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SETAB: An Edit/Insert Program for Automatic Typesetting of Spectroscopic and Other Computerized Tables

U.S. DEPARTMENT OF COMMERCE
National Bureau of Standards

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Contents

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An Edit/Insert Program for Automatic Typesetting of Spectroscopic and other Computerized Tables

by

Robert C. Thompson and Joseph Hilsenrath

SETAB is a FORTRAN program which accepts a card deck or Fortran records on magnetic tape and inserts the appropriate flags and shift symbols required by many programs associated with phototypesetting devices. The program is specialized to the particular application, the phototypesetter and typography programs, and to the desired typefaces by means of parameter cards supplied at run time. Examples are shown of spectroscopic tables typeset on the Linofilm phototypesetter at the Government Printing Office using the Autoset Typography Program. The program has also been used for tables of other types of data. The program can handle any records which can be read by a FORTRAN "READ" statement under "A" format control. The original record can be divided into as many as 40 fields and these fields can be combined in any order with any of 26 strings in front of or between the pieces. The program will, on a signal, replace a field by another field or by a combination of fields and strings. The output lines are blocked and paged via the insertion of the required strings between blocks and pages.

Keywords: Automatic typesetting; computer-assisted typesetting; edit insertion program; FORTRAN program; phototypesetting of spectroscopic tables; typesetting of tables.

1. Introduction

For years spectroscopists have been sending handwritten manuscripts to the printer to have their spectroscopic tables typeset in graphic arts quality. This was quite natural as long as all data logging and data manipulation were performed manually. With the advent of automatic data logging and the use of the computer for data reduction, the spectroscopists began to keep their data on punched cards. The appearance of phototypesetters provided a mechanism for the typesetting of machine readable data without the necessity of rekeyboarding the data.

A technique for automatic typesetting of spectroscopic tables direct from magnetic tapes was developed by W. R. Bozman in 1962. [1]. Since that time several books of data have been produced by this method. The production of each of these books entailed the preparation of special programs by a programmer experienced in machine language programming and having detailed knowledge of the operation of the Linofilm phototypesetting machine.

The design of the SETAB program was motivated by the conviction that the economic viability of computer-assisted typesetting rested on the use of general-purpose rather than special-purpose programs. That this is indeed the case, has been born out by experience with a number of applications that are discussed in this paper.

In an earlier report, [2] McClenon and Hilsenrath have shown that the FORTRAN program REFORM can be used to insert the flags required by the typography programs. However, REFORM lacks a number of features desirable in a generalized edit/insertion program for phototypesetting of tables. Therefore, the program SETAB, described in this report, was written incorporating many of the features of REFORM and containing a number of additional features desired for an edit/insert program.

While the magnetic tapes produced by Bozman had the codes required to drive the photounit directly, SETAB produces tapes which need to be processed by a typography program before the material can be set. It is, however, a feature of SETAB that it can insert any required flags. It is therefore not restricted to a particular typography program or to a particular typesetting machine. The specific flags are supplied at run time.

Except for two READ statements (500,510), the program is written in a subset of ANSI FORTRAN. No logical statements are used, since the format of these deviates from the standard on some computers. Particular care was taken to make it machine independent with respect to internal bit configuration and as system independent as possible. The logical unit numbers designating the system card reader, printer, card punch and tape drives differ not only from machine to machine, but also from installation to installation. Therefore some changes will probably be necessary if this program is to be used at any other installation. In order to minimize the modifications required in implementation, the input and output devices are designated by variables which are defined at the beginning of the program.

2. Characteristics of SETAB

The program discussed here operates on a fixed field file consisting of cards, card images or Fortran records on a magnetic tape, and produces a magnetic tape suitable for input to typography programs such as those used by the Government Printing Office. The program, suitably instructed via parameter cards, divides the original record into as many as 40 fields and then combines these fields in the specified order with up to 26 strings. These strings can be typesetting flags such as locators to be put at the beginnings of lines or columns, or a grid change flag to set a particular column in boldface or italics.

Since a field can be defined as a single character, it is possible to make a character, a subscript or a superscript by bracketing it with the required typesetting flags. It is also possible to add information that is not in the input data stream if the information is to appear in the same place in every typeset line. Also, card decks often have blank cards between blocks of data, and computer listings often have blank lines between blocks. When that information is typeset the blank line between blocks is usually of a different spacing than the spaces between normal data lines. To accomodate this the program deletes all blank cards or lines and inserts specified typesetting flags after each block of a specified number of lines and after each page of a specified length. There are times when a character in the input is not the character that is desired in the typeset copy. To cope with this, the program can be instructed to replace one character by another in a specified portion of the record.

The over-all format of an output line is controlled by a parameter card that designates the order of the fields and the strings, if any, to be inserted. The latter control the typography and may even insert information which was not contained in the original record. However, there are times when the way the information in a given field is to be printed depends not only on its position but also on its content. An example of the need for handling information in a designated field differently depending on the content of a portion of that field is shown in figure 1. Here the information in the classification column is handled quite differently from line to line depending upon whether the character in position 44 is numeric or alphabetic.

TABLE 3. *Observed and classified lines of* W I

Wavelength Å	Intensity		Wavenumber (cm^{-1})		Classification
	Arc	Spark	Observed	o−c	
2746.734	40		36396.11	+0.02	15_3— 518°_4
2747.005	50	2	36392.52	+0.06	$^3P_1$— 496°_2
2747.155	15	3	36390.54		
2747.826	40	2	36381.65	−0.21	$^5D_4$— 426°_3
				+0.16	$^5D_2$— 397°_2
2748.312	20	15 *s*	36375.21	−0.04	$^3G_4$— 528°_3
2748.577	30	3	36371.71	+0.02	18_3— 553°_4
2748.767	5		36369.20	−0.10	20_2— 573°_3
2748.844	80	20	36368.17	+0.03	$^5D_3$— 411°_4
2748.997	25	2	36366.15	+0.15	19_2— 556°_2
2749.538	1	2	36359.01		
2749.641	10		36357.65		
2750.145	40	4	36350.98	−0.02	$^3G_3$— 496°_2
2750.325	10	20 *s*	36348.60	+0.01	19826_5— 561°_4
2750.444	10		36347.03	+0.08	19_3— 561°_4

2746.734	40		36396.11	+0.02	153 - 51840	$^3G_4$— 527°_5
2747.005	50	2	36392.52	+0.06	3P1 - 49620	19_4— 555°_4
2747.155	15	3	36390.54			19_6— 559°_5
2747.826	40	2	36381.65	-0.21	5D4 - 42630	18_1— 544°_1
				+0.16	5D2 - 39720	19535_5— 558°_4
2748.312	20	15S	36375.21	-0.04	3G4 - 52830	
2748.577	30	3	36371.71	+0.02	133 - 55340	
2748.767	5		36369.20	-0.10	202 - 57330	
2748.844	80	20	36368.17	+0.03	5D3 - 41140	
2748.997	25	2	36366.15	+0.15	192 - 55620	$^5D_2$— 396°_3
2749.538	1	2	36359.01			22852_4— 591°_4

Figure 1. A portion of a spectroscopic table phototypeset from information supplied on ordinary punched cards. Note how differently the lines containing pure numerics are treated from those that contain mixtures of letters and numbers.

3. Discussion of the Parameter Cards

A partial listing of the parameter cards for one run is shown in figure 2. A number of the cards were removed to permit one of each type of parameter card to be shown in a single figure. The first card contains the alphabet, beginning with A in column 1 and the digits starting with zero in column 27. Column 47 must be blank and column 80 contains the character used as a string delimiter.

The second card contains the following parameters in I3 format.

1. The number of fields in the input record
2. The length of the input record
3. The number of lines in an output block
4. The number of lines on an output page (This must be an integral number of blocks)
5. The input unit number
6. The output tape unit number
7. The output print switch; = 0 for a printer copy of the output, = 1 for only writing an output tape
8. The EOF switch;=0 for an end of file to be written at end of output file, =1 if no EOF is to be written
9. The input tape rewind switch; = 0 for tape to be rewound before reading, = 1 if input tape is not to be rewound
10. The output tape rewind switch. =0 for tape to be rewound before writing =1 if not

The last three fields are normally left blank or set equal to zero. These switches were provided to permit the processing of several input files into one output file.

The third parameter card contains the character stream required to achieve the spacing desired between blocks. The fourth card contains the character stream which is desired to be placed at the end of each page. The fifth card contains the line to be printed at the end of the table.

The sixth card, in 26I3 format, gives the beginnings and lengths of the input fields in pairs. Columns 1-3 contain the character or column number that begins the first field. Columns 4-6 contain the number of characters in the first field. Columns 7-9 contain the character or column number that begins the second field, and so forth. If more than 13 fields are desired, they are put on another card. A maximum of 40 fields can be specified. The input record cannot exceed 132 characters.

The seventh card, in 26 (I2,A1) format, specifies the makeup of the output. If the output is to begin with a string, columns 1 and 2 can be left blank or made zero. However, if any other pair of columns that would specify a field number is blank or if the field number is zero, this is taken as the end of the output record specification and no more fields or strings are put into the output record.

The eighth and succeeding cards contain the strings to be inserted between fields of the input. Each string is terminated by the character in column 80 of the first parameter card. The last card is to have the character in column 1. This terminates the reading of strings. Only 26 strings are permitted. The strings are automatically assigned names, which are the letters of the alphabet in order.

The next set of cards contains the fields and characters for the single character substitution. The cards are in 4I3 format. The first field (columns 1-3) contains the column number where the substitition is to start.

