiring flexibility. They have more varied attachments and auxiliary equipment, and a wider variety of punched card machines.

The International Business Machines Corporation concentrates on the production and development of punched card equipment while Remington-Rand, Inc.

maintains a relatively complete line of business machines and furnishings. IBM maintains service bureaus for production of business records and reports on a time or volume basis. Both maintain offices and offer service for maintenance of machines in the principal cities in all parts of the country. Both do international sales business. Both offer some exclusive performance by punched-card machines. Both have customers in all parts of the nation and abroad. In Oklahoma, however, comparatively few Remington Rand punched-card machines are used. The largest user of Remington Rand machines is the United States Government. Both organizations have contributed much in the search for speed, efficiency and precision in obtaining and dealing with business facts.

The International Business Machines Corporation rents or leases all punched-card equipment. Their policy is to keep the machines in repair and to replace equipment as it becomes obsolete or inadequate for the customers' use. The charge is made according to the number and kind of pieces used. Except the punches, their punched-card machines are operated by means of plug-boards which can be wired by the customer to suit his needs. If he has no need for the flexibility thus provided, he can procure permanently wired boards from the factory and use them indefinitely. Minor changes can be made in the permanent board in a moment, often without even removing it from the machine. Thus the user can run the report immediately upon the decision that it is needed. The International Business Machine Corporation is exclusively interested in punched-card and related equipment, machines for making and analyzing business records. The corporation produces a great variety of machines and auxiliaries which will accomplish almost anything business requires in the way of records. The manufacturers claim this flexibility and the assurance of the newest models without purchase expenditure the chief advantages of this rental plan.

Remington Rand, Inc. furnishes machines on either a rental or an ownership basis. If the machines are purchased outright, four percent of the purchase price is charged per year for maintenance. A permanently prepared unit is purchased on order from the factory for each new style of report. However, mechanical levers allow minor omissions and inclusions for certain fields of operation. Also, different reports can be produced by changing the punching sequence in the cards, allowing some flexibility. Some users of the machines have no need of special reports differing from the periodic reports sufficiently to require special changes in the permanent set-up mechanism. Use of the permanent unit eliminates the need for training employees in the tedious task of wiring a board. Simplicity of operation enables a new employee to use the machine with few instructions.

Owned machines can be set for greater speed in feeding cards, thus saving time, if the owner considers the saving worth the extra wear on the machine. Wear increases rapidly with increased speed. If great speed is not essential, a sorter, for example, can be rented at a reduced rate if used to feed only 250 cards per minute. The manufacturers claim this freedom of use of the machines and a possible saving in expense the chief advantages of the ownership plan.

CHAPTER III

GENERAL ACCOUNTING APPLICATIONS OF PUNCHED-CARD MACHINES

The tabulating departments of companies using punched-card machines differ in the responsibility and functions of the department, the number and types of machines used, source document used, and the kinds of documents and reports prepared. However, there are certain accounting applications of punched-card machines, described in this chapter, which are used by almost every kind of business using punched card machines. The procedures used by each business, and the form of cards and reports will depend upon the needs of the business; however, there is enough similarity in the procedures used that an understanding of one of the methods used in handling each of the problems will enable an accountant to readily understand the methods used by most companies. Applications described in this chapter are not the methods used by any one business, except as indicated, but are brief descriptions of methods recommended by the manufacturers of punched-card equipment.

General Ledger Accounting. It has become increasingly important that the general accounting books be closed promptly at the end of the month, and that financial statements be made available to management as early as possible. The basic statements upon which the executive of any business depend are the Balance Sheet, the Statement of Goods Manufactured and Sold, and the Statement of Profit and Loss.

The preparation of these financial statements requires the use of general ledger accounts to classify and summarize financial transactions, the number and type of general accounts used being determined by the size and kind of business.

The medium for grouping similar transactions and totaling them for entry in the general accounts is the journal or register. Common sources of increase

and decrease in the general accounts are:

Accounts Payable Distribution Summary

Labor Distribution Summary

Material Distribution Summary

Cash Receipts Journal

Cash Disbursements Journal

In addition to these special journals one other source of increase and decrease is the journal voucher prepared for such entries as depreciation, depletion, appraisals, revaluations, etc. Punched card methods may be used to prepare these journals, registers, and vouchers, as will be explained in the remainder of this chapter. While these journals are being tabulated, journal totals are punched automatically in general ledger detail cards. General ledger detail cards thus produced are obtained with practically no separate expenditure of time, and are assured of being in agreement with the detail cards for the transactions involved during the accounting period.

At the close of the month all general ledger cards are sorted by account number and are tabulated to prepare the entries to the general ledger accounts. At the same time a summary card may be punched each month, showing the balance in each account. These summary cards can be combined with the detail charges and credits for the succeeding month, to obtain a new monthly balance. The general ledger summary cards are sorted and tabulated to prepare a Balance Sheet, a Statement of Cost of Goods Manufactured and Sold, and an Income Statement. If punched card methods are used for all general ledger accounts, any special analysis and subsidiary statements which may be desired are easily repared. Examples of such reports include comparison with corresponding statements of the preceding year, listing variances over or under. If budgets are used, a Statement of Profit and Loss for the current period and year to date,

with budget comparison, and variances over or under budget. Specialized Statements of Profit and Loss for divisions, districts or other operating subdivisions are easily prepared. The same card can and should be used to produce listings which will simplify audit by internal or professional accountants.

Accounts Payable. The underlying purposes of accounts payable records are the prompt payment of creditors, the securing of all profitable discounts, and an accurate statement of total liabilities. In addition, expenditures must be distributed to internal accounts before the books can be closed and the financial status known. Generally, a great amount of detail is necessary with a peak load at the end of the accounting period if the method is one of individual posting and balancing. With the punched card method no posting is required except the transcribing of the original data into punched-card form. Balances are obtained automatically and peak loads are eliminated.

An effective accounts payable system currently in use is that of the Jones & Laughlin Supply Company in Tulsa, Oklahoma.

All remittance advices, checks, voucher registers and check registers are written from punched cards in the tabulating department. A form of voucher check is used, and the duplicate of the check serves as a voucher jacket. All vendor invoices, credit and debit memoranda, personal expense reports, store disbursement reports, and voucher orders are paid through this medium, without exception.

As unpriced invoices and other documents are received for payment, the invoices are priced, checked for terms, coded for vendor number, general ledger distribution codes assigned, and hand-sorted into groups by due date. Items to be paid at once or within a few days are processed first.

Each invoice or other document is coded with a 5-digit code representing the payee. This code has been arranged so that a numerical sort of cards will

also produce an alphabetical arrangement.

Serial voucher numbers are placed on all documents with a numbering machine. Invoices and other documents are passed to the key-punch operators in bundles of convenient size, serially numbered, and accompanied by an adding machine tape showing the net amount of the invoices. The total of the tape is entered on a control sheet which is arranged by due date.

