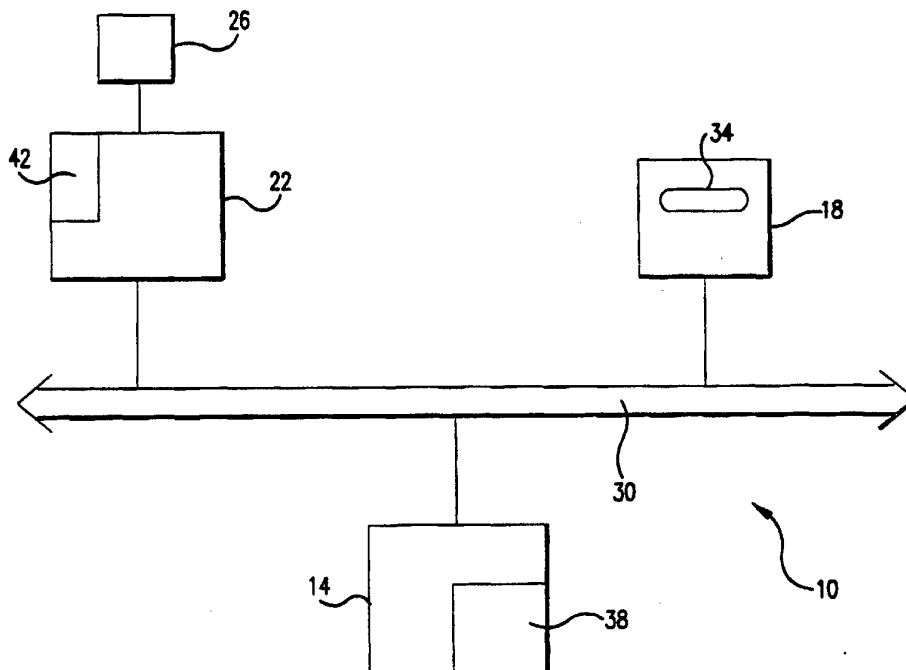




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(54) Title: METHOD FOR UPDATING THE COLOR LOOK UP TABLES OF VIDEO DISPLAY DEVICES TO DISPLAY DIGITAL VIDEO SIGNALS



(57) Abstract

A method for updating the color look up tables (42) of video display devices during the active scan of the raster display without disrupting the normal viewing of the video display is disclosed. In operation, the present invention accesses color index information from only a first selected partition (50) of the color look up table (42) while updating color index information in another partition (54) of the color look up table (42). Then, color index information is accessed only from the updated partition of the color look up table while updating the color index information in the first selected partition (50). In this manner, the entirety of the color look up table (42) is updated while ensuring data integrity and minimizing the disruption of the normal viewing of the video display.

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METHOD FOR UPDATING THE COLOR LOOK UP
TABLES OF VIDEO DISPLAY DEVICES TO
DISPLAY DIGITAL VIDEO SIGNALS

5 Field Of The Invention

1 The present invention relates to a method for updating
the color look up tables (CLUTs) of video display devices, and
more particularly to a method for updating the color look up
tables during the active scan of the raster display without
10 disrupting the normal viewing of the video display.

Background Of The Invention

 Typically, video display devices (such as personal
computers, video game apparatus, and so-called "CD
15 Interactive" devices, to name a few) are capable of generating
detailed pictures on the screen of a cathode ray tube at a
rate of up to 60 pictures per second. Each of these pictures
may be referred to as a field. Movement of objects or people
on the screen is accomplished by successively changing the
20 shape, horizontal position and/or vertical position of the
objects or people during each successive field that is
displayed.

 The picture itself is composed of tiny dots, referred to
as pixels. To determine what color will be displayed for a
25 given pixel, video display devices often use what are commonly
referred to as color look up tables or color palettes. At any
given point in time, each pixel on the screen may emanate only
one color from a limited number of available colors in the
color look up tables.

