United States Patent [19]

Langnickel

[11] **3,924,225**

[45] **Dec. 2, 1975**

[54] **CHARACTER DISPLAY DOT RASTER SIGNAL GENERATOR PROVIDED WITH CHARACTER MEMORY**

[75] Inventor: **Wolfgang Langnickel,** Braunschweig, Germany

[73] Assignee: **Olympia Werke AG,** Wilhelmshaven, Germany

[22] Filed: **May 30, 1974**

[21] Appl. No.: **474,863**

[30] **Foreign Application Priority Data**

May 30, 1973 Germany 2327474

[52] **U.S. Cl.** ..... **340/324 AD;** 178/30

[51] **Int. Cl.²** **G06F 3/14**

[58] **Field of Search** .... 340/324 M, 324 AD, 324 A; 178/30

[56] **References Cited**

UNITED STATES PATENTS

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Primary Examiner—Marshall M. Curtis

Attorney, Agent, or Firm—Spencer & Kaye

[57] **ABSTRACT**

In a data read-out system in which the read-out of lines of characters is effected by the production of a pattern of dots constituted by a series of dot rows and in which a representation of the dot pattern of each available character is stored in a respective individually addressable location of a character memory, a capability of reading out each such line by producing either a succession of vertical rows or horizontal rows of the dot pattern for an entire line is achieved by connecting to the outputs of the memory to a dot pattern read-out device via a vertical row selector and a horizontal row selector and by enabling only one of the selectors during a given read-out operation.

