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Adkins

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[54] **DOT MATRIX GRAPHIC CHARACTER GENERATOR**

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[52] **U.S. Cl.** .....**340/324 AD,** 315/18, 315/22

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

[58] **Field of Search** .....340/324 A, 324 AD; 315/18, 22

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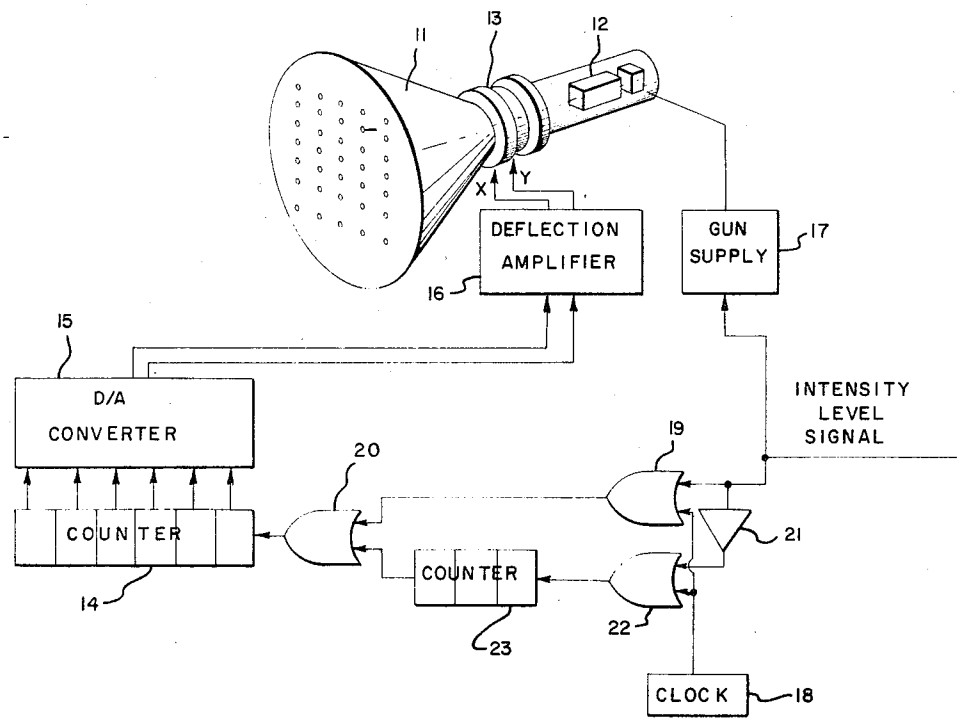
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[57] **ABSTRACT**

In a dot matrix type character generator for displaying graphic information the cathode ray beam dwells on a dot location only if that dot is intensified. The matrix generator has a plurality of dot locations on a phosphor screen which are selectively energized by a cathode ray beam. The intensity of the beam is modulated with an on-off intensity level signal. The beam indexes from dot to dot in a fixed pattern. Logic circuitry senses when a dot is to be intensified by the beam. In this case the beam dwells on the dot. Otherwise the beam is indexed from dot to dot by high speed clock pulses.

