United States Patent

Nagai

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[54] **VIDEO GENERATOR**

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[51] **Int. Cl.**.....**G06f 3/14**

[58] **Field of Search**.....340/324 A, 174.1 P, 174.1 L

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[57] **ABSTRACT**

A video generator having means for selectively reading out one of many patterns recorded on a first track of a magnetic disc and repeatedly writing this pattern on a second track. The pattern at a desired position on the second track is solely read out to be written on a third track of the magnetic disc, and the video signal thus recorded on the third track is displayed on a CRT display.

3 Claims, 5 Drawing Figures

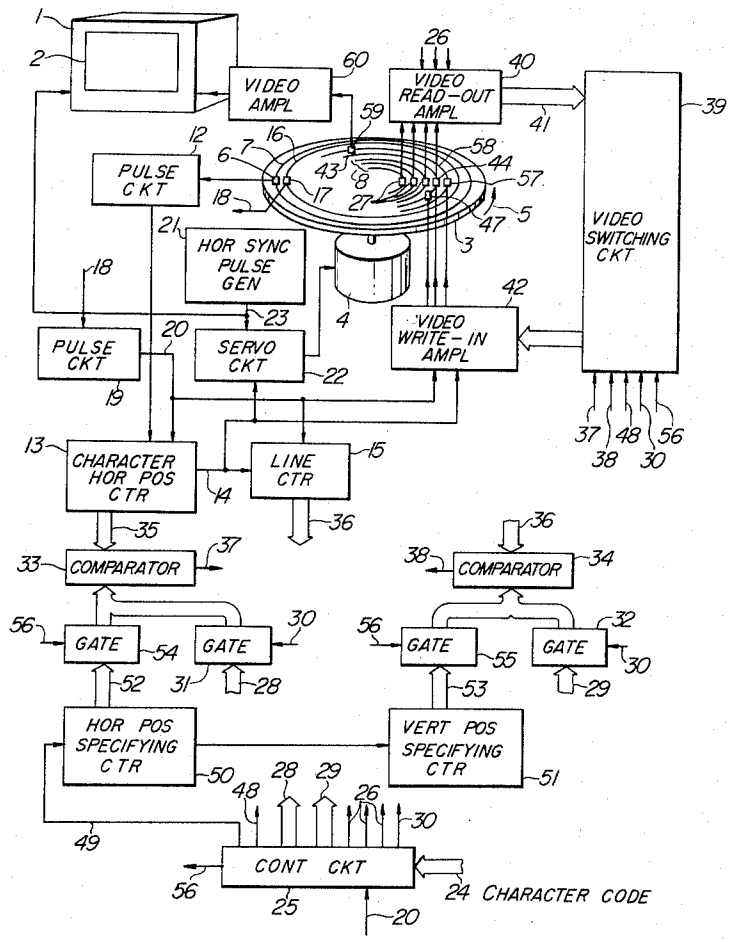
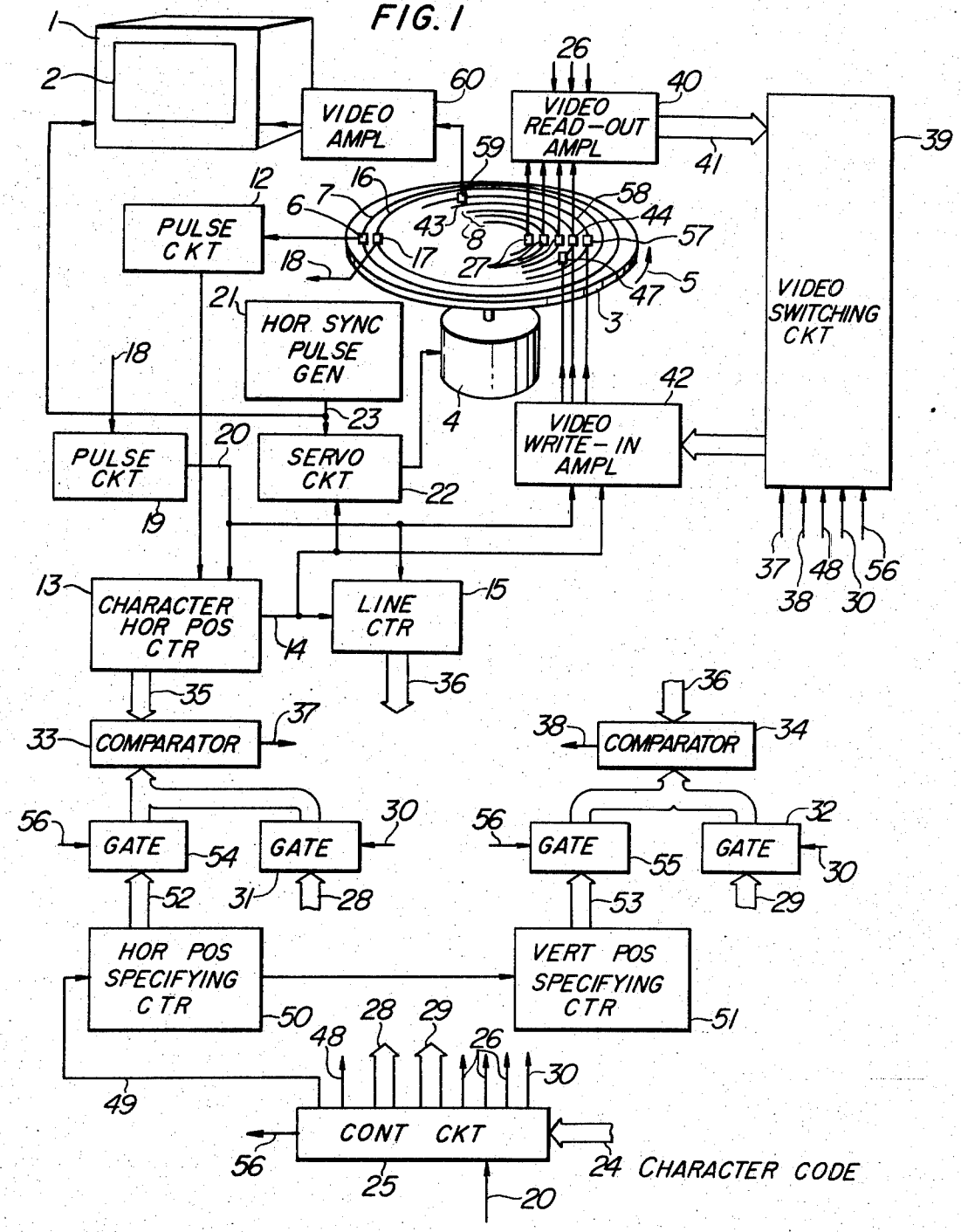


