

MACHINE METHODS OF ACCOUNTING

THE DESIGN OF TABULATING CARDS

THE application of tabulating machines, and especially the design of the tabulating cards around which the system has been developed, affords a wide range for the use of ingenuity. The various accounting and statistical records which are compiled by means of the electric bookkeeping and accounting machine method reach into practically every phase of modern business and governmental activity. The cards themselves reflect this wide variety of business applications and rarely are two identical card forms used by different companies, regardless of the similarity of the nature of the job.

In order to be able to design the most effective card for a particular application, it is essential, first, that the preliminary requirements of good card design be recognized. One of the primary requisites is a general knowledge of the accounting practice and statistical methods being employed in order to appreciate fully not only the present needs of the problem but also

its future possibilities. It is also essential to have a general knowledge of the rules governing the design of accounting records and documents so that the proposed plan for use of accounting machines may be installed to effect a maximum of efficiency with a minimum of change and disruption in the associated record-keeping departments. The third factor is a knowledge of the operation of all units in the tabulating machine line of products so that the work may be accomplished with a minimum amount of effort. Lastly, it is essential that the person who designs and approves the card form which is proposed has an accurate detailed knowledge of the special problem to which the machines are being applied.

Although there are many basic principles governing the designing of card forms, it must always be remembered that good sound common sense and practical experience will contribute much to the selection of the one best way to do the work.

Determination of Card Data

The first step in card design is to determine the data which will be needed from the card in order to meet the requirements of the contemplated record routine. In order to accomplish this, all of the following factors must be considered in the order presented.

Report Requirements

Of all the factors affecting card design the most important are the requirements of the finished reports that are to be prepared. These reports should be kept in mind constantly so that all necessary information may be included in the card and arranged to facilitate their final preparation. The factors so determined may be considered as the desired or ideal card requirements. Certain modifications may then be required to conform with any of the limiting conditions discussed later.

Availability of Data

The factors next in importance are determined by the sources of the original information. These must be studied to see whether all the desired data are available on the original documents to be used in punching. If not, or if too much labor is required to get them on these documents, it will be necessary to revise

the list of card data, or substitute other data which will accomplish a similar purpose. A study of the source records will also determine whether a dual card can be used advantageously to replace these records. It will further show whether certain available data can be conveniently included in the card and a new use devised which was not originally planned, or which may be needed in the future. At this point, also, a study of reference punching should be made so that the card may be identified with the original record from which it is punched, if this is necessary. Dual cards will need no reference punching since they are also the original records.

Summarizing Card Data

After the above studies have been completed, the final results should be prepared in list form. This list will serve in assigning the proper number of columns to each field and may be conveniently divided into the following three groups for the purposes of discussion:

Reference Data—Date, Invoice No., etc.

Controlling Data—Branch, Salesman, Product, etc.

Adding Data—Quantity, Amount, etc.

Preliminary Card Design

Size of Fields

The number of columns required to record each type of information should be added to the memorandum list previously mentioned and illustrated below. For reference and controlling fields, this is determined by the largest single number to be recorded as indicated by the codes which have been devised for the machine application. Thus, two columns might be left for month (twelve being the largest number), two for day, four for invoice number if the number series is repeated after 9,999 is reached, two for branch if there are 99 branches or less, etc.

With the adding fields, the problem becomes difficult. In the first place, the space needed to record the largest amount may not be readily available, and in the second place, this amount may be very unusual. It is a good plan to provide columns enough to take care of all except the unusual cases and to handle these by punching extra cards or by using the class selection device. For example, the amount \$67,265.80 may be recorded in a six-column field by punching six cards of \$9,999.99 and one card for

\$7,265.86 (or any combination of six-digit numbers totaling \$67,265.80).

Attention should be given at this time to the possibility of consolidating certain fields on the card. The original list may include several types of information which can be carried in a single field if they do not occur simultaneously. Successive cards may be used where a cross spread of the data fields is not desired. This applies more particularly to quantity and amount fields.

After the proper number of columns has been assigned to each field the total of all fields will indicate whether the data are within the capacity of the card. If this total is considerably beyond the desired card capacity, a thorough study of the individual problem is the only means for determining what should be included and what should be omitted. This point is very important. Omission of some needed information may lessen the usefulness of the installation, and keeping unnecessary information will just as surely decrease its efficiency.

SALES and ORDER ANALYSIS											
REMARKS:											
IF FOLLOWING DATA TO BE PUNCHED ARE NOT ALREADY CODED, SECURE SUFFICIENT INFORMATION TO PERMIT CONSTRUCTION OF SUITABLE CODES. INVESTIGATE CONSTRUCTION OF PRESENT CODES											
Punching Data	No. of Classifications	No. of Digits	Punching Data	No. of Classifications	No. of Digits	Punching Data	No. of Classifications	No. of Digits	Punching Data	No. of Classifications	No. of Digits
Date	0/00/0	4	Customer Number	30	2	Commission Rate	-	-	Transportation	999.99	5
Reference Number	9999	4	Class of Business	6	1	Amount of Commission	-	-	Shipping Point	28	2
Branch Number	18	2	Ledger Number	-	-	Date Required for Shipment	-	-			
Salesman Number	90	2	Commodity Number	40	2	Trade in Allowance	-	-			
Sales District	-	-	Class of Commodity	6	1	Class of Sales Return	5	1			
Country	9	2	Size	00.000	5	Amount of Sale	9999.99	6			
State	50		Kind of Package	-	-	Discount	999.99	5			
County	-	-	Quantity	9999	4	Cost Amount	-	-			
City	150	3	Unit of Measure	-	-	Profit Amount	-	-			
Population Group	-	-	Source of Order	-	-	Profit Class	-	-			

Rules Governing Tabulating Card Design

A systematic study of the rules governing the design of tabulating cards can be made only

by analyzing carefully the considerations that are imposed by various widely differing factors.