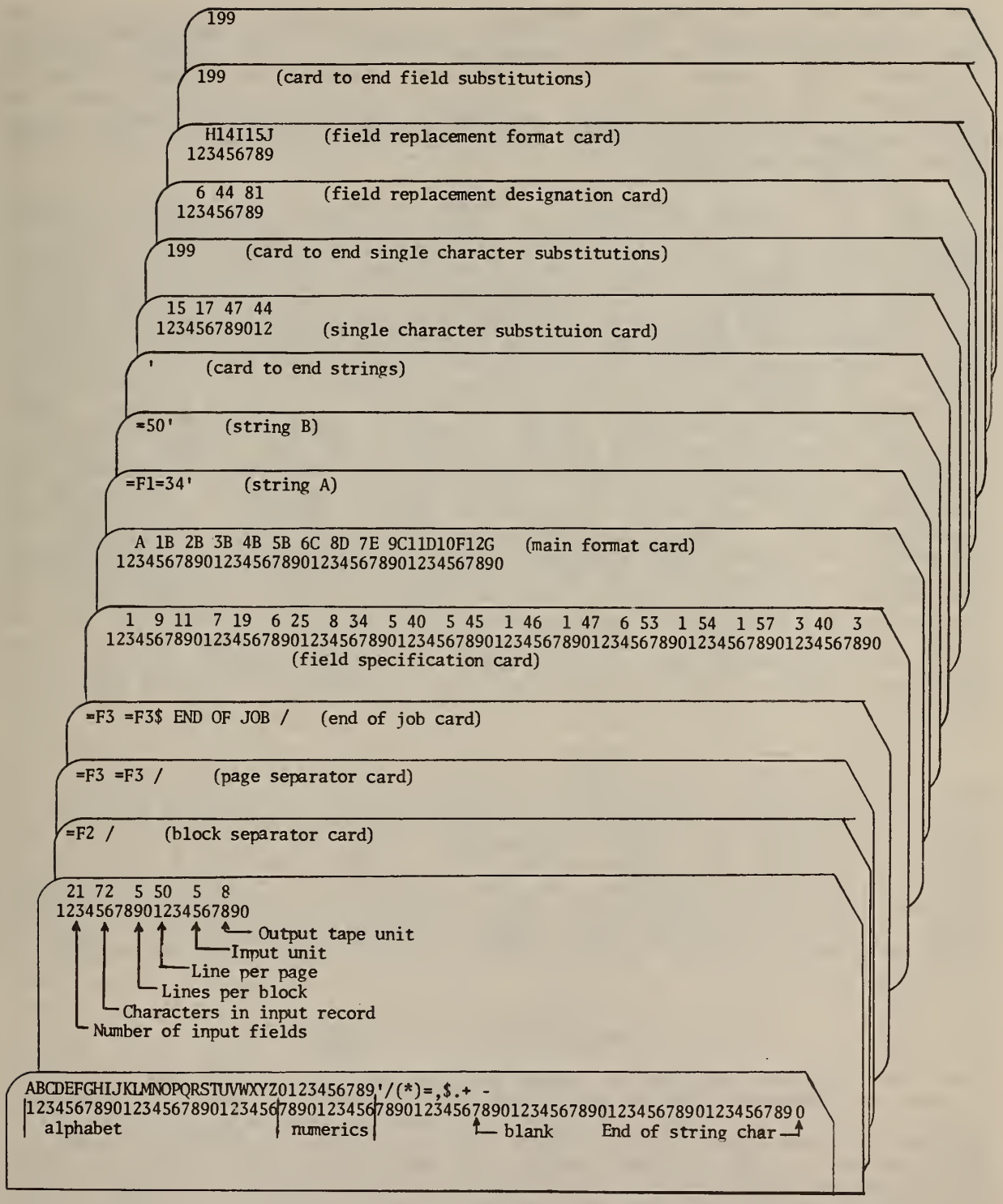

Figure 2. Sample Parameter Cards - A sampling of the parameter cards required for a run, showing at least one of each type used. The numbers on the second line of some of the cards are put there to show the position for fixed field input.

The second field (columns 4-6) contains the column number of the last column for this substitution. The third field (columns 7-9) is the character code (the card column from the first parameter card) of the character to be replaced. The fourth field is the character code of the character that is to replace the original character. The last card of the set must have the number 199 in the first field. This signals the end of this set of cards. Only 25 cards are allowed in this set unless the dimensions of IBST, IBEN, LCAR, and LREP are changed.

The next cards contain, in pairs of cards, the changes in output desired in up to 30 different fields. The first card of the pair, in 3I3 format, contains: in columns 1-3, the field to be replaced; in columns 4-6, the input card column in which the flag character is to be found; in columns 7-9, the column of the first parameter card that contains the character that is to act as a flag signaling the change in format. The second card of the pair contains the strings and fields to replace the given field. This card has the same format as the seventh parameter card which specified the normal output. A maximum of 30 fields may be substituted for. The last card of this set must have the number 199 in columns 1-3. If the column number given for the flag character is 80 or less, it designates the character in that card column of the first parameter card. If the number is 81 it designates that the flag character is one of the characters in columns 1-26 of the first parameter card, i.e., any alphabetic character. The number 82 designates that the flag character is numeric (column 27-36 of the first parameter card). 83 designates any graphic character (not a character in columns 1-36 of the first parameter card). 84 designates any nonalphabetic character (not in columns 1-26 of first parameter card). 85 designates any non-numeric character (not in columns 27-36 of first parameter card). 86 designates any non-graphic character (any character in columns 1-36 of the first parameter card). The same character on input can be used to signal changes in output for more than one field. The last card of this set shall have the number 199 in the first field signaling the end of the set of cards.

The last card, in 4I3 format, specifies the condition that signals when the counter containing the number of lines processed is to be reset. When the card contains the number 199 in columns one to three, the program will insert the characters required to start a new page on the basis of the line count in accord with the instructions given on card two. When it is desirable to start a new page on the basis of the content of a line, it is done by matching characters in the input to one of the ad hoc strings. Columns 1-3 specify the beginning character number, columns 4-6 specify the final character to be matched, columns 7-9 specify the number of the string to be matched, and columns 10-12 contain the number to which the counter is to be reset.

4. Description of the Program

The program consists of a main program with no subroutines. There are a number of comment cards at the beginning that explain how the parameter cards are to be prepared. In order to minimize changes when adapting this program to other installations, the input and output instructions reference the variables: ITAPE, IOTAPE, IRTAPE, and IPTAPE. The latter two are defined via parameter cards input at the beginning of the program. In the listing of the program accompanying this report, ITAPE is equated to logical unit 5 which is the card reader, IOTAPE is equated to 6 which is the printer, IRTAPE may have a default value of 5, and IPTAPE may have a default value of 3 specifying the card punch. The last two are normally specified on the second parameter card, and only if the units specified are obviously incorrect are the default values used. In installations where these peripherals have different numbers, the nine statements (cards 790-870)

which check whether they have been correctly specified would have to be changed. The first executable statements define ITAPE as the card reader and IOTAPE as the printer.

A block diagram of the program is shown in figure 3. The first parameter card serves to define the punch configuration for the characters on the data and parameter cards. The presence of the characters on the first card obviates the need to define them explicitly in the program. This simple device makes the program independent of a variety of incompatabilities which are often such a source of trouble in adapting programs to different computers. The program logic uses the disposition of the characters on the first parameter card in such a way as to avoid entirely the need to know how a particular machine recognizes a character on a card, what the internal bit representation of that character is, and where that character is placed in a machine word. In this way the program is independent of whether the particular machine stores away 3 characters per machine word, or 6 or even 7. Nor is it dependent on whether a single character is stored left-adjusted, right-adjusted or in any other way. The second card specifies the input and output parameters. The program checks the values supplied for the input and output units to see if they are reasonable and, if not, assigns default values. The strings to be inserted between blocks and pages and at the end of the file are read into buffers. The beginning and length of the fragments on the input record are defined. Then the normal output format card is read, and the fields are checked to see that they were specified. The strings are then read into a buffer, and the lengths of the strings are determined and stored. After reading the cards specifying the single character substitutions, the field replacements and the new page signal, the program is ready to process the input.

First a record is read into buffer IB in 132A1 format. If the record is a blank line a new record is read in. The record is checked to see if it has a flag signaling a change in paging. If the flag is found the line counter is reset to the value specified. The single character substitution is performed next.

The program is now ready to start building a new record in buffer IBUFR, from pieces of the input record and the strings. The first number on the output format card is checked, and the specified piece of the input buffer IB is moved into IBUFR. If the first number is zero the program skips down to the next step. Then the program checks the alphabetic character to determine which string is to be transferred, and the specified string is moved to IBUFR. If the alphabetic character is a blank no string is moved. The program then checks to see if the next field number is zero or blank, if it is, this signals that the record is complete. If the next field number is one that is sometimes replaced by a different field or combination of fields and strings, the program checks the flag character. If the field is to be replaced, the program moves the appropriate fields and strings into IBUFR, otherwise it moves the specified field in. Then the program places the next string into IBUFR and checks to see if the next field number is zero or blank signaling that the record is complete.

If the record is complete, it is written out on tape, and if the print switch (ITEST) is nonzero the record is also written on the printer. The line counter is advanced by one. The counter is then checked to see if the record was the last of a block. If it was, the counter is checked to see if the line was the last line on the page. If the line was the end of a page or a block the appropriate string is written on the output tape. Then the program reads in a new record.

