1945

Principles of the IBM punched card method; Use of the IBM accounting method by the public accountant; Educational meeting (New York State Society of Certified Public Accountants)

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OF

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EDUCATIONAL MEETING

New York City

December 11, 1945

SUBJECTS:

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USE OF THE IBM ACCOUNTING METHOD BY THE
PUBLIC ACCOUNTANT

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PRINCIPLES OF THE IBM PUNCHED CARD METHOD

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THE IBM CARD

One can almost picture an accountant confronted by apparently endless facts and hopelessly dreaming of some way he could dump his labor tickets into a machine, push a button and get his payroll; then push another button and get reports of production costs, comparisons of actual cost with standard, analyses of indirect labor, and similar significant reports of efficiency.

Accountants have exercised remarkable ingenuity in developing special books, special columns, short-cuts to eliminate entries and postings and calculations. Yet, every step of the way they were confronted by the one basic fact that a figure once written on paper is fixed and not readily available for critical cross-analysis.

Take the sale of one product appearing on an invoice as an example. The data appearing on the original record might be needed in a dozen or more different records such as the finished stock ledgers, the cost of goods sold report, salesmen's commission statements, customers' purchase summaries, sales tax records, and other revenue summaries. The accountant could look at it and say, "If you, now here, in the finished stock ledger, could only be there in the sales tax record too! Every time I want to use you, I must do the work. Why can't you, once created, go by yourself to the many places you are needed?" The item might have answered, "I have all the facts I need; give me substance, give me a body, give me mobility, and I will go everywhere you direct."

The card and the hole in the card were the answer.

Take the data from a flat surface. Give the recorded item thickness and substance. Give the data permanence in significant holes, and the position of the holes will direct the data wherever they are desired, often directly from the original record to the final result.

It is easy to visualize an ordinary adding machine with rows of vertical keys. Most people know that to add $56.74, the keys in the four columns to the right are depressed in sequence according to the value in each of the individual positions.

In the IBM Accounting Machine Method all the transaction information is transcribed into cards by punching holes in predetermined positions. For example, in sales accounting work, sections of the card are reserved for punched holes that show the invoice reference number, transaction date, sales district and salesman credited for the sale, the customer, the product sold, the quantity shipped and the financial amount of the transaction.

THE PUNCHED CARD PRINCIPLE

A pencil is a commonplace tool. Everybody recognizes that it will do different things for different people and this wide range in usefulness is generally accepted without a second thought of "How" or "Why." A similar concept of the card as a tool is basic. Its form may be conducive to short-cuts that can be utilized to advantage, but, essentially, it is only a tool. It actuates machines that sense nothing but the position of the holes, that read no printing or writing. Just like a pencil, pen, or writing machine, it *produces* records.

The next step is to appreciate in every day language the various things these holes can do.

Can an operator depress keys and make a machine write numbers or words? Holes will make machines do exactly that.

Can an operator set up an amount in an ordinary adding machine by pressing proper keys? This the holes will do.

Does an operator know, from visual inspection, the end of each classification in a pile of sorted documents? The holes make it possible for the machine to sense each change in classification automatically.

Can an operator take sub-totals or final totals by pulling a lever or pressing a bar? The holes will make machines do this automatically.

Can an operator look at an item representing a shipment, for example, and determine its effect on various columns of

SALES ANALYSIS

REPRESENTATIVE COMPANY

INVOICE NUMBER	DATE		DISTRICT	SALESMAN NO.	CUSTOMER NUMBER	QUANTITY	PRODUCT NUMBER	SALES AMOUNT
	MO.	DAY						

IBM 714572 PRINTED IN U.S.A. LICENSED FOR USE UNDER PATENT 1,772,492

49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

What the PUNCHED HOLE can do

1. Add itself to another number
2. Subtract itself from another number
3. Multiply itself by another number
4. Divide itself into another number
5. Post itself
6. Eliminate itself
7. Reproduce itself
8. Sort itself
9. Select itself
10. Print itself on the card
11. Produce an automatic balance forward
12. File itself
13. Cause a form to feed to a predetermined position or to be ejected automatically, or to space from one position to another
14. Cause a total to be printed

HOLES CAN BE AUTOMATICALLY PUNCHED AND VERIFIED FROM PENCIL MARKS ON THE CARD

THE PUNCHED CARD

Demonstrates the first step in the

INTERNATIONAL ELECTRIC ACCOUNTING MACHINE METHOD

BUSINESS INTERNATIONAL MACHINES

a report—deduct from unfilled orders, add to sales, and deduct from inventory? One significant hole identifying the transaction and one amount punched in the card will not only put the amount in every affected column of the report, but, also, will tell the machine whether to add or subtract it. All of this is performed simultaneously and automatically.