30 By way of an analogy, a color look up table is comparable
to an actual palette of a painter which has only a limited
number of different colors of paints in the wells of the
palette. At any given time, the artist can select any of the
colors in the artist's palette to be used in a painting. For
35 example, the artist may choose to paint the sky blue, the
grass green, and a barn yellow. At some point, the artist may
wish to change his colors in his color palette, for example,
if the artist wanted to paint a new picture.

Similarly, it is often desirable for video display devices to change the colors contained in their color palettes. By updating the color information in the color look up tables, a wider range of colors can be displayed on the screen of the cathode ray tube.

A primary method for updating the color look up tables of video display devices involves the writing of new color information into the color look up tables during vertical retrace -- the time interval when the raster scan beam moves from its lowest vertical position to its highest vertical position. The above method, while workable, has certain drawbacks and deficiencies. Specifically, the above method requires that the updating of the color look up table be completed during the finite time interval during vertical retrace. In addition, due to the hardware constraints of some video display systems, updating color look up tables during vertical retrace is not always possible.

If it is not possible to update the color look up tables adequately during vertical retrace, another method for updating the color look up tables can be employed involving the writing of new color information during the active scan period of the raster. By updating the color information during active scan, the video display system is not limited to the finite interval of vertical retrace. However, updating the color look up tables during active scan also has certain drawbacks and deficiencies. Since the color look up tables are constantly being accessed during active scan at the same time that they are being updated, it is very difficult to ensure data integrity (e.g. that the expected or proper colors will be found in the table when needed). In addition, if the updating process is not completed by the beginning of the next active scan period, the same pixels in subsequent fields may change colors inadvertently and cause an undesirable flashing or flickering of the screen.

Summary Of The Invention

Accordingly, a general object of the present invention is

to provide a reliable and predictable method for updating the color look up tables during the active scan of the raster display.

Another object of the present invention is to provide a method for updating the color look up tables while ensuring data integrity.

An additional object of the present invention is to provide a method for updating the color look up tables without disrupting the normal viewing of the video display.

The foregoing and other objects are, in the present invention, embodied in an improved method for updating color look up tables. In accordance with one aspect of the present invention, the updating of the color look up table is achieved by first accessing color index information from only a first selected partition of said color look table while simultaneously updating color index information in another inaccessible partition of the color look up table. Then, color index information is accessed only from the formerly inaccessible and now updated partition of the color look up table while simultaneously updating the color index information in the first selected partition. In this manner, the entirety of the color look up table is updated while ensuring data integrity. To minimize the disruption of the normal viewing of the video display, the primary colors needed to display a given field remain accessible to the video display device at all times during the updating of the color look up tables.

An advantage of the present invention includes the ability to smoothly and efficiently update the color look up tables when the updating of the color look up tables is not possible during vertical retrace.

While the invention will be described in connection with certain preferred embodiments, it is not intended that the invention be limited to those specific embodiments but rather that it be accorded a broad scope commensurate with the appended claims, consistent with the prior art.

Brief Description Of The Drawings

FIG. 1 is a block diagram of a typical video display device which may utilize the method of a preferred embodiment of the present invention to update the color look up table.

FIG. 2 is a diagram of a partitioned color look up table of FIG. 1.

FIG. 3 is a diagram showing multiple color look up tables which may be updated in an alternate embodiment of the present invention.

FIG. 4 is a diagram showing the color look up table partitions of FIG. 2 that sequential fields may access while using a preferred embodiment of the present invention to update the color look up table.

Detailed Description of the Preferred Embodiments

Referring to FIG. 1, there is shown a block diagram of a typical video display device 10 which may utilize the method of a preferred embodiment of the present invention to update the color look up table 42. The video display device 10 may be, for example, a personal computer having a microprocessor 14 and other compatible peripherals comprising a compact disc drive 18, a video graphics card 22, and a display monitor 26. Communication between the microprocessor 14 and the peripherals is achieved through a communication bus 30.

While the above elements used in the illustrative embodiment of the present invention have been specifically identified above, many variations and substitutions, known to those skilled in the art, can be employed without deviating from the intended scope of the present invention. Specifically, the present invention is designed for use with any video display device employing color look up tables.