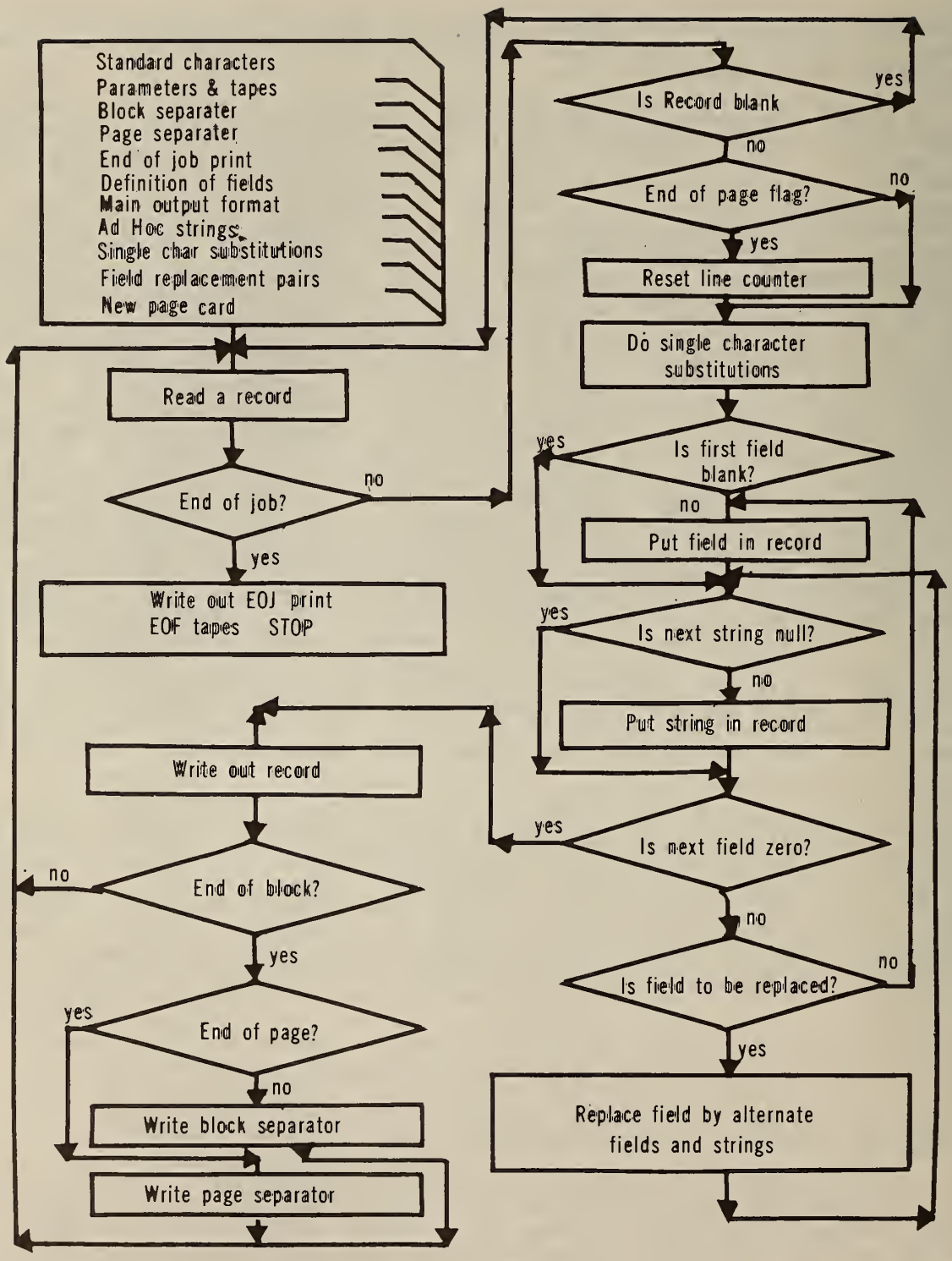

Figure 3. Block diagram of SETAB.

5. Applications of SETAB

An example of a simple table in a NSRDS publication [3] typeset by using this program is shown in figure 4. The parameter cards and the data cards for this portion of the table are shown in figure 5. The output of the program is shown in figure 6. The program, following the instructions on the format card, has put =F1 at the beginning of each line of data. This was used as the format flag for the Autoset Typography Program at the Government Printing Office. It serves to select the desired typeface, point size and leading (space between lines). The =40 causes 40 units of space to be set between columns. The slash at the end of each line is the end of record character. Between each block of five lines the character string =F2=P1./ is defined to put the desired quad line between blocks. There is nothing in the output to instruct the phototypesetting machine how to set the column headings. This program does not have provision for table headings, column headings, or rules. We prefer to have these set only one time and then put on the table as an overlay.

TABLE 2. *Thermodynamic Functions for Copper*

Gram atomic wt.=63.5400, T °K=273.15+t °C, 1 cal=4.1840J

T	C_P°	$H_T^\circ - H_0^\circ$	$(H_T^\circ - H_0^\circ)/T$	S_T°	$-(G_T^\circ - H_0^\circ)$	$-(G_T^\circ - H_0^\circ)/T$
°K	J/deg-mol	J/mol	J/deg-mol	J/deg-mol	J/mol	J/deg-mol
1.00	0.000743	0.000359	0.000359	0.000711	0.000351	0.000351
2.00	0.00177	0.00158	0.000790	0.00152	0.00145	0.000727
3.00	0.00337	0.00409	0.00136	0.00251	0.00345	0.00115
4.00	0.00582	0.00860	0.00215	0.00379	0.00657	0.00164
5.00	0.00943	0.0161	0.00322	0.00546	0.0112	0.00223
6.00	0.0145	0.0279	0.00466	0.00760	0.0176	0.00294
7.00	0.0213	0.0456	0.00652	0.0103	0.0265	0.00379
8.00	0.0301	0.0712	0.00889	0.0137	0.0385	0.00481
9.00	0.0414	0.107	0.0119	0.0179	0.0542	0.00602
10.00	0.0555	0.155	0.0155	0.0229	0.0746	0.00746
11.00	0.0727	0.219	0.0199	0.0290	0.100	0.00913
12.00	0.0936	0.302	0.0251	0.0362	0.133	0.0111
13.00	0.119	0.407	0.0313	0.0447	0.173	0.0133
14.00	0.149	0.541	0.0386	0.0545	0.223	0.0159
15.00	0.184	0.706	0.0471	0.0660	0.283	0.0189
16.00	0.225	0.910	0.0569	0.0791	0.355	0.0222
17.00	0.273	1.158	0.0681	0.0941	0.442	0.0260
18.00	0.328	1.458	0.0810	0.111	0.544	0.0302
19.00	0.390	1.816	0.0956	0.131	0.665	0.0350
20.00	0.462	2.242	0.112	0.152	0.806	0.0403
25.00	0.963	5.703	0.228	0.305	1.917	0.0767
30.00	1.693	12.25	0.408	0.541	3.995	0.133
35.00	2.638	22.99	0.657	0.871	7.487	0.214
40.00	3.740	38.89	0.972	1.294	12.86	0.322
45.00	4.928	60.54	1.345	1.802	20.57	0.457
50.00	6.154	88.23	1.765	2.385	31.01	0.620
55.00	7.385	122.1	2.220	3.029	44.52	0.809
60.00	8.595	162.0	2.701	3.724	61.38	1.023
65.00	9.759	208.0	3.199	4.458	81.82	1.259
70.00	10.86	259.5	3.708	5.222	106.0	1.514

Figure 4. A portion of Table 2 of NSRDS-NBS-18 which was set on the Linofilm phototypesetter from punched cards using SETAB to insert the flags required by the Autoset Typography Program at the Government Printing Office. The rules and headings were supplied with overlays.

```
ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789'(*)/=,$.+                          $
  7 72  5 50  5  7  0  1
=F2 =P /
=F3 =P /
=F4 =P /
  2  6  9  9 20 11 32  9 42  9 52 11 64  9
  A 1B 2B 3B 4B 5B 6B 7C
=F1$
=40$
 /$
$
199
199
199

   1.00  0.000743    0.000359  0.000359  0.000711    0.000351  0.000351CU JOULE
   2.00  0.00177     0.00158   0.000790  0.00152     0.00145   0.000727CU JOULE
   3.00  0.00337     0.00409   0.00136   0.00251     0.00345   0.00115 CU JOULE
   4.00  0.00582     0.00860   0.00215   0.00379     0.00657   0.00164 CU JOULE
   5.00  0.00943     0.0161    0.00322   0.00546     0.0112    0.00223 CU JOULE
   6.00  0.0145      0.0279    0.00466   0.00760     0.0176    0.00294 CU JOULE
   7.00  0.0213      0.0456    0.00652   0.0103      0.0265    0.00379 CU JOULE
   8.00  0.0301      0.0712    0.00889   0.0137      0.0385    0.00481 CU JOULE
   9.00  0.0414      0.107     0.0119    0.0179      0.0542    0.00602 CU JOULE
  10.00  0.0555      0.155     0.0155    0.0229      0.0746    0.00746 CU JOULE
  11.00  0.0727      0.219     0.0199    0.0290      0.100     0.00913 CU JOULE
  12.00  0.0936      0.302     0.0251    0.0362      0.133     0.0111  CU JOULE
```

Figure 5. The parameter cards and a portion of the data cards input to SETAB to produce the table shown in Figure 4. Note that the text in columns 73-80 of the original file is ignored by defining the input record to extend only to 72 characters. Had these comments appeared between the desired data, they could have been ignored in the same manner that the blanks are ignored in the field definition card.

```
=F1  1.00=40 0.000743=40   0.000359=40 0.000359=40 0.000711=40   0.000351=40 0.000351 /
=F1  2.00=40 0.00177 =40   0.00158 =40 0.000790=40 0.00152 =40   0.00145 =40 0.000727 /
=F1  3.00=40 0.00337 =40   0.00409 =40 0.00136 =40 0.00251 =40   0.00345 =40 0.00115  /
=F1  4.00=40 0.00582 =40   0.00860 =40 0.00215 =40 0.00379 =40   0.00657 =40 0.00164  /
=F1  5.00=40 0.00943 =40   0.0161  =40 0.00322 =40 0.00546 =40   0.0112  =40 0.00223  /
=F2 =P /
=F1  6.00=40 0.0145  =40   0.0279  =40 0.00466 =40 0.00760 =40   0.0176  =40 0.00294  /
=F1  7.00=40 0.0213  =40   0.0456  =40 0.00652 =40 0.0103  =40   0.0265  =40 0.00379  /
=F1  8.00=40 0.0301  =40   0.0712  =40 0.00889 =40 0.0137  =40   0.0385  =40 0.00481  /
=F1  9.00=40 0.0414  =40   0.107   =40 0.0119  =40 0.0179  =40   0.0542  =40 0.00602  /
=F1 10.00=40 0.0555  =40   0.155   =40 0.0155  =40 0.0229  =40   0.0746  =40 0.00746  /
=F2 =P /
=F1 11.00=40 0.0727  =40   0.219   =40 0.0199  =40 0.0290  =40   0.100   =40 0.00913  /
=F1 12.00=40 0.0936  =40   0.302   =40 0.0251  =40 0.0362  =40   0.133   =40 0.0111   /
=F1 13.00=40 0.0119  =40   0.407   =40 0.0313  =40 0.0447  =40   0.173   =40 0.0133   /
=F1 14.00=40 0.0149  =40   0.541   =40 0.0386  =40 0.0545  =40   0.223   =40 0.0159   /
=F1 15.00=40 0.0184  =40   0.706   =40 0.0471  =40 0.0660  =40   0.283   =40 0.0189   /
=F2 =P /
```

Figure 6. The output of SETAB resulting from the input shown in Figure 5. This was processed by the Autoset Typography Program at the Government Printing Office and run on the Linofilm Phototypesetter to produce the results shown in Figure 4. The character inserted by SETAB serve the following functions =F1 is a format flag which serves to select the type face, the point size and loading the sequence =F2 =P / provides for an appropriate space between the data blocks. =40 introduces 40 units of space between the columns. The slash acts as an end of record symbol.