8 Claims, 4 Drawing Figures

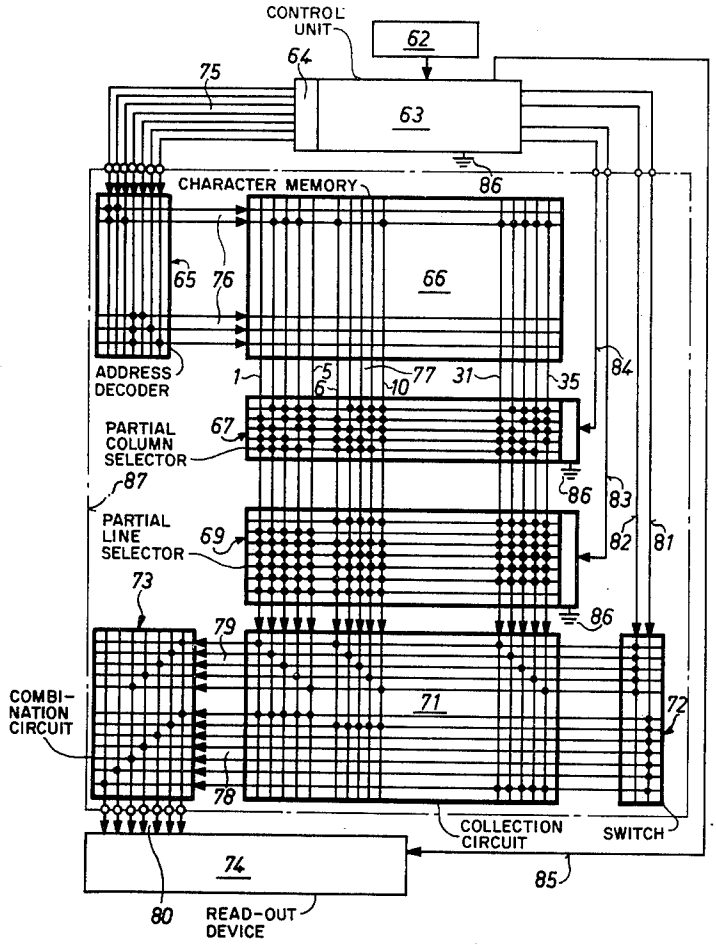


FIG.1

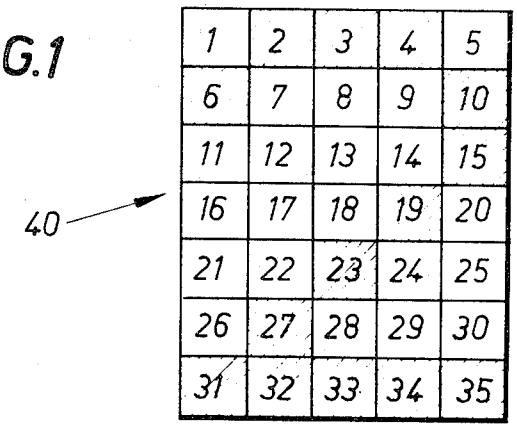


FIG.2

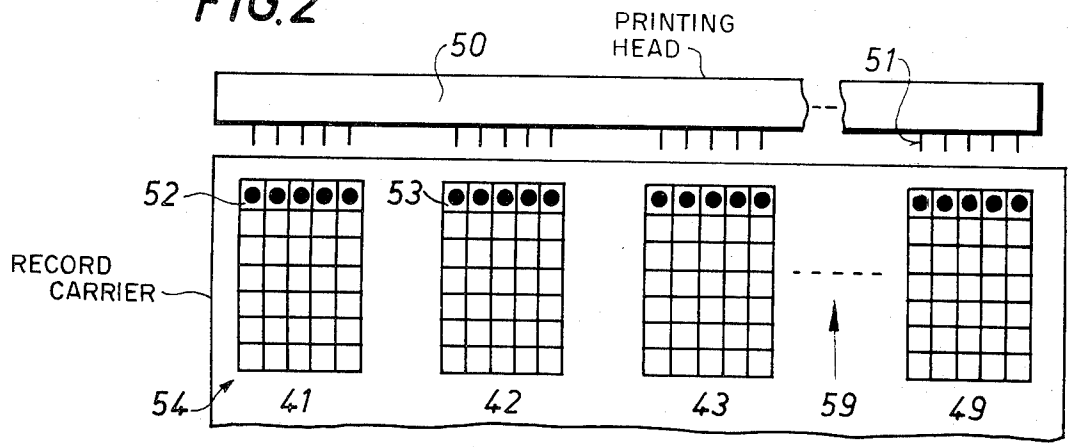


FIG.3

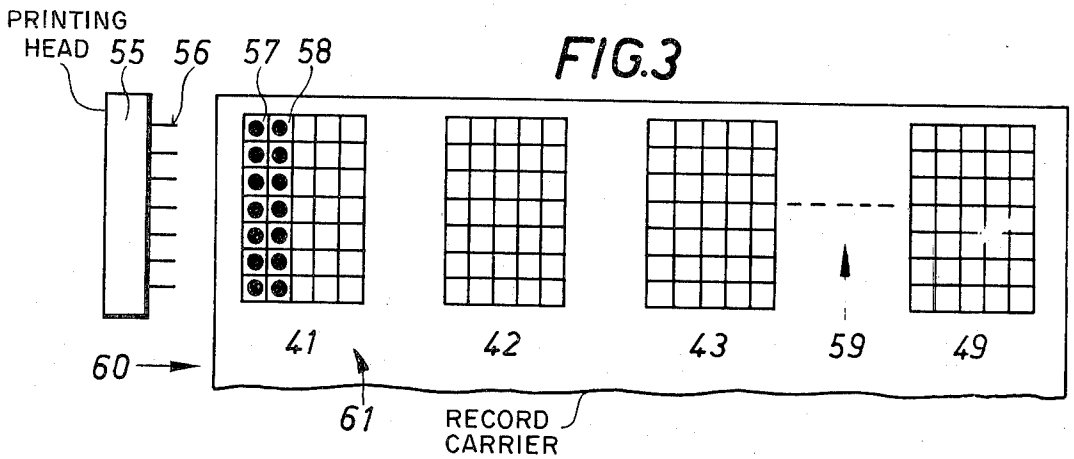
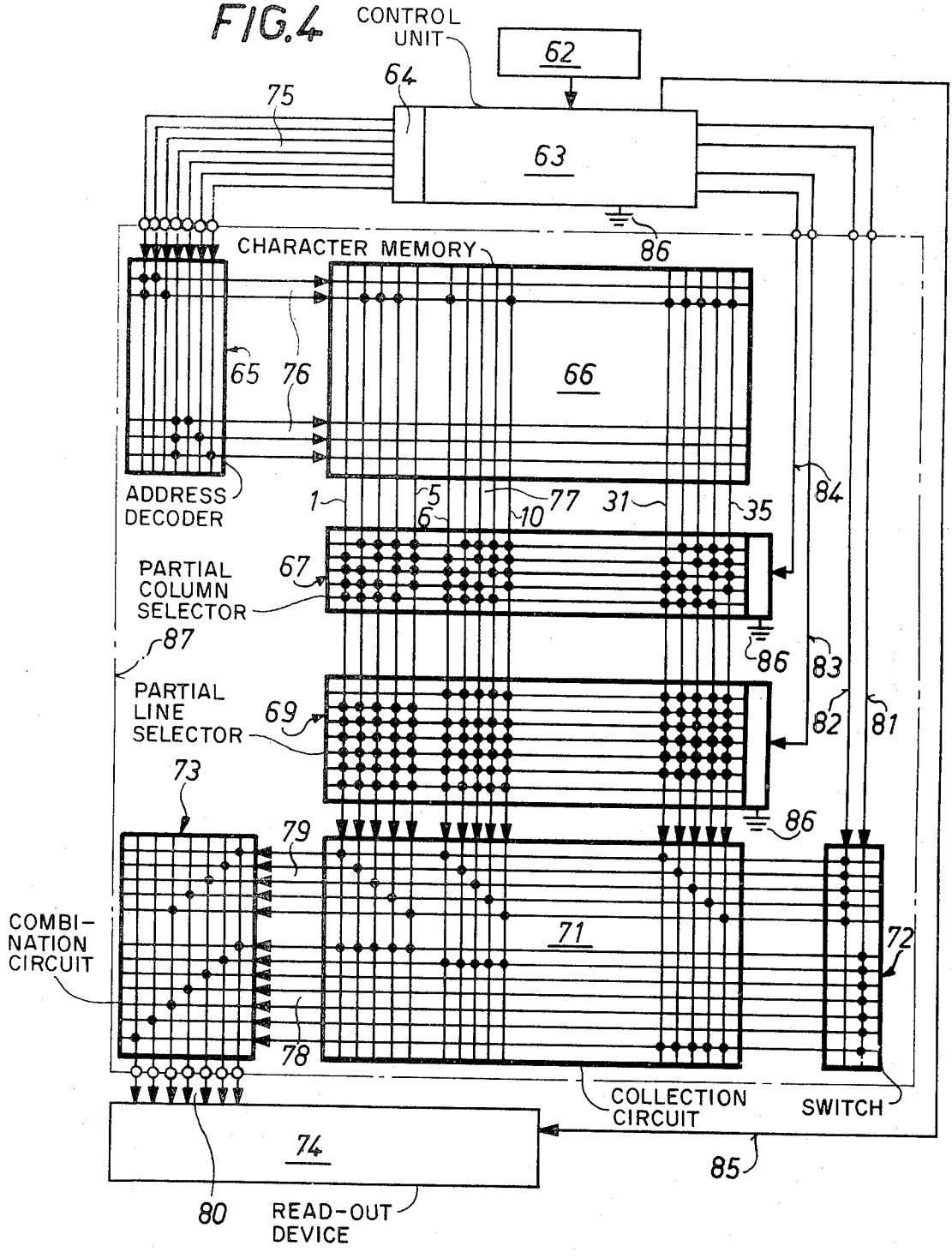


FIG.4


CONTROL UNIT
62
64
75
63
86
CHARACTER MEMORY
65
76
66
ADDRESS DECODER
1
5
6
77
10
31
35
84
PARTIAL COLUMN SELECTOR
67
87
86
83
PARTIAL LINE SELECTOR
69
82
81
73
86
79
COMBI-NATION CIRCUIT
71
72
78
COLLECTION CIRCUIT
SWITCH
74
85
80
READ-OUT DEVICE

CHARACTER DISPLAY DOT RASTER SIGNAL GENERATOR PROVIDED WITH CHARACTER MEMORY

BACKGROUND OF THE INVENTION

The present invention relates to a character display signal generator for controlling dot raster elements in a data display or data printing device. The invention particularly relates to arrangements in which the character display is in the form of a dot pattern selected from the elements of a dot raster and sections, i.e. parts of lines or parts of columns, of the entire dot raster are produced in succession. The invention relates more specificially to character display control systems of the type including a character memory into which is fed address information which determines which character is to be selected and at whose output the complete dot pattern information for the selected character is available; a section selector which is switched from section to section and which selects, from the complete dot pattern information, the sections to be used; and a collection circuit which collects the information signals relating to the selected sections in output lines.

Dot raster printers or mosaic printers, and corresponding display devices, are known in which the printing head prints the complete dot pattern image simultaneously and the head is moved with respect to the record carrier from location to location.