FIG. 1



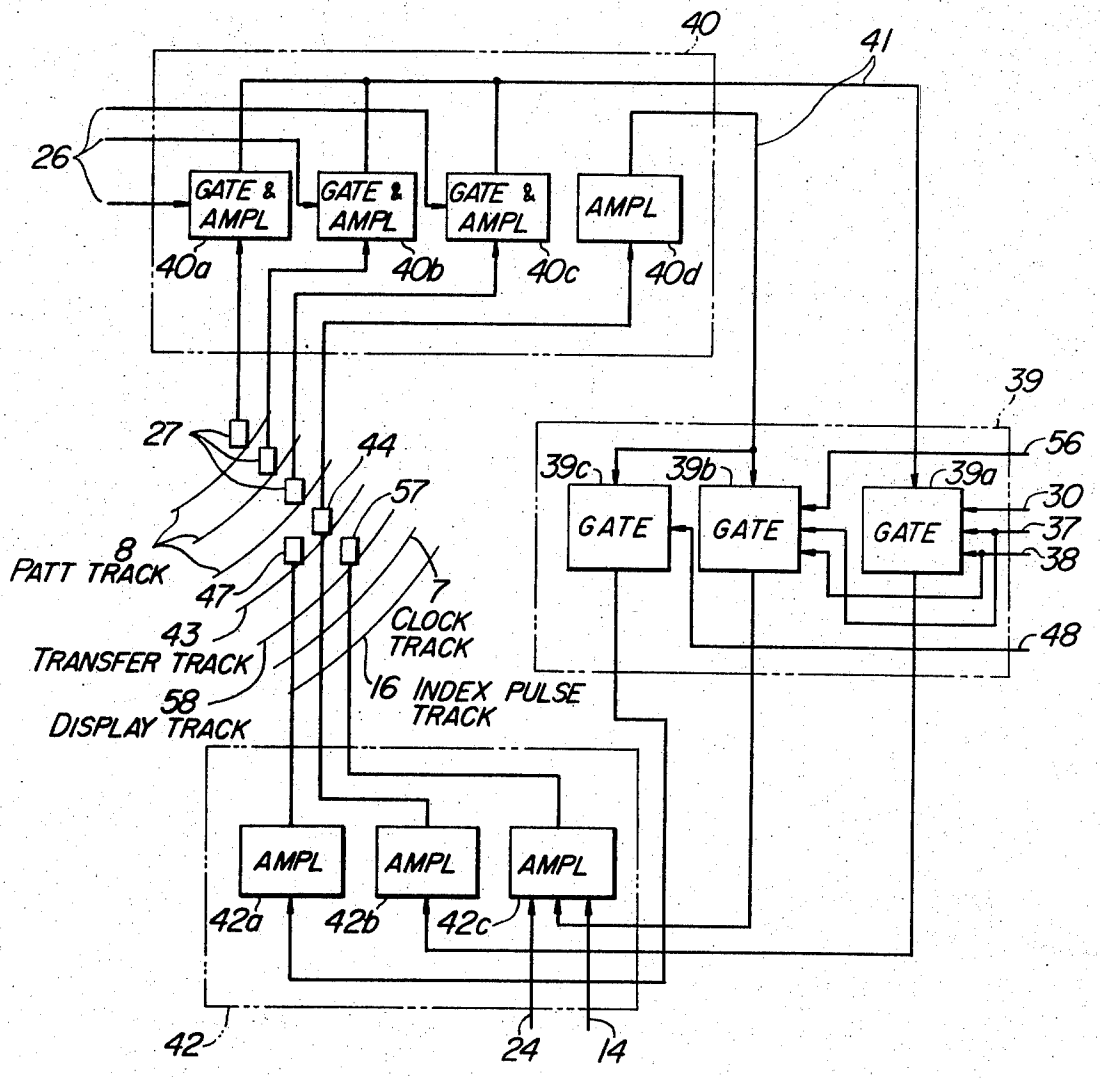
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FIG. 2



