USE OF INTERNATIONAL BUSINESS MACHINE TECHNIQUE IN TABULATING DRILLING DATA[1]

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The International Business Machines are primarily electrically operated accounting machines, designed to reduce error and time in handling large and complicated financial records.

The system is based on punching the data into cards which form a permanent record and which may be used to compile data in a variety of ways.

There are three principal machines: (1) a punch machine, on which the cards are prepared; (2) a sorter, which mechanically arranges the cards in any desired order; and (3) a tabulating machine, which mechanically prints the data from the punched cards.

The sorter handles 440 cards per minute, and the tabulator prints the data from the cards at the rate of 80 cards a minute.

All cards used in the International Business Machines are of the same size and kind of paper. There are 80 vertical columns across the card, allowing one number or letter to be punched in each. Within a column there is space for twelve accurately located holes to be punched. The position of the hole or holes in any one column determines the number or the letter punched.

When the punched cards are fed into any other machine, these holes permit electric contacts to be made which mechanically sort the cards, list the data, or reproduce the punched holes.

The Coal Division of the Illinois State Geological Survey has adapted the use of these machines to facilitate the handling of tabulated geological data that accompany structural contour maps. Thus it is possible to assemble the necessary data for each datum point for use both in the preparation of the map and for publication.

The information for use with structure contour maps is first written on the lower portion of the "log record" card. Along the upper part of the card are the column headings for the information that is to be punched on the card.

The card is then placed in an Alphabetic Punch machine, which has a keyboard similar to that of a standard typewriter, and the data are punched into the card. Simultaneously with the punching operation, the characters are printed along the upper edge of the card. The card shown in figure 1 has been punched from the information written on it.

As the amount of information which can be punched on any one card is limited (by the number of columns in the card) to 80 characters, it is frequently desirable to use more than one card for any one well record. In such a case, the first card shows the full location of the well by township, range, section, and fraction of section, the ground elevation above sea-level, the year drilled, type of hole, total depth, county map number, company name and number, and the depth, altitude, and thickness of two coal beds. The second card repeats the location and county number but also gives the farm name and number and data regarding two other formations. Additional cards that may be needed repeat only the location and county

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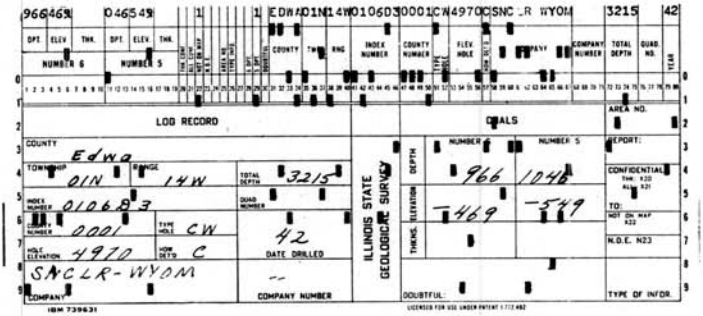

FIG. 1.—Well log record card punched from handwritten data on IBM card.

number (for identification), and give data on any additional two formations. Although the location and county numbers are punched on all the cards for each datum point, these items are printed only once when the data are listed.

The cards are mechanically arranged in the desired order by the sorting machine. This machine will sort according to one column at a time, arranging the cards by the positions of the holes in that column. Thus the cards when removed from the pockets of the machine will be in numerical order 0-9. Each letter is represented by two holes, so that the cards must be sorted twice on a column in order to be arranged alphabetically.

Suppose we wish to tabulate data on 350 wells with two cards for each well, or a total of 700 cards. It takes about 25 minutes to sort all the cards by county number and by location in township, range, section and fraction of section. It takes another 15 minutes to print the list. Each line of printing represents one card.

The printing is done on the Alphabetic Accounting machine or tabulator. The cards are placed in the upper hopper and pass one at a time between two sets of brushes and rollers which make the electric contacts, and then the cards emerge in the lower hopper. The electric contacts send impulses through the machine to a plugboard where they are connected by wires to the type bars.

Figure 2 shows a list of tabulated data arranged by county number. Figure 3 shows a list from the same cards arranged by location.

The data need not be printed in the same order in which it appears on the card or in these lists. This permits considerable flexibility in the use made of the cards.

If the cards have been checked and are known to be correct, there is no further need to proofread these lists.

These lists may be photographed, reduced, and planographed for publication.

In addition to straight listing of data, this machine will add or subtract and print totals. It will omit certain punched data, enabling the same cards to be used for Survey lists and also for publication where confidential information is to be withheld.

By using a reproducing punch machine, it is possible to take the correctly punched cards and mechanically punch all or part of the information into a new set of cards. This is much faster than manual punching.