From this point on, the handling of the invoices or other documents differ, depending upon payment term. They fall into two classes: (1) Specials, which are vendor invoices or other documents on which payment terms are short, and (2) Build-ups, which are vendor invoices or other documents carrying terms allowing cash discounts but due and payable only on certain dates such as 10th, 20th, or 1st, etc.

Key punch operators punch, from vendor invoices or other documents, the following type cards: (1) A payment card for each invoice or other document which carry a single distribution code; (2) A payment card for invoices or other documents carrying multiple distribution codes; (3) Distribution cards for each distribution code on multiple distribution invoices or other documents; (4) A distribution card for single code cards. This card is reproduced mechanically from the No. 1 card above.

All of the above cards are punched to show the following:

Bundle No.	General Ledger Account No.
Date (Day and Month)	Location
Journal Entry No.	Sub-Account or Commodity
Card No.	Gross Amount
Document Code	Cash Discount
Voucher No.	Net Amount
Payment Code (Due Date)	Invoice Date
Vendors Code	Special Alphabetical Information

The punched cards are sorted to separate the number 1 and 2 cards, which are the accounts payable cards, from the 3 and 4 cards, which are the distribution cards. Both sets of cards are listed and balanced to both the adding machine tapes and the controls. The distribution cards are filed until the end of the month.

The account payable cards are then collated with master cards which carry the vendor's name and address, and are then used to prepare the remittance advice and check statement, the duplicate of which becomes the voucher jacket. The checks are automatically numbered as they are written. Totals are accumulated during this operation and again checked against the controls. If in balance, invoices or other documents will be attached to the voucher jacket, and all documents sent to the general accounting sections for audit approval. If the documents are found to be in order, they will go to the Treasury Department and Executive Department for check signatures and for the mailing of the remittance advices and checks. The vouchers and all attachments are perforated "paid," and are immediately filed alphabetically by payees. The accounts payable cards are filed in a "paid" file, in sequence by voucher number.

Bundles of invoices or other documents for build-up vouchers, separately bundled by due dates, come to the key-punch operators throughout the month, serially numbered in a different series than the special bundles, with adding machine tapes on the net amounts attached.

Key-punching, reproduction of distribution cards, listing and balancing to tapes and controls, verification of key-punching, separation of payment and distribution cards are handled as outlined above for special vouchers, except that prior to the separation of the payment and distribution cards, master cards are collated with the detail cards and from the master cards the vendor's name and payment code is reproduced into the detail cards. Master

cards are removed by sorting, the detail cards separated, listed and balanced as above. The distribution cards are filed by voucher number, and the payment cards filed by due date.

At the end of the month, after the last invoice or other document for the month has been punched, a build-up voucher register is prepared. Payment cards will be pulled from the due date file, and sorted by voucher number. A voucher register is prepared listing vendor code number, voucher number, vendor name, and the net amount of the voucher. This build-up voucher register prepared at the end of each month and the voucher register prepared daily from the special cards use the same statement form and follow the same procedure, except the daily register will carry cumulative totals and will be balanced to the control sheet, and, that payment dates must be inserted on the build-up voucher.

As due dates for the build-up vouchers come up during the following days of the month, payment cards will be pulled from the due-date file and merged with the special cards being used for payment on that particular day. After checks have been written, and while payment cards are still in check number order, the check register, covering all checks written for the day, both special and build-ups is tabulated. The check register will include the opening balance of cash, and will show the daily deposits, and the ending balance.

At the end of each month all distribution cards are sorted by general ledger account number and a distribution summary report prepared. Summary cards are automatically punched for each distribution account total, and these cards are filed in the general ledger file.

Summary cards can be punched for the daily total of vouchers payable, cash disbursements, cash discounts, etc., as the other reports are run. These summary cards are filed by account number in the general ledger card file for use in statement preparation.

Billing. The primary objectives of billing are the preparation of customers' invoices and customers' credit memorandums. Other uses of cards prepared during the billing operation will be explained in this chapter under "Sales Accounting" and "Accounts Receivable."

Cards used in preparing these documents are prepared from two basic documents: Customers' Purchase Orders, or internally prepared sales orders, and Pricing Records. Upon the receipt of an order, the original source document is reviewed to determine that all information on the order is correct and that the customer's credit is satisfactory. The order is then forwarded to the billing department where the invoice is prepared.

The invoice to be prepared must show basically the same information as shown on the customer's purchase order. This information is commonly classified as: (1) heading information, which includes customer's name, address and number; (2) miscellaneous data, which includes customer's purchase order number, date of order, vendor's invoice number, and salesman's number; (3) and body of invoice, which includes a description of items, quantity, and unit and total prices. Separate tabulating cards are prepared for each of these classifications.

Much of the invoice information is repetitive, in that goods are shipped to the same customers regularly, and the same commodities are shipped from day to day. Cards in which such information has been recorded in advance of its use are known as pre-punched cards. Two types of pre-punched cards are used in accounts receivable accounting. One set of cards known as a master customer card file contains cards for each customer in which the customer's name, address, number, and classification are punched. Cards in the master deck are re-used for each billing to the same customer. Pre-punched commodity cards are stored in files with the master heading cards in files known as tub files.

When the customer's purchase order is received in the Billing Department,

pre-punched cards are pulled from the tub files for the heading cards, and one product card for each kind of commodity ordered. Commodity cards will receive further explanation in the portion of this chapter titled "Inventory." The quantity and discount percent is punched in the commodity cards and variable miscellaneous data is punched into heading cards by means of a key-punch. Quantity and price extensions are made on a multiplier or calculator such as the Model 602-A calculator. Next, the three types of cards--heading cards, miscellaneous data cards, and commodity cards--are assembled in that order, and placed in the accounting machine. The machine automatically prepares the complete invoice.

It might be well to review at this point certain information stated in a previous chapter. In Chapter One it was pointed out that machines could do only that which they were directed to do, and later a statement was made that most punched card machines are controlled by control panels which are somewhat like a telephone switchboard. For applications such as Accounts Receivable or Accounts Payable or other operations a separate control panel is usually kept wired at all times and is not changed except for minor wiring changes until the application is revised. Thus for any punched card installation there may be any number of permanently wired control panels. Throughout this study statements have been made stating that machines have prepared statements automatically. In order to have a machine operate automatically for a certain operation, such as the printing of invoices, the operator must place the proper control panel in the machine rack, start continuous forms through the feeding device, place properly sorted cards in the feed hopper, adjust certain control switches, and then start the machine. The operator is then free to work on other machines until the first machine runs out of cards or forms.

The flow of accounts receivable information has been described for one

invoice. Actually a very large volume of invoices are prepared simultaneously by numerous people, keeping several machines busy most of the time. Simultaneous with the preparation of invoices by the tabulating machine, a summary punch attached to the tabulating machine will prepare an account receivable debit card for the total amount of the invoice.

After completion of the invoice run, the invoice number and date, customer and salesman numbers, and certain other information are automatically transferred to the commodity cards from the heading and miscellaneous data cards by the use of a reproducing punch.