Typically, the video display device 10 operates and may be used as follows. A compact disc 34 containing the video data to be displayed is inserted into the compact disc drive

18. Under the direction of the microprocessor 14, the compact disc drive 18 retrieves video data from the compact disc 34 and sends the video data to the microprocessor 14 via the communication bus 30. The microprocessor 14 stores the video data in the random access memory (RAM) 38. The microprocessor 14 also uncompresses, if necessary. To display the video data, the microprocessor 14 sends the video data to the video graphics card 22. The video data contains index information into a color look up table 42 of the video graphics card 22. As pixels are displayed, color information in the color look up table 42 is accessed, and the video graphics card 112 sends the color information to the display monitor 26 to be displayed.

Referring to FIG. 2, there is shown a diagram of the partitioned color look up table 42 of FIG. 1. In a preferred embodiment of the present invention, the color look up table 42 is capable of storing color information for 256 colors. The color look up table is comprised of three partitions: 1) a main partition 46, 2) a partition A 50, and 3) a partition B 54. The main partition 46 in the preferred embodiment is capable of storing color information for 16 colors. The main partition 46 stores color information for commonly used colors covering a large portion of the color spectrum. These colors are always available to be displayed and are not updated. Color partitions A 50 and B 54 are each capable of storing color information for 120 colors.

Referring now to FIG. 4, there is shown a diagram showing the color look up table partitions that sequential fields may access while using a preferred embodiment of the present invention. Initially, at a point marked X in FIG. 4, the field 100 may be displayed by accessing both partitions A 50 and B 54 (and the main partition, if necessary) for color information. In a preferred embodiment, one partition for a given field is that field's primary partition. The primary partition is comprised of the most predominant colors to be displayed during the display of the field. Another partition for that field is its secondary partition, which is comprised

of the remaining, less frequently accessed colors (or colors which only differ subtly from colors in the primary partition). At the point X, partition A 50 is the primary partition for field 100 and partition B 54 is the secondary partition for field 100. Similarly, fields 102 and 104 and fields between fields 102 and 104 [not shown] are displayed by accessing both partitions A 50 and B 54 (and the main partition, if necessary), with partition A 50 being the primary partition and partition B 54 being the secondary partition for the fields.

If it becomes necessary or desirable to update the color look up table 42 at a transition point Y, the field 106 before the transition point may be displayed by accessing partition A 50 (and the main partition, if necessary), but not partition B 54. While field 106 is being displayed by accessing partition A 50, information in partition B 54 is updated with the most predominant colors to be displayed in the next field 108.

After partition B 54 is updated, field 108 (after the transition point Y) may be displayed by accessing only partition B 54 (and the main partition, if necessary), but not partition A 50. While field 108 is being displayed by accessing partition B 54, information in partition A 50 is updated with the remaining less frequently accessed colors for field 108. When both partition A 50 and B 54 are updated, fields 110 through 114 may be displayed by accessing both partitions A 50 and B 54 (and the main partition, if necessary), with partition A 50 being the secondary partition and partition B 54 being the primary partition for fields 110 through 114.

It is important to note that very little disruption, if any, of the normal viewing of the video display occurs during the display of the fields around the transition point Y because each of the fields are displayed by accessing their respective primary partitions and the main partition. In addition, since none of the fields are displayed by accessing the partitions being updated, data integrity is maintained while updating the color look up table 42.

Similarly, if it becomes necessary or desirable to update the color look up table 42 again at a transition point Z, the field 116 before the transition point may be displayed by accessing its primary partition B 54 (and the main partition, if necessary), but not its secondary partition A 50. While field 116 is being displayed by accessing partition B 54, information in partition A 50 is updated with the most predominant colors to be displayed in the field 118. After partition A 50 is updated, field 118 (after the transition point Z) may be displayed by accessing only partition A 50, but not partition B 54. While field 118 is being displayed by accessing partition A 50, information in partition B 54 is updated with the remaining less frequently accessed colors for field 118. After both partition A 50 and B 54 are updated, field 120 and fields thereafter [not shown] may be displayed by accessing both partitions A 50 and B 54, with partition A 50 being the primary partition and partition B 54 being the secondary partition for fields 110 through 114.

