

- [54] METHOD AND APPARATUS FOR
INDEPENDENT COLOR CONTROL OF
ALPHANUMERIC DISPLAY AND
BACKGROUND THEREFOR
- [75] Inventor: **Minoru Takeda**, Hirakata, Japan
- [73] Assignee: **Matsushita Electric Industrial Co., Ltd.**, Kadoma, Japan
- [22] Filed: **Sept. 10, 1973**
- [21] Appl. No.: **395,836**

Related U.S. Application Data

- [63] Continuation-in-part of Ser. No. 281,029, Aug. 16, 1972, abandoned, which is a continuation of Ser. No. 78,125, Oct. 5, 1970, abandoned.

Foreign Application Priority Data

- [30] Oct. 8, 1969 Japan..... 44-80940
- [52] U.S. Cl..... 340/324 AD; 340/366 CA
- [51] Int. Cl.²..... G06F 3/14
- [58] Field of Search..... 340/324 AD, 324 R, 324 A, 340/366 CA; 178/5.4 AC, 5.4 CD, 5.2 R

[56] **References Cited**
UNITED STATES PATENTS

3,284,663	11/1966	Stocker.....	340/324 AD
3,307,170	2/1967	Aoyama et al.....	340/324 R
3,345,458	10/1967	Cole et al.....	340/324 AD

Primary Examiner—Marshall M. Curtis
Attorney, Agent, or Firm—Stevens, Davis, Miller & Mosher

[57] **ABSTRACT**

A signal which represents the background color of a pattern to be displayed on a color cathode ray tube device is inserted in the space of at least one character to be displayed between one character signal and the preceding character signal. By determining the background color of a group of patterns from a signal representing the background color, which appears next to the pattern signal, an improvement in the display function is made possible without increasing the capacity of the memory employed in an alphanumeric display.

6 Claims, 8 Drawing Figures

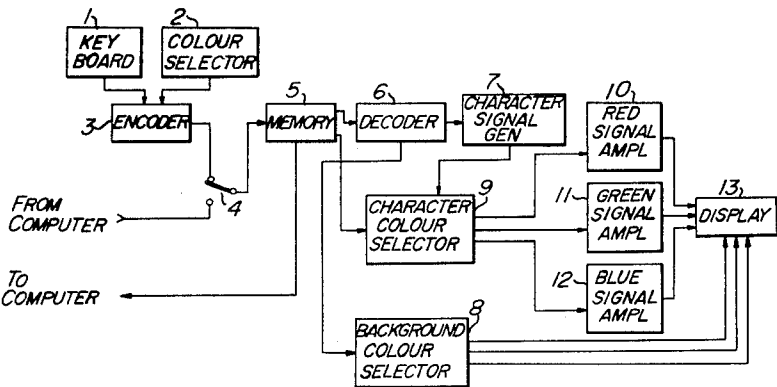


FIG. 1



FIG. 2a

BACKGROUND
COLOUR
SIGNAL

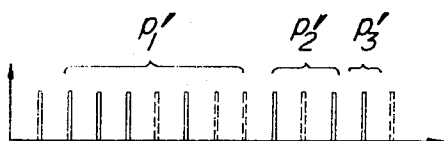


FIG. 2b

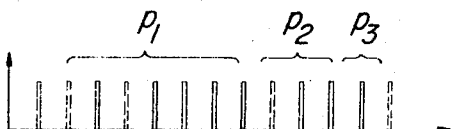
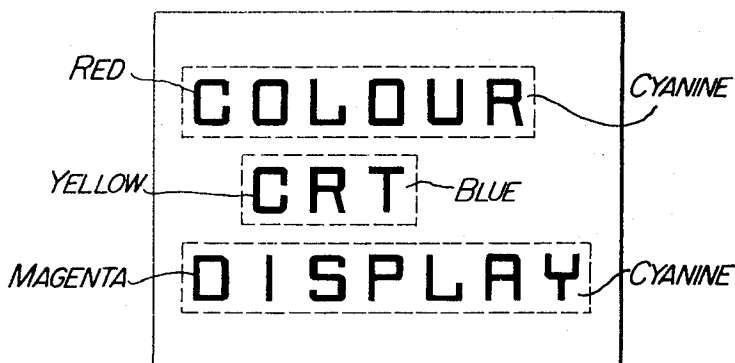