4 Claims, 6 Drawing Figures



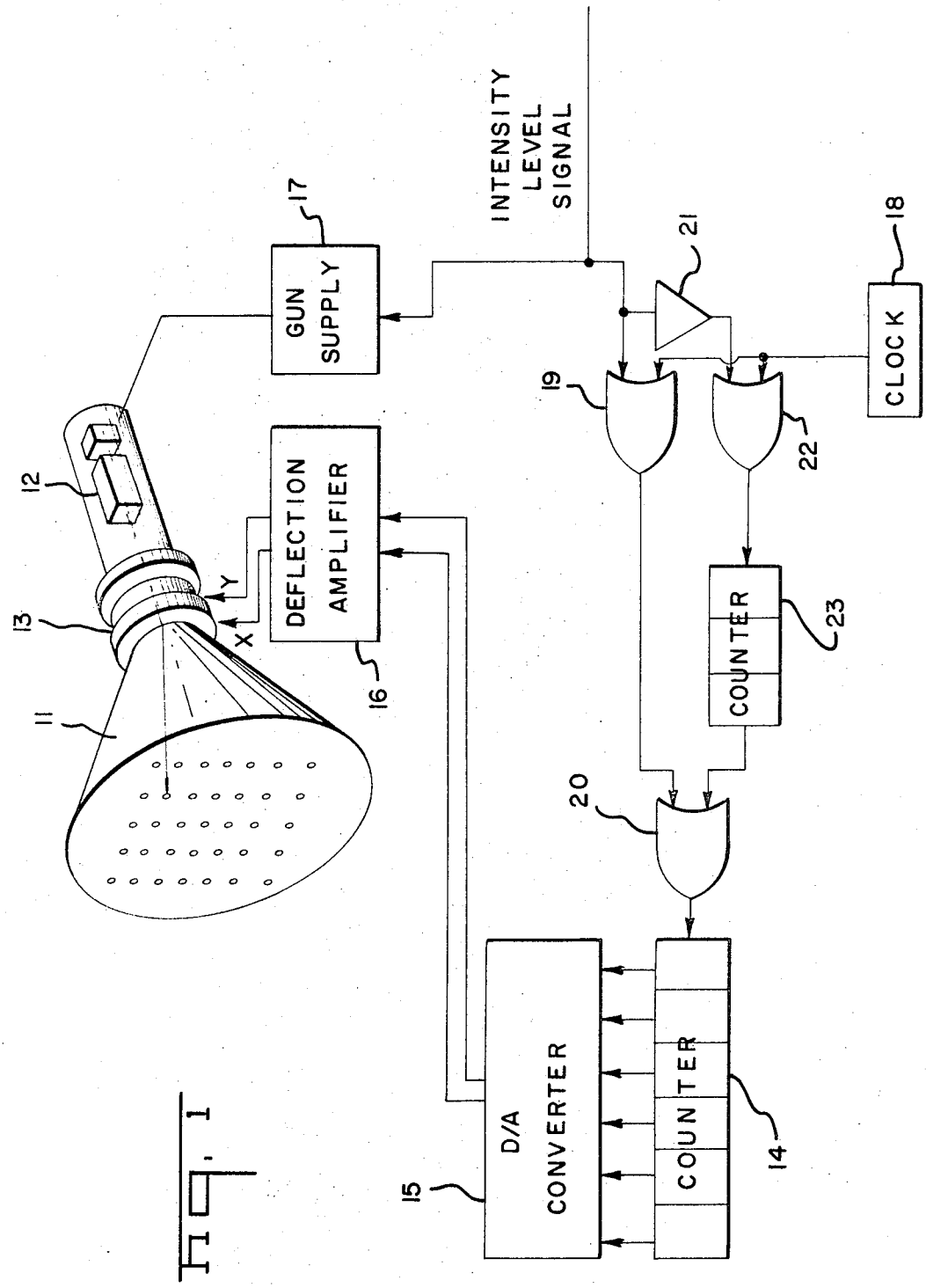

INTENSITY LEVEL SIGNAL
GUN SUPPLY
17
DEFLECTION AMPLIFIER
16
Y
X
12
13
11
21
18
CLOCK
19
22
COUNTER
23
20
D/A CONVERTER
15
COUNTER
14

Fig. 1

Fig. 2

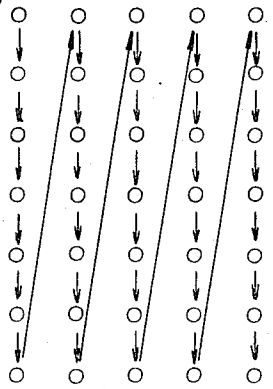


Fig. 3

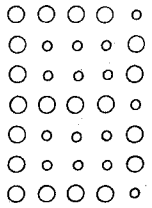
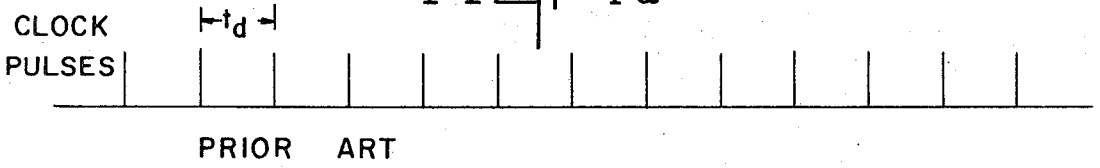


Fig. 4a



PRIOR ART

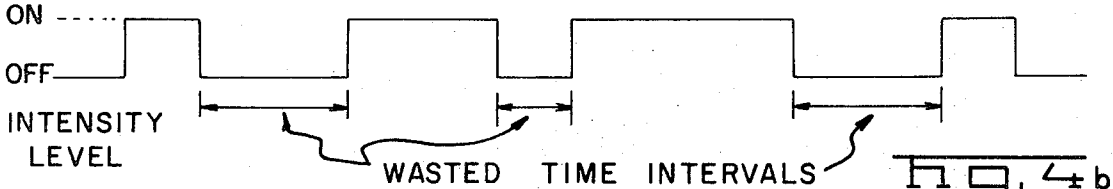
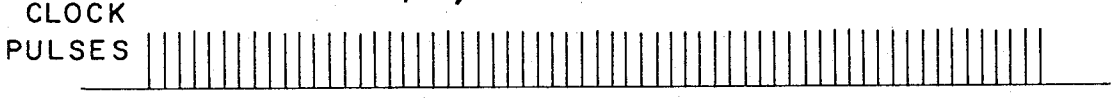


Fig. 4b

Fig. 5a



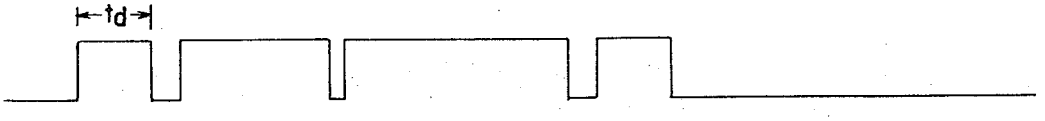


Fig. 5b

DOT MATRIX GRAPHIC CHARACTER GENERATOR

BACKGROUND OF THE INVENTION

This invention relates to graphic character generators and more particularly to a graphic character generator which operates in a time-saving mode.