These sets of special conditions can be grouped for convenience under the following general classifications:

1. General rules governing good form design.
2. General rules governing transcript card design.
3. General rules governing dual card design.
4. Influences of printing and manufacturing of tabulating cards on card design.
5. Rules to facilitate key punching.
6. Influence of key punch construction on card design.
7. Influence of sorter construction on card design.
8. Influence of accounting machine construction on card design.
9. Influence of auxiliary machine construction on card design.

Rules Governing Good Form Design

Accountants and office managers have recognized the important part played by careful design of record forms in simplifying and speeding up office routine. In order that all documents might be made to conform with accepted standards of good form design, they developed a set of rules and basic principles governing the

procedure for drawing up new and revised forms.

Since tabulating cards constitute a group of accounting forms, many of these rules are applicable to tabulating card design. Although there are a large number of factors that must be considered, some general rules of form design have been selected and enumerated below because of their special significance in connection with the design of tabulating cards and tabulating routines.

1. The name of the company should appear on all of its record forms, and its trademark should be printed on all documents which reach outside organizations or individuals.
2. All essential reference information should be placed at or near the top of unbound forms to facilitate the filing and locating of permanent records.
3. Headings or titles of spaces for written information should be placed so that the actual writing will be forced into the desired position.

In the illustration, one of the cards shows how a violation of this rule results in inconvenience. The other, a more desirable arrangement, forces the writing closer to the top. When block headings

		DATE ORDERED		DATE WANTED	
PART NUMBER		TOOL NUMBER		TOOL NAME	
DATE COMPLETED	TYPE TOOL	ORDER NUMBER		APPRO. NUMBER	EST. HRS.
RETIREMENT DATE	EXPECTED LIFE MOS.	OTHER PARTS PRODUCED		TOOL AND EQUIPMENT ORDER FILE THIS COPY IN DEPT. MAKING ORDER	
COST	MONTHLY DEPR.				
DIVISION-PRODUCT	SOURCE OF TOOL	MANUFACTURER			

Rule 2

ORDER NO.		SYMBOL		MAN NO.	
SUPERVISION		DETAILS		HOLIDAY VACATION	
STUDY OR INVESTIGATION		ASSEMBLING OR TESTING		PERSONAL	
DESIGN OR LAYOUT		CHECKING OR CATALOG		SICKNESS	
CHECKING SECTION 4					

Wrong

PART NO.		ORDER NO.			
MAN NO.		PART NAME			
DEPT. CHG.	CODE	OPER.	REMARKS		
QUAN. ON OPER.					

Rule 3

Right

are printed at the top of a space, reference information is forced down below the point of ready visibility.

- Information to be checked visually should be placed at the left end (or sometimes the right) of the document for convenience in fanning.

The image shows a sample payroll record card with a curved layout. The card is fanned to show multiple copies. The fields are filled with the following information:

- 6150
- 217
- 10
- 36
- \$176
- 8/10/34
- 8/7/34
- Ralph Jones
- 4e
- Bivel Gear
- 16
- 60
- Cutting
- J. Waters

Rule 4

- All related information should be grouped and placed in the position which will promote efficiency in recording. As a practical example, refer to the payroll record.

DEPT' NO.	MAN NO.	NAME	DESCRIPTION OF WORK	
ORDER OR ACCT' NO	OPER. NO.			
OPERATION NAME				
	START STOP			
	HOURS			
GOOD PIECES	RATE	AMOUNT	IND 1	DIR 2

Rule 5

Hours is in position for convenient notation after subtraction of start and stop time. All data recorded by shop clerks or workers are placed together for convenience. Time registration at margin is in sequence to facilitate visual subtraction. Rate is located between hours and pieces to facilitate either calculation. Earned amount is placed near quantities extended to prevent errors in the transcription of amounts.

- Each document should carry specific directions with regard to its purpose, use, and/or disposition.
- Provide adequate space for large writing where records are to be made by workers

and not by regular shop clerks. The average machine worker is not a skilled penman and may frequently use a thick lead pencil which will necessitate provision for two or three times the minimum amount of space required by a regular clerk.

- Furnish ample space for recording additional miscellaneous remarks and descriptions. Several lines may frequently be required, and therefore a large portion of the unused space may be devoted to this purpose.
- Essential written information should be reduced to a minimum of manual recording by providing for automatic printing (such as time stamps, addressing plates, etc.) and by marking preprinted descriptions whenever practical.
- Company slogans should appear on record forms which have wide circulation in several departments. Safety warnings to factory workers are most common.
- Titles or descriptive headings should always be the same for like items whether they appear on various documents or at different places on the same document.
- Eliminate all duplication of items which must be recorded manually or semi-automatically.
- Check carefully the limitations of mechanical recording equipment such as typewriter spacing, clock registration, serial numbering machines, addressing machines, stamps, etc., in order to provide the proper position and ample room for printing.
- Standardize the sizes of paper upon which forms are to be printed for simplification of filing and handling.
- Provide for all contingencies which arise in the preparation and handling of multiple carbon copies so that legible, well-aligned originals and duplicates may be obtained.
- When large numbers are to be written, make provision for guide lines or dots to designate the position of digits or periods of numbers. This corresponds in principle to the pen-ruling of amount fields on journal and ledger sheets.
- Choose a color for paper stock upon which the form is to be printed that will not interfere with the utility of the record. Plain white or yellow is satisfactory and economical but if colored paper is used to

INTERNATIONAL BUSINESS MACHINES CORPORATION
TABULATING MACHINE DIVISION



RETURN PARTS TAG

FOR CHANGE OF MACHINE SPECIFICATIONS

T-518 END.