The billing cards are then separated; heading cards are returned to the tub file for re-use, miscellaneous data cards are discarded, and commodity cards are available for compiling accounting records and statistical reports. The accounts receivable debit cards are used as described in the next sub-section of this chapter.

Other documents which may be prepared as a by-product of the billing operation are: packing lists, shipping label, sales register, and credit memorandums.

Accounting and statistical reports which may be prepared from the billing operation include sales analysis reports, sales accounting reports, cost of sales reports, commission statements, tax reports, inventory control, and finished stock reports.

The principal advantage of the punched card method of billing is the speed and accuracy of the system and economy of operation.

Sales Accounting and Analysis. The billing, sales, accounts receivable, and finished goods inventory applications of punched card machines are overlapping in many cases. It is possible for a business to be using certain of these applications without the others. In those cases cards must be prepared

from different documents than would be the case of all records were being kept by punched-card methods. The basic record used in sales accounting and sales analysis is the sales invoice. If punched card methods are used in billing, sufficient information is punched in cards at the time of the billing as an automatic by-product of that operation. If billing is performed manually, information from the sales invoice must be transcribed into punched cards by a keypunch. Other source documents used in this operation are cash sales slips, and debit and credit memorandums. The total cards for each invoice or other document serve as debit or credit cards for the subsidiary Accounts Receivable Ledger, and the totals for such cards serve as the debits and credits to Accounts Receivable and Sales Accounts.

It is important for management to have detailed analyses of sales. If they are to make decisions wisely, they must know who sold their products, what was sold, who purchased the goods, how profitable sales were, where the goods were sold, and how much was sold. A report recommended by one of the punched card manufacturers called a Sales Summary Report would classify sales into the following major classifications: sales by salesmen, by brokers, by agents, by branch offices, by districts, and by divisions. Sales in each of these groups would be further classified by product, class of customer, class of trade, order size, discount terms, state and city, product class, customer, package style and industry classification. Tabulating procedures for such analyses are usually very simple, requiring sorting by various classifications followed by a run through an accounting machine which prints the report.

Sales analyses performed by the use of punched-card methods are principally statistical analyses and as such are beyond the field of this study. Many accountants fail to realize that accounting and statistics are very closely related and that it is impossible to determine just where accounting ends and statistics begins.

Accounts Receivable. The sales invoice, whether prepared by punched card or other methods is the basis for most of the debits to Accounts Receivable. Credits to customers' accounts arise from payments received, credit memoranda and journal vouchers.

The Accounts Receivable debit cards are punched at the same time as the sales accounting cards, sometimes as an automatic by-product of the sales accounting or billing operation. Debit or Credit cards are punched for each entry originating from debit or credit memoranda and journal vouchers.

From these cards a permanent record of accounts receivable entries is prepared. This is referred to as an Accounts Receivable Register. It serves as the basis for auditing charges and credits to Accounts Receivable, and at the same time furnishes an automatic means of proving that the accounts receivable cards and the sales accounting or billing cards are in balance. After preparation of the Accounts Receivable Register and establishment of daily accounts receivable controls, the cards are placed in a file, known as the Accounts Receivable Ledger, in date sequence by customer account number where they are available for reference, analysis and ultimate withdrawal from the active file upon payment or credit.

At the end of an accounting period a balance forward card is prepared by running the accounts receivable ledger cards through an accounting machine, thus transactions cards are segregated by periods in which transactions take place.

The cards covering payments of accounts receivable are first used to prepare the Cash Receipts Register; the totals obtained when preparing this register provide the means of proving that the accounts receivable cards and the total of cash receipts are in balance. The cards are then filed by customer number in chronological order to become subsidiary Account Receivable Ledger credit cards.

The ledger file permits automatic listing of a trial balance. This trial balance of accounts receivable subsidiary ledger accounts can be automatically aged to show amounts owing for the current month, and amounts overdue for periods of 30, 60, 90 days or more.

Monthly statements to be sent to customers are easily prepared by a run through the accounting machine. Other statements which may be prepared as a result of the accounts receivable application include the Cash Anticipation Report, and Commission Statements, where such statements are based upon amounts billed or collected.

Plant and Equipment Accounting. The function of plant and equipment accounting is to account for fixed assets and the depreciation of these assets.

The source document from which tabulating cards are punched is the Plant and Equipment History Ledger Card which is prepared by manual methods. This ledger card contains a complete description of each fixed asset, how and when it was acquired, cost, salvage value, estimated life, periodic depreciation charge, and certain other information including machine attachments used. As new assets are acquired and made ready for use, an Acquisition Register showing all the details of the transactions is prepared from the punched cards. In the same manner, a Retirement Register is made of units sold, scrapped or traded.

In every business the fixed assets should be physically checked at regular intervals. To facilitate this work an Inventory Verification List may be prepared by punched-card methods which will describe and give the location of all equipment.

One of the most important functions of this application of punched-card machines is the preparation of the Depreciation Allocation report which is the

supporting document for depreciation charges. This report shows the distribution of depreciation costs to the proper departments or processes of production. The schedules required by the Bureau of Internal Revenue to reconcile depreciation charges per income statement and depreciation charges per tax return are easily prepared by punched-card methods. This application is particularly valuable to oil companies and similar companies which have large investments in fixed assets, many of which are partially owned, and are transferred from one lease or operating division to another lease or sub-division of the company.

Payroll Accounting. In recent years the accounting for payrolls has become increasingly complex. For a large business the volume of detailed reports required causes manual methods of payroll accounting to become tedious and time consuming, while the punched-card method once properly established works smoothly and rapidly.

Wages for most business employees are determined by one of four methods: (1) hourly wage plus a bonus for time worked in excess of forty hours; (2) piece rate plus incentive bonuses for production above a certain standard; (3) by a combination of these methods; (4) by monthly salary.

The first problem in payroll accounting is to determine the total wages earned by each employee and to prepare payroll checks for the amount due.

Usually there are only two or three basic cards used for each punched-card machine application. In payroll accounting there may be many more. When an employee is first hired a Payroll Master Card is prepared which has punched in it the employee's name, social security number, rates for regular and overtime, various tax information including number of tax exemptions claimed, department and clock numbers, and the date hired. Each employee must prepare an Attendance Card for the period covered by the payroll, from which the number

of regular and overtime hours can be determined. The payroll master cards and attendance cards are interfiled by customer number by the use of a collator. The merged cards are then run through a calculator which multiplies regular hours times regular rate, and overtime hours times over-time rate, adds the two products to determine the total wages earned which is punched in the attendance cards.

At the time the employee is first hired he must fill out a W-4 Form, which is a U.S. Treasury Department Employee's Withholding Exemption certificate. This form may be printed on a tabulating card, and information written by the employee may be punched in the same card.