Can an operator look at an item and decide that it doesn't belong in a particular report? One hole will make the machine ignore such an item.

Can an operator decide what information belongs in a customer's address, in shipping instructions or in the body of an invoice, and space her typing accordingly? Holes will do this automatically.

Can the operator determine when the items on an invoice run over to a second or third sheet? Can she then space to the body of the next form? Again, this is accomplished automatically with IBM punched cards.

Can an operator set numbers in a machine and have them multiplied either by turning a crank or by pressing a bar? Amounts in a card will not only make a machine multiply, but will cause the product to be punched in the very card which produced the result.

There is no operation mentioned here that is not commonplace in office routine. Those referred to are enough to illustrate that most of the attributes of the punched hole make fully automatic those operations which under other methods are performed manually or are machine-assisted.

Producing accounting reports—like producing manufactured goods—may be accomplished manually, by semi-automatic, machine-assisted operations, or by fully automatic machinery.

The use of IBM punched card methods in an office is directly comparable to the use of an automatic screw machine in a machine shop, a thermostatically controlled heating system, a Jacquard loom in a textile mill, a player piano, or any similar automatic electrical or mechanical device. The operator *sets up* the machine to perform a specific task such as preparing a payroll, a stock status summary, an in-

voice, or other accounting records. From that point on the operations are automatic except to *feed* more work and *remove* the finished reports.

The hole in the card does the work.

Wherever an operator has to look, decide and act, punched holes cause detection, selection and action. Each operation, actuated by the IBM punched card, is accomplished with uniform speed and machine accuracy.

SIMPLICITY OF IBM ACCOUNTING

There are three basic IBM Accounting Machine operations:

Punching—Creating the IBM Card (the tool)

Sorting—The IBM Card arranging itself

Producing Results—The IBM Card producing finished results

Punching the basic data into the cards is obviously the first step. In its simplest form, punching is a straight-forward operation, familiar in many ordinary office appliances—a key-stroke by an operator. The document containing the data to be recorded in holes is placed at the operator's left hand and the cards, especially designed to provide for easy progressive reading of the information to be punched, are fed into punching position and ejected automatically. Operators quickly develop expert speed and accuracy in producing media which, once checked, are permanently correct, for the holes cannot move. In the development of procedures, several more automatic operations for putting the holes in the cards are performed. In many systems no key punching is necessary at any point in the complete job. Punching from pencil marks has been one development that has eliminated much of this key punching.

The sorting of punched cards is even more simple, but it solves with ease the difficult problem of arranging and rearranging information recorded on flat surfaces. To see a sorter in action is a spectacular sight. To benefit by its operation in classifying items in practice opens avenues of available analyses where none were even suspected before its development.

The producing of results from classified cards embraces the whole field of preparing documents, reports, and records—the same field

served by pencils, pens, and writing machines. From ten feet away, one cannot tell whether an IBM Accounting Machine is producing a payroll, a sales analysis, or a report of inventory position. The cards are being fed into one end, a report is being printed at the other, with complete alphabetic descriptions if desired—frequently without attention from the operator who may be busy at another task.

The automatic printing capacity of the IBM method can be expressed best in the following comparisons:

METHOD	CHARACTERS WRITTEN PER MINUTE
Manual	140
Key driven	745
IBM punched card	7040

In the manual method, 140 characters represent an average number of characters written by hand for one minute.

In the key driven method, 745 characters represent Miss Hamma's championship speed on the IBM Electromatic Typewriter, 149 five-stroke words per minute.

In the IBM punched card method, 7040 characters represent 88 characters per line at 80 lines a minute on the IBM Alphabetical Accounting Machine.