TAG NUMBER	
CUSTOMER NAME	
OFFICE	MACHINE SERIAL
DESCRIPTION OF CHANGE	
SERVICEMAN	DATE RETURNED
<p>IMPORTANT: THIS PORTION OF TAG TO ACCOMPANY PARTS RETURNED TO ENDICOTT. IF NO PARTS ARE TO BE RETURNED THIS PORTION IS TO BE RETURNED WITH CHANGE IN MACHINE SPECIFICATION REPORT.</p>	

Rule 6

JUN 20

WEEK ENDING.....
I. T. R. Co. Form No. 1212

No. **85100**
NAME JOSEPH TEMPLETON

MORNING IN	NOON OUT	NOON IN	NIGHT OUT	EXTRA IN	EXTRA OUT	
8 04	12 01	12 48	4 32			7 1/4
7 54	12 02	12 52	3 58			6 3/4
7 58	11 30	12 54	4 36			7
7 59	12 07	1 02	4 31			7

MAN NO.	AMOUNT	CODE	REASON FOR DEDUCTION
0 0 0 0			
1 1 1 1		1	STOCK PURCHASE
2 2 2 2		2	CLUB DUES
3 3 3 3	.25	3	BENEFIT ASSOCIATION
4 4 4 4		4	PAYROLL ADVANCE
5 5 5 5		5	PERSONAL JOB
6 6 6 6		6	AUTOMOBILE
7 7 7 7		7	PURCHASE
8 8 8 8		8	TOOLS
9 9 9 9	.70	9	MISCELLANEOUS
20 30 31 32			

PAYROLL DEDUCTION CARD

Rule 9

LOCATION		JOB OR ACCT. NO.		
				STOP
				START
ELAPSED TIME		RATE	AMOUNT	
SIGNATURE				

DATE CODE	OPER.	DEPT. RATE	ACCT. OR
6			
5			
4			
3			
2			
1			
+			

NO.		DAY	
MATERIAL CONSUMED			
R	S	NUMBER	CR. FROM A/C DEPT.
PRODUCT PRODUCED			
REF.	SYM.	NUMBER	C
DEBIT DEPT.		BATCH NO.	
POUNDS CONSUMED			
IN PROCESS END OF MO.			

Rule 16

facilitate the segregation of various kinds of documents, the light colors should be used to increase the legibility of written information.

18. Care should be taken to place essential permanent information in such a position that it will not be obliterated or destroyed by stamps or punches, or torn off with detachable stubs.
19. Paper stock of proper weight should be used to meet the limits imposed by machine paper feeding as well as the wear and tear imposed by handling and atmospheric conditions.
20. The choice of proper type—both size and style—is important in increasing the facility with which the document can be understood.
21. All forms should carry a definite form number as a positive means of indentifying them for reordering and other reference purposes.
22. The routine handling to which the document is to be subjected should be simple. Eliminate all unnecessary recording, checking, and calculating operations before the form is designed.
23. Make provision for convenient binding margins on all records to be permanently filed, as well as on padded forms.
24. Make some provision for the recording of authorizations and auditing information.
25. Consider the possibility of multiple uses. Make one document serve as a standard

form for as many related records as possible. For example, a material requisition can usually be designed to provide for recording returns to stock.

26. Make new documents which are to replace those already in use as similar to the old document as possible in order to reduce clerical confusion.
27. When the document is completely drawn up it should have a good symmetrical appearance.

Rules Governing Transcript Card Design

Transcript tabulating cards possess certain peculiarities which set them apart from many of the record forms used in accounting and statistical routines. Because of the specialized application to which they are devoted, some additional rules and principles must be observed in their design:

1. All single column fields should have decoding abbreviations placed above each corresponding punching position.
2. Wherever letter type codes are used in connection with billing machines, the corresponding numerical symbols on the card should be replaced by the alphabetic characters. These should be placed slightly above the punching positions so that they will not be obliterated.
3. Whenever complement fields are used, the digits 1 to 8 should be omitted in the first column at the left of that field.
4. Whenever fractional wheels are placed on

INSURANCE NUMBER	LOCATION		CHARGE SYMBOL
	TRACT	PL	
12 43 44 45 46 47 48 49 50 51 52 53 54 55 56	0 0 0 0 0 0 0 0	0 0	0 0 0 0 0 0 0 0
1 1 1 1 1 1 1 1	A W 1 1	A J A W 1	
2 2 2 2 2 2 2 2	B 2 B 2	B N B N 2	
3 3 3 3 3 3 3 3	C 3 C 3	E R E R 3 7	
4 4 4 4 4 4 4 4	D 4 D 4	G S G S 4	
5 5 5 5 5 5 5 5	E 5 E 5	H T H T 5 5	
6 6 6 6 6 6 6 6	F 6 F 6	K V K V K V 6	
7 7 7 7 7 7 7 7	G 7 G 7	X L X L C L	
8 8 8 8 8 8 8 8	H 8 H 8	Y M Y M D M	
9 9 9 9 9 9 9 9	J 9 J 9	Z P Z P F F	