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FIG. 3

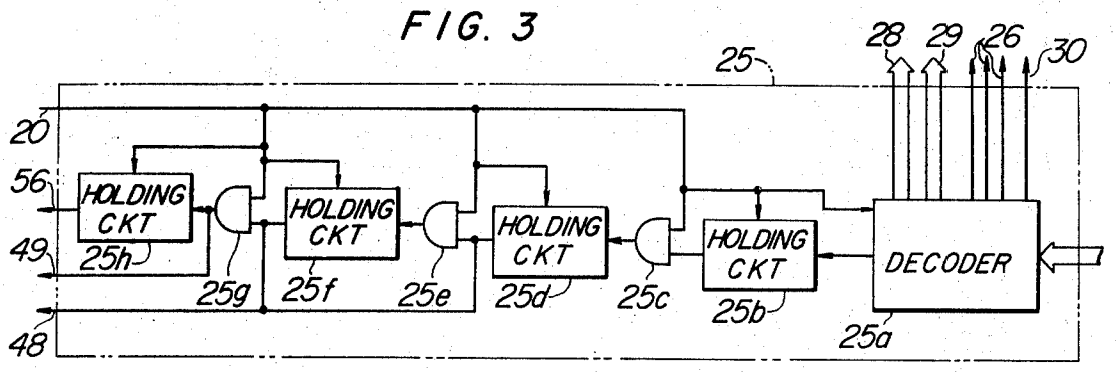


FIG. 4

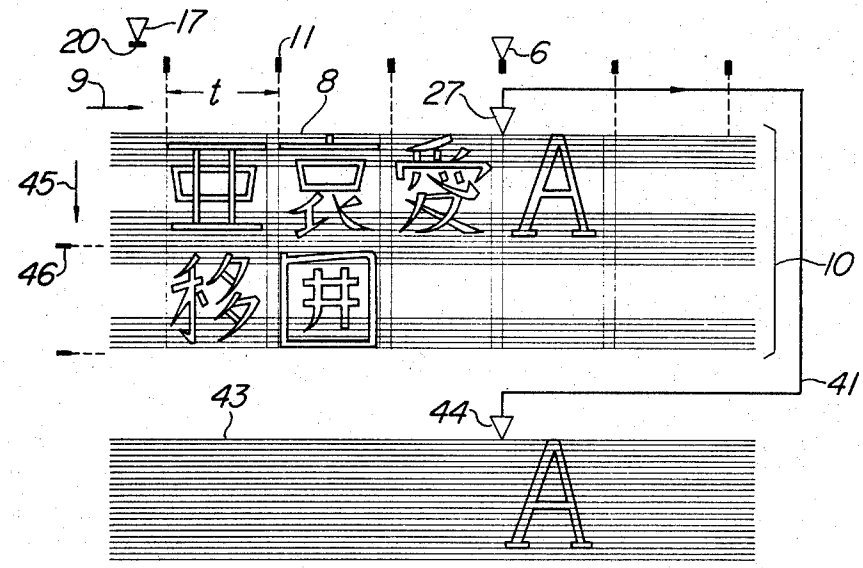
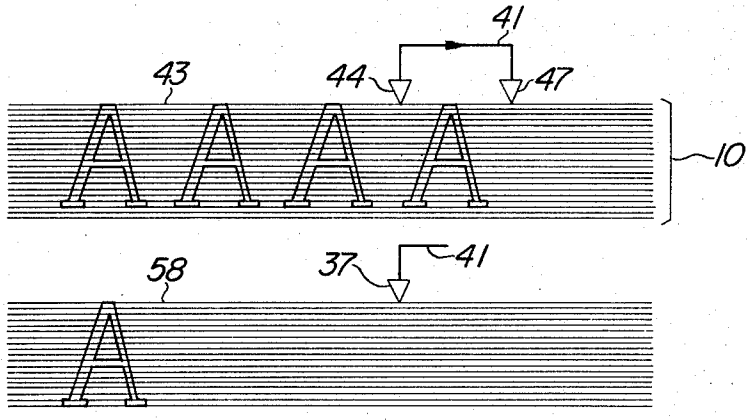