A more interesting example of the use of SETAB for spectroscopic tables is shown in figure 1 taken from a paper by Corliss [5]. A portion of the original card deck used to produce the results shown in that figure are reproduced in figure 7. Figure 8 shows the character strings inserted in the original records by SETAB from the instructions shown in figure 9 to achieve the results shown in figure 1. The requirement that a digit in a particular position be typeset as a superscript character when it was part of a term designation and as a normal character when part of a number was met by using the field replacement capability. Field 6 begins at position 40 and contains five characters. The normal format assumed the field contained all digits or blanks and digits. The bracketed pair of field replacement cards in figure 8 changes the format for term designations. The first card of the pair can be read as: Replace Field 6 if the character in position 44 is an alphabetic character (designated by 81), by the strings and fields specified on the next card. The second card of the pair says the replacement format is string P (!25!G2), field 14 (position 43), string L (!G1() , field 15 (position 44), string M ()). String P (!25!G2) puts in 25 units of space so columns line up and pulls in the superscript grid. Field 14 is the character to be set as a superscript. String L brings back the normal grid and shifts to upper case. Field 15 is the alphabetic character and String M shifts to lower case. The next pair of cards accomplishes the same effect for the second level.

```
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
1111111111111111111111111111111111111111111111111111111111111111111111111111111
 2746.734    40              36396.11 +0.02     153 -  51840
 2747.005    50       2      36392.52 +0.06     3P1 -  49620
 2747.155    15       3      36390.54
 2747.826    40       2      36381.65 -0.21     5D4 -  42630
                                      +0.16     5D2 -  39720
 2748.312    20      15S     36375.21 -0.04     3G4 -  52830
 2748.577    30       3      36371.71 +0.02     183 -  55340
 2748.767     5              36369.20 -0.10     202 -  57330
 2748.844    80      20      36368.17 +0.03     5D3 -  41140
```

Figure 7. A part of the original card deck used to produce the table shown in figure 1.

```
!F1 2746.734!51  40$$$!45   $$$!5236396.11!58+0.02!56   15!G2$!G33!G1-  518!G2O!G34!60!G4   /
!F1 2747.005!51  50$$$!45  2$$$!5236392.52!58+0.06!56!25!G23!G1(P)!G2$!G31!G1-  496!G2O!G32!60!G4   /
!F1 2747.155!51  15$$$!45  3$$$!5236390.54!!58# /  !56     !C2$!G3$!G1      !G2$!G3$!60!G4   /
!F1 2747.826!51  40$$$!45  2$$$!5236381.65!58-0.21!56!25!G25!G1(D)!G2$!G34!G1-  426!G2O!G33!60!G4   /
!F1!78!51!72!45!63!52!69!58+0.16!56!25!G25!G1(D)!G2$!G32!G1-  397!G2O!G32!60!G4   /
!F2 !P /
!F1 2748.312!51  20$$$!45 15S$$!5236375.21!58-0.04!56!25!G23!G1(G)!G2$!G34!G1-  528!G2O!G33!60!G4   /
!F1 2748.577!51  30$$$!45  3$$$!523637].71!58+0.02!56   18!G2$!G33!G1-  553!G2O!G34!60!G4   /
!F1 2748.767!51   5$$$!45   $$$!5236369.20!58-0.10!56   20!G2$!G32!G1-  573!G2O!G33!60!G4   /
!F1 2748.844!51  80$$$!45 20$$$!5236368.17!58+0.03!56!25!G25!G1(D)!G2$!G33!G1-  411!G2O!G34!60!G4   /
!F1 2748.997!51  25$$$!45  2$$$!5236366.15!58+0.15!56   19!G2$!G32!G1-  556!G2O!G32!60!G4   /
!F2 !P /
```

Figure 8. The records from figure 7 showing the character strings inserted by SETAB via the instructions shown in figure 9.

```
ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789'/(*)=,$.+ - S          #
 22 72  5 50  5  8
!F2 !P /                  BLOCK SEPARATOR
!F3 !F3 !F3 !P /          PAGE SEPARATOR
!F3 !P /                  END OF TABLE
  1  9  11  7 19  6 25  8 34  5 40  5 45  1 46  1 47  6 53  1 54  1 57  3 40  3
 43  1 44  1 47  1 51  1 52  1 57  1 50  1 59  1 58  1
  A 1B 2C 3D 4E 5F 6G 8H 7I 9G11H10J12K
!F1'              STRING A      LOCATOR TO BEGIN LINE
!51'              STRING B      SPACE BETWEEN COLS  1 AND 2
!45'              STRING C      SPACE BETWEEN COLS  2 AND 3
!52'              STRING D      SPACE BETWEEN COLS  3 AND 4
!58'              STRING E      SPACE BETWEEN COLS  5 AND 6
!56'              STRING F      SPACE BETWEEN COLS  7 AND 8
!G2'              STRING G    SUPERSCRIPT GRID FLAG
!G3'              STRING H      SUBSCRIPT GRID FLAG
!G1'              STRING I      NORMAL GRID FLAG
!60!G4            STRING J
 /'               STRING K     END OF STRING SYMBOL
!G1'              STRING L
(                 STRING M      LOWER CASE SHIFT SYMBOL
)                 STRING N      UPPER CASE SHIFT SYMBOL
!25!G2'           STRING O
!25!G2'           STRING P
!16'              STRING Q
!78'              STRING R      WIDTH OF COLUMN 1
!72'              STRING S      WIDTH OF COLUMN 2
!63'              STRING T      WIDTH OF COLUMN 3
!69'              STRING U      WIDTH OF COLUMN 4
'                 END OF STRINGS
 15 17 47 50    IN COLS 15 THRU 18 REPLACE A BLANK (47) BY A $ (50)
 22 24 47 50
 36 36 47 50    IN COL 36 REPLACE A BLANK (47) BY A / (38)
 45 46 47 50
 53 54 47 50
 34 34 47 60
199             END OF CHARACTER REPLACEMENT CARDS
  1  6 47       REPLACE FIELD 1 IF COL 6 IS BLANK
  R                                          BY STRING R
  2  6 47       REPLACE FIELD 2 IF COL 6 IS BLANK
  S                                        BY STRING S
  3  6 47       REPLACE FIELD 3             IF COL 6 IS BLANK
  T                      BY STRING T
  4  6 47
  U
*[6 44 81       REPLACE FIELD 6 BY THE FOLLOWING IF COL 44 IS ALPHABETIC
*[P14L15M
  9 52 81       REPLACE FIELD 9 BY THE FOLLOWING IF COL 52 IS ALPHABETIC
16Q20G17L18M
 12 57 18
  N19M22
199
199
```

Figure 9. The parameter cards used with SETAB to produce the output shown in figure 8. The bracketed pair of field replacement cards are the ones that permit the typographic variation between lines in the classification column in figure 1. The grey area contains comments which the program ignores.

An example of a different spectroscopic table from a paper by Sugar [6] is shown in figure 10. The parameter cards input to SETAB are shown in figure 11. Note that J values in the classification column are given as integers in columns 33 and 42 with an added 1/2 being implied. It was possible to change the integers to fractions by making use of the field replacement feature of the program. The J value is defined as a separate field. The string !G3 inserted before the J value calls up the subscript grid. Then pairs of field replacement cards are used to replace the integers by the required fractions. Field 7 is a single character in position 33. The bracketed pair of field replacement cards replace a 2 by 5/2. The first card of the pair can be read as: Replace Field 7, if the character in position 33 is a 2 (designated as character 29), by the strings and fields specified on the next card. The second card of the pair specifies the replacement format as string M, which is 5/2. Ten sets of cards are required to handle the ten possible digits which define the J values in one field. Since this is done for two fields, a total of forty cards are required for this purpose.

λ_{air} Å	Intensity	σ (cm^{-1})	Classification
3011.282	20 * *v*	33198.77	$50227\ _{5/2} - 83426^{\circ}{}_{5/2}$
3006.469	60 * *r*	33251.92	$38726\ _{7/2} - 71978^{\circ}{}_{7/2}$
3004.002	10 * *r*	33279.22	$52026\ _{3/2} - 85306^{\circ}{}_{5/2}$
3002.106	2	33300.24	$38694\ _{5/2} - 71994^{\circ}{}_{5/2}$
2982.236	9 * *r*	33522.11	$45844\ _{3/2} - 79366^{\circ}{}_{5/2}$
2980.583	5 * *r*	33540.70	$50869\ _{1/2} - 84409^{\circ}{}_{3/2}$
2978.907	9 * *v*	33559.57	$45807\ _{5/2} - 79366^{\circ}{}_{5/2}$
2976.347	40 * *v*	33588.43	$45807\ _{5/2} - 79395^{\circ}{}_{7/2}$
2963.032	2	33739.36	$36642\ _{13/2} - 70381^{\circ}{}_{13/2}$

```
3011.282   20*V   33198.7750227 2- 8342602
3006.469   60*R   33251.9238726 3- 7197803
3004.002   10*R   33279.2252026 1- 8530602
3002.106    2     33300.2438694 2- 7199402
2982.236    9*R   33522.1145844 1- 7936602
2980.607    5C    33540.4250869 0- 8440901
2980.583    5*R   33540.7050869 0- 8440901
2978.907    9*V   33559.5745807 2- 7936602
2976.347   40*V   33588.4345807 2- 7939503
2963.032    2     33739.3636642 6- 7038106
2940.896    7*V   33993.3051312 2- 8530602
2933.827    1     34075.2137919 3- 7199402
2930.192   50*V   34117.4835291 4- 6940805
2924.661    2*V   34181.9950227 1- 8440901
2910.612   70*V   34346.9828885 4- 6323203
```