It is also known to provide a stationary printing head which extends across the full width of the record carrier. With a 5 × 7 mosaic raster for each character location, for example, such a printing head includes five juxtaposed dot printing elements per character printing location so that, in one printing step with the record carrier stationary, one horizontal row of dots constituting a portion of a line of characters can be printed simultaneously for all character locations. After a full line of dots, or partial character line, has been printed in this way, the record carrier is advanced transversely to the direction of the line and then the next line of dots is printed for all locations. A sequence of seven such printing steps thus produces a complete line of characters.

It is also possible, however, to provide a printing head which has seven printing elements, arranged in the vertical direction, in the case of a 5 × 7 mosaic raster, for example. With the record carrier stationary the printing head is advanced in the direction of the line and prints successive columns, or vertical rows, of dots, or partial character columns. When a complete line has been printed, the record carrier is advanced transversely to the direction of the printed line and then the next line of characters is printed.

With all these dot raster printers and dot raster display devices the character generation is relatively complicated. Fixed value memories are utilized for this purpose and are addressed via address lines according to the desired character. They then provide signals designating the desired character pattern at their outputs. These fixed value memories, however, are designed either for partial column operation or for partial line operation, described above, so that different fixed value memories must be provided for the different operational modes.

SUMMARY OF THE INVENTION

It is an object of the present invention to overcome this drawback by providing a character display signal generator including a fixed value memory, or a character memory, which can be used for all conceivable modes of operation in dot raster printers.

The character signal generator according to the present invention is distinguished in that it includes two section selectors which operate with common outputs, with one selector acting as a partial vertical row, or column, selector when the column mode is selected and the other selector acting as a partial horizontal row, or line, selector when the line mode is employed; and a collection circuit which combines the output signals of the two section selectors in partial columns in the one mode and in partial lines in the other mode and furnishes them to respective output lines. Such a character generator can be easily switched to any conceivable mode of operation.

An advantageous embodiment of the present invention is characterized in that the output lines for the partial columns and partial lines are combined in a combination circuit and a switch connects either the one or the other output lines to common output lines. In this way the number of output terminals is reduced, which is of considerable advantage in the case of character signal generators arranged on an integrated circuit because the size of the circuit elements which need be accommodated in integrated circuits is usually not limited by the number of individual elements but rather by the number of external leads.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is a schematic representation of a dot raster image.

FIG. **2** is a schematic representation of the operation of a dot raster printer which prints partial character lines.

FIG. **3** is a schematic representation of a dot raster printer which prints partial character columns.

FIG. **4** is a block circuit diagram of a preferred embodiment of a display signal generator according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. **1** is a schematic representation of a dot pattern character **40** formed from selected dots of a 5 × 7 raster composed of elements **1** to **35.** The raster dots **1** to **5** form the first partial line, raster dots **6** to **10** form the second partial line, etc. Raster dots **1, 6, 11, 16, 21, 26, 31** form the first partial column and raster dots **2, 7, 12, 17, 22, 27, 32** form the second partial column, etc. If the character "2" is to be displayed or printed, the corresponding dot pattern is constituted by dots at the locations of raster elements **2, 3, 4, 6, 10, 15, 19, 23, 27, 31, 32, 33, 34** and **35.**

FIG. **2** shows a printing head **50** which, in the present example of a 5 × 7 raster, has five printing elements **51** per character location, and which extends across the entire printing width of a record carrier **54.** Technically, such a printing head could print a full partial character line, i.e., a line of dots for every character in the row across carrier **54,** at the same moment. However, this would require expensive control circuits for the printing elements **51.** For this reason, the following mode of operation is usually selected: The printing ele-

ments 51 of the first character location are addressed first and the first partial line 52 of the first mosaic character 41 is printed. Then the printing elements of the second character location are addressed and the first partial line 53 of mosaic character 42 is printed. This process is continued over the full printing width of the record carrier 54 for characters 43–49 and thereafter the record carrier is moved by the distance between successive dot raster rows in the direction of arrow 59. Thereafter, the second partial line for all mosaic characters 41 to 49 is printed and after seven such sequences a complete line has been printed. The advancing of the record carrier can be continuous because the sequence of addressing successive character locations is very fast. The switching devices for switching between the individual locations are not part of the present invention and are therefore not shown in detail.

FIG. 3 shows a different mode of operation which is widely used. For this operation, a printing head 55 contains seven printing elements 56 which are arranged transversely to the direction of a line and with which a partial column 57 can be printed simultaneously. In operation, printing head 55 is moved across the record carrier 61 in the direction of the line, as indicated by arrow 60, and after printing of the first partial column 57, partial column 58 is printed. As soon as a full line has been printed, i.e., five columns for each of character locations 41–49, the record carrier 61 is advanced by the space of one line in the direction of arrow 59 and the printing head 55 returns to column 57 and then prints the next full line.