FIG. 5



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VIDEO GENERATOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a video generator.

2. Description of the Prior Art

Teletype apparatus connected to computers have generally been employed heretofore as a means for carrying out man-machine communication. However, to meet the recent demand for handling information at a higher speed with better efficiency, a display system of the kind displaying characters and any other patterns on a CRT (cathode-ray tube) on the basis of the video technique used in television is gradually replacing the conventional teletype apparatus adapted for printing characters on a sheet of paper. The CRT display is advantageous over the conventional apparatus in that not only man-machine communication of data can be carried out at high speeds but also data displayed on the viewer screen can be visually checked so that necessary correction and re-touch can be easily made on the displayed data. The CRT display is further advantageous in that printed data need not be kept at hand due to the fact that necessary information can be immediately obtained at any time when so required and thus storage of information media, for example, preservation of printed matters becomes unnecessary. In a system including such a CRT display for displaying character information, a character generator which converts digital information forwarded to or transmitted from the system into video information to be displayed on the CRT occupies a considerable proportion of the whole system. Further, due to the function of the CRT which displays a televised moving picture, the scene is renewed at a rate of more than 30 times per second. According to this system, digital information stored at the receiving or transmitting end is read out one character after another and is then converted into video information. Thus, associated control means are required to continuously operate for the renewal of the scene. The above fact means that a set of a character generator and associated control means is required for each CRT, and this is a great hindrance to the desired reduction in the cost of the CRT display system.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a video generator including a character generator and associated control means capable of simultaneously serving a plurality of CRT displays.

Another object of the present invention is to provide a video generator whose cost per display is quite low.

The video generator according to the present invention is provided with a magnetic disc which has a number of concentric tracks. These tracks include a clock track on which clock pulses are recorded at equal intervals, a plurality of pattern tracks on which various kinds of characters are recorded at an interval equal to the interval between the clock pulses recorded on the clock track, a transfer track and at least one display track. One complete rotation of the magnetic disc corresponds to one scene displayed on the CRT display, and they are in synchronism with each other. The CRT display displays successively the characters written on the display track. All the characters to be displayed are recorded on the pattern tracks, and in response to the application of a character code from external means, the corresponding character is read out from the pattern tracks to be repeatedly written on the transfer track at an interval equal to the interval between the clock pulses recorded on the clock track. Therefore, the transfer track is entirely filled with a train of the selected single characters which are written on such track at an interval equal to the interval between the clock pulses. In response to a display position signal, the character at the corresponding position on the transfer track is written on the display track at the same position with respect to the clock. Display means reads out successively the characters written on the display track and displays such characters on the CRT display so that the desired characters can be displayed at the desired positions on the CRT display

The present invention which utilizes a magnetic disc is advantageous in that associated control means are free from continuous operation for the scene renewal at a rate of more than thirty times per second.

A plurality of display tracks may be provided and connected to respective CRT displays so that these CRT displays can be simultaneously controlled and the cost of the system per CRT display can be reduced.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of an embodiment of the present invention.

FIG. 2 is a diagram showing the detailed structure of the video switching circuit and associated elements shown in FIG. 1.

FIG. 3 is a diagram showing the detailed structure of the control circuit shown in FIG. 1.

FIG. 4 is a diagrammatic view illustrating the manner of transferring a character from a pattern track to a transfer track.