FIG. 5



M. TAKEDA

INVENTOR

BY *Stevens, Davis, Miller & Moskowitz*

ATTORNEYS

FIG. 3

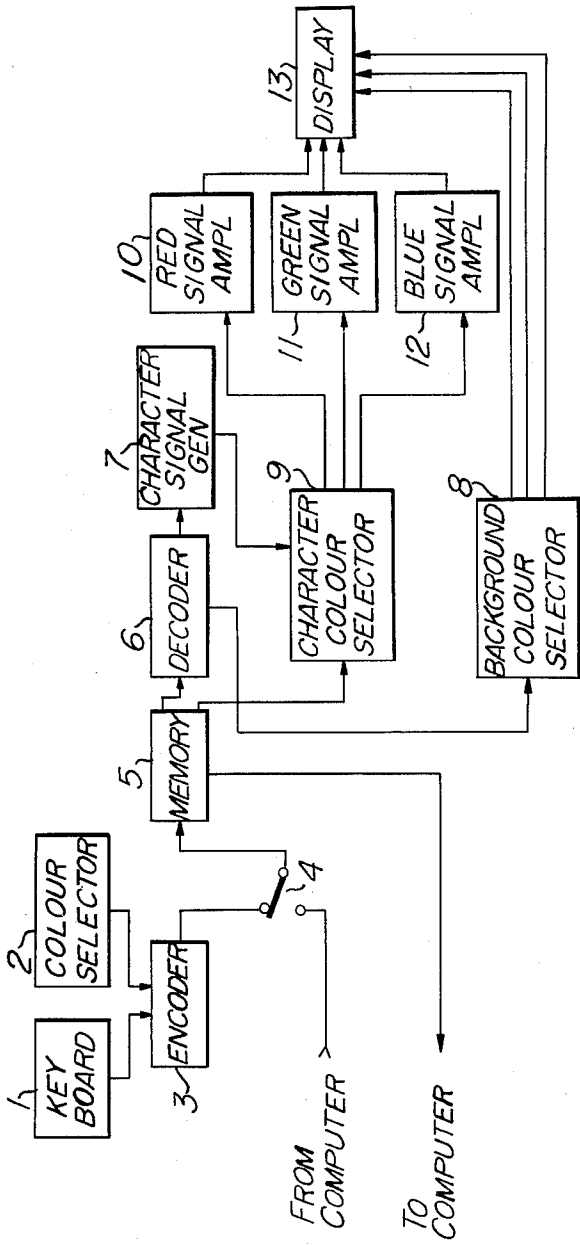
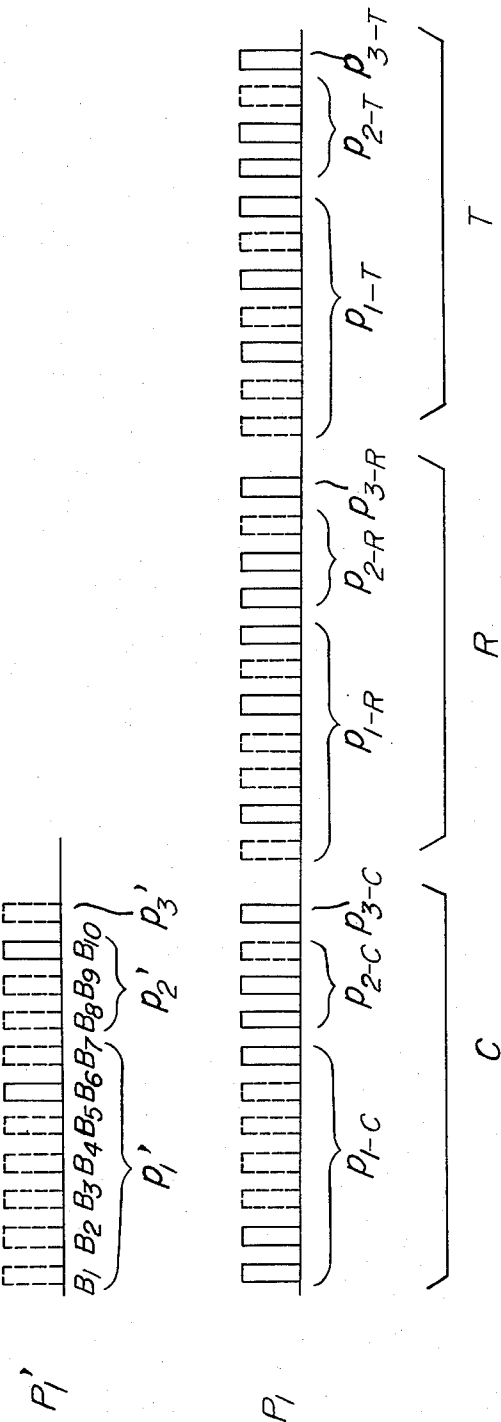