These basic functions of punching, sorting, and producing reports are the vital elements upon which the entire IBM Accounting procedure is established.
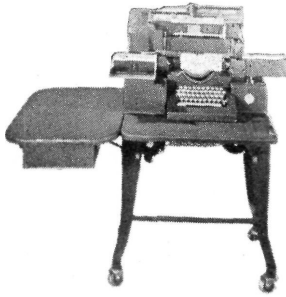
IBM Card Punching Machine with
Printing and Duplicating Features
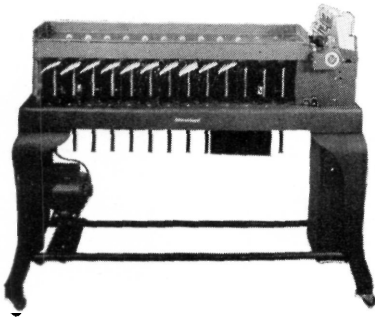
IBM Card Sorting Machine

IBM Alphabetical Accounting Machine

USE OF THE IBM ACCOUNTING METHOD BY THE PUBLIC ACCOUNTANT

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The purpose of the following remarks is to compare IBM punched card accounting with other methods and to examine how and why IBM accounting procedures may provide the internal or independent auditors with an additional tool for carrying out certain phases of the examination.
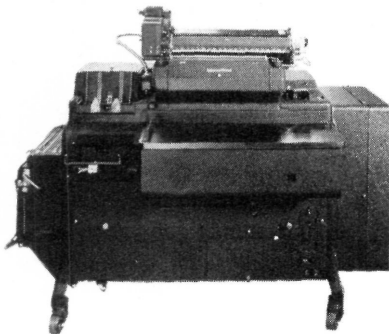
The meaning of IBM punched card accounting should be clearly established. Basically, IBM punched card procedures represent a means—not a end. They are transitional in character in that they tie together the source document and the end result. We may, therefore, conclude that the sole differences between this method of accounting and other generally accepted methods is the rapidity and flexibility by which printed records, classifications of source data, and computations are obtainable.

A review of minimum requirements of the IBM punched card system indicates that they are the same as those required of other methods, namely:

1. Reference in the general ledger to a book of original entry.

2. Books of original entry that are clerically accurate, providing a cross reference to the source document.

3. Accurate subsidiary records cross referenced to source documents, supporting general ledger control accounts.

4. Periodic trial balances of subsidiary records which agree with related control accounts.

5. The system must incorporate such principles of internal check as to assure an accurate recording of all of the transactions, classified properly, in the books of account.

If IBM punched cards are used to prepare the general ledger, and/or books of original entry, and/or supporting trial balances of subsidiary records, this in no way changes the minimum requirements.

IBM punched card accounting methods, like all other accounting means, serve to record and preserve all of the original transactions, to classify and reflect the results of these transactions in the books of account, and to provide a convenient means of tracing back from the end result to the source document at some later date.

An indication that there is some misunderstanding of the similarity in principle between IBM punched card accounting and other methods is the often-repeated question, "What happens when a card is lost?" The answer is, of course, that by reference to the book of original entry a cross reference to the source document is found; and since the source document—not the card—is the important matter, it makes no difference. If a card is lost prior to the preparation of the book of original entry, it is immediately discovered, since detail cannot agree with controls. This often happens in any accounting approach, and by various means the missing card or document is traced to its source and the error or omission corrected.

Assuming that we agree to the similarity of fundamental approach of the IBM punched card method with other methods, it follows that the problems of review of the system of internal control and audit procedures are not dissimilar either, except that IBM accounting equipment may provide the auditor with a tool to speed up certain clerical phases of his examination.

As we all appreciate, a decision must be made during every examination concerning where to stop in the testing made for the purpose of estimating the extent to which the system of internal check is operative. Of course the type of audit has a bearing on the amount of time that can be devoted to a review of detail transactions. Accountants generally agree that a greater scrutiny of detail is desirable, but that the cost and time involved often make it impracticable.

Let us look at some representative IBM accounting procedures as they are applied to major classifications of the balance sheet and consider how such records might be tested by the auditor.