FIG. 5 is a diagrammatic view illustrating the manner of repeatedly recording the character on the transfer track and transferring the character from the transfer track to a display track.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, there is shown a video generator embodying the present invention which includes a magnetic disc 3 adapted to be continuously driven in a direction of the arrow 5 by a servomotor 4. A number of concentric tracks are provided on the magnetic disc 3, and a number of magnetic heads are associated with the respective tracks. The outermost track is a clock track 7 on which clock pulses are recorded at equal intervals to be read out by as associated magnetic head 6. The clock pulses read out by the magnetic head 6 are applied to a pulse circuit 12 in which they are subject to wave shaping and amplification and are then applied to a character horizontal position counter 13 which counts the horizontal position of characters. When the character horizontal position counter 13 counts a fixed value, an overflow output appears from the horizontal position counter 13 to be applied to a line counter 15 by a lead 14. The character horizontal position counter 13 is reset to its initial value or 0 after having applied its overflow output to the line counter 15. This overflow output is also applied to a servo circuit 22 to which the output from a horizontal synchronizing pulse generator

21 is applied by a lead 23. The servo circuit 22 compares the overflow output applied from the character horizontal position counter 13 with the horizontal synchronizing pulses applied from the horizontal synchronizing pulse generator 21 so as to ensure regular rotation of the magnetic disc 3. The horizontal synchronizing pulses are also applied to a CRT display 1 to act as a signal for starting the horizontal scanning in the CRT display 1. In the CRT display 1, a viewer screen 2 is scanned according to the scanning method employed in television and horizontal scanning rasters appear in synchronism with the horizontal synchronizing pulses. Thus, the scanning in the CRT display 1 and the rotation of the magnetic disc 3 are in synchronism with the horizontal synchronizing pulses generated by the horizontal synchronizing pulse generator 21.

An index pulse track 16 is disposed adjacent to the clock track 7. A single pulse or index pulse is recorded on the circumference of the index pulse track 16 and this pulse is read out by an associated magnetic head 17. The index pulse read out by the magnetic head 17 is applied by a lead 18 to a pulse circuit 19 which is similar to the pulse circuit 12. The output from the pulse circuit 19 is applied by a lead 20 to the character horizontal position counter 13 and line counter 15 to reset same.

The magnetic disc 3 is further provided with a plurality of pattern tracks 8. Character patterns of all the characters including the letters of the alphabet, Arabic numerals and special symbols used for display are recorded in the form of an analog video signal on the pattern tracks 8 at an interval equal to the interval between the clock pulses recorded on the clock track 7. The character patterns recorded on the pattern tracks 8 are read out by associated video heads 27 to be supplied to a video read-out amplifier 40.

FIG. 4 shows one of the pattern tracks 8 and the characters are shown in the same form as when they are displayed on the CRT display 1 for the convenience of easy understanding. FIG. 4 also shows the clock pulses 11 recorded on the clock track 7 and it will be seen from FIG. 4 that the characters are recorded on the pattern track 8 at an interval equal to the interval t between the clock pulses 11.

A transfer track 43 is disposed adjacent to the outermost pattern track 8. A magnetic head 44 is connected to the video readout amplifier 40 and to a video write-in amplifier 42, and a magnetic head 47 is connected to the video write-in amplifier 42. The transfer track 43 is associated with these magnetic heads 44 and 47, and a character pattern selected from one of the pattern tracks 8 is transferred to the transfer track 43 from such pattern track 8. The magnetic heads 44 and 47 are spaced apart by one character, that is, by the pulse interval of the clock pulses recorded on the clock track 7, and for the reason which will be described later, a train of single character patterns are written on the entire circumference of the transfer track 43.

The magnetic disc 3 is further provided with a display track 58. The display track 58 is associated with a magnetic head 57 connected to the video write-in amplifier 42, and the character pattern transferred to the transfer track 43 is written by the head 57 on the display track 58. The display track 58 is further associated with another magnetic head 59. This magnetic head 59 is connected to the CRT display 1 through a video amplifier 60 so that the character pattern on the display track 58 can be displayed on the viewer screen 2 of the CRT display 1. One complete rotation of the magnetic disc 3 corresponds to one scene displayed on the viewer screen 2, and therefore, the display track 58 has a number of positions which correspond to the respective displaying positions on the viewer screen 2. For instance, the starting point of the display track 58 corresponds to the first character in the first line on the viewer screen 2.

In the CRT display 1, 30 rasters constitute one line and thus one character is constituted by 30 rasters. The CRT display 1 displays 10 lines each consisting of 20 characters and the fly-back time of each raster is selected to be equal to the period of two characters, that is, $2t$ in which t is the clock pulse interval. 6,600 clock pulses are recorded on the clock track 7 at equal intervals. The character horizontal position counter 13 counts 22 clock pulses and is reset after applying its overflow output to the line counter 15 in response to the 23rd clock pulse. The count of the line counter 15 is advanced by 1 after having been applied with 30 overflow pulses from the character horizontal position counter 13. Thus, the character horizontal position counter 13 and the line counter 15 indicate the angular position of rotation of the magnetic disc 3, and at the same time, indicate the displaying position on the CRT display 1.