LICENSED FOR USE

Wrong

INDIVIDUAL JOB TICKET										
DEPT.	MAN NO.	ORDER OR ACCT.	PL.	HRS.	PIECES	AMT.	CODE			
0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0	0 0 0 0 0 0	0 0 0 0 0 0	0 0 0 0 0 0	0 0			
1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 1	1 1 1 1 1 1	1 1 1 1 1 1	1 1 1 1 1 1	1 1			
2 2 2 2 2 2 2 2	2 2 2 2 2 2 2 2	2 2 2 2 2 2 2 2	2 2	2 2 2 2 2 2	2 2 2 2 2 2	2 2 2 2 2 2	2 2			
3 3 3 3 3 3 3 3	3 3 3 3 3 3 3 3	3 3 3 3 3 3 3 3	3 3	3 3 3 3 3 3	3 3 3 3 3 3	3 3 3 3 3 3	3 3			
4 4 4 4 4 4 4 4	4 4 4 4 4 4 4 4	4 4 4 4 4 4 4 4	4 4	4 4 4 4 4 4	4 4 4 4 4 4	4 4 4 4 4 4	4 4			
5 5 5 5 5 5 5 5	5 5 5 5 5 5 5 5	5 5 5 5 5 5 5 5	5 5	5 5 5 5 5 5	5 5 5 5 5 5	5 5 5 5 5 5	5 5			
6 6 6 6 6 6 6 6	6 6 6 6 6 6 6 6	6 6 6 6 6 6 6 6	6 6	6 6 6 6 6 6	6 6 6 6 6 6	6 6 6 6 6 6	6 6			
7 7 7 7 7 7 7 7	7 7 7 7 7 7 7 7	7 7 7 7 7 7 7 7	7 7	7 7 7 7 7 7	7 7 7 7 7 7	7 7 7 7 7 7	7 7			
8 8 8 8 8 8 8 8	8 8 8 8 8 8 8 8	8 8 8 8 8 8 8 8	8 8	8 8 8 8 8 8	8 8 8 8 8 8	8 8 8 8 8 8	8 8			
9 9 9 9 9 9 9 9	9 9 9 9 9 9 9 9	9 9 9 9 9 9 9 9	9 9	9 9 9 9 9 9	9 9 9 9 9 9	9 9 9 9 9 9	9 9			

Right
Rules 1 and 2

DIV.	STA.	CITY	WHERE EMP.		DATE EMP.	
			MO.	YR.	MO.	YR.
0 0	0 0	0 0 0 0	0 0	0 0	0 0	0 0
1 1	1 1	1 1 1 1	1 1	1 1	1 1	1 1
2 2	2 2	2 2 2 2	2 2	2 2	2 2	2 2
3 3	3 3	3 3 3 3	3 3	3 3	3 3	3 3
4 4	4 4	4 4 4 4	4 4	4 4	4 4	4 4
5 5	5 5	5 5 5 5	5 5	5 5	5 5	5 5
6 6	6 6	6 6 6 6	6 6	6 6	6 6	6 6
7 7	7 7	7 7 7 7	7 7	7 7	7 7	7 7
8 8	8 8	8 8 8 8	8 8	8 8	8 8	8 8
9 9	9 9	9 9 9 9	9 9	9 9	9 9	9 9

Right

DISTRIBUTION											
CLASSIFICATION			SALES BILLED				COST OF SALES				
TR	SALES										
0	0	0	0	0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9	9	9	9
26	27	28	29	30	31	32	33	34	35	36	37
38	39	40	41								

Rule 3

DEDUCTION COMPLEMENT		DEDUCTION		CODE	
0	0	0	0	0	0
1	1	1	1	1	1
2	2	2	2	2	2
3	3	3	3	3	3
4	4	4	4	4	4
5	5	5	5	5	5
6	6	6	6	6	6
7	7	7	7	7	7
8	8	8	8	8	8
9	9	9	9	9	9
62	63	64	65	66	67
68	69	70	71	72	73
74	75				

ITEM NUMBER											
CLASS NO	ITEM NO	SUB-ITEM	ALPHA LETTER			QUANTITY					
0	0	0	0	0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9	9	9	9
6	7	8	9	10	11	12	13	14	15	16	17
18	19	20	21	22	23	24	25	26	27		

Rule 4

- the tabulating machine, the card columns reserved for use in recording fractions should contain only the digits corresponding to the denominator of the fraction less one. For example, if a fourths wheel is used, the column would contain only the numbers 1, 2, 3; if an eighths wheel is used the column would contain the numbers, 1, 2, 3, 4, 5, 6, 7.
- Perhaps the most important rule of transcript card design is the one governing the sequence of punched fields. It is absolutely essential to place punched fields in the same sequence as the data being transcribed from the original document. This facilitates key-punching and, consequently, speeds up the entire tabulating procedure.
 - Field headings should usually be placed along the top of the card, between the zeros and the edge.
 - Field headings should be as explicit as possible. Avoid the use of obscure abbreviations.
 - Every transcript card should carry a field for reference punching which will positively identify the punched card with the original document from which it was prepared. A sales card, for example, will usually have the invoice number punched on it; or invoice date and customer may sometimes be used when card capacity is limited; in other cases the date and the last two digits of invoice number may be sufficient.
 - Avoid unnecessary duplication of refer-