FIG. 4 shows a block circuit diagram of a preferred embodiment of the character signal generator of the present invention and the associated control devices and data emission devices. The dot-dash line 87 indicates the extent of the individual units making up the character generator, which units are preferably all formed in an integrated circuit. The character signal generator 87 is controlled by a control unit 63 and emits its output signals via outputs 80 to a data read-out device 74 which is either a printer or a display unit.

Character generator 87 includes an address decoder 65 which controls a character memory 66 by delivering signals via its output lines 76. This character memory provides at its output lines 77 the full dot pattern information for a dot pattern character. This information passes through a partial column selector 67 and a partial line selector 69 to a collection circuit 71. A switch 72 selects from the information contained in the collection circuit 71 either the information for printing in partial columns or for printing in partial lines, and the selected information travels through a combination circuit 73 to common outputs 80 for the data read-out device 74.

The operation of such read-out will now be described in detail. The information to be read out reaches the control unit 63 through an input device 62 and the data identifying the characters to appear in a full printed line is stored in a line memory 64. From this memory the signals relating to one character at a time are fed via code lines 75 to the address decoder 65 and the decoder operates to produce an address signal at one of its output lines 76, each such line corresponding to a predetermined character and being connected to a corresponding location in character memory 66. For example, if the character 2 is to be printed, an address signal is produced on the second one from the top of lines 76. By addressing this second line 76 the address is provided to character memory 66 and corresponding character signals pass through the corresponding linkage points to the output lines 77. In the case of 5 × 7 character mosaic rasters, 35 output lines 77 are provided. Each of lines 77 corresponds to one of the raster elements of FIG. 1 and is correspondingly numbered.

It is now assumed that a read-out by partial lines is desired. In this case the partial column selector 67 is made ineffective, i.e., it permits the signals on lines 77 to pass therethrough. The partial line selector 69 is brought into a first position, or selection condition, by control unit 63, by a signal applied via a control line 83, which means that the first line, i.e., the uppermost horizontal line, of the partial line selector 69 is connected to ground potential at grounding point 86. This means that the signals from all lines 77 which are linked with the first line of partial line selector 69 are suppressed. Linking is depicted throughout by solid dots. Thus only the signals from the first five (1–5) lines 77 are permitted to pass; these lines correspond to the first partial line 52 of the first character 41, as shown in FIG. 2. The signals in these first five lines 77 travel via linking points in collection circuit 71 to the partial line outputs 79. Switch 72 is switched to partial line emission by the application of ground potential on control line 81 from control unit 63 and thus suppresses all signals in the partial column outputs 78. The signals in the partial line outputs 79 are transmitted, via linkage points in the combination circuit 73, to the common outputs 80. From there they control the data read-out device 74 which is synchronized by signals delivered via a further control line 85 from control unit 63.

Then line memory 64 furnishes, via code lines 75, signals identifying the character intended for the second character location, i.e., 42 of FIG. 2. The address decoder 65 places an address signal on the appropriate output line 76 and the character memory 66 provides the corresponding output signals at output lines 77. The partial line selector 69 is still in the first position so that only the information in lines 1 to 5 is transmitted to outputs 80. In this way the first partial line 53 of the second character location is printed. This process is repeated until all first partial lines of the mosaic characters 41 to 49 have been printed.

Now the partial line selector 69 is switched to the second partial line, i.e., the second horizontal line from the top, by a switching signal applied via control line 83. The line memory 64 again furnishes the signals identifying the character corresponding to the first character location 41 to the address decoder 65 and the character memory 66 provides the corresponding output pattern at lines 77. Since the partial line selector 69 is now in the position of the second partial line, however, only the output signals corresponding to lines 6 to 10 are permitted to pass through to the inputs to circuit 71. These signals pass over the corresponding linkage points in collection circuit 71 and through combination circuit 73 to the common outputs 80. This process is repeated until all partial lines have been printed. Now the line memory 64 can provide the information for the characters to appear in the next full printed line.