A character code for the purpose of display of a specific character is applied to a decoder 25*a* (FIG. 3) in a control circuit 25 by a lead 24. The index pulse is applied from the pulse circuit 19 to the control circuit 25 by the lead 20 so that the control circuit 25 operates in synchronism with the index pulse. The decoder 25*a* decodes the character code applied thereto and delivers a track selecting level signal 26, a character horizontal position specifying signal 28, a line specifying signal 29 and a position selecting level signal 30. The track selecting level signal 26, character horizontal position specifying signal 28 and line specifying signal 29 represent the position of the character of the applied character code on the pattern track 8. Suppose that a character code representing the character A is applied by the lead 24. It is known from FIG. 4 that the position of the character A on the magnetic disc 3 corresponds to the fourth position in the first line. Therefore, the character horizontal position specifying signal 28 and the line specifying signal 29 delivered from the decoder 25*a* are 00100 and 0000 respectively according to the binary notation. Further, another output from the decoder 25*a* acts to set a holding circuit 25*b* to be utilized as a signal which will be described later.

The character horizontal position specifying signal 28 is applied to a gate 31, while the line specifying signal 29 is applied to a gate 32. Simultaneously with the application of the character horizontal position specifying signal 28 and the line specifying signal 29 to the respective gates 31 and 32, the position selecting level signal 30 is applied to these gates 31 and 32 from the decoder 25*a* for opening these gates. As a result, these specifying signals 28 and 29 are applied through the gates 31 and 32 to comparators 33 and 34 respectively. The comparator 33 compares the output 35 from the character horizontal position counter 13 with

the output from the gate **31**, and when these two signals coincide with each other, a coincidence output appears from the comparator **33** on a lead **37**. The comparator **34** compares the output **36** from the line counter **15** with the output from the gate **32**, and when these two signals coincide with each other, a coincidence output appears from the comparator **34** on a lead **38**. The appearance of the coincidence signals from both these comparators **33** and **34** shows the fact that the desired character pattern A is located beneath the associated video head **27**. The coincidence outputs from the respective comparators **33** and **34** and the position selecting level signal **30** from the decoder **25***a* are applied to a gate **39***a* in a video switching circuit **39** as shown in FIG. **2**. The gate **39***a* is opened solely when the coincidence signals appears on both the leads **37** and **38**. Since there are a plurality of pattern tracks **8**, the specific track **8** having the character pattern A thereon must be specified. To this end, the track selecting level signal **26** obtained by decoding the given character code is applied from the decoder **25***a* to gates and amplifiers **40***a*, **40***b* and **40***c* in the video read-out amplifier **40** so as to select only one video head **27**. Therefore, the selected video head **27** associated with the specific pattern track **8** is connected to the head **44** associated with the transfer track **43** through the gate **40***a*, **40***b* or **40***c*, video signal lead **41**, gate **39**a and amplifier **42***b* so that the character pattern A on the specific pattern track **8** is written on the transfer track **43** by the head **44**. Further rotation of the magnetic disc **3** advances the count of the character horizontal position counter **13**. As a result, the coincidence output having appeared on the lead **37** disappears to close the gate **39***a* and no information is written on the transfer track **43** by the video head **44**. Upon counting 23 clock pulses **11**, the character horizontal position counter **13** delivers an overflow pulse and is reset to the initial state of 00000. However, due to the fact that the line counter **15** is designed so that 30 overflow pulses applied from the character horizontal position counter **13** advances the count by 1, the coincidence output is continuously delivered from the comparator **34** to appear on the lead **38** during this period of time. The coincidence output is delivered from the comparator **33** to appear on the lead **37** again when further rotation of the magnetic disc **3** advances the count of the character horizontal position counter **13** to 00011 again. Thus, the gate **39***a* is opened in response to the application of both the coincidence outputs from the comparators **33** and **34** by the leads **37** and **28**, and **38**, video head **44** associated with the transfer track **43** is connected to the selected video head **27** associated with the specific pattern track **8** to write the character pattern on the transfer track **43**. Since one character is constituted by 30 rasters, on-off of the coincidence output on the lead **37** is repeated 30 times at an interval of 23 clock pulses during the period of time in which the coincidence output appears continuously on the lead **38**, that is, during the period of time of 660 clocks, and the gate **39***a* is opened 30 times during one complete rotation of the magnetic disc **3**. In other words, the pattern track **8** is in the form of a series connection of 130 rasters or scanning lines **10** (30 rasters per character × 10 lines), or more precisely, referring to FIG. **4**, the pattern track **8** comprises a raster train in which the rasters **10** are successively connected in series from above from a direction shown by the arrow **9** toward a direction shown by the arrow **45**. Therefore, a character pattern on the pattern track **8** comprises a series of rasters **10** ranging from the first 30th raster **10** with the adjacent rasters being spaced apart by 23 clock pulses. Thus, the gate **39***a* is opened 30 times at an interval of 23 clocks during one complete rotation of the magnetic disc **3**.