Withholding tax master cards, which show the amount of money to be withheld for all employees who have salaries between certain ranges according to the number of exemptions claimed, may be used to determine the amount of withholding tax deduction for each employee. Attendance cards are sorted by earnings and by exemptions, and a reproducing punch is then used to punch the proper withholding tax deduction in the attendance cards or deduction cards. A similar process may be used to determine the amount of deduction for state unemployment compensation, and Old Age and Survivors Insurance taxes, or a calculator or multiplier may be used. There may be separate cards for each deduction, or several deductions on the same card for all deductions. Deductions which are optional with the employee include insurance, contributions, employee purchases, advances, etc. All deduction cards are collated with the Payroll Master Card and Attendance Cards, and are then run through an accounting machine which prints automatically a payroll check and a statement of earnings and deductions.

After payroll checks are prepared the next problem is to prepare controls and summary cards for use in the General Ledger. These cards may be prepared as the Payroll and Labor Distribution Register is printed. Deduction cards

used in preparing payroll checks are sorted and used to prepare a Deduction Register for each type of deduction. This register is used for reference, and as a basis of remitting money deducted for various purposes. Individual reports must be sent to employees at the end of each calendar year showing the total amount of Income Tax Withheld on a W-2 Income Tax Report. All of these operations may be performed by punched-card machines.

Labor Accounting. The purpose of labor accounting is to allocate labor costs to various operating expenses and costs of production. The speed and detail provided by punched-card methods of accounting make cost accounting analyses particularly valuable because variances can be detected at a time when corrective action may be taken. Punched-card methods are equally applicable to process cost systems and job order cost systems, whether kept at actual or standard cost.

The source documents for punching labor distribution cards usually are the individual job tickets prepared by each employee for each type of operation performed during a work day. Information punched in job tickets usually includes the employee's name and number, department number, order number, operation name, operation number, date, hours spent on operation, and the number of good units produced. Time not accounted for on jobs must be approved by the foreman and is properly charged as idle time. A Payroll and labor distribution register is prepared from labor distribution cards. Control totals are established and summary cards prepared for the general ledger. Any manufacturing firm using punched card methods for labor costs usually propares all cost accounting records by the same method. In such firms a Detail Cost Statement showing the material, labor and overhead costs by operation or process, by item and total, and unit cost are prepared easily. More detailed statements may be made of each department or process for direct and indirect labor for each

operation within each process. Standard cost variances may be computed and numerous other reports may be prepared automatically, such as a list of variances from standards where costs are higher than standard.

CHAPTER IV

THE USE OF PUNCHED-CARD MACHINES IN BUSINESSES IN OKLAHOMA

Information concerning punched-card methods used by businesses in Oklahoma, as described in this chapter, was compiled from personal visits to many of the installations described, from company procedure manuals, by correspondence, and from fifty IBM field trip reports prepared in recent years by students at Oklahoma Agricultural and Mechanical College.

The purpose of this chapter is to present the general flow of information through the tabulating departments of several businesses, and through such illustrations further clarify the functions of punched-card machines in various types of businesses today.

For the purpose of this study businesses have been classified by industry, and the uses made of punched-card machines by one of the leading firms in each group has been explained. Only those applications peculiar to certain types of businesses have been explained in detail in each sub-section of this chapter. Other operations which are common to all businesses using punched-card machines have been explained in the previous chapter. In firms other than the ones described there are many variations from the procedures described, which may be more clearly understood by reference to the card designs and reports in the appendix.

I. THE PETROLEUM INDUSTRY

In size and number the petroleum industry exceeds any other classification of business in the utilization of punched-card methods in accounting. Every phase of petroleum accounting, from development through production, refining, and sales may be kept by punched-card methods. The methods used by various petroleum companies are similar in many respects, but differ in the number and types of reports prepared, and this necessarily causes a variation in the

card and report forms and procedures followed.

Crude Oil Production Accounting. One machine application peculiar to the oil industry is the methods of accounting for crude oil purchased, for the costs and taxes thereon, and for royalty payments to landowners.

Accounting for the purchase of crude oil and gas by hand methods would at best be a time consuming, tedious chore. The punched-card method is very efficient for this operation, and furnishes a means of internal control not available by hand methods. There are many complicating factors in this phase of accounting caused by variations in tax laws of different states, and the large number of royalty owners. Most of the difficulty can be eliminated by special control panel wiring plus much careful planning. This phase of accounting is now routine work for most petroleum companies.

Major pipe line companies purchase crude oil in numerous states, each of which have varying laws in regard to the state production tax on gas and crude oil and distillate produced. Some state taxes are based on quantity, some on value, and others on quantity or value, whichever results in the higher tax. Reports and remittances must be made to the various states at regular intervals.

Most oil is produced under a leasing agreement whereby the owner of the land has a one-eighth interest in all crude oil and gas produced. Some royalty interests have been resold and divided so that payments have to be made to 200 or more separate royalty holders monthly for one lease.

The company purchasing the oil may also be the producer, or several companies may be joint producers on the same lease. Different companies may contribute labor and materials to the same lease, thus requiring a careful record and distribution of lease costs.

Labor distribution records allocate the costs of direct labor used on each lease, either capitalizing or charging to operating expense the cost

incurred. Similarly, records of materials requisitioned allocate costs of equipment, materials, and supplies to each lease. There may be invoices from many outside sources for services rendered for well cementing, acidizing, treating of oil, and numerous other operations. When such invoices are received, the allocation of costs is recorded by marking on the invoice the code numbers of the accounts debited and credited, and the total for the invoice. Several invoices are usually punched at one time, preparing one card for each detailed item. The invoices are coded and control totals established outside the tabulating room. When all cards are punched, a sort is made on account number. The cards are then listed and tabulated. The totals are then checked against the pre-determined totals. Detail cards are then filed away, and summary cards prepared during the tabulating operation are filed in the general ledger file. Invoices are attached to detailed cards which is used as a voucher jacket. The detail listing thus serves the purpose of a book of original entry.

A representative of the company purchasing the oil inspects the oil in the tanks of the producer and records the information on a Run Ticket. This is the only source document used in accounting for the value of crude oil purchased. Tank tables are used to determine the volume of oil, the second gauge being subtracted from the first gauge to determine gross barrels. The price of the oil is determined by the gravity. The gravity must be increased approximately one degree for every ten degrees of temperature below sixty. Some companies refer to tables for this operation. Others collate run ticket cards with master cards which contain proper adjustment factors and perform the operation on a punched-card calculator. The gross barrels adjusted for temperature minus the percentage of bottom sediment and water equals net barrels. The computation of net barrels by tabulating machines may be done by several methods. One of the most efficient involves the use of the 602-A calculator.

Run ticket cards are punched when run tickets are received. At the end of a month run ticket cards are sorted by lease number, and are tabulated to determine the total quantity of oil run. This amount is multiplied by price on a calculator or multiplier to determine value. Reproduced royalty owner detail cards are collated with run ticket summary cards, and are run through a multiplier or calculator which multiplies each owners' decimal interest in the lease times the value of oil produced to determine the amount of royalty payments to each owner. Royalty owner master name and address cards are then collated with the detail cards. The combined cards are then used to prepare royalty payment checks, division of interest statements, and a check register.