It should be recognized by those skilled in the art that the color look up table 42 could be partitioned without having a main partition or by having additional partitions (e.g. partition C, partition D, etc...) without deviating from the scope of the present invention. In addition, as shown in FIG. 3, the methodology of the present invention can be employed by video display devices having multiple color look up tables 58, 62 and 66, as opposed to multiple partitions of a single color look up table 42.

What is claimed is:

1. A method for updating the color look up table of a video display device during active scan of a cathode ray tube to display digitized video signals comprising the following steps:

5 accessing color index information from a first partition of said color look up table;
 updating color index information in a second partition of said color look up table while restricting access to said second partition;

10 accessing color index information from said second partition of said color look up table;
 updating color index information in said first partition of said color look up table while restricting access to said first partition.

15 2. The method of claim 1 wherein said first partition initially contains primary color index information for the fields displayed before updating said color look up table.

20 3. The method of claim 2 wherein said first partition is updated with secondary color index information for subsequent fields displayed after updating said color look up table.

25 4. The method of claim 1 wherein said second partition is updated during the display of one field on the screen of said cathode ray tube.

30 5. The method of claim 1 wherein the color information and video data is stored and retrieved from a peripheral storage device.

35 6. A method for updating multiple color look up tables of a video display device during active scan of a cathode ray tube to display digitized video signals comprising the following steps:

 accessing color index information from a first color

look up table of said video game apparatus;

 updating color index information in a second color
look up table while restricting access to said second color
look up table;

5 accessing color index information from said second
color look up table;

 updating color index information in said first color
look up table while restricting access to said first color
look up table.