Even when the character pattern A is transferred from the pattern track **8** to the transfer track **43**, the character pattern is merely transferred to a different track to occupy the same position with respect to the specific clock and cannot be displayed at the desired position on the viewer screen **2**. If the character pattern A on the transfer track **43** is displayed on the viewer screen **2**, it will be displayed at the fourth character position in the first line. This character pattern A can be displayed at any desired position on the viewer screen **2** by writing the character pattern A on all the positions of the transfer track **43** so that the same character A may be displayed over the entire surface of the viewer screen **2**. By this arrangement, the character A can be displayed at any desired position on the viewer screen **2** by selectively deriving the video signal representative of the character A from this position of the track for displaying the character A.

The transfer of the character pattern A from the pattern track **8** to the transfer track **43** is completed upon one rotation of the magnetic disc **3**. After this transfer operation, the index pulse is applied to an AND gate **25***c* by the lead **20** to open the AND gate **25***c* thereby setting a holding circuit **25***d* and resetting the holding circuit **25***b*. The output from the holding circuit **25***b* is applied by a lead **48** to a gate **39***c* in the video switching circuit **39** to open the gate **39***c*. As a result, the head **44** is connected through an amplifier **40***d*, gate **39***c* and amplifier **42***a* to the head **47** which is spaced apart from the head **44** by one clock position on the same transfer track **43**. Thus, the character pattern A having been read out by the head **44** is written by the head **47** at a position which is advanced by one clock position. After the period of time corresponding to one clock pulse interval, the video signal having been written by the hand **47** is read out by the head **44** and this video signal is written by the head **47** again at a position which is advanced by one clock position. The above operation is repeated during the rotation of the magnetic disc **3** so that the character A is repeatedly written on the transfer track **43**. The position at which the video signal is transferred from the pattern track **8** to the transfer track **43** varies depending on the character pattern, and therefore, the repeated writing described above does not necessarily take place in response to the appearance of an index pulse due to the decoding of a character code. In the case of the character A, the repeated writing takes place in a period of time corresponding to 4 clocks after an index pulse has appeared. The character A is not yet written on the entire circumference of the transfer track **43** at the time at which the next index pulse appears, and the magnetic disc **3** must be rotated for a period of time corresponding to 4 clocks in order that the character A can be written on the entire circumference of the transfer track **43**. In other words, the magnetic disc **3** must make two complete rotations in order that the same

character can be written on the entire circumference of the transfer track **43**. To this end, the lead **48** is also connected to a holding circuit **25***f* so as to maintain the signal until the magnetic disc **3** completes two rotations thereby to keep open the gate **39***c* during this period of time. Thus, the character A is written on the entire circumference of the transfer track **43**. When the pattern on the transfer track **43** is displayed on the viewer screen **2**, the character A will be displayed over the entire surface of the viewer screen **2** as seen in FIG. **5**. The character A will also be written on the portions corresponding to the fly-back period of the two character length, but this character is not displayed.