Phillips Petroleum Company. The IBM installation of Phillips Petroleum Company at Bartlesville, Oklahoma is the largest punched-card machine installation used by any business in Oklahoma. Rental on the machines used by this company exceeds 120,000 dollars per year. About 1,350,000 cards are used each month. This tabulating unit has five distinct divisions, each handling different types of transactions. They are as follows: (1) key punch unit; (2) Refining Operations, marketing and partnership billing; (3) General Section--Voucher and Land Operations; (4) Oil Purchases and Sales, and operating statements; (5) Marketing Vouchers, Chemical Products Vouchers, and Philgas billing. Phillips uses IBM for almost every phase of their petroleum accounting including Authority for Expenditure Ledger, oil purchases, and partnership billings. About 10,000 royalty checks are paid each month. Customers are billed on a sixty day cycle for Philgas, a butane product that is marketed directly. There are approximately 16,000 different customers.

All original documents are sent from the operating departments to the distribution section where they are classified and coded. Journal entries are coded on the original documents when the extensions are proven correct by the

use of a manual calculator. Control totals are recorded, and the cards are sent in "batches" to the key punch unit where operators punch necessary information into cards. There are 33 different card forms used, several of which are cards of the same design but of a different color, the colors indicating different types of operations. Only cash transaction cards are verified by key punch operators.

Punched cards are sent to the tabulating section handling the type of information punched in the cards where the cards are tabulated and sight checked against the pre-determined total of the vouchers. Thus the proof of the correctness of the punching operation is established. The cards are then sorted by account number and a voucher listing sheet is tabulated. While the listing is run a summary card is punched for the total of each account. This summary card is used in a subsequent run to prepare a more condensed voucher. The detail cards are then filed by account number until the end of the month when detailed statements and analyses are prepared.

Other Petroleum Companies. Other users of IBM punched-card methods of accounting in the petroleum industry are: British-American Oil Producing Co., Carter Oil Company, Continental Oil Company, Gulf Oil Corporation, Interstate Oil Pipe Line Company, Mid-Continent Petroleum Company, Shell Oil Company, Sinclair Oil and Gas Company, Skelly Oil Company, Stanolind Oil and Gas Company, Stanolind Oil Purchasing Company, Texas Pipe Line Company, Tide Water Associated Oil Company, and Warren Petroleum Corporation. Other companies in the Oklahoma City area which use IBM equipment have not been mentioned.

In addition to the firms which have installations in their own offices, several firms have some of their accounting work done at the IBM service bureau. Two of these firms are The Anchor Petroleum Company, and Midstates Oil Corporation.

Only one large oil corporation keeps records by the use of Remington Rand punched-card machines. The supervisor of the tabulating department of this company, The Sun Ray Oil Company, is well pleased with the results of his equipment. Although the machines lack the flexibility needed for special jobs, the machines perform the accounting work of this company with efficiency comparable to that of IBM equipment. Most transactions, records, and reports of oil companies vary but little from month to month; therefore, permanently wired operating units of these machines work efficiently, several different reports being prepared by the use of each unit. The supervisor of this installation believes the key punch of Remington Rand is far superior to that of IBM. The machine is much less noisy, and the card set-up arrangement of the machine does save many cards from being wasted. Some of his operators who have previously used IBM key punches, now punch approximately fifty percent more cards each day by using Remington Rand key punches. Printed card designs are not used by this company.

Most oil compaines have a rather large number of card designs in use. One exception is Continental Oil Company in Ponca City which uses four basic card designs, one of which is used for ninety-five percent of all tabulating operations. The chief clerk of the tabulating division of this company believes this design saves much work, particularly in re-wiring control panels, and eliminating the necessity of numerous plugboards. When a different tabulating job is to be performed, only a few minor wiring changes have to be made because most of the fields are in the same place for most reports.

Very few if any companies use punched-card methods for all of the accounting operations. The largest company, Phillips Petroleum Company does not use punched-card methods for preparing income statements, the balance sheet, and accounts payable records. All records could be prepared by machines, but the

internal auditors and comptrollers of many companies believe certain records and reports can be most efficiently prepared by other methods. For most companies the tabulating department operates as a service department for the operating divisions and other service departments of the company including the purchasing department, sales department, traffic department, general accounting department, pipe line accounting department, comptroller's department, and research department.

PUBLIC UTILITIES

Public Utilities are closely regulated industries, and are required to submit at frequent intervals voluminous detailed reports to various regulatory agencies. This requirement alone seems to justify the use of punched-card equipment. However, this is not the reason why most public utilities use this method. The volume of accounts which must be billed at regular intervals requires some fast economical and accurate method for recording receivables.

Public Service Company. The Public Service Company of Tulsa, Oklahoma supplies electricity to about 165,000 customers each month. A maximum of 9,000 accounts receivable billings may be prepared each day. Billing is on a monthly cycle and utilizes fifty-five percent of the machines of the installation.

The source documents used for billing are the meter books prepared by meter readers in the field. The meter books are reviewed by a field office where the readings are checked for reasonableness, corrections made, and changes in name, address, and tax status of customers are recorded. Meter books are sent to the central office in Tulsa on a definite schedule. A card is punched for each page in the book; however, only nine columns need be punched in each card because most information used in the cards is the same for each month. Such information is pre-punched by the use of a reproducer

which transfers all constant information to the same columns, and transfers the new reading of the old card to the old reading column of the new card. Different rates are charged customers based on the amount of electricity used. After cards are punched, a sort by rate is made. By a run through a calculator, the first reading is subtracted from the second to determine the consumption in kilowatt hours. Consumption is multiplied by rate to determine the gross amount. Tax exempt customers must not be charged a tax. This factor must be considered when computing the gross amount due which is punched in the card.

Corrected master name and address cards are collated with the detail cards and monthly bills are tabulated. This process works very efficiently, requiring only that meter books arrive at scheduled times, and that all corrections regarding customers' names, addresses, and tax status be reported properly.

The general accounting section handles all information on payrolls, insurance reports, social security payments, operating reports, and general plant accounting. The Public Service Company, like most other public utilities, operates under a classification of accounts which must be in accord with that set up by the Federal Power Commission and the Oklahoma Corporation Commission.

The company is divided into twelve operating districts, and monthly statements of revenue, costs, and expense are provided for each of the areas.

Source documents, such as freight drafts, petty cash vouchers, cash vouchers, transportation costs, material issues, and labor distribution records are manually footed, taped for batch total, and are routed to the punch room. Detail cards are punched and verified, and are then proven to the total on the batch slip. Detail cards for each entry are sorted by detail account classification, and a detail description listing is made. Summary cards prepared as a result of this listing are used to prepare a journal entry, and are then filed in a general ledger file. Budgetary controls are established for each district.

The detail cards are charged to each district, and are used to prepare an Area Detail Ledger. Detail ledger summary cards are used to prepare an Area Operating Report.

Other Public Utilities Companies. The Oklahoma Natural Gas Company furnishes gas over a wide geographical area throughout Oklahoma. The principal punched-card machine application of this machine is the current billing for 238,000 customers. Most other accounting work is done by methods not involving the use of punched-card machines.