- ence data—such as the use of both order number and invoice number when one would provide adequate reference.
- Whenever alternative information is to be recorded, one field should be used instead of two. For example, sales reference punching would serve to identify either an invoice or a credit memorandum; therefore a single field heading "Invoice or Cr. Memo. No." would suffice. The use of two fields—one headed "Invoice No." and the other "Cr. Memo. No." would be a waste of valuable card capacity since only one reference number would ever be punched on any one card.
 - Since no written information appears on the card, any color or striping of cards may be used.
 - Purely reference information which is never to be printed by the tabulator may be placed in the 11th and 12th positions of a column, or in columns set aside for multiple-punching.
 - The corner-cut should be placed so that it will not interfere with the operation of alphabetic equipment. As a deep corner-cut corresponds to a "12" punching, the corner-cut which does not interfere with alphabetic recording should be selected.
 - Vertical lines used to separate fields should be drawn midway between the columns of numbers and should not reach beyond the line of column numbers at the bottom of the card.
 - Whenever five or more columns appear in

a single field, dotted lines should be drawn to mark off the position of the decimal point, where it is involved, and other periods of numbers in groups of three columns.

16. It is absolutely essential that punched classifying information which is to be used for purposes of automatic control on the accounting machines be placed in the same columns on all cards that are to be jointly tabulated.
17. Alignment of fields which contain data to be accumulated simplifies machine wiring for joint tabulations.
18. Fields for products of multiplications and summary-punched totals should be placed at the right-hand end of the card for maximum machine efficiency.
19. Whenever several different card forms are to be tabulated together, the card form with the greatest volume should be designed for maximum efficiency. The other cards may then be made to conform with the limitations of the card with the greatest volume.
20. Twenty columns for the alphabetic punching of names is sufficient for most work. This should be carefully checked, however, on each individual job.

A recent study of the columns required for recording names and addresses reveals that 95% of names of individuals can be recorded in 18 columns or less; that 95% of names of companies require 20 columns or less; that 90% of street addresses require 18 columns or less; and that 99% of cities and states (abbreviations) require 20 columns or less.

21. Be sure that the column capacity of each field is sufficient to take care of all recording except the very unusual items.
22. When designing tumble or sectional cards be sure that the two types of work have approximately the same card volume. For instance, it would be impractical to combine sales analysis and voucher distribution on a tumble card if there were 200,000 sales items and 30,000 voucher items each month. Under such conditions 170,000 cards a month would be unused on the tumbled section.
23. The nature of tumble and sectional cards ordinarily does not permit their use as dual or permanent record cards.
24. Every card form should carry the IBM in-

dustry classification code of the user. The code number is printed on the bottom center or along the end, depending upon the method of card printing.

Rules Governing Dual Card Design

Dual cards incorporate all of the principles involved in the design of transcript tabulating cards as well as some additional distinctive features to facilitate their use. The design of dual cards is especially important because of their use in departments other than that in which the tabulating machines are actually used. They may be found as requisitions, payroll tickets, and miscellaneous shop records throughout the plant and therefore simplicity of design becomes one of the most important factors.

Dual cards have attained a rather wide use not only because of the part they play in the actuation of the accounting machines to prepare final reports automatically but also because of the fact that original records may be automatically sorted in any desired sequence. In this manner the actual original document can be analyzed for any specific detail without the necessity of preparing a complete tabulated report. The dual tabulating card presents the only automatic means of sorting original documents.

A dual card, as an original record, must satisfy accounting requirements. To do this it must contain all the data relative to a given transaction so that pertinent facts may be reconstructed without the aid of memory. Because of the limitations of the size of the card, care must be exercised to provide ample room to meet this requirement and still not permit the possible obliteration of the data in subsequent punching operations.

One of the factors most frequently overlooked in the designing of dual cards is the incorporation of radical changes in what is to be the new original document. If the maximum efficiency of all clerical departments using the record is to be attained, the form of the tabulating card should resemble as closely as possible the original form which it is about to displace. Only in those instances where definite operating advantages are going to be obtained should the design be varied from the accustomed form.

1. Generally, the written information should be placed on the left end of the card to obtain visibility of recorded data while punching, except when alphabetic printing punches are used. This type of punch permits complete visibility of the top half of the card except the half-inch to the left and right of the column being punched.

PREM RATE		PREM. AMT		D.W. ERNGS.		DATE			
TOOL O.	ACCT. NO.	PART NO.	MACH. NO.	C.P.	HRS.	PREM. AMT	D.W. ERNGS.		
000000	000000	000000	000000	0000	0000	000000	000000		
TOOL ROOM JOB TAG									
DO NOT BEND OR FOLD THIS TAG									
								1111	1111
								2222	2222
								3333	3333
								4444	4444
								5555	5555
								6666	6666
								7777	7777
NAME OF EMPLOYEE								8888	8888
APPROVED BY FOREMAN								9999	9999
<small> 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 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 80 430-258 LICENSED FOR USE UNDER PATENT 1,772,482 </small>								9999	9999

Wrong

PAYROLL RECORDS SHOW FOLLOWING COMPANY PROPERTY LOANED TO YOU. IF STILL IN YOUR POSSESSION, SIGN BELOW AND RETURN TO HEAD CLERK OR DEPT. CHIEF. IF NOT, ENTER DISPOSITION BEFORE RETURNING.