The character pattern A repeatedly written on the transfer track **43** is then transferred to the display track **58**. The operation for transferring this character pattern A to the display track **58** so as to display the character A at a desired position on the viewer screen **2** will now be described. At the time at which the repeated writing of the character pattern A on the transfer track **43** is completed, the holding circuit **25**f is in its set position, and in response to an index pulse appearing thereafter, an AND gate **25***g* is opened to set a holding circuit **25***h* in place of the holding circuit **25***f*. The AND gate **25***g* delivers a specified position advancing pulse which is applied to a horizontal position specifying counter **50** by a lead **49**. The count of the horizontal position specifying counter **50** is advanced each time the advancing pulse is applied thereto. The horizontal position specifying counter **50** is reset to 0 after counting 20 which is equal to the number of characters to be displayed in one line on the viewer screen **2**, and at the same time, the count of a vertical position specifying counter **51** is advanced. The count of these two counters **50** and **51** is advanced in the manner above described in response to the application of a character code to the control circuit **25** thereby to indicate the position of the specific character on the viewer screen **2**. The output lead **56** of the holding circuit **25***h* is connected to gates **54** and **55** so that the signal applied from the holding circuit **25***h* opens these gates **54** and **55** with the result that the outputs **52** and **53** from these two counters **50** and **51** are applied to the comparators **33** and **34** respectively. As described previously, the respective outputs **35** and **36** from the character horizontal position counter **13** and line counter **15** represent the angular position of rotation of the magnetic disc **3** corresponding to the scanning position for the viewer screen **2**, and these two outputs **35** and **36** are applied to the respective comparators **33** and **34** as another input thereto. The coincidence outputs appearing on the output leads **37** and **38** of the respective comparators **33** and **34** and the signal appearing on the output lead **56** of the holding circuit **25***h* are applied to a gate **39***b* to open same thereby connecting the head **57** associated with the display track **58** to the head **44** associated with the transfer track **43** so that the character pattern A at the position coinciding with the displayed position on the viewer screen **2** is written by the head **57** on the display track **58** at the same position with respect to the specific clock. The head **59** associated with the display track **58** is connected to the CRT display **1** so that the pattern on the display track **58** is displayed on the viewer screen **2** of the CRT display **1**. Since the rotation of the magnetic disc **3** is in synchronism with the scanning on the viewer screen **2**, the position on the display track **58** is exactly displayed as the position on the viewer screen **2**. For example, when the horizontal position specifying counter **50** and the vertical position specifying counter **51** indicate that the character A be displayed at the first character position in the first line on the viewer screen **2**, the first character pattern A on the transfer track **43** corresponding to this position is selected and written at the first clock position of the display track **58**. In writing the video signal on the display track **58**, the index pulses or vertical synchronizing signal appearing on the lead **20** and the overflow pulses appearing on the lead **14** are superposed on the video signal so as to obtain a so-called composite video signal and this composite video signal is written on the display track **58**.

The above description has referred to the case in which the character pattern A is selected and written at a desired position in response to the application of the character code representative of the character A by the lead **24**. It will be seen that a video signal representative of a desired character is read out from the pattern track **8** and is repeatedly written on the transfer track **43** so that the character can be displayed at any desired position on the viewer screen **2**. The character pattern at the desired position is read out from the transfer track **43** having a series of such character patterns repeatedly written thereon and is written on the display track **58**. In this manner, various characters are successively written on the display track **58**, and the video head **59** associated with the display track **58** reads out these character patterns in response to the synchronizing signal so as to display the characters on the viewer screen **2** of the CRT display **1**.

According to the present invention, a plurality of display tracks **58** may be provided and connected to a plurality of CRT displays **1** respectively so as to simultaneously control these CRT displays **1**. In this case, gates and amplifiers similar to the gates and amplifiers **40***a*–**40** disposed in the video read-out amplifier **40** may be provided in the video write-in amplifier **42**. An external signal indicating a specific display number may be applied to the control circuit **25** to open the gate and amplifier for the display track corresponding to the specific display number so that a specific character pattern is transferred from the transfer track to be written on the specific display track. Once the character pattern is selected and written on the display track, the operation for generating the character pattern is unnecessary because the character pattern to be displayed exists on the display track already. Thus, the system is now free to operate for the selection and display of characters for other viewer screens and can singly serve the character selecting operation for all the CRT displays.

I claim:

1. A video generator comprising a continuously driven magnetic disc provided with a clock track having clock pulses recorded thereon at equal intervals, a pattern track having various kinds of character patterns recorded thereon at an interval equal to the interval between the clock pulses recorded on said clock track, a transfer track and a display track, display means operating in synchronism with said magnetic disc to read out the character patterns on said display track for

successively displaying the characters on a display unit, means for reading out a specific character pattern from said pattern tracks in response to the application of a specific character code to repeatedly write said character pattern on said transfer track at an interval equal to the interval between the clock pulses recorded on said clock track, and means responsive to a display position signal for writing the character pattern occupying the specified position of said transfer track on said display track at the same position with respect to the specific clock.

2. A video generator as claimed in claim 1, in which said magnetic disc is provided with a plurality of display tracks, and a plurality of display units are connected to said display tracks respectively so that said display units can be simultaneously controlled.

3. A video generator as claimed in claim 1, in which said transfer track is associated with two magnetic heads which are spaced apart by one clock pulse interval of the clock pulses recorded on said clock track, and the head disposed on the trailing side with respect to the direction of rotation of said magnetic disc reads out the character pattern from said transfer track, while the other magnetic head disposed on the leading side writes the character pattern on said transfer track so as to repeatedly write the character pattern on said transfer track.

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