Figure 10. A portion of a table phototypeset using SETAB as the Edit/Insertion program to transform the records shown as an insert. Note that the character before the dash is an integer. Each of the integers in this position is replaced by a fraction as follows: 2 becomes 5/2, 3 becomes 7/2 etc. This table was set in 8 point type in galley form and pasted up into 2 columns. The rules and column headings were stripped in manually.

```
ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789'/(*)=,$.+ - $          #     %
 11 72  5 55  7  8
!F1 !P %                              BLOCK SEPARATOR
!F1 !F1 !F1 !F1 !P %                  PAGE SEPARATOR
!F1 !F1 !F1 !F1>E<ND OF JOB %         END OF TABLE
  2  8 11  4 15  2 18  9 27  5 32  1 33  1 34  7 41  1 42  1 16  1
  A 1B 2  3C 4V 5D 6E 7F 8D 9E10G
!F1'              STRING A   LOCATOR TO BEGIN LINE
!45'              STRING B   SPACE BETWEEN COLS. 1 AND 2
!45'              STRING C   SPACE BETWEEN COLS.2 AND 3
!G2>'             STRING D   SUPERSCRIPT GRID FLAG
!G3<'             STRING E   SUBSCRIPT GRID FLAG
!G1<'             STRING F   NORMAL GRID FLAG
 % '              STRING G   END OF LINE SYMBOL
!68'              STRING H   WIDTH OF COLUMN 1
!36'              STRING I   WIDTH OF COLUMN 2
!77'              STRING J   WIDTH OF COLUMN 3
1>/<2$'           STRING K   REPLACES 0
3>/<2$'           STRING L   REPLACES 1
5>/<2$'           STRING M   REPLACES 2
7>/<2$'           STRING N   REPLACES 3
9>/<2$'           STRING O   REPLACES 4
11>/<2'           STRING P   REPLACES 5
13>/<2'           STRING Q   REPLACES 6
15>/<2'           STRING R   REPLACES 7
17>/<2'           STRING S   REPLACES 8
19>/<2'           STRING T   REPLACES 9
!G4>-<!G1'        STRING U
!54'              STRING V
'                 END OF STRINGS
 15 16 47 50      IN COLS 15-16 REPLACE A BLANK(47) BY A $(50)
 31 31 47 65      IN COL 31 REPLACE A BLANK(47) BY A #(65)
 32 32 15 43      IN COL 32 REPLACE A 0(15) BY A ,(43)
 32 32 27 43      IN COL 32 REPLACE A 0(27) BY A ,(43)
 32 32 47 50
 41 41 15 43
 41 41 27 43
 41 41 47 50
199               END OF CHARACTER REPLACEMENT CARDS
  1  1 40         REPLACE FIELD 1 IF COL 1 IS A *(40)
  H                        BY STRING H (WIDTH OF COL 1)
  2  1 40
  I
  3 15 40         REPLACE FIELD 3 IF COL 15 IS A *(40)
  U11                   BY STRING U, FIELD 11
  4  1 40
  J
  7 33 27         REPLACE FIELD 7 IF COL 33 IS A 0(27)
  K               BY STRING K(1/2)
  7 33 28
  L
  7 33 29         REPLACE FIELD 7 IF COL 33 IS A 2(29)
  M               BY STRING M(5/2)
                        ETC.
199               END OF FIELD REPLACEMENT CARDS
199               LAST PARAMETER CARD
```

Figure 11. The parameter cards used with SETAB to produce the output shown in figure 10. The bracketed pair of field replacement cards are the ones that permit phototypeseting a 5/2 for the 2 before the dash on the first line.

6. Summary and Conclusions

SETAB is a general-purpose program written in ANSI FORTRAN that inserts into a character stream, symbol sequences required by typography programs at the U.S. Government Printing Office. This program permits any computer user to prepare a magnetic tape for phototypesetting of spectroscopic and other tables from fixed field records. The generality of the program arises from the fact that all of the typographic instructions are supplied in the form of parameter cards which are external to the program. The use of this program makes it economical to produce tables with complex spectroscopic notation for tables as short as 10 pages or less. The program is listed in Appendix I. The examples used in this report are from jobs run through an old 1401 Autoset program. Since then the G. P. O. has changed the computer as well as the typesetting programs, and the typesetting flags they recognize. In spite of these substantive changes in the typesetting programs, the SETAB program described here did not need to be rewritten, because the typographic instructions are carried on the control cards. For example, the present method uses the string !I01 instead of !F1. Similarly the string !P is no longer used at the end of the strings used to denote block separaters, page separators, etc.

The program listed in Appendix I produces an output tape containing a separate record for each line to be printed. Now that the Typography programs at the Government Printing Office have large input buffers they request blocked records. The modification used at NBS is listed in Appendix II. It was not written in ANSI FORTRAN because the NBS computer can not write FORTRAN records longer than 132 characters.

References

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[3] George T. Furukawa, William Saba, and Martin L. Reilly, "Critical Analysis of Heat-Capacity Data of the Literature and Evaluation of Termodynamic Properties of Copper, Silver and Gold from 0 to 300°K", Nat. Stand. Ref. Data Ser. Nat. Bur. Stand. (U.S.), 18 (Apr. 1968). Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402

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[5] Jack Sugar, "The Third Spectrum of Praseodymium (Pr III) in the Vacuum Ultraviolet", J. Res. Nat. Bur. Stand. (U.S.), 73A (Phys. and Chem.) No. 3 (May - June 1969)