DO NOT FOLD THIS CARD

OPER. CODE	DEPT.	CLOCK NO.	E NUMBER
11111111111111111111	1111	1111	111111
WHAT WAS DISPOSITION OF PROPERTY NOT NOW IN YOUR POSSESSION			
2222	2222	2222	222222
3333	3333	3333	333333
TO BE RETURNED			
4444	4444	4444	444444
TO PAYROLL			
5555	5555	5555	555555
ADJUSTMENT ORGN			
6666	6666	6666	666666
7777	7777	7777	777777
8888	8888	8888	888888
EMPLOYEES SIGNATURE			
8888	8888	8888	888888
PROPERTY LOANED			
9999	9999	9999	999999

Right

Rule 5

- Punched fields should be placed at least 8 columns (on a 45-column card) or 14 columns (on an 80-column card) to the right of the written data to be punched.
- Dual cards, generally, should not be designed as multiple-use cards.
- Written descriptive information should be placed in the portion of the card reserved for punched fields. This information may be readily reconstructed even though part of it may be obliterated by punching.
- Horizontal lines should be drawn through the mid-points of the regularly printed digits. This will cause the writing to be located in such a position that it will not be obliterated by punching.
- Do not punch purely reference information. As the dual card is the original record, no cross-reference is required.
- Retain as many as possible of the column digits which show the positions of punching. This facilitates the reading of the punched holes wherever it may be necessary.
- Filing information should be placed across the top or end of the card, depending upon the method of filing to be used.
- Field headings for dual cards may be placed at either top or bottom of card.
- Follow as closely as possible the appear-

SEWING PAYROLL

IMPERFECTIONS		IMPERFECTION CODE		BURLER:	
RATE	EXTENSION	1 HARD THR'DS		EXAMINER:	
1		2 3 PLY THR'DS			
		3 4 " "			
		4 COARSE "			
2		5 COARSE PKXS			
		6 MIS PKXS			
3		7 HARNESS SKIPS			
		8 FLOATS			
4		9 ENDS OUT			
		10 WRONG DRS			
5		11 DOUBLE ENDS			
		12 GEN. COURSE			
6		13 SHORT ENDS		APPROVED:	
		14 SLACK THR'DS		OVERSEER:	
B STYLE	DASH	PATT. COLOR	PIECE NO.	YDS.	IMPERFECTIONS
9999	9999	9999	9999	9999	9999
15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 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					

INDIVIDUAL JOB TICKET

		DATE		MAN OR ORDER		HRS.		PIECES		AMT.	
		MO.	DAY	NO.	ACC'T.	NO.	NO.	NO.	NO.	NO.	NO.
		00	00	00	00	00	00	00	00	00	00
OPER. NO.		1111	1111	1111	1111	1111	1111	1111	1111	1111	1111
		2222	2222	2222	2222	2222	2222	2222	2222	2222	2222
		3333	3333	3333	3333	3333	3333	3333	3333	3333	3333
STOP		4444	4444	4444	4444	4444	4444	4444	4444	4444	4444
START HOURS		5555	5555	5555	5555	5555	5555	5555	5555	5555	5555
		6666	6666	6666	6666	6666	6666	6666	6666	6666	6666
		7777	7777	7777	7777	7777	7777	7777	7777	7777	7777
AMOUNT		8888	8888	8888	8888	8888	8888	8888	8888	8888	8888
JS FOR		9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
		43	44	45	46	47	48	49	50	51	52

NATIONAL MFG. CO. IND. CODE NO. 150

Rule 9

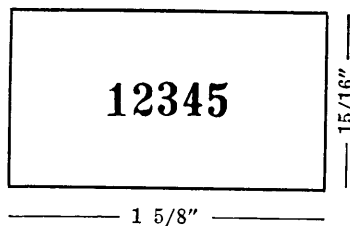
Influences of Printing and Manufacturing

Tabulating cards are printed from either cylinder or flat plates. Different printing limitations exist for each type, which are best illustrated in the accompanying diagrams.

Transcript cards are usually printed from the cylinder type, while cards that are to be serially numbered, prepunched, furnished with stubs, scored, made in connected strips, or collated are printed from flat plates.

The specific restrictions necessitated by the printing and manufacturing operations may be enumerated as follows:

1. If prenumbering of the cards is to be performed in one position on the card, no other printing should appear in the space required for the numbering head. This numbering should appear on either the upper left or the upper right corner. The dimensions of the numbering head are illustrated and tabulated below, but it is recommended that one full inch be allowed on the proposed card form in preference to the $15/16''$ inch minimum.



Digits	Numbering Space
5	$15/16'' \times 1-5/8''$
6	$15/16'' \times 1-11/16''$
7	$15/16'' \times 1-15/16''$
8	$15/16'' \times 1-15/16''$

2. When the space for the numbering head is not available, prenumbering may be accomplished in any one or two positions of the card at a slight additional cost without restriction concerning additional printing in the space ordinarily reserved for the numbering head.
3. Long cards are furnished with standard size stubs of $1/2''$ or $1-9/16''$. Short cards may be furnished with a standard stub of $1\ 3/4''$. This is really a long card which is scored so that when the stub is removed a standard short card remains. Practically any length stubs can be printed, but special prices not listed in the Manual of Business Instruction must be quoted by the Sales Department in New York City.

4. Prepunching of serial numbers is limited to nine consecutive columns.
5. Eyelets, when used, should always be placed on the stub. The space required is $3/16''$ in diameter.
6. Cards for padded forms may be bound together by providing a scored stub or a scored corner through which the binding staple can be placed.
7. Definite designation of corner-cut and stub locations must accompany the draft of the card form to enable the etching and printing departments to proceed without the necessity for additional correspondence.
8. Whenever special designs or trademarks are to be incorporated in the printed matter on the card, original drawings, photos, or negatives should be forwarded to the etching department.
9. No printing can appear within $1/8''$ of the top or bottom of a card which is to be printed from a flat plate.
10. When cylinder type is used for printing, the cards with upper left corner-cut can not have any printing within $3/16''$ of the left edge and $3/32''$ of the right edge. When the corner-cut is on the upper right, the sizes of the blank spaces are reversed.
11. The standard allowance for scored connector strips between continuous fanfold tabulating cards is $1/4''$.
12. Unless very definite advantages are to be gained by variations, printing should be black.
13. Any printing to be placed on covers of padded forms should be as carefully laid out as proposed tabulating card forms.