Telephone companies in Oklahoma are not using punched-card methods at the present time although the manufacturers state that punched-card methods can be readily adapted to the accounting problems of this industry.

III. INSURANCE COMPANIES

The operation of insurance companies, like public utilities, is closely controlled by regulatory agencies. The principal accounting problems of insurance result not from the difficulty or complication of accounts, but because of the volume of applications, receipt of premiums, and payment of benefits and commissions. Since most transactions of insurance companies are recurring and are handled in large volume, punched card methods are easily adapted. The supervisor of an insurance company punched-card machine installation in Dallas stated that punched-card methods are almost mandatory from the very inception of an insurance company because of the financial and statistical reports which are required by regulatory agencies.

Group Hospital Service. Group Hospital Service is a non-profit health protection organization that is nation-wide. This organization has had a rapid growth, and without punched-card equipment it would have been impossible for the firm to expand as rapidly as they have.

The main function of IBM machines in the office at Tulsa, Oklahoma is

the billing of premiums due and recording payments for over 250,000 members in Oklahoma. Individual applications for Blue Cross and Blue Shield plan membership are not accepted at the Tulsa office, new members being accepted by groups only.

As group applications for Blue Cross and Blue Shield plans are approved, a statistical card is punched for each member. Membership identification cards are prepared from the statistical cards. Shortly before premiums become due, statistical cards are collated with policy holders master name and address cards, and the combined cards are used to bill each group. Members who leave the group are billed individually. The billing cards are pulled from the files as payments are received, and are sent to the machine room to be used in preparing a cash receipts record. The unpaid billing cards represent unpaid premiums and policies are automatically cancelled one month later if not paid. At that time statistical cards for the policy holder are removed from the file of active members. Information such as changes of address, babies born, children adopted, deaths, divorces, etc. must be recorded by substituting corrected statistical cards in the files. These changes must be made immediately so that correct rates will be charged, bills will be sent to the proper address, and members will receive prompt medical attention to which they are entitled.

When a member is hospitalized or receives surgical care an application is sent to Group Hospital service by the hospital or physician. This application is coded and punched in a card. Cards are sorted twice monthly by hospital number, and are collated with hospital name and address cards. These cards are then used to prepare a remittance advice and check for services rendered by policy holders.

Other Insurance Companies. Four other insurance companies in Tulsa which use IBM machines are: Atlas Life Insurance Company, Insurors Indemnity &

Insurance Co., Standard Insurance Company, and Tri-State Casulty Insurance Company. There are several others in the Oklahoma City area.

Insurance companies as a group probably make a more complete use of punched-card machines than do other types of business. A large percentage of the work done by punched-card machines by these companies is statistical work.

IV. MANUFACTURING

Production Planning. Manufactured goods must be produced without any waste of manpower, materials or supplies. The first step in economical production of goods is production planning. Through sales commitments of customers and sales analyses the requirements for finished goods may be determined in advance for many companies. Punched-card records of prior years for each product concerning material, supplies, labor, machine hours, and spoilage per unit of each type of finished goods may be used to estimate the requirements for producing goods needed. Requirements may be compared with existing resources, and supplies and materials needed may be ordered, and men hired. Schedules may be prepared for the completion of various products by different departments at definite times. Much of the detail of production planning may be performed by punched-card machines if labor distribution, inventory, and machine performance records are kept by punched-card methods.

Inventory and Material Accounting. In one method of accounting for inventory, a single card is punched for each type of item for the beginning inventory, and cards representing increases and decreases are punched for subsequent transactions. Inventory may decrease due to sales or use in manufacturing, or may increase due to purchases, sales returns, or the completion of a manufacturing process. The present inventory may be determined at any time by sorting the transaction cards by product number and merging the beginning inventory cards with the transaction card. The beginning inventory plus all increases

minus decreases should equal the remaining inventory.

Another punched-card method of accounting for inventory involves the use of pre-punched cards which have punched in them such information as the name of the material, code number, where located, quantity, and value at list price. Several cards are punched for each quantity in which items are ordered. For instance, cards for one product might be divided into denominations of 1/12, 1, 6, 12, 60, and 120 dozens. The total quantity represented by all cards in the file is the same as the quantity physically present in the warehouse. When goods are purchased or are received from a manufacturing process several cards are punched in various denominations. The total quantity represented by the cards will be the same as the quantity of goods received. The cards are then filed by product number in tub files.

When a purchase order is received from a customer, the credit rating of the customer is verified, then a clerk withdraws from the tub file cards representing the quantities of various commodities ordered. Information such as shipping instructions is key-punched into a special card. The Customer's master name and address cards are removed from a file and are combined with the special card and the commodity cards. The customer information is then transferred into commodity cards by the use of a reproducing punch. At this point the product cards carry the sales value at full list price. To give effect to the customer's trade discount, the cards are placed in the multiplying punch or calculator which multiplies the discount rate reciprocal times the list price. Combined cards are used to prepare an invoice. One copy of the invoice is used as a packing list, one as a shipping order, one is sent to the customer, and one retained by the accounting department. This system of inventory control used by McKesson and Robbins, Inc. resulted in 96 percent fewer errors than hand posting of experienced clerks working on the perpetual inventory ledger sheets

previously used.

Materials used in production are handled in a similar manner except that production cards are used for preparing a daily material distribution register and are recorded at cost.

Halliburton Oil Well Cementing Company. This company, located at Duncan, Oklahoma, manufactures machinery and equipment used in the petroleum industry, sells well cementing and acidizing services, and sells supplies purchased from other manufacturers. This company has customers in nineteen states and two foreign countries. Special well cementing apparatus is manufactured and installed on standard truck frames at the Duncan plant.

One important function of punched-card machines in this company is the control of material, supplies, and other inventories. There are 70,000 different kinds of materials located in sixteen warehouses in Duncan and thirty-six warehouses in other parts of the country which must be controlled. An eight digit code number is assigned to each kind of material. The first three digits of the code represent the department or warehouse in which the items are located, and the other five digits represent the number of the item. Transaction cards are prepared for purchases and sales of items, and are combined with the beginning inventory card to produce a new summary card for each item for each warehouse and department. A listing of summary cards is made for each warehouse or department and a physical check may be made. The remaining inventory is priced at average cost.

The payroll procedure used by this company does not differ greatly from methods previously described. There are over 4100 employees scattered throughout the United States and Arabia, each of whom must prepare a time record sheet every two weeks. Each man in the service department is on call twenty-four hours each day and is given a munimum wage guarantee of eighty-four hours.

Since most men do not work in excess of this number of hours, there is very little variation in the payroll for most months.

Although the comptroller favors keeping all accounting records by punched-card methods a complete transition from manual to punched-card methods has not yet been made.