FIG. 7



METHOD AND APPARATUS FOR INDEPENDENT COLOR CONTROL OF ALPHANUMERIC DISPLAY AND BACKGROUND THEREFOR

CROSS-REFERENCE TO RELATED APPLICATION

The present application is a continuation-in-part application of the copending application Ser. No. 281,029 filed on Aug. 16, 1972, now abandoned, which is in turn a continuation application under the Rule 60 of the earlier application Ser. No. 78,125 filed on Oct. 5, 1970, now abandoned.

The present invention relates to an alphanumeric display method and a device therefor, and more particularly to a method of color alphanumeric display on a color cathode ray tube and a device therefor.

With the development of signal processing techniques, the technique has been coming into use in which the output of signal processing means such as, for example, electronic computers, transmission signals in communications systems, and the like are directly displayed on a cathode ray tube in the form of numerals, characters, symbols, etc., hereinafter referred to collectively as "characters."

When signals are to be displayed in the form of such characters, the background color of the displayed characters has a considerable effect on the display. It is desirable for a prompt and exact understanding of the operator to display processed information on a cathode ray tube in such a manner that the background color of words, numerals, etc. to which particular attention is to be paid is made different from that of the remaining words, numerals, etc., or the display color of certain characters per se is made different from that of the remaining ones.

An ordinarily utilized character can be represented by a signal of 7 bits. In addition, a signal of 3 bits for specifying display color and a signal of 1 bit for parity check are necessary. Thus, a total of 11 bits is required to display one character. On the other hand, the background color can be determined by a signal of 3 bits. However, considering the capacity of the memory in a display system, it is practically difficult from the economical point of view to add the signal of 3 bits for the background color to the signal of 11 bits for each character because of the increase in the number of bits.

An object of the present invention is to provide a method of displaying characters in a plurality of colors while adding a signal representing the background color to a signal representing each of the characters without increasing the number of bits of a given character.

Another object of the present invention is to provide a method of increasing the kind of colors in which characters are displayed without increasing the capacity of the memory in a display system by inserting a signal determining the background color in each space interval between words.

A further object of the present invention is to provide a system for carrying out the above-mentioned method.

According to one aspect of the present invention, an alphanumeric display method is provided comprising the step of inserting a signal specifying the background color of a word of at least one character, represented by a train of pulses, in the space reserved for at least one character between each pulse train representing a word to determine the background color of at least one

of the words corresponding to the pulse train adjacent to the inserted background color signal.

According to another aspect of the present invention, an alphanumeric display system is provided which comprises a signal source for generating a signal corresponding to each character, and a signal indicating each space between words composed of these characters, color selector means for generating a color signal for each of said signals, means for encoding outputs from said signal source and said color selector means, a memory for storing an encoded signal, means for decoding an output of said memory to divide it into a signal representing a pattern of each character, a signal representing the display color of said pattern, and a signal representing the background color of said pattern, means for gating said signal representing each of the characters by said signal representing pattern display color, and means for transmitting a signal supplied by said gating means and said signal representing the background color to a cathode ray tube display device for pattern display.

The present invention will become more apparent from the following detailed description of the preferred embodiments of the invention when taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a diagram showing a pulse train which is obtained by coding characters, numerals or symbols for transmission;

FIGS. 2a and 2b are diagrams showing the detail of the pulse train of FIG. 1;

FIG. 3 is a block diagram of a system for carrying out the method according to the present invention;

FIG. 4 is a diagram of the construction of an important part of the system of FIG. 3;

FIG. 5 is a diagram of a practical pattern display;

FIG. 6 shows a pulse code table for use with this invention; and

FIG. 7 shows an example of a coded pulse sequence for controlling the apparatus of this invention.

A signal which determines the display color of each of the desired characters, numerals and symbols should be added to a signal which represents each of the characters, per se. However, considering the display effect, the background color is not necessary to be determined for each character, but it is sufficient to vary it for each word or for each sentence. Since there is at least one character space between one word and the next succeeding one, the signal which specifies the background color can be easily arranged in this space.