CASH

Two kinds of IBM accounting methods are used in developing a cash disbursements record. Under one method IBM cards are used to

write the cash disbursements book or payroll, with related checks prepared in the usual manner. Under the other method this procedure is carried one step further and the checks themselves are IBM cards. You may have seen the Army and Navy allotment checks which are prepared in this fashion.

In regard to reconciliation of bank accounts, and particularly where large payroll accounts are involved, electrical accounting methods usually involve the setting up of a reproduced file of IBM cards, each card representing a check issued, and bearing the check number, date, payee and amount. This file is set aside for the purpose of reconciling the bank account when the paid checks are returned. If card checks were issued, it is only necessary to sort the checks returned by the bank to check number and machine-match these with the checks-issued file. In tabulating parlance, this operation is termed collation, a process by which the unmatched checks issued are separated from those that are matched with the paid check. The tabulating check carries the check number and date and the amount which was punched in it prior to issuance. When regular paper checks are issued, cards are punched with like information, from the checks returned by the bank. Sorting machine speeds are at the rate of 450 cards per column per minute and cards containing this small amount of information may be punched very rapidly, thus facilitating the reconciliation of bank accounts involving a great number of expenditures—for instance, large industrial payrolls. By running the cards for a total at the rate of 150 per minute, it is practically no task at all to verify the accuracy of the bank statement.

Let us assume that the foregoing procedures or some slight variation thereof are being used by company A. The auditor is aware of these procedures and wishes to take advantage of them for the purpose of speeding up certain phases of his examination of the payroll transactions and related bank balances. Let us further assume that the fiscal period ends December 31st, that he has selected the month of December for his test and that paid checks are returned by the bank at the end of each month. He might proceed somewhat as follows:

Records required:

1. Payroll registers for month of December

2. IBM cards from which payrolls were prepared

3. List of outstanding checks at November 30th

4. IBM cards from which list of outstanding checks at November 30th was prepared.

5. IBM cards representing checks issued during December.

6. Paid checks returned by the bank at December 31st

Procedure:

1. To prove outstanding total at November 30th—Total the "outstanding" IBM cards (150 cards per minute)

2. To prove December payroll register footings—Total the IBM cards used to prepare the payroll registers. There may be several types, for example:
   a. Gross payroll cards
   b. Individual classes of deduction cards

3. To prove the checks issued total (net amount of payroll)—Total the IBM cards representing checks issued during December

4. To check exact sequence of check numbers issued during December—Run IBM cards through collator wired for sequence checking

5. To prove clerical extension of hours-times-rate—Sort gross payroll cards to hours and then to rate (450 cards per column per minute). Tabulate cards for total of each hour group under each individual rate. The tabulation will show total hours and total amount in each group and the matter of checking extensions for x thousands of payroll entries will resolve down to perhaps less than 100 hand extensions depending, of course, on the spread of rates and hours.

6. To vouch payroll entries—Select representative IBM cards used to prepare the payroll—both gross payroll cards and deduction cards. Sort them into the sequence in which the source documents are filed, list them on the electrical accounting machine showing date, name, hours, rate, etc., and use these lists as the basis for comparison with personnel department records, original attendance records, withholding certificates, deduction authorizations, etc. These listings may then be filed in the audit working papers.

7. To prove clerical accuracy of the December 31st bank statement—Assuming that paper checks were received from the bank, IBM cards will be punched therefrom under the supervision of an auditor. These cards will be tabulated for a total which can then be used as part of a simple manual computation to prove the accuracy of the bank statement.

8. To determine the new list and total of outstanding checks at December 31st—IBM cards covering the checks returned by the bank at December 31st are sorted into check number sequence and are put in one feed of the collator. Cards representing checks outstanding at November 30th and cards covering checks issued during December which are also in check number sequence are put in the other feed of the collator. The collator will match the cards representing checks paid by the bank with the related cards representing checks issued and pull the latter out of the checks issued file. The balance of cards in this file represent the new outstanding checks. These cards are listed, showing date, check number, payee's name and amount. The total is used in the reconciliation and the list may be used for the working papers, for discussion of the older items shown thereon, etc.

There are several points worthy of mention in connection with this audit procedure:

First: Such matters as scrutiny of endorsements, authorized signatures, bank cancellations, the transfers of cash to the payroll bank account, etc., are purposely omitted since we are here concerned solely with the phases related to the use of IBM cards.