APPENDIX I

The program as listed here was written to permit easy implementation on various computers and compilers of different vintage. If it is desired to block the output, modifications must be made. The markings to the right of the listings indicate which lines of the program were replaced by correspondingly marked lines in APPENDIX II to provide blocked output from the NBS computer. The < means insert and the dot and brace denote lines to be replaced by corresponding sections in APPENDIX II.

```
C                                    SETAB                                  STB  10
C                                                                           STB  20
C     THIS PROGRAM WAS WRITTEN BY R.C.THOMPSON NBS NSRDS IN AUGUST 1968.    STB  30
C   IT IS A EXPANSION OF CTGPO WRITTEN BY R.C.THOMPSON IN DECEMBER OF 67    STB  40
C   IT CAN BE USED TO REFORMAT TABLES IN GALLY FORMAT INTO GPO FORMAT.       STB  50
C   THE PROGRAM DIVIDES THE CARD OR LINE INTO A MAXIMUM OF 40 FIELDS. THESTB  60
C   NEW LINE IS COMPOSED OF THESE FIELDS REARRAINGED IN ANY ORDER WITH     STB  70
C   AD HOC STRINGS ADDED BETWEEN THE FIELDS. SINGLE CHARACTER SUBSTITUTIOSTB  80
C   MAY BE PERFORMED ON ANY RUN OF COLUMNS. USING A COL AS A FLAG A FIELDSTB  90
C   MAY BE REPLACED BY A LIST OF STRINGS AND FIELDS.                        STB 100
C     THE FIRST CONTROL CARD CONTAINS THE LIST OF CHARACTERS WITH THE       STB 110
C   LETTER A IN COL 1, B IN COL 2, ET SEQ. THE NUMBERS FOLLOW WITH ZERO     STB 120
C   IN COL 27 ET SEQ. COL 47 IS BLANK AND COL 80 HAS THE CHARACTER USED     STB 130
C   TO END THE STRINGS.                                                     STB 140 • A
C     THE SECOND CARD IS IN 26I3 FORMAT, ALL NUMBERS TO BE RIGHT ADJUSTEDSTB 150
C   COLS 1-3 IS THE NUMBER OF FIELDS TO DIVIDE THE INPUT RECORD INTO,      STB 160
C   4-6 LENGTH OF INPUT RECORD, 7-9 IS NUMBER OF LINES IN A BLOCK, 13-12 STB 170
C   IS THE NUMBER OF LINES ON A PAGE, 13-15 IS THE INPUT TAPE  UNIT, IF   STB 180
C   THIS FIELD IS 0 OR BLANK A DEFAULT NUMBER OF 5 DESIGNATING THE CARD   STB 190
C   READER IS USED. 16-18 IS THE OUTPUT TAPE NUMBER, A DEFAULT NUMBER OF STB 200
C   3 DESIGNATES THE CARD PUNCH. 19-21 IS 1 IF  A COPY OF THE OUTPUT ON   STB 210
C   THE PRINTER IS NOT DESIRED. 22-24 IS 1 IF A END OF FILE IS NOT DESIRESTB 220
C   ON THE OUTPUT TAPE. 25-27 IS 1 IF THE INPUT TAPE IS NOT TO BE REWOUNDSTB 230
C   28-30 IS 1 IF THE OUTPUT TAPE IS NOT TO BE REWOUND.                     STB 240
C     THE THIRD CARD CONTAINS THE LINE TO BE PRINTED BETWEEN BLOCKS.        STB 250
C   THE FOURTH CARD CONTAINS THE LINE TO BE PUT AT THE END OF A PAGE.       STB 260
C   THE FIFTH CARD CONTAINS THE LINE TO BE PUT AT THE END OF THE TABLE     STB 270
C   THE SIXTH CARD IN 26I3 FORMAT GIVES THE START AND WIDTHS OF THE INPUTSTB 280
C   FIELDS, IF MORE THAN 13 FIELDS ARE REQUIRED  THEY ARE PUT ON ANOTHER STB 290
C   CARD.  THE NEXT CARD IN 26(I2,A1) FORMAT SPECIFIES THE MAKEUP OF THE STB 300
C   OUTPUT CARD OR LINE. THE INPUT AND OUTPUT CAN NOT EXCEED 132 CHARS.   STB 310
C     THE FOLLOWING SET OF CARDS CONTAIN THE STRINGS TO BE INSERTED. EACHSTB 320
C   STRING MUST BE TERMINATED BY THE CHARACTER IN COL 80 OF THE FIRST     STB 330
C   CONTROL CARD. A CARD WITH THAT CHAR IN COL 1 TERMINATES THE READING   STB 340
C   OF STRINGS.  ONLY 26 STRINGS ARE PERMITTED.                           STB 350
C     THE NEXT SET OF CARDS CONTAINS THE FIELDS AND CHARACTERS FOR THE    STB 360
C   SINGLE CHAR SUBSTITUTION. IN 4I3 FORMAT.  THE FIRST FIELD CONTAINS    STB 370
C   THE COL WHERE SUBS STARTS, THE SECOND FIELD WHERE SUBS ENDS ,THE THI STB 380
C   RD FIELD IS THE CARD COL OF THE FIRST CONTROL CARD OF THE CHAR TO BE STB 390
C   REPLACED, THE FOURTH FIELD IS CARD COL OF CHAR TO BE INSERTED IN PLACSTB 400
C   OF THE ORIGINAL CHAR. THE LAST CARD OF THIS SET IS TO HAVE 999 IN THESTB 410
C   FIRST FIELD, THIS TERMINATES THE READING OF THIS SET. ONLY 25 CARDS   STB 420
C   ARE ALLOWED IN THIS SET.                                              STB 430
C     THE NEXT CARDS CONTAIN IN SETS OF TWO CARDS THE CHANGES IN OUTPUT   STB 440
C   REQUIRED IN UP TO 30 DIFFERENT FIELDS. THE FIRST CARD IN 3I3 FORMAT   STB 450
C   CONTAINS 1 THE FIELD TO BE REPLACED, 2 THE COL THE FLAG IS TO BE IN. STB 460
C   3 THE CHAR THAT IS TO ACT AS A FLAG SIGNALING REPLACEMENT. THE        STB 470
C   SECOND CARD CONTAINS THE STRINGS AND FIELDS TO BE INSERTED IN TH SAMESTB 480
C   FORMAT AS IN THE CARD SPECIFYING THE OUTPUT.  IF THE NUMBER OF FIELD STB 490
C   2 IS 80 OR LESS IT DESIGNATES THE CHARACTER IN THAT CARD COL OF THE  STB 500
C   FIRST CONTROL CARD. IF IT IS 81 IT DESIGNATES ANY ALPHABETIC CHARACTRSTB 510
C   82 IS ANY NUMERIC CHAR, 83 IS ANY GRAPHIC CHAR, 84 IS ANY NONALPHABETSTB 520
C   CHAR, 85 IS ANY  NONNUMERIC CHAR, 86 IS ANY NONGRAPHIC CHARACTER.     STB 530
C     THE LAST CARD IN 4I3 FORMAT SPECIFIES THE CONDITION THAT IS TO      STB 540
C   START A NEW PAGE. COL 1-3 CONTAINS THE STARTING COL.  4-6 CONTAINS    STB 550
C   THE LAST COL. 7-9 CONTAINS THE NUMBER OF THE STRING TO BE MATCHED.    STB 560
C   10-12 CONTAINS THE NEW NUMBER THE LINE COUNTER IS TO BE SET TO.       STB 570
C   TO START A NEW PAGE WITH THE LINE MATCHED, THE NUMBER OF LINES PER    STB 580
C   PAGE IS PUT IN COL 10-12.                                             STB 590
C     IF THE NUMBER INPUT AS THE STARTING COL. IS GREATER THAN 150 THE    STB 600
C   PROGRAM SKIPS THE CHECK FOR A NEW PAGE.                               STB 610
C                                                                         STB 620
      DIMENSION ISTRT(40), IWIDTH(40), IA(100), ISTRNG(26,80), IB(132)    STB 630
      DIMENSION IBUFR(135), IBTX(100), IPTX(100), IETX(100), IFNBR(30)    STB 640
      DIMENSION ISNBR(30), LNGTH(29), IBST(25), IBEN(25), LCAR(25), LREPSTB 650
     1(25)                                                                STB 660
      DIMENSION JFNBR(30), JCAR(30), JCOL(30), KFNBR(30,30), KSNBR(30,30STB 670
     1)                                                                   STB 680 < B
C     THE NEXT TWO CARDS ARE INSTALLATION DEPENDENT.                      STB 690
      ITAPE=5                                                             STB 700
      IOTAPE=6                                                            STB 710
C     INPUT PARAMETER CARDS.                                              STB 720
      READ (ITAPE,1140) (IA(J),J=1,80)                                    STB 730 • C
      WRITE (IOTAPE,1150) (IA(J),J=1,80)                                  STB 740
      READ (ITAPE,1160) NFLDS,IRLNG,IBLK,IPAG,IRTAPE,IPTAPE,ITEST,IEND,ISTB 750
     1RCK,IPCK                                                            STB 760
```

```
C     THE NEXT TEN CARDS CHECK I/O TAPES AND ARE INSTALLATION DEPENDENT STR 770
      IF (IRTAPE-5) 10,50,20                                            STR 780
10    IRTAPE=5                                                          STR 790
      GO TO 50                                                          STR 800
20    IF (IRTAPE-6) 10,10,30                                            STR 810
30    IF (IRCK) 50,40,50                                                STR 820
40    REWIND IRTAPE                                                     STR 830
50    IF (IPTAPE-6) 60,90,70                                            STR 840
60    IPTAPE=3                                                          STR 850
      GO TO 90                                                          STR 860
70    IF (IPCK) 90,80,90                                                STR 870
80    REWIND IPTAPE                                                     STR 880
90    WRITE (IOTAPE,1170) NFLDS,IRLNG,IBLK,IPAG,IRTAPE,IPTAPE,ITEST,IENDSTR 890
     1,IRCK,IPCK                                                        STR 900
C     INPUT BLOCK AND PAGE SEPARATOR AND END OF JOB CARDS.              STR 910
      READ (ITAPE,1140) (IBTX(J),J=1,80)                                STR 920
      WRITE (IOTAPE,1150) (IBTX(J),J=1,80)                              STR 930
      READ (ITAPE,1140) (IPTX(J),J=1,80)                                STR 940
      WRITE (IOTAPE,1150) (IPTX(J),J=1,80)                              STR 950
      READ (ITAPE,1140) (IETX(J),J=1,80)                                STR 960
      WRITE (IOTAPE,1150) (IETX(J),J=1,80)                              STR 970 < D
C     INPUT FIELD SPECIFICATION CARDS, 40 FIELDS MAXIMUM.               STR 980
      READ (ITAPE,1160) ((ISTRT(J),IWIDTH(J)),J=1,NFLDS)                STR 990
      DO 110 J=1,NFLDS                                                  STR1000
      K=J                                                               STR1010
      KLS=J                                                             STR1020
      IF (ISTRT(J)) 100,120,100                                         STR1030
100   IF (IWIDTH(J)) 110,120,110                                        STR1040
110   CONTINUE                                                          STR1050
      GO TO 130                                                         STR1060
120   WRITE (IOTAPE,1200) NFLDS,K                                       STR1070
130   WRITE (IOTAPE,1170) ((ISTRT(J),IWIDTH(J)),J=1,NFLDS)             STR1080
C     INPUT THE OUTPUT FORMAT CARD, CHECK IF FIELD IS DEFINED.          STR1090
      READ (ITAPE,1180) ((IFNBR(J),ISNBR(J)),J=1,26)                    STR1100
      WRITE (IOTAPE,1190) ((IFNBR(J),ISNBR(J)),J=1,26)                  STR1110
      DO 140 J=1,26                                                     STR1120
      KK=IFNBR(J)                                                       STR1130
      IF (KK-K) 140,140,150                                             STR1140
140   CONTINUE                                                          STR1150
      GO TO 160                                                         STR1160
150   WRITE (IOTAPE,1210) KK,K                                          STR1170
      STOP                                                              STR1180
160   WRITE (IOTAPE,1220)                                               STR1190
      JJ=1                                                              STR1200
C     INPUT AD HOC STRINGS.                                             STR1210
170   READ (ITAPE,1140) (ISTRNG(JJ,J),J=1,80)                           STR1220
      IF (ISTRNG(JJ,1)-IA(80)) 180,280,180                              STR1230
180   K=1                                                               STR1240
190   K=K+1                                                             STR1250
      IF (ISTRNG(JJ,K)-IA(80)) 200,270,200                              STR1260
200   IF (K-80) 190,210,210                                             STR1270
210   DO 220 L=1,80                                                     STR1280
      LE=81-L                                                           STR1290
      IF (ISTRNG(JJ,LE)-IA(47)) 230,220,230                             STR1300
220   CONTINUE                                                          STR1310
230   LNGTH(JJ)=LE                                                      STR1320
      K=LE+1                                                            STR1330
      IF (ISTRNG(JJ,LE)-IA(47)) 270,240,270                             STR1340
240   WRITE (IOTAPE,1230) JJ                                            STR1350
      JJ=JJ+1                                                           STR1360
250   IF (JJ-27) 170,170,260                                            STR1370
260   WRITE (IOTAPE,1240) IA(80)                                        STR1380
      STOP                                                              STR1390
270   LNGTH(JJ)=K-1                                                     STR1400
      M=K-1                                                             STR1410
      WRITE (IOTAPE,1150) (ISTRNG(JJ,J),J=1,80)                         STR1420
      JJ=JJ+1                                                           STR1430
      GO TO 250                                                         STR1440
280   NSTRNG=JJ-1                                                       STR1450
      WRITE (IOTAPE,1250) NSTRNG                                        STR1460
      K=1                                                               STR1470
      KNTR=0                                                            STR1480
      LINES=0                                                           STR1490
      WRITE (IOTAPE,1260) IRLNG                                         STR1500
      IF (IRLNG) 300,300,290                                            STR1510
290   IF (IRLNG-132) 310,310,300                                        STR1520
300   WRITE (IOTAPE,1270)                                               STR1530
```

```
      STOP                                                          STR1540
310   J=1                                                           STR1550
      WRITE (IOTAPE,1280)                                           STR1560
      IREP=0                                                        STR1570
C     INPUT SINGLE CHARACTER SUBSTITUTION CARDS.                    STR1580
320   READ (ITAPE,1160) IBST(J),IBEN(J),LCAR(J),LREP(J)             STR1590
      IF (IBST(J)-199) 330,340,340                                  STR1600
330   IREP=J                                                        STR1610
      WRITE (IOTAPE,1170) IBST(J),IBEN(J),LCAR(J),LREP(J)           STR1620
      J=J+1                                                         STR1630
      GO TO 320                                                     STR1640
340   J=J-1                                                         STR1650
      WRITE (IOTAPE,1290) J                                         STR1660
      L=1                                                           STR1670
      K=KLS                                                         STR1680
C     INPUT FIELD REPLACEMENT SPECIFICATION CARDS.                  STR1690
350   READ (ITAPE,1160) JFNBR(L),JCOL(L),JCAR(L)                    STR1700
      WRITE (IOTAPE,1170) JFNBR(L),JCOL(L),JCAR(L)                  STR1710
      IF (JFNBR(L)-40) 360,360,390                                  STR1720
360   READ (ITAPE,1180) ((KFNBR(L,K),KSNBR(L,K)),K=1,26)            STR1730
      WRITE (IOTAPE,1190) ((KFNBR(L,K),KSNBR(L,K)),K=1,26)          STR1740
      DO 370 J=1,26                                                 STR1750
      KK=KFNBR(L,K)                                                 STR1760
      IF (KK-K) 370,370,150                                         STR1770
370   CONTINUE                                                      STR1780
      L=L+1                                                         STR1790