Rules to Facilitate Key-Punching

The key-punching operation is the only step in the tabulating machine method of accounting which is not fully automatic. It is, therefore, the only phase in which the rate of production is subject to variation. Anything which can be done to simplify the work of the operator will tend to increase the rate of punching and consequently reduce the time required for the preparation of management reports.

The value of early reports makes it necessary to take every precaution in the design of cards to avoid any factors which will retard punching speed. Careful consideration should be given to these rules:

1. Provide for the use of the duplicating

punch and master code cards, or other automatic punches, whenever possible.

2. Align fields to be skipped in such order as to accomplish the work with a minimum number of skip bars.
3. The sequence of punched fields should be the same as that of the data to be punched from the original document.
4. Eliminate the punching of unnecessary zeros by keeping the size of fields down to the number of columns that are absolutely essential for efficient handling of the majority of transactions.
5. Do not have less columns in the field than are required to handle most of the transactions.
6. Proper use of indicating cards and group-sorting cards will frequently eliminate the necessity for providing for some of the punched fields on detail cards.
7. Provide for most legible records, especially in the design of dual cards.
8. Give consideration to the use of prepunched cards.

Influences of Machine Construction Upon Card Designing

A few basic restrictions must be observed in designing cards if all the advantages of the tabulating machine method are to be obtained. Actually the rules are not limitations of the accounting routine, but they are standards that have been generally accepted so that uniform machines could be designed to perform the task of accounting more automatically.

The rules for the design of cards which are based upon machine specifications are grouped under the title of the machines to which they apply.

Key Punches

1. When less than the full number of columns of a card are to be punched on machines in which cards are manually-fed, the punched fields should be placed at the right-hand end of the card.
2. No columns are visible on the key punches equipped with automatic card feeding when the card is fully inserted, the alphabetic printing punches excepted. On these latter machines the top half of the card

CUSTOMER'S MASTER CODE CARD																				
LEDGER NUMBER	CUSTOMER'S NUMBER	CLASS OF TRADE	CITY	STATE	SALESMAN'S NUMBER	SUSP & SPL ARRANGEMENTS	LEDGER NUMBER	NAME AND ADDRESS:												
0	0000	00	00	00	00	00	03													
1	1111	11	11	11	11	11	1462													
2	2222	22	22	22	22	22														
3																				

SALES ANALYSIS CARD																													
LEDGER NUMBER	CUSTOMER'S NUMBER	CLASS OF TRADE	CITY	STATE	SALESMAN'S NUMBER	SUSP OR SPL ARRANGEMENTS	DATE	INVOICE NUMBER	SOURCE	ITEMS	KIND	GROUP	LINE OR ASSORTMENT	QUANTITY	SALES AMOUNT	COST AMOUNT	FRT & EXP												
0	0000	00	00	00	00	00	10	000000	00	00	00	00	00	0000	0000	0000	0000	00000000000000000000											
1	1111	11	11	11	11	11	11	111111	11	11	11	11	11	1111	1111	1111	1111	11111111111111111111											
CODED AUTOMATICALLY BY																													
CUSTOMER'S MASTER CODE CARD																													
3	3333	33	33	33	33	33	33	333333	33	33	33	33	33	333333	333333	333333	333333	33333333333333333333											
4	4444	44	44	44	44	44	44	444444	44	44	44	44	44	444444	444444	444444	444444	44444444444444444444											
5	5555	55	55	55	55	55	55	555555	55	55	55	55	55	555555	555555	555555	555555	55555555555555555555											
6	6666	66	66	66	66	66	66	666666	66	66	66	66	66	666666	666666	666666	666666	66666666666666666666											
7	7777	77	77	77	77	77	77	777777	77	77	77	77	77	777777	777777	777777	777777	77777777777777777777											
8	8888	88	88	88	88	88	88	888888	88	88	88	88	88	888888	888888	888888	888888	88888888888888888888											
9	9999	99	99	99	99	99	99	999999	99	99	99	99	99	999999	999999	999999	999999	99999999999999999999											

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 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
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Rule 4 (Key Punches)

is visible except for the half-inch on both sides of the column being punched.

3. Fields to be duplicated should be grouped together and placed at the left end of the card.
4. Fields to be punched from master code cards to detail cards by means of the duplicating key punch (or automatic gang punch) must be aligned column for column.
5. When a dual card is to be punched completely, starting at column one, a portion of the card is visible on manually-fed punches. If the card is fully inserted, 19 columns are visible at the right on a 45-column mechanical punch and 8 columns on the electric punch. Approximately two-thirds more columns are visible on the corresponding 80-column equipment.
6. Manually-punched fields should not be interspersed among duplicated, gang-punched, reproduced, or summary - punched fields.
7. Fields that are always skipped, or X-skipped, should be as uniformly placed on various card forms as conditions will allow.
8. As a general rule the left side of a tumble card should be inverted when using manually-fed punches; the right side should be inverted when using automatically-fed punches.
9. On alphabetic printing punches, the printing appears at the top of each column and requires 3/16" from the top edge of the card.