Second: Since tabulating procedures vary with individual circumstances, the above can be termed applicable in a general way only.

Third: It is interesting to note the similarity in basic function of IBM card accounting with all other accounting methods—either hand or mechanical. We have totaled and multiplied; we have classified; we have filed; we have written.

Fourth: Since in every case our end product was a cross-referenced listing, and in every case our beginning was an original source

document, it is clear that the IBM card itself represented a bridge between the end result and the source—a bridge we were able to cross much faster than by other means.

Fifth: It is interesting to note at this point that reports or listings of a different form and character were all prepared on the same IBM accounting machine. The operator, by changing certain switches and wiring in the control panel, is able to direct the machine activity as he chooses. The same machine prepares payroll registers, customer billings, vendor's remittance advices, etc., with equal facility. This inherent factor of flexibility is an important part of the punch card method.

CASH RECEIPTS

Companies having a great amount of cash received detail, as the result of customers' billings, very often use IBM card methods somewhat as follows:

The accounts receivable detail is composed of IBM cards from which customers' billings were originally made. As remittances are received, they are converted to IBM cards. These cards are listed; the list, giving complete information as to date remitter's name, amount, invoice or statement reference, etc., is the cash receipts record. The cards are then machine matched with the accounts receivable detail file to pull the related matching items, thus effecting the credit entry to the detail file set up by the entry to the control account in the cash receipts book. If the auditor wishes to save time in his examination these punch cards will give him a ready means for proving the accuracy of the cash receipts book totals and preparation of working papers to be used for comparison with the original remittance advices and bank deposit slips.

NOTES RECEIVABLE

The auditor might make good use of the underlying IBM detail where used by a large credit firm for the purpose of preparing his confirmations to be mailed directly to the debtor, and for the preparation of a parallel listing of such confirmations mailed showing complete information as to dates, makers' names, due dates, amounts and interest rates. This information, of course, incorporated as part of the work-

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ing papers, may be readily compared with the notes in the usual fashion. The chief saving here is the writing and totalling time.

Accounts Receivable

The items mentioned under notes receivable are likewise herein applicable. After the accountant has determined to his satisfaction that the open file of IBM cards representing all of the outstanding balances is complete as to composition and detail, the cards may be sorted to age classifications, and totals accumulated and individual listings prepared of the older age groups requiring more study or perhaps discussion with the responsible officials. When thousands of open items exist, the amount of time saved by the use of IBM accounting machines can prove substantial.

It can be noted that it is even feasible when a great number of direct confirmations are required, to make the confirmation an IBM card and to record on this card all the required information from the holes punched in the card. The confirmation cards may be created—punching and all—from the open balance cards in the accounts receivable detail file. The cards are then arranged by sorting according to customer number sequence. They can be listed for the working paper file and mailed directly to the debtor for return to the auditor. If the accountant keeps an identical file of IBM cards in his possession, he may collate cards returned by the debtor on a daily basis to pull out the matching items. The collator is used for this purpose—either by one of the assistants on the examination or by one of the tabulating employees, under the observation of the auditor. The reducing file of unmatched duplicates represents confirmations not returned, and may be used for the purpose of sending out additional confirmations as required.

Perhaps some time in the future, procedures of this kind may be carried on by the public accountant on equipment maintained in his own office for this purpose, particularly should there be a decided trend in the direction of enlarging the percentage of direct confirmations mailed to debtors.

Inventories

There exists a multiplicity of IBM card procedures covering inventory accounting. For the purpose of this discussion, let us take one that is in actual use by Company X. Time does not allow an analysis

of the detail procedures followed, but we can review the procedure in a general fashion:

1. About 75,000 items are carried in the materials inventory

2. The approximate valuation is $15,000,000

3. Receiving reports are priced at average price, and cards punched therefrom. These cards are totaled to get the debits and credits to the inventory and uninvoiced receipts control accounts respectively. The cards are reproduced and one set is sorted into the inventory detail file and the other is sorted into the uninvoiced receipts detail file.

4. Material requisitions are written up on cards and after punching are totaled to get the credit to the inventory control account. These cards are sorted into the inventory detail file and act as deductions.