      IF (L-30) 350,350,380                                         STR1800
380   WRITE (IOTAPE,1130)                                           STR1810
C     INPUT NEW PAGE SPECIFICATION CARD.                            STR1820
C     *  NEXT STATEMENT NOT ASA FORTRAN  *****                      STR1830
390   READ (ITAPE,1160,END=395) MCST,MCEN,MSTRNG,MLINE              STR1840
      GO TO 400                                                     STR1854
395   MCST = 199                                                    STR1858
      WRITE (IOTAPE,1170) MCST,MCEN,MSTRNG,MLINE                    STR1850
C     START PROCESSING RECORDS.                                     STR1860
C     INPUT A RECORD.                                               STR1870
C     *  NEXT STATEMENT NOT ASA FORTRAN  *****                      ***** STR1880
400   READ (IRTAPE,1140,END=1070) (IB(J),J=1,IRLNG)                 STR1890
      L=1                                                           STR1900
C     CHECK FOR END BY PARAMETER CARD                               STR1910
      DO 410 J=1,26                                                 STR1920
      IF (IB(J)-IA(J)) 420,410,420                                  STR1930
410   CONTINUE                                                      STR1940
      GO TO 1070                                                    STR1950
420   I=1                                                           STR1960
      IF (IBLK) 450,450,430                                         STR1970
C     CHECK FOR BLANK LINE, IF BLANK READ NEW LINE                  STR1980
430   DO 440 J=1,IRLNG                                              STR1990
      IF (IB(J)-IA(47)) 450,440,450                                 STR2000
440   CONTINUE                                                      STR2010
      GO TO 400                                                     STR2020
450   IF (MCST-150) 460,480,480                                     STR2030
460   K=0                                                           STR2040
      DO 470 J=MCST,MCEN                                            STR2050
      K=K+1                                                         STR2060
      IF (IB(J)-ISTRNG(MSTRNG,K)) 480,470,480                       STR2070
470   CONTINUE                                                      STR2080
      LINES=MLINE                                                   STR2090
480   IF (IREP) 520,520,490                                         STR2100
C     START CHARACTER SUBSTITUTION BY FIELDS                        STR2110
490   DO 510 J=1,IREP                                               STR2120
      LC=LCAR(J)                                                    STR2130
      LR=LREP(J)                                                    STR2140
      LS=IBST(J)                                                    STR2150
      LE=IBEN(J)                                                    STR2160
      DO 510 K=LS,LE                                                STR2170
      IF (IA(LC)-IB(K)) 510,500,510                                 STR2180
500   IB(K)=IA(LR)                                                  STR2190
510   CONTINUE                                                      STR2200
C     BUILD A NEW RECORD FROM OLD RECORD AND AD HOC STRINGS.        STR2210
520   N=IFNBR(I)                                                    STR2220
      IF (N) 530,550,530                                            STR2230
530   NN=ISTRT(N)                                                   STR2240
      DO 540 J=NN,NX                                                STR2260
      KNTR=KNTR+1                                                   STR2270
      IF (KNTR-132) 540,540,1120                                    STR2280 • E
540   IBUFR(KNTR)=IB(J)                                             STR2290
```

```
550   IF (ISNBR(I)-IA(47)) 560,610,560                                  STB2300
560   N=ISNBR(I)                                                        STB2310
      DO 580 J=1,26                                                     STB2320
      IF (N-IA(J)) 580,570,580                                          STB2330
570   M=J                                                               STB2340
      GO TO 590                                                         STB2350
580   CONTINUE                                                          STB2360
      GO TO 610                                                         STB2370
590   N=LNGTH(M)                                                        STB2380
      DO 600 J=1,N                                                      STB2390
      KNTR=KNTR+1                                                       STB2400
      IF (KNTR-132) 600,600,1120                                        STB2410 • F
600   IBUFR(KNTR)=ISTRNG(M,J)                                           STB2420
610   I=I+1                                                             STB2430
      IF (IFNBR(I)) 620,940,620                                         STB2440
620   IF (IFNBR(I)-JFNBR(L)) 520,640,630                                STB2450
630   IF (L-30) 930,520,520                                             STB2460
C     CHECK TO SEE IF FIELD REPLACEMENT IS REQUIRED.                    STB2470
640   LCO=JCOL(L)                                                       STB2480
      IF (JCAR(L)-81) 650,660,680                                       STB2490
650   LCA=JCAR(L)                                                       STB2500
      IF (IA(LCA)-IB(LCO)) 810,820,810                                  STB2510
660   DO 670 J=1,26                                                     STB2520

      IF (IB(LCO)-IA(J)) 670,820,670                                    STB2530
670   CONTINUE                                                          STB2540
      GO TO 810                                                         STB2550
680   IF (JCAR(L)-83) 690,710,740                                       STB2560
690   DO 700 J=27,36                                                    STB2570
      IF (IB(LCO)-IA(J)) 700,820,700                                    STB2580
700   CONTINUE                                                          STB2590
      GO TO 810                                                         STB2600
710   IF (IB(LCO)-IA(47)) 720,810,720                                   STB2610
720   DO 730 J=1,36                                                     STB2620
      IF (IB(LCO)-IA(J)) 730,810,730                                    STB2630
730   CONTINUE                                                          STB2640
      GO TO 820                                                         STB2650
740   IF (JCAR(L)-85) 750,770,790                                       STB2660
750   DO 760 J=1,26                                                     STB2670
      IF (IB(LCO)-IA(J)) 760,810,760                                    STB2680
760   CONTINUE                                                          STB2690
      GO TO 820                                                         STB2700
770   DO 780 J=27,36                                                    STB2710
      IF (IB(LCO)-IA(J)) 780,810,780                                    STB2720
780   CONTINUE                                                          STB2730
      GO TO 820                                                         STB2740
790   DO 800 J=1,36                                                     STB2750
      IF (IB(LCO)-IA(J)) 800,810,800                                    STB2760
800   CONTINUE                                                          STB2770
      GO TO 820                                                         STB2780
810   L=L+1                                                             STB2790
      GO TO 620                                                         STB2800
C     REPLACE FIELD BY NEW FORMAT.                                      STB2810
820   K=1                                                               STB2820
830   N=KFNBR(L,K)                                                      STB2830
      IF (N) 840,860,840                                                STB2840
840   NN=ISTRT(N)                                                       STB2850
      NX=NN+IWIDTH(N)-1                                                 STB2860
      DO 850 J=NN,NX                                                    STB2870
      KNTR=KNTR+1                                                       STB2880
      IF (KNTR-132) 850,850,1120                                        STB2890 • G
850   IBUFR(KNTR)=IB(J)                                                 STB2900
860   IF (KSNBR(L,K)-IA(47)) 870,910,870                                STB2910
870   N=KSNBR(L,K)                                                      STB2920
      DO 880 J=1,26                                                     STB2930
      IF (N-IA(J)) 880,890,880                                          STB2940
880   CONTINUE                                                          STB2950
      GO TO 910                                                         STB2960
890   M=J                                                               STB2970
      N=LNGTH(M)                                                        STB2980
      DO 900 J=1,N                                                      STB2990
      KNTR=KNTR+1                                                       STB3000
      IF (KNTR-132) 900,900,1120                                        STB3010 • H
900   IBUFR(KNTR)=ISTRNG(M,J)                                           STB3020
910   K=K+1                                                             STB3030
      IF (KFNBR(L,K)) 830,920,830                                       STB3040
920   L=L+1                                                             STB3050
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      GO TO 550                                                          STR3060
C     CHECK FOR END OF BLOCK AND END OF PAGE.                            STR3070
930   L=L+1                                                              STR3080
      GO TO 620                                                          STR3090
940   WRITE (IPTAPE,1140) (IBUFR(JX),JX=1,KNTR)                          STR3100
      IF (ITEST) 960,950,960                                             STR3110
950   WRITE (IOTAPE,1150) (IBUFR(JX),JX=1,KNTR)                          STR3120
960   KNTR=0                                                             STR3130
      LINES=LINES+1                                                      STR3140
      IF (LINES) 400,1010,970                                            STR3150
970   IF (IBLK) 400,400,980                                              STR3160
980   IF (IBLK*(LINES/IBLK)-LINES) 400,990,400                           STR3170
990   IF (IPAG) 1010,1010,1000                                           STR3180
1000  IF (IPAG*(LINES/IPAG)-LINES) 1010,1040,1010                        STR3190
1010  WRITE (IPTAPE,1140) (IBTX(J),J=1,80)                               STR3200
      IF (ITEST) 1030,1020,1030                                          STR3210
1020  WRITE (IOTAPE,1150) (IBTX(J),J=1,80)                               STR3220
1030  GO TO 400                                                          STR3230
1040  WRITE (IPTAPE,1140) (IPTX(J),J=1,80)                               STR3240
      IF (ITEST) 1060,1050,1060                                          STR3250
1050  WRITE (IOTAPE,1150) (IPTX(J),J=1,80)                               STR3260
1060  GO TO 400                                                          STR3270
C     END LAST PAGE                                                      STR3280
1070  WRITE (IPTAPE,1140) (IETX(J),J=1,80)                               STR3290
      IF (ITEST) 1090,1080,1090                                          STR3300
1080  WRITE (IOTAPE,1150) (IETX(J),J=1,80)                               STR3310
1090  IF (IFND) 1110,1100,1110                                           STR3320
1100  END FILE IPTAPE                                                    STR3330
      WRITE (IOTAPE,1150) IA(47),IA(5),IA(15),IA(6)                      STR3340
1110  STOP                                                               STR3350
1120  WRITE (IOTAPE,1300)                                                STR3360
      STOP                                                               STR3370
C                                                                        STR3380
C                                                                        STR3390
C                                                                        STR3400
1130  FORMAT (79H  ONLY 30 FIELD SUBSTITUTIONS ARE PERMITTED. THE ABOVE  STR3410
     1WAS THE 31ST SPECIFIED. )                                          STR3420
1140  FORMAT (132A1)                                                     STR3430
1150  FORMAT (1X,131A1)                                                  STR3440
1160  FORMAT (26I3)                                                      STR3450
1170  FORMAT (1X,26I3)                                                   STR3460
1180  FORMAT (26(I2,A1))                                                 STR3470
1190  FORMAT (1X,26(I2,A1))                                              STR3480
1200  FORMAT (20H  YOU HAVE SPECIFIED,1I4,26H FIELDS, BUT DEFINED ONLY ,STR3490
     11I4)                                                               STR3500
1210  FORMAT (26H  YOU HAVE REQUESTED FIELD,1I3,26H THE LAST DEFINED FIESTR3510
     1LD IS,1I3)                                                         STR3520
1220  FORMAT (18H  THE STRINGS ARE )                                     STR3530
1230  FORMAT (11H *** STRING,1I3,13H IS BLANK. $$)                       STR3540
1240  FORMAT (82H *** YOU HAVE MORE THAN 26 STRINGS OR YOU FORGOT TO ENDSTR3550
     1 THE LIST OF STRINGS WITH A,1A1,10H IN COL. 1)                     STR3560
1250  FORMAT (11H  THERE ARE,1I3,9H STRINGS )                            STR3570
1260  FORMAT (26H  THE LENGTH OF RECORD IS ,1I5)                         STR3580
1270  FORMAT (83H *** THE PROGRAM CAN NOT READ RECORDS SHORTER THAN 1 ORSTR3590
     1 LONGER THAN 132 CHARACTERS.)                                      STR3600
1280  FORMAT (28H  THE SUBSTITUTION CARDS ARE)                           STR3610
1290  FORMAT (12H  THERE ARE ,1I3,20H SUBSTITUTION CARDS.)               STR3620
1300  FORMAT (73H ***  YOU ARE TRYING TO WRITE RECORDS OF MORE THAN 132 STR3630
     1CHARACTERS. STOP. )                                                STR3640
      END                                                                STR3650-
```