It is possible to perform general ledger accounting by punched-card methods even though other methods are used for recording some of the subsidiary records. In 1948 the trial balance for this company was usually completed about three weeks after the end of each monthly accounting period. The principal sources of information for forming the general ledger trial balance is as follows:

1. Cumulative Detail Register - Information from field tickets and bills for services to customers is punched in invoice detail cards. As voucher detail cards are tabulated the summary punch prepares general ledger cards simultaneously.
2. Distribution Listing - Information from all checks and petty cash vouchers are punched into voucher detail cards. General ledger cards are punched as a by-product of this listing.
3. Journal Vouchers - Entries which do not affect cash are punched in voucher detail cards. General ledger cards are punched as voucher detail cards are tabulated.
4. Cash Receipts Register - General ledger cards are summary punched for each general account as the cash receipts register is tabulated.
5. Cost Accounting Records - These records are kept by Burroughs machines. Cards punched from summaries of these records are used to prepare vouchers, and for use in the general ledger.
6. Material Distribution Register - General ledger cards are prepared by a summary punch as detail cards are tabulated.

Other Manufacturing Companies. Some of the other Oklahoma manufacturing companies using punched card methods are: Bethlehem Supply Company, Engineering Laboratories, Exploration Drilling Company, Franks Manufacturing Corporation, Glencliff Dairy Products, Loffland Brothers Company, and Spartan Aircraft Company.

One of the manufacturers and distributors in Oklahoma City is the Oklahoma Publishing Company which publishes two daily newspapers and one monthly magazine, operates an express service, and owns WKY and WKY-TV, a radio and television station. The Mistletoe Express is a motorized express service which services 409 Oklahoma Communities daily, delivering the Daily Oklahoman and The Oklahoma City Times newspapers.

This company, like most companies first starting the use of punched-card machines, started by using the payroll application, then developing general ledger, payroll, accounts payable, contract classified billing, and national display billing applications. Circulation is the next planned application, and in the future it is also planned to install transient advertising billing.

In April of 1949 this company had only four people in the tabulating department. At that time the circulation of the papers were as follows: The Oklahoma City Times - 118,000; The Daily Oklahoman - 130,000; The Sunday Oklahoman - 260,000. Payroll checks for 1400 employees are written each week. Approximately 12,000 cards are required each month in order to prepare bills for classified billing. Approximately 500 local display advertisers and 350 national display advertisers are billed monthly.

V. TRANSPORTATION

Railroads, busses, and airlines all operate under franchises and are closely controlled by regulatory bodies. The reports which must be prepared for these agencies is considered one of the main justifications for the use of

punched-card machines in accounting. The supervisor of one airline company stated that the same type reports are required of all airline companies regardless of size. He complained rather bitterly that one special detailed operating report for a four-month period required by one regulatory agency cost approximately $15,000 to prepare. The special report was not only expensive, but also disrupted the normal tabulating schedules. From his admittedly biased viewpoint he stated that he believed certain regulatory agencies have unfairly taken advantage of the ability of punched-card machines to produce almost any type of statistical report.

American Airlines. The principal function of the American Airlines IBM installation at Tulsa, Oklahoma, is to account for revenues and payrolls, for the entire company. Reports prepared by the Tulsa office are sent to the home office in New York. A payroll for about 5,000 men is prepared in this office. Revenue must be accounted for from five sources: passenger, mail, baggage, and freight income. About 150,000 transaction cards are used monthly to bill approximately 12,000 accounts for the various types of revenue. Revenue collected by different companies must be properly distributed to companies rendering services, such distribution being based upon passenger miles or pound miles for freight. Inter-company sales and services presents a rather complicated problem requiring reciprocal billing between companies.

A comparatively new type of report made by the company is the Station Performance Report. This statement is essentially a cost accounting or statistical report that is being used to increase the efficiency of operation of the airline. Approximately 1,000 station performance records are filled out and sent to the Tulsa office each day. One report is prepared during each flight. From these documents cards are punched and twenty-three statistical reports are tabulated. These reports give information which can be used to prescribe

loading and unloading standards, give information for schedule changes, etc. This report provides a quick means of recording the load of aircraft and evaluation of the efficiency of work performed by stations in loading and unloading aircraft.

Other Transportation Companies. The Midland Valley Railroad has a separate installation, and the M K & O Coach Lines has certain accounting work done at the IBM Service Bureau. There are other transportation companies in Oklahoma City which use punched-card methods.

VI. MISCELLANEOUS BUSINESSES

The inventory method described in this chapter is the principal use of punched-card machines by wholesale distributors such as the Associated Grocers of Oklahoma, and Oklahoma Tire and Supply Company in Tulsa.

Retail distributors such as Brown-Dunkin and Vandevers Dry Goods Company in Tulsa, and Brown's in Oklahoma City use punched-card methods in sales analysis to advantage.

Oklahoma County uses punched-card methods in accounting for property taxes, and for budgetary control in their general accounting system. The accounting records of the Veteran's Administration in both Tulsa and Oklahoma City, and the Oklahoma Tax Commission in Oklahoma City are kept by punched-card methods. The largest punched-card installation in Oklahoma is the one operated at Tinker Field in Oklahoma City. Although accounting records are kept by each of these installations, the principal function of most of them is to prepare statistical analyses.

CHAPTER V

FACTORS DETERMINING USE OF PUNCHED-CARD METHODS

Punched-card machines versus single posting accounting machines. The National Cash Register Machine Company, Burroughs, and several other companies make excellent bookkeeping machines which print a journal entry and post the customer's subsidiary ledger account simultaneously. Small companies must make the decision whether to use hand methods or one of these machines. As companies grow larger these methods may become slow and cumbersome. A decision must then be made whether to continue using bookkeeping machines or to use punched-card methods.

One of the bases for making this decision in the past has been the number of times the information was used. This is not always a sound basis. If most of the card punching can be done by pre-punching, manually punching only a few columns, then punched-card methods may be desirable because of the saving of time and expense involved even though the cards are used only once. In large companies there seems to be little doubt that punched-card methods can be used for certain phases of accounting; however, the decision to be made by management in medium large businesses is often a difficult one.

Situations where punched-card methods are needed. The complexity and size of modern business have greatly enlarged the problem of business record keeping. When business was operated on the scale of home crafts and later as individual ownerships or partnerships of moderate size, one man or two could keep themselves informed by observation, and could control the business by personal direction. As size increased, business required more complex organizations, and the quantity of detail alone precluded the possibility of personal familiarity with all parts of the organization. New methods were necessary to regulate each phase of such an organization's activities and to coordinate the activities

of all parts into a whole that moved smoothly and profitably. More information became essential as the necessity developed for properly formulating over-all policies for large companies and for devising means of effecting these policies. It also became necessary to keep more records in order to provide for purchases, payments, collections, and other financial and operational needs on a large scale.

Apparently, in stages of developments and growth past that size where written records are necessary at all, the rate of increase in the need for records and for greater numbers and kinds of records is more rapid than the increase in the size of the business organization itself or its volume of business. Businessmen, in their need for control and policy-making information, look for the most efficient means of acquiring, organizing and analyzing business facts. Both in production of accounting records and relevant reports the punched card method has proved the best solution where the quantity of work is great. Punched cards eliminate the need for clerical performance of great quantities of irksome routine work incident to the performance of modern business operations.