5. Each day the entire inventory file is tabulated for item totals and a summary card punched for the new net total of each item.

6. From copies of invoices cross-referenced to the related receiving reports, IBM cards are punched and totaled to get the credit to the accounts payable control. They are collated with the detail uninvoiced receipts file and the matching items (which were originally punched from receiving reports at average price) are pulled. The cards pulled out are totaled to get the debit to the uninvoiced receipts control and the difference is charged or credited to the price variance account.

7. Individual variances are listed by material code, showing invoice reference, and this report is used to review variances each month with a view to adjustment of average prices when warranted.

8. Four times within each year Company X counts its inventory and reconciles the physical counts with the perpetual records maintained in the tabulating department.

9. For this purpose the tabulating department maintains a file of IBM cards for all storage locations in the plant. In each card is punched the material code and names of items stored in each bin of each shelf of each section of each building.

If an item is stored in four different locations, four cards will be in this file. If counters are assigned to count electrical supplies, cards coded with that class are sorted from the file, listed and given to the counters, who proceed to the indicated location where the counts are made. Counts recorded on cards are later reconciled with the balances shown in the detail inventory punch card file.

As it happened in one particular instance, the auditor familiarized himself with the underlying procedures commented on above. The company had never adequately considered the problem of obsolescence. It was generally known to the auditor that many of the items carried had been obsoleted by reason of engineering changes and design. A question of the utmost importance was to what extent and in what approximate amount was the factor of obsolescence represented in the $15 million. A second question was how much of the physical existence of the $15 million inventory could be practicably verified by actual count. A third question arose in regard to pricing of the materials concerned. These questions were answered satisfactorily from the audit viewpoint by reason of the auditor's knowledge of how the records were built up through the punch card medium, as follows:

Question 1: IBM cards representing receipts of material and requisitions for a six-month period were sorted to material code and listed in such fashion that usage during this six-month period could be readily compared with purchases during the period and balances at the end of the period. Those items revealing little or no movement were written up and handed to the company for an immediate investigation. Explanations were reviewed in the light of their soundness and a figure was arrived at which stated the obsolescence factor with a more than reasonable degree of accuracy. The company also benefiited because it immediately set in motion the machinery to dispose of many of those items which were readily marketable. The figures thus obtained were arrived at with minimum of clerical effort, since practically all the work was done by the punch card equipment.

Question 2: The best way to verify physical existence of the inventory.

All of the IBM inventory balance cards were sorted to money value and totaled in the following groups: items of $1 to $10, $10 to $50, $50 to $100, $100 to $500, $500 to $1,000, $1,000 to $5,000 and

over $5,000. In addition this tabulation showed the total number of items in each amount classification. It was immediately ascertainable that 80 per cent of the total money value was represented in approximately 5 per cent of the items. These items were counted completely and test counts were made of selected items occurring in the other amount groups. Again, the auditor, through the use of punched card methods, had made it possible to do a most comprehensive verification of the inventory with a minimum of useless clerical effort.

Question 3: In regard to verification of prices, the auditor selected a large number of the items falling into the 5 per cent group, had the IBM cards listed in the form of working paper schedules, and had the original vendor's invoices pulled in the accounts payable department for comparison of prices. A representative number of smaller items was likewise tested.

This is an outstanding example of an efficient use of the company's internal IBM punched card procedures for facilitating the audit procedures.

ACCOUNTS PAYABLE

A representative IBM installation will produce a commitment register, an invoice register, remittance advices, and an accounts payable journal. Supporting punch card detail will provide trial balances of open purchase orders and unpaid invoices. The auditor, by referring to the invoice register, may indicate the items he wishes to list for his working papers as a record of items vouched. The open accounts payable may be aged under his observation, confirmations mailed directly to vendors may be listed for the working papers, etc.

* * * *

It is possible to go on almost without end, commenting on the individual punch card applications being used by business and industry today. No day passes in our business without our learning of some new use to which our equipment is being applied. Yet we feel that we are merely seeing the beginning of its usage.

We believe that a thorough understanding by the accountant of the use of punch cards as a basic function will result in improved

punch card systems and may aid him substantially in pursuing his investigations where such methods exist.