More particularly, as is shown in FIG. 1, there is space for at least one character, i.e., for at least 11 bits, between successive arrangements of signals of 11 bits together constituting a word. A signal P_2' of 11 bits which determines the background color of the word P_2 can be added to signals for the word without increasing the capacity of the memory by inserting the signal P_2' in this space. Among the 11 bits of the signal P_2' , 7 bits are employed as a signal p_1' for indicating that the signal P_2' is a signal relating to the background and not to a character, 3 bits are employed as a signal p_2' for specifying the color of the background, and the remaining 1 bit is employed as a signal p_3' for parity check. FIG. 2a shows the pulse train of the background signal P_2' . FIG. 2b shows the pulse train of a signal for specifying a character in which parts p_1 , p_2 and p_3 are employed as signals for specifying the character, display color and parity check, respectively.

By thus treating the signal for specifying the background color as a signal equivalent to the signal for specifying a character and making the signal of the initial 7 bits indicate the signal of the succeeding 3 bits to be a signal for specifying the background, an increase in the capacity of the memory is avoided. The fact that the signal for determining the color of the characters is added to the signal for representing the characters per se enables a variety of displays on a color cathode ray tube combining the color of the characters and the background color.

Hereunder, a more detailed description will be given about the composition of the pulse sequences as shown in FIGS. 1, 2a and 2b. FIG. 6 shows a pulse coding table for composing pulse sequences indicating a character and a color to be imparted thereto. Each character or space is represented with a ten-bit signal ($B_1 B_2 B_3 \dots B_{10}$). Assuming that a word CRT should be displayed in yellow on a blue background, as an example, the proper pulse sequence to be composed is as shown in FIG. 7, in which signal marks P_1' , P_1 , and etc. correspond to the counterparts shown in FIGS. 1, 2a and 2b. Namely, signal P_1' , consists of a code indicating a space and a code for blue color, while signal P_1 consists of codes representing the characters C, R and T followed by a code for yellow color.

An arrangement for carrying out the above-described method and the operation thereof will next be described with reference to FIG. 3. A keyboard 1, the handling of which is similar to that of a typewriter, is utilized as a signal generator for producing a signal for designating a particular character. The output of the keyboard 1 is supplied, together with the output of a color selector 2 for selecting the color of the character specified by the signal produced by the keyboard 1, to an encoder 3. In the encoder 3, a signal of 7 bits corresponding to the character specified by the signal generated by the keyboard 1, a signal of 3 bits for specifying the display color of the character, and a signal of 1 bit for parity check are combined and once supplied through a switch 4 to a one frame-memory 5 and stored therein. The signals stored in the memory 5 are successively read and transmitted to a signal processing means, for example, a computer.

The signal for specifying the background color is also encoded in the encoder 3, similarly to the signal representing the character, by the keyboard 1 and the color selector 2. The binary signals read from the memory 5 synchronously with the scanning of a cathode ray tube display device are separated in a decoder 6 into a character signal and a background color signal which are supplied to a character signal generator 7 and a background color selector 8, respectively. At the same time, the signal of 3 bits for designating the character color is extracted by means of a character color selector 9 to selectively operate a red signal amplifier 10, a green signal amplifier 11 and a blue signal amplifier 12, depending on the extracted signal. For example, when the color of the character is red, the red signal amplifier 10 is operated to amplify a signal produced by the character signal generator which decodes the binary character signal into a display analogue signal. The amplified output of the red signal amplifier 10 is applied to the corresponding electrode of a color cathode ray tube of a display device 13. At the same time, the signal specifying the background color is also supplied to the color cathode ray tube.

FIG. 4 particularly shows circuits within the character color selector 9 and the background color selector 8, as well as a portion of circuits within the decoder 6. It should be remembered that a background color signal has been inserted in the space between two pulse sequences representing two words. A space instruction is detected by appearance of a bit sequence 0 0 0 0 1 0 for B_1 to B_7 in a sequence of B_1 to B_{10} in the binary signal derived from the memory 5, as will be understood from FIG. 6. A background color signal is obtained from this space instruction signal and a color instruction signal B_8 to B_{10} , and is held in the associated holding circuit 18 (such as a flip-flop) until the next space instruction appears. The outputs of the background color selector 8 are supplied to the control electrodes 135, 136 and 137, respectively, of the color cathode ray tube 13 to determine the background colors. On the other hand, the character signals are applied to the cathodes 132, 133 and 134 of the tube 13.