For effecting partial column operation, the partial line selector 69 is rendered ineffective. The partial column selector 67 is switched from partial column to partial column by the appropriate control signals delivered via control line 84 from control unit 63. In a manner similar to partial line selector 69 it selects from all the information available at output lines 77 that informa-

tion which corresponds to the partial column to be printed. While printing the first partial column **57**, indicated in FIG. **3**, only the information in output lines **1, 6, 11, 16, 21, 26, 31** is permitted to pass and all other signals are suppressed. After printing the first partial column **57** the second partial column **58** of the first character location **41** is printed. This process is repeated until a complete line has been printed. The line memory **64** must, in a corresponding manner, provide information identifying the character at one location after another across the printing line for access for decoder **65.**

In this mode of operation switch **72** receives a signal via control line **82** which causes the partial line outputs **79** connected with this line to be short-circuited. In this way the corresponding information will pass only through partial column outputs **78,** via combination circuit **73,** to the common outputs **80.**

It is of course also possible to eliminate the address decoder **65** from the character generator **87** and to address the address lines **76** directly. This is advisable only with a small store of characters, however, because otherwise too many connecting lines would result. It is also possible to obtain the output signals directly — depending on the mode of operation employed — either at the partial line outputs **79** or at the partial column outputs **78** instead of at lines **80.**

In the present example the following assumptions were made to facilitate the description of the character generator according to the present invention: the address decoder **65** is provided with AND elements at its points of linkage, and the character memory **66** has OR elements at its points of linkage. The partial column selector **67** and the partial line selector **69** were described as if they had suppression elements at their points of linkage; the same applies for switch **72.** The collection circuit **71** and the combination circuit **73** were described as if they had OR elements at their points of linkage. It is of course also possible to replace these various linkage elements by other linkages, for example NOR linkages.

It will be understood that the above description of the present invention is susceptible to various modifications, changes and adaptations, and the same are intended to be comprehended within the meaning and range of equivalents of the appended claims.

I claim:

1. In a character signal generator for selecting the dot raster elements to be produced in a data read-out dot raster display device having a plurality of signal inputs in which signals representing, selectively, partial horizontal or vertical rows of an entire dot raster are emitted in succession, the generator including a character memory composed of a plurality of memory locations each containing a representation of a respective character available for read-out and arranged to receive address signals identifying the memory location corresponding to the character to be read out, said memory having a plurality of outputs for presenting signals containing the complete dot raster information of the addressed character, row selector means connected to the memory outputs and arranged to be switched from row to row for selecting, from the complete dot raster information, successive rows to be read out, and a collection circuit having output lines and arranged to collect the information relating to the selected rows at its output lines, the improvement wherein: said selector means comprise first and second row selectors both connected to said selector means output lines, said first row selector being constructed to operate as a vertical row selector when a succession of vertical dot raster rows are to be read out and said second row selector being constructed to operate as a horizontal row selector when a succession of horizontal dot raster rows are to be read out; said generator further comprises means connected for rendering one of said selectors ineffective during any read-out operation; and said collection circuit comprises means connected to link the output signals of a selected one of said row selectors to conduct such signals to corresponding output lines of said collection circuit.

2. An arrangement as defined in claim **1** further comprising an address decoder connected for supplying address signals to said character memory.

3. An arrangement as defined in claim **1** wherein said collection circuit has two sets of output lines, with each being connected to receive the output signals from a respective one of said row selectors, and further comprising: switch means connected to said collection circuit for permitting output signals to appear on only one of said sets of output lines during any read-out operation; and a combination circuit having a group of common output lines and connected to both of said sets of output lines of said collection circuit for conducting the signals appearing on said one set of output lines to said common output lines.

4. An arrangement as defined in claim **3** wherein said character memory, said first and second row selectors, said collection circuit, said switch means and said combination circuit are together constituted by a matrix composed of intersecting conducting lines and linkage means at selected points of intersection of said conducting lines.

5. An arrangement as defined in claim **4** further comprising an address decoder connected for supplying address signals to said character memory and constituted by a portion of said matrix.

6. An arrangement as defined in claim **4** wherein one set of said conducting lines constitutes the output lines of said character memory and of said first and second row selectors and the input lines of said collection circuit, and said first and second selector circuits constitute signal suppression circuits.

7. An arrangement as defined in claim **4** wherein said switch means are connected for selectively suppressing signals on that set of output lines on which output signals are not to appear.

8. An arrangement as defined in claim **3** wherein said signal inputs of said display device are connected to said common output lines of said combination circuit and said combination circuit is arranged to supply the signals for a row to be read out simultaneously to said display device signal inputs.

* * * * *