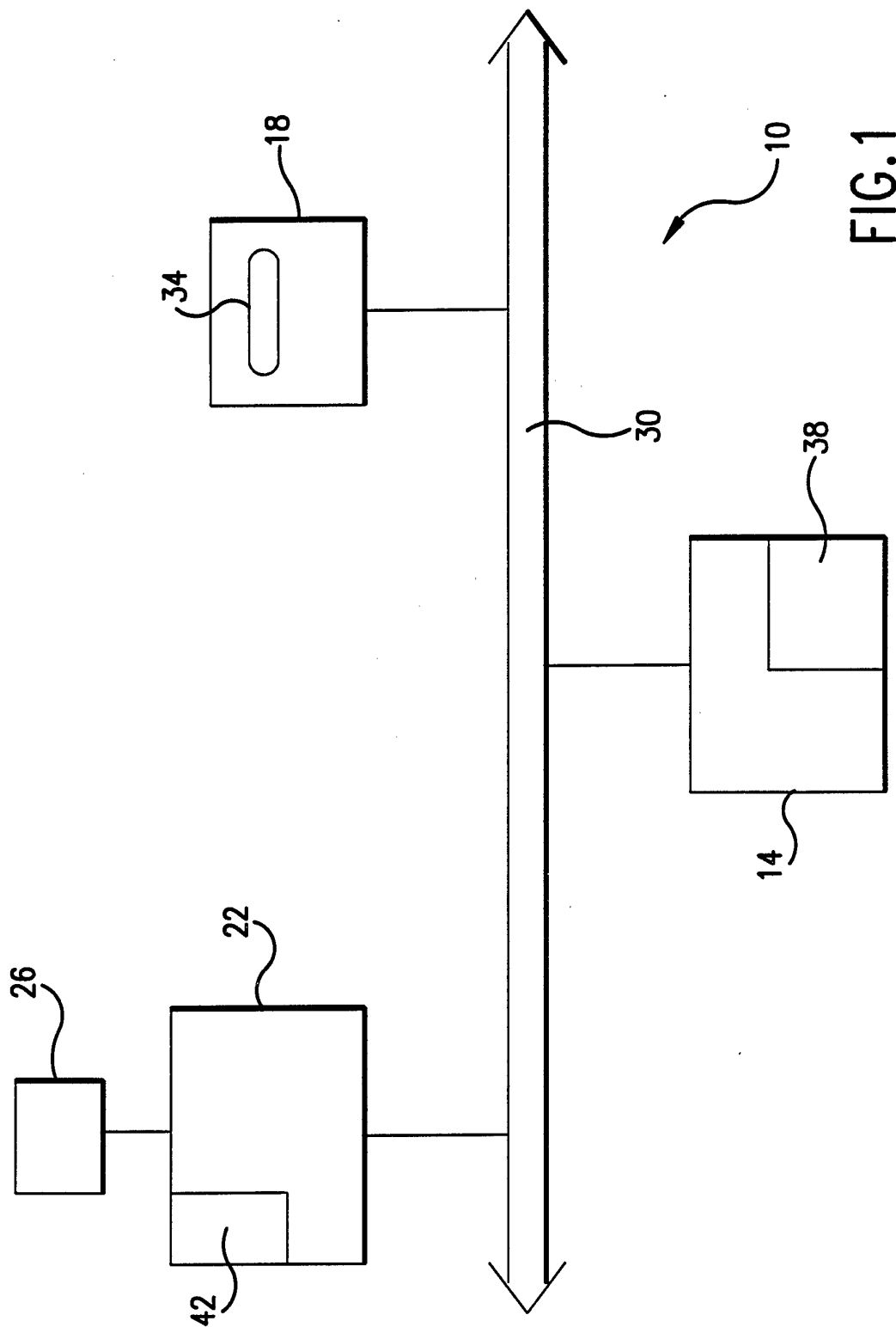


FIG.1

2/3

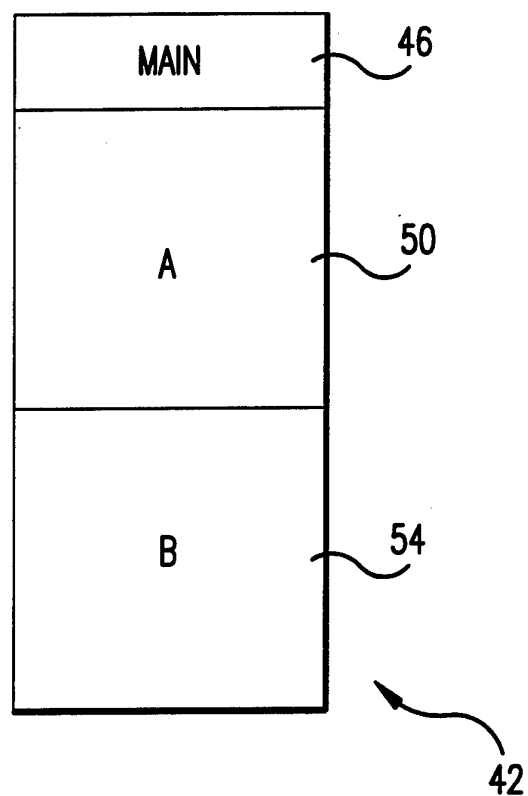


FIG. 2

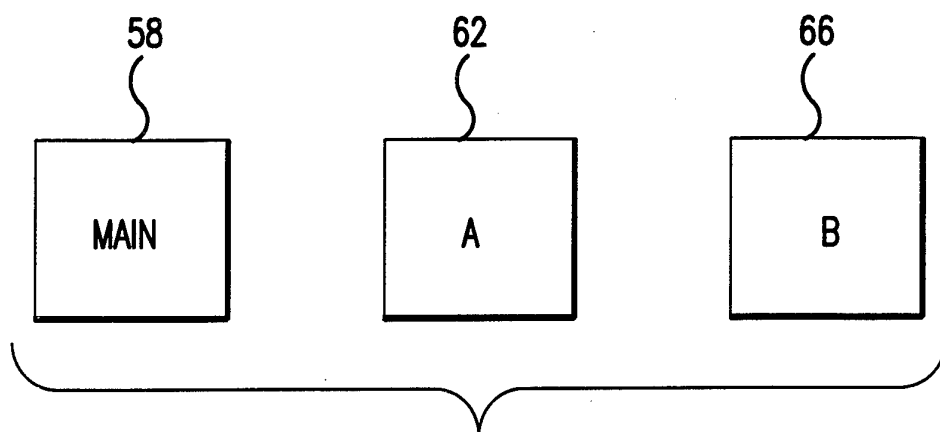
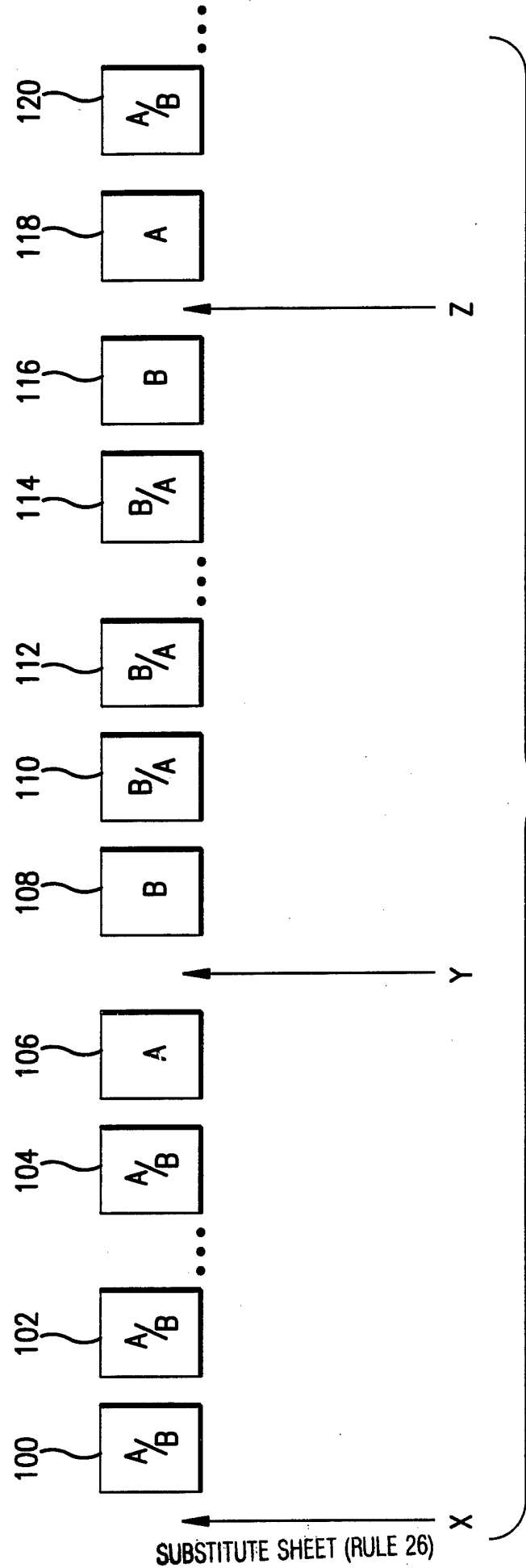


FIG. 3



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US93/12213

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) : G09G 1/28

US CL : 345/199

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 345/199, 164 ; 358/75, 80

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y,P	US, A, 5,204,665 (Bollman et al.) 20 April 1993, col. 2, line 67, col. 5, lines 30-40 and fig. 2.	1-6
Y	US, A, 4,901,258 (Akiyama) 13 February 1990, col. 2, lines 1-7, fig. 1 and fig. 6.	1-6
Y	US, A, 4,862,154 (Gonzalez-Lopez) 29 August 1989, col. 5, line 51 to col. 6, line 19 and fig. 8.	1-6
Y	US, A, 4,598,282 (Pugsley) 01 July 1986, col. 4, lines 51-65 and fig. 4.	5



Further documents are listed in the continuation of Box C.



See patent family annex.

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