As has been described above, the background color of a word can arbitrarily be selected by inserting a signal which determines the background color of the characters composing the word into the space between that word and the preceding one.

FIG. 5 is an example of the display on the cathode ray tube 131. In order to make COLOR red and to make the background color thereof cyanine when displaying the words COLOR CRT DISPLAY, the character signal obtained by decoding the coded binary signal is amplified by the red signal amplifier 10 and supplied to the cathode ray tube 13. At the same time, during the period other than the mark period of the signal, that is during the space period, the outputs of the background color selector 8 corresponding to green and blue are supplied to the control electrodes 136 and 137 of the cathode ray tube 13. When CRT is to be made yellow and the background color thereof is to be made blue, the outputs of the amplifiers 10 and 11 are applied to the cathodes 132 and 133, respectively, of the cathode ray tube 13, and, at the same time, during the space period a control signal is applied to the control electrode 137 of the cathode ray tube 13. Similarly when the words DISPLAY are to be made magenta and the background color thereof is to be made cyanine, the character signals obtained by decoding the coded binary signal are supplied to the cathodes 132 and 134 of the cathode ray tube 13, and the control signals are supplied to the control electrodes during the space period.

The signals produced by decoding the coded binary signal are synthesized into a predetermined character pattern at the cathode ray tube display device 13.

What is claimed is:

1. In an electron beam tube character display system wherein the characters to be displayed on an electron beam tube are represented by a series of pulse signals comprising a portion of a pulse train, a method for selecting the color of the background against which said characters are to be displayed, comprising the steps of:
 - representing the background color information as a series of pulses;
 - inserting a pulse series representing said background color information in a space in said pulse train between two pulse series representing respective characters to be displayed; and

controlling the background color generated by said electron beam tube by said pulse series representing said background color information.

2. A method according to claim 1, comprising the further step of inserting said pulse series representing said background color information in a space in said pulse train preceding the pulse series representing the character to be displayed against said background color.

3. A method according to claim 1, comprising the further steps of:

encoding a pulse train with a first pulse series representing said character to be displayed, a second pulse series representing the color of said character to be displayed, and a third pulse series representing the background color against which said character represented by said first pulse series is to be displayed;

transmitting the encoded pulse train to decoding means;

decoding said encoded pulse train into said respective first, second and third pulse series;

applying said second and third pulse series to character color selector means and to background color selector means, respectively;

generating character color and background color control signals in said character color and background color selector means, respectively; and

controlling the electron beam generating means of said electron beam tube with said character color and background color control signals to control the color of the character to be displayed and background against which said character is to be displayed.

4. A method according to claim 1, wherein the pulse series representing a character to be displayed comprises a first series of pulses representing the character, a second series of pulses representing the color of said character and a further pulse representing a parity check signal; and wherein said pulse series representing said background color information comprises a first series of pulses identifying the signal as a pulse series representing background color, a second series of pulses

identifying said background color, and a further pulse representing a parity check signal.

5. A method according to claim 4, wherein said first and second pulse series comprising the pulse series representing said character to be displayed comprise seven pulses and three pulses, respectively; and wherein said first and second series of pulses comprising said pulse series representing said background color information comprise seven pulses and three pulses, respectively.

6. An electron beam tube character display system comprising:

first means for generating a first pulse series representing a character to be displayed and the color of said character;

second means for generating a second pulse series representing the background color against which said character represented by said first pulse series is to be displayed;

means coupled to said first and second generating means for encoding said first and second pulse series into a composite pulse train;

means coupled to said encoding means for storing the encoded pulse train;

means coupled to said storing means for decoding the stored encoded pulse train into said respective first and second pulse series and for decoding the decoded first pulse series into two further signals representing the identity of the character to be displayed and the color thereof;

means coupled to said decoding means for generating control signals representing the identity of the character to be displayed, the color thereof, and the color of the background against which said character is to be displayed;

a color display tube having electron beam generating means; and

means coupling said control signal generating means to said electron beam generating means of said display tube for controlling the electron beam generated thereby with said control signals representing the identity of said character, the color thereof and said background color.

* * * * *

45

50

55

60

65