For instance, we compile mechanically the data for use in preparing maps showing the interval between

LOCATION OF HOLE			COUNTY NUMBER	TYPE OF HOLE	OPERATOR	OP'R'S NUMBER	SURFACE ALTITUDE		TOTAL DEPTH	QUAD. NUMBER	YEAR DRILLED	COURTESY INFORMATION	COAL NO. 6				COAL NO. 5			
TOWNSHIP	RANGE	SECTION											DEPTH (FEET)	ALTITUDE (MSL)	THICKNESS FT.	THICKNESS IN.	DEPTH (FEET)	ALTITUDE (MSL)	THICKNESS FT.	THICKNESS IN.
					EDWARDS NOV 15 1945															
1N	14W	6 D3	1	CW	SNCLR WYOM BIERHAUS A	1	4970	C	3215		42		966 709	469* 212*			1046 912	549* 415*		
1S	10E	16 E7	2	CW	NELSON DEV REID A	1	4270	D	3388	239	43		940 666	513* 239*			1034 893	607* 466*		
1S	11E	7 G6	3	CW	MAGNOLIA GOULD E	1	5070	C	3350	239	42		926 698	419* 191*			1012 888	505* 381*		
2S	10E	8 E7	4	CW	NELSON DEV BUNTING C	1	4690	C	3447	239	43		975 709	506* 240*			919	450*		
2S	10E	19 A1	5	CW	SUN OC MCKIBBEN R	1	4370	D	3394	239	42		938 646	501* 209*			1015 862	578* 425*		
3S	10E	8 B2	6	CW	SNCLR WYOM PERKINS H	1	4140	C	3410	239	42		878 604	464* 190*			1019 837	605* 423*		
3S	14W	17 H1	7	CW	HALBERT R C PROCTOR	1	4060	D	3100	238	43		844 572	438* 166*			918 792	512* 386*		
2S	14W	20 A6	8	CW	KINGWOOD OC COWLING W	1	4670	D	3247	239	43		928 651	461* 184*			1023 879	556* 412*		
1N	10E	18 D2	9	CW	MIDSTATE OC MCKINLEY	1	3940	D	3350		43		946 686	552* 292*			1041 904	647* 510*		
3S	10E	13 H8	10	CW	MIDSTATE OC COAD M		4830	C	3240	239	43		964 711	481* 228*			1055 934	572* 451*		
1N	14W	10 F1	11	CW	MAGNOLIA MATTHES	1	4130	D	2918	234	43		790 548	377* 135*			905 738	492* 325*		
1N	10E	4 C5	12	TD	ILL PROD BARBER H C	1	4420	C	3301		43		955 710	513* 268*			1030 918	588* 476*		
1N	10E	9 A3	13	TD	RYAN FRTNR RALSTON	1	4450	C	3336		43		984 721	539* 276*			1063 943	618* 498*		

FIG. 2.—Wells listed by county number.

two formations, by using our standard "log record" cards. This is done by reproducing the location of the well and the elevations of all formations into a new set of cards containing one card for each well.

The cards are then run through the tabulating machine which me-

LOCATION OF HOLE			COUNTY NUMBER	TYPE OF HOLE	OPERATOR	OP.W.S. NUMBER	SURFACE ALTITUDE	TOTAL DEPTH	QUAD. NUMBER	YEAR DRILLED	COMMENTS	COAL NO. 6				COAL NO. 5			
TOWNSHIP	RANGE	SECTION										DEPTH (FEET)	ALTITUDE (FEET)	THICKNESS FT.	THICKNESS IN.	DEPTH (FEET)	ALTITUDE (FEET)	THICKNESS FT.	THICKNESS IN.
					EDWARDS NOV 15 1945														
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1N	10E	9 A3	13	TD	RYAN FRTNR RALSTON	1	4450 C	3336		43		984 721	539* 276*			1063 943	618* 498*		
1N	10E	9 C5	14	TD	BANDER OLDS IBBOTSON G	1	4550 D	3294		43		1003 737	548* 282*			1082 961	627* 506*		
1N	10E	13 A1	15	TD	WALSH DYE TULL W S	1	4830 C	3302		42		934	451*		*0	1013 895	530* 412*		
1N	10E	16 G3	16	TD	ARMOUR ETL RALSTON	2	4710 D	3319		43		1000 737	529* 266*			1076 957	605* 486*		
1N	10E	18 D2	9	CW	MIDSTATE OC MCKINLEY	1	3940 D	3350		43		946 686	552* 292*			1041 904	647* 510*		
1N	14W	6 D3	1	CW	SNCLR WYOM BIERHAUS A	1	4970 C	3215		42		966 709	469* 212*			1046 912	549* 415*		
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2S	14W	20 A6	8	CW	KINGWOOD OC COWLING W	1	4670 D	3247	239	43		928 651	461* 184*			1023 879	556* 412*		

FIG. 3.—Wells listed by location.

chanically subtracts one elevation from another and prints a list showing for each well, its location and the interval from the No. 6 coal to each of the other formations.

The machines can also be adapted to handling chemical analyses of coals or other types of data.