I

J

APPENDIX II

This Appendix shows how the program in Appendix I was modified to provide blocked output from the NBS computer. The subroutine used to take advantage of the buffered tape write is also listed. These changes should also serve as a guide for modifying the program for other systems.

```
C  TO END THE STRINGS. COL 78 IS USED TO FILL THE LAST RECORD OUTPUT.   STB 140 • A

      COMMON /A/ ITAPE,IOTAPE,IW,ITEST,ICHK,NSTAB,TABNO,IEND            STB 681
      COMMON /B/ IAT(100),IE(750)                                       STB 682
      COMMON /G/ IBLEN,IBFR(3000)                                       STB 683
      COMMON /H/ IPTAPE,IOUT                                            STB 684
      EQUIVALENCE (IBFR(1),IBUFR(1)),(IAT(1),IA(1))                     STB 685  B
      IOUT = 1998                                                       STB 686
      IBLEN = 2995                                                      STB 687
      ICHK = 1                                                          STB 688
      CALL TNPACK(1)                                                    STB 689

      READ (ITAPE,1140,END=1100) (IA(J),J=1,80)                         STB 730 • C

      DO 1500 J = 1,80                                                  STB 971
      K = 81-J                                                          STB 972
      IF (IBTX(K) - IA(47)) 1510,1500,1510                              STB 973
 1500 JBTX = K                                                          STB 974
 1510 DO 1530 J = 1,80                                                  STB 975
      K = 81-J                                                          STB 9755 D
      IF (IPTX(K) - IA(47)) 1540,1530,1540                              STB 976
 1530 JPTX = K                                                          STB 9765
 1540 DO 1560 J = 1,80                                                  STB 977
      K = 81-J                                                          STB 9775
      IF (IETX(K) - IA(47)) 1570,1560,1570                              STB 978
 1560 JETX = K                                                          STB 9785
 1570 CONTINUE                                                          STB 979

      IF (KNTR-2900) 540,540,1120                                       STB2280 • E

      IF (KNTR-2900) 600,600,1120                                       STB2410 • F

      IF (KNTR-2900) 850,850,1120                                       STB2890 • G

      IF (KNTR-2900) 900,900,1120                                       STB3010 • H

 940  IW = KNTR                                                         STB3100
      CALL REPACK (IWRT,IKOWT)                                          STB3105  I
 945  IEND = 0                                                          STB3108
      IF (ICHK) 960,960,950                                             STB3110

 1010 IW = JBTX                                                         STB3200
      DO 1020 J = 1,JBTX                                                STB3210
 1020 IBUFR(J) = IBTX(J)                                                STB3215
      CALL REPACK (IWRT,IKOWT)                                          STB3220
 1030 GO TO 400                                                         STB3230
 1040 IW = JPTX                                                         STB3235
      DO 1050 J = 1,JPTX                                                STB3240
 1050  IBUFR(J) = IPTX(J)                                               STB3250
      CALL REPACK (IWRT,IKOWT)                                          STB3260
 1060 GO TO 400                                                         STB3270
C     END LAST PAGE                                                     STB3280
 1070 IW = JETX                                                         STB3282
      DO 1080 J=1,JETX                                                  STB3284
 1080 IBUFR(J) = IETX(J)                                                STB3286  J
      CALL REPACK (IWRT,IKOWT)                                          STB3288
      IF (IKOWT - IOUT) 1094,1094,1097                                  STB3290
 1094 JOT = IOUT - IKOWT + 2                                            STB3294
      DO 1095 J = 1,JOT                                                 STB3298
      IBUFR(J) = IA(78)                                                 STB3300
      IW = J                                                            STB3302
      IF (J-2000) 1095,1095,1096                                        STB3304
 1095 CONTINUE                                                          STB3306
 1096 CALL REPACK (IWRT,IKOWT)                                          STB3308
      IF (IKOWT - IOUT) 1094,1097,1097                                  STB3310
 1097 IF (IWRT) 1098,1098,1090                                          STB3312
 1098 IF (IWRT + 2) 1099,1099,1097                                      STB3314
 1099 WRITE (IOTAPE,1600) IWRT                                          STB3316
 1600 FORMAT (44H NTRAN WRITE ERROR ON LAST RECORD. STATUS = ,I5)       STB3318
 1090 IF (IEND) 1110,1100,1110                                          STB3320
```

```
QIT FOR REPAK,REPAK
      SUBROUTINE INPACK (IK)
      COMMON /A/ ITAPE,IOTAPE,ICHAR,ITEST,ICHK,NSTAR,TABNO,IEND          RPC  20
      COMMON /B/ IA(100),IE(750)                                        RPC  30
      COMMON /G/ IBLEN,ISTRIN(3000)                                     RPC  40
      COMMON /H/ IPTAPE,IOUT                                            RPC  50
      DIMENSION IWORDS(1000)                                            RPC  60
      K=IK                                                              RPC  70
      IOPT=IOUT/6                                                       RPC  80
      IF (IOUT-6*IOPT) 10,20,10                                         RPC  90
10    WRITE (IOTAPE,230) IOUT                                           RPC 100
      STOP                                                              RPC 110
20    RETURN                                                            RPC 120
      ENTRY REPACK (IWRT,IKOWT)                                         RPC 130
30    IF (IWRT) 40,60,60                                                RPC 140
40    IF (IWRT+2) 50,50,30                                              RPC 150
50    WRITE (IOTAPE,240) IWRT                                           RPC 160
60    IF (K-IOUT-1) 150,90,70                                           RPC 170
70    K1=1                                                              RPC 180
      K2=K/6+1                                                          RPC 190
      K3=IOPT+1                                                         RPC 200
      DO 80 J=K3,K2                                                     RPC 210
      IWORDS(K1)=IWORDS(J)                                              RPC 220
80    K1=K1+1                                                           RPC 230
90    K=K-IOUT                                                          RPC 240
      IF (K-IOUT-1) 150,100,100                                         RPC 250
100   CALL NTRAN (IPTAPE,1,IOPT,IWORDS,IWRT)                            RPC 260
      IF (ITEST) 110,30,110                                             RPC 270
110   DO 140 I=1,IOPT,21                                                RPC 280
      J=I+20                                                            RPC 290
      IF (J-IOPT) 130,130,120                                           RPC 300
120   J=IOPT                                                            RPC 310
130   WRITE (IOTAPE,250) (IWORDS(L),L=I,J)                              RPC 320
140   CONTINUE                                                          RPC 330
      NREC=NREC+1                                                       RPC 340
      WRITE (IOTAPE,260) NREC,IOUT,ICHAR,IOPT,K                         RPC 350
      GO TO 30                                                          RPC 360
150   DO 160 I=1,ICHAR                                                  RPC 370
      IK=I+K-1                                                          RPC 380
      J=IK-((IK-1)/6)*6                                                 RPC 390
      IZ=(IK-1)/6+1                                                     RPC 400
      FLD(6*(J-1),6,IWORDS(IZ))=FLD(0,6,ISTRIN(I))                      RPC 410
160   CONTINUE                                                          RPC 420
      K=K+ICHAR                                                         RPC 430
      IKOWT=K                                                           RPC 440
      IF (K-IOUT-1) 220,170,170                                         RPC 450
170   CALL NTRAN (IPTAPE,1,IOPT,IWORDS,IWRT)                            RPC 460
      IF (ITEST) 180,220,180                                            RPC 470
180   DO 210 I=1,IOPT,21                                                RPC 480
      J=I+20                                                            RPC 490
      IF (J-IOPT) 200,200,190                                           RPC 500
190   J=IOPT                                                            RPC 510
200   WRITE (IOTAPE,250) (IWORDS(L),L=I,J)                              RPC 520
210   CONTINUE                                                          -PC 530
      NREC=NREC+1                                                       RPC 540
      WRITE (IOTAPE,260) NREC,IOUT,ICHAR,IOPT,K                         RPC 550
220   RETURN                                                            RPC 560
C                                                                       RPC 570
  230 FORMAT (1X,44H OUTPUT WIDTH NOT AN EVEN NUMBER OF WORDS =  ,1I6  )
  240 FORMAT (29H  NTRAN WRITE ERROR. STATUS =  ,1I4)
250   FORMAT (1X,21A6)                                                  RPC 600
260   FORMAT (17H  ABOVE IS RECORD,1I5,6H IT IS,1I5,17H CHARACTERS LONG.-PC 610
     1,6I10)                                                            RPC 620
      END                                                               RPC 630-
```

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16. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)

SETAB is a FORTRAN program which accepts a card deck or Fortran records on magnetic tape and inserts the appropriate flags and shift symbols required by many programs associated with phototypesetting devices. The program is specialized to the particular application, the phototypesetter and typography programs, and to the desired typefaces by means of parameter cards supplied at run time. Examples are shown of spectroscopic tables typeset on the Linofilm phototypesetter at the Government Printing Office using the Autoset Typography Program. The program has also been used for tables of other types of data. The program can handle any records which can be read by a FORTRAN "READ" statement under "A" format control. The original record can be divided into as many as 40 fields and these fields can be combined in any order with any of 26 strings in front of or between the pieces. The program will, on a signal, replace a field by another field or by a combination of fields and strings. The output lines are blocked and paged via the insertion of the required strings between blocks and pages.

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Automatic typesetting; computer-assisted typesetting; edit insertion program; FORTRAN program; phototypesetting of spectroscopic tables; typesetting of tables.

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