Sorters

1. Master cards and detail cards for use on the card matching device should have opposite corners cut, unless the device is to be actuated by a punched hole in the 12th position of a column.
2. Careful consideration should be given to the selection of the corner-cut arrangement for cards to be group-sorted.
3. Whenever a card is to be used for statistical analysis, it is advisable to combine several classes of statistical data in a single column. This is especially true of alternative responses on questionnaires.
4. The eleventh and twelfth punching positions can be utilized for recording reference data to be sorted but never tabulated.
5. If the multiple column selection device is to be used to select simultaneously a group of cards from two or more small fields, they should be adjacent in order that they will appear under the six adjacent brushes.

Tabulators

1. Fields to be used for automatic control must be in corresponding columns of all cards to be tabulated jointly.
2. Adding fields should not contain more columns than the direct adding capacity of a counter (usually 8 columns).
3. Control fields must not be skipped. Zeros must be punched in columns if other digits do not appear.
4. When non-listing automatic control machines are used the cards must have the corner-cut on the side that has been specified for the machine.
5. Fields containing adding data which are to be simultaneously tabulated from two or more card forms should be aligned to simplify machine wiring.
6. The eleventh position (X) punching which governs class selection or subtraction should never be placed over fields used for automatic control or alphabetic printing.
7. Double-punched columns can not be used for automatic controlling on numerical tabulators.
8. Tab index cards can not be fed into a tabulator satisfactorily unless tab index card clips have been placed on the stacker drum.
9. Information appearing in a single field of a card may be introduced into any counter or group of counters, or eliminated entirely, by means of the class selection de-

TICKET										
PIECES	AMT.		NATIONAL MFG. CO. IND. CO. STR. NO. 199							
0	0	0	0	0	0	0	0	0	0	INDIRECT
1	1	1	1	1	1	1	1	1	1	DIRECT
2	2	2	2	2	2	2	2	2	2	DAY WORK
3	3	3	3	3	3	3	3	3	3	PIECE WORK
4	4	4	4	4	4	4	4	4	4	STRAIGHT TIME
5	5	5	5	5	5	5	5	5	5	OVERTIME
6	6	6	6	6	6	6	6	6	6	
7	7	7	7	7	7	7	7	7	7	
8	8	8	8	8	8	8	8	8	8	
9	9	9	9	9	9	9	9	9	9	
72173	74	75	76	77	78	79	80			

Rule 3 (Sorters)

- (a) Above the 12 position, as on the standard interpreter
 - (b) Between the 12 and 11 positions
 - (c) Between the 11 and 0 positions
 - (d) Between the 0 and 1 positions
 - (e) Between the 1 and 2 positions
6. Check amounts are ordinarily interpreted on the lowest line of printing as shown above. The center of the type is on a line $1\frac{1}{8}$ " from the top edge of the card.
 7. In those positions in which special width pin-point type bars are used for interpreting money amounts, $10/32$ " must be allowed for the width of each type character. One special pin-point character requires the same space as two ordinary interpreted characters.

Auxiliary Machines—Multiplier

1. Fields for the products of multiplications or nets of cross-footing operations should be placed as near to the right-hand end of the card as possible.
2. Fixed multipliers may be taken from any

field on the detail cards except the field containing the multiplicand.

3. The factors to be multiplied may appear in any columns of the card.
4. Fields to be multiplied can not exceed 8 digits each.
5. Fields to be subtracted in cross-footing operations can not exceed 8 digits. Fields to be added can not exceed 12 digits.

Auxiliary Machines—Summary Punch

1. Fields to be duplicated, pre-indicated, or manually punched in cards that are being summary punched should appear to the left of the columns reserved for counter totals.
2. Fields to be punched from tabulator counter totals should be as near the right-hand end of the card as possible.
3. "X" punching of selected balances must appear in a column punched with a digit from 0 to 9.

Special Expedients

In those cases where the preliminary draft of column requirements shows a need for a few more columns than the capacity of a card, some of the following expedients may be used to bring the requirements within the range of the card capacity without dropping any fields.

1. Reducing the size of reference or controlling fields by having these fields serve as sub-classifications of other fields. Thus, invoices instead of being numbered separately, may start with "1" each month; or a separate series of salesmen's numbers may be used for each branch, instead of one series for all branches.
2. Reducing the size of reference or controlling fields by recoding so as to eliminate one or more digits.
3. Reducing the size of reference or controlling fields by ignoring one or more digits which may not be essential. Thus, it may be possible to punch only four digits of a six-digit invoice number and preserve positive identification.
4. Reducing the size of adding fields where amounts seldom exceed the capacity of the reduced field.
5. Recording in the 11th and 12th positions information which is never used for tabulating. This can best be used where the information to be punched is the same for large groups of cards.
6. Using the class selection device to eliminate one or more adding fields where both fields are not required on the same card.
7. Using multiple-punching in certain columns to reduce the number of columns required. This practice should be avoided where fields are to be tabulated but may be very desirable in fields which are to be sorted only.
8. Using the class selector to distribute a carry-over amount which has been punched on a second card. Thus, a card punched 7,265.80 and one punched 6 can be selected to produce 67,265.80 as the desired result, saving one column in the amount field.
9. The group sorting device may be used to eliminate common information from detail cards.

Of no little importance in card drafting are the clearness and workmanship of the final design to be submitted to the customer and the card factory. Many delays and misunderstandings may be caused by incomplete and poorly drawn card forms.