Characteristics of work which warrants the use of punched-card methods. Punched-card methods are adaptable to business record keeping only in businesses with a sufficient quantity of work to warrant paying the charges of a complete installation of the machines or paying for the services of a service bureau. In Oklahoma, service bureaus are maintained by IBM only in Oklahoma City and Tulsa. A firm known as Exaktomatic in Oklahoma City and Tulsa uses Remington Rand machines, and offers about the same kind of service as the IBM service bureau. Service bureaus are maintained by IBM only in business areas sufficiently concentrated to keep the bureau machines busy most of each day. Work is done there for a charge by the hour or by the hundred cards.

Too many changes in types of products at too frequent intervals can render the punched-card method inadvisable. If the operations of a business are similar enough from month to month that procedures can be standardized and the same type reports prepared each month, either Remington Rand or IBM machines may be used. If special type reports are required on short notice, Remington Rand machines do not provide the flexibility necessary for this work.

One of the outstanding features of the punched-card method is the variety of useful reports that may often be produced from one basic record. Quite extensive analysis of sales is useful to management in forming business judgments and regulating activities, yet the entire analysis can be made from one record, the sales ticket. The same information from the basic records when punched into a card, can be used an indefinite number of times by a simple run through the machines. Reports are thus made on sales by salesman, by area, by class of merchandise, by product, by size of sale, by day, etc. The tedious sorting by hand of an appreciable volume for this purpose would be unprofitable.

The computation of sales taxes of various kinds require such quantity and accuracy of work that hand methods are expensive and irksome, yet the punched-card method produces the desired figure from the same run that makes a sales report.

Many routine office tasks, such as writing checks and billing customers, can be done by means of punched cards. The simultaneous performance of many routine tasks save thousands of man hours formerly expended in doing such tasks.

Payroll work, once looked upon as a routine part of accounting, has become a major task. Enactment of social security legislation, labor regulations, pension plans, and the growth of voluntary deductions for such things as purchasing government bonds and paying union dues have increased the volume

and complexity of payroll accounting. Payroll record keeping is perhaps the most universal task performed by the use of punched cards.

Where speed is required, nothing is comparable to the punched-card method of making records. Daily reports of shipments, manufacturing processes, sales analyses, and financial statements can be prepared in a matter of minutes once the cards are punched. If the cards have to be punched, more time is needed, but a trained operator should punch several hundred cards an hour. Some large companies have reduced the time required to produce financial statements from twenty days to six days following the end of an accounting period.

Accuracy is reasonably assured if cards are punched, verified, and listed or tabulated by machines. There should be practically no errors in preparing shipping orders, no doubt about whether an order can be filled from stock, and no wrong classification of items on account, and clerical errors should not be present when punched cards are used. Sorting is automatic and rapid, and each record is automatically verified for correctness. Assuming proper internal control over the records as made by punched cards, audits can be made without the long and tedious hand processes if records have been kept on punched cards. There is less chance of covering up fraud and a very small chance of machine error if internal control is present. However, one supervisor stated that some of the machines do not work properly if the room temperature is allowed to drop much below sixty degrees because of the contraction of metal in certain electrical mechanisms of the machines. Air-conditioned machine rooms reduces such errors to a minimum.

Factors to be considered when contemplating a change to punched card methods. One IBM salesman stated that he had three selling points: speed, accuracy, and efficiency. In determining whether it would be efficient for a company to use punched-card methods he stated that he made a study of the

requirements of a potential customer, outlined the procedures, and determined the approximate cost of operation. If the same, more, or better records could be produced at a cost less than that of the system presently used, he usually made a sale. If the cost exceeded the cost of the presently existing system, the additional cost must be justified by the additional speed, accuracy, or variety of useful reports. He stated that it was impossible to determine for any classification of industry at just what volume it was most profitable to change from other systems to punched-card methods. Even the profitableness of the use of punched-card methods by one firm does not indicate that another firm of the same size would receive the same benefits. Such a change must be determined by each individual business. If the method used by any business is operated efficiently, the change to punched-card methods will probably come as a result of expansion beyond the point where the old system has become too slow or will not produce the variety of reports needed. On the other hand, a comparatively small firm using an inefficient method might change to punched-card machines much sooner than a firm having an efficient system using other methods.

When a change is made to punched-card methods, it is best to adopt only one application at a time, gradually replacing the old accounting system. The employee's resistance to change is more easily overcome if the change to punched-card methods takes place over a period of time.

The comptroller and punched-card methods. The punched-card method of keeping any records will break some fundamental habits acquired with hand methods. Businessmen who have grown accustomed to strict secrecy in making payrolls feel that secrecy is being violated by the use of punched cards. However, it is simply a shift of the responsibility of secrecy from one department to another. It is less difficult to keep card records under lock than

to so keep the more cumbersome bulk of hand records, and it is entirely possible to have the cards made and run by the employees who performed the hand process of making payrolls.

There is often a feeling, too, that since no check is necessary in some parts of the punched-card process, no check should be made. This is a misconception. More checks on accuracy are used with punched cards because it can be done easily and with less expense. Checking is simply done in a different manner and at a different time. Proof checking can be done with little time and effort in the machine process. That fact is the quality which often makes possible an audit of records kept by the punched-card method in as little as one half of the time originally needed.

The greatest resistance which has to be overcome in introducing the punched-card method is often that of executives who are inclined to hold tenaciously to old habits developed by long experience with hand methods. It is impossible for some of them to accept machine processes as being as reliable as their trusted employees. And not knowing enough about what the machines can accomplish, they are irritated by the thought of changing the processes they know. The human fear of anything that is unfamiliar plus distrust of anything mechanical may cause a dogged resistence against new methods.

Service and Personnel Supply. To use the machines for accounting a company should be near a service department. This repair or maintenance service is furnished from local offices in Tulsa and Oklahoma City. Repair men are sometimes assigned to just one large installation, thus providing immediate repair for machines used.

Personnel for operating an installation are not always easily obtainable. Workers object to the noise of the machines and the amount of work which has to be done standing. The principal deterrent, however, is the low salaries

offered for workers on the machines. The oil companies pay the highest salaries, and as a result have the lowest turnover in employees. Draughns Business College, Oklahoma Business College, and several other schools train operators in the use of various machines. Some businesses train inexperienced persons in the use of the machines.

Probable future developments. There have been a few firms which have over-expanded in the use of punched-card machines. Such firms have found the cost greater than the benefit received and have changed to other systems of accounting. Such shifting will continue in the future as such errors are made, but on the whole, the future is likely to bring expanding use of machine accounting.

Most of the firms presently using punched-card machines for some operations probably will expand the functions of the machine department to include other accounting operations. The increase in number and type of functions will require additional machines. For example, one function not used by any of the companies in Oklahoma at the present is the use of punched-card machines for geophysical and chemical research computations. Also, punched-card methods have been adapted to the accounting problems of banks, and many new adaptations will, no doubt, be worked out in the future.

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