A dot matrix generator contains a phosphor screen with a fixed number of display locations, or dots, which are selectively energized by a movable energy beam, usually a cathode ray beam. The cathode ray beam is deflected from dot to dot in a fixed pattern. By intensifying selected dots, graphical information is displayed on the cathode ray tube.

In character display systems of this type the electron beam must dwell on a dot a certain period of time in order to intensify it. In prior art systems the cathode ray beam is indexed at a constant rate from dot to dot and dwells on each dot location the same period of time. The time period of dwell is determined by the time required to intensify the dot. Because of this, the dwell time spent on non-intensified dots is wasted as far as the display of graphic information is concerned.

SUMMARY OF THE INVENTION

In accordance with this invention the indexing rate of the energy beam in a dot matrix character generator changes in accordance with whether a dot location is being intensified or not intensified. The beam is indexed from dot to dot by high speed clock pulses until the beam reaches a dot which is to intensified. Then, the beam dwells on that dot for a time period sufficient to intensify the dot.

The intensity of the beam is modulated with an on-off intensity level signal which is generated in timed relation with the clock pulses. In accordance with another aspect of this invention, logic circuitry responds to the clock pulses and to the intensity level signal to produce index pulses in time coincidence with the clock pulses when the intensity level signal is off and producing index pulses time spaced by a dwell time when the intensity level signal is on.

In character generators of this type it is common to deflect the energy beam from dot to dot by deflection circuitry which includes a digital counter controlling a digital-to-analog converter. The counter counts index pulses to step it from stage to stage. The digital-to-analog converter responds to the stepping of the counter by producing a beam deflection current which indexes the beam from location to location. In accordance with the present invention the digital counter counts high speed indexing pulses when the beam is being stepped between locations which are not intensified. However, when the intensity level signal is on, the logic circuitry produces an index pulse only after a predetermined dwell time following the preceding index pulse.

In accordance with another aspect of this invention the logic circuitry includes a dwell time counter for producing the dwell time delay between index pulses when a dot is being intensified.

The foregoing and other objects, features and advantages of the invention will be better understood from the following more detailed description, appended claims, and drawings.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of the invention;

FIG. 2 shows the beam deflection pattern for a 5×7 matrix generator;

FIG. 3 shows the letter B represented within a 5×7 matrix;

FIG. 4*a* shows the clock pulses and FIG. 4*b* shows the intensity level signal for a prior art matrix generator; and

FIG. 5*a* shows the clock pulses and FIG. 5*b* shows the intensity level signal for the matrix character generator of the present invention.

DESCRIPTION OF A PARTICULAR EMBODIMENT

Referring to FIG. 1 the matrix generator is of the type which includes a cathode ray tube 11. The cathode ray tube includes a continuous coating of phosphor deposited on the face of the tube. Only certain locations, or dots, on the phosphor are addressed by the cathode ray beam. The dots are arranged, for example, in a 5×7 matrix. These dots are selectively intensified by the cathode ray beam produced by the cathode ray gun 12. The beam is deflected from dot to dot by deflection circuitry which includes the deflection coils 13.

The beam is indexed from dot to dot by an address signal generated by circuitry which includes the digital counter 14 and the digital-to-analog converter 15. As the counter 14 steps from stage to stage in response to applied index pulses, the digital-to-analog converter 15 produces incrementing deflection currents. These deflection currents are applied through deflection amplifier 16 to the deflection coils 13. These deflection currents are an address signal which indexes the beam from location to location.

One example of a pattern in which the beam is stepped from dot to dot is shown in FIG. 2. The energy beam is selectively intensified during this pattern tracing to generated the desired character. One example is shown in FIG. 3 wherein the character B is depicted by selective intensification of the dots in 5×7 matrix.

This intensification is controlled by an intensity level signal which is applied to gun supply 17 to brighten the beam, that is, turn it on when a dot is to be intensified. The intensity level signal may be derived from a number of available sources, for example from a digital computer. Alternatively, the intensity level signal may be stored in a read-only memory or recorded on magnetic tape in timed relationship to the clock pulses. When a character is to be generated, the intensity level signal is retrieved from storage in timed relationship to the clock pulses.

Such an intensity level signal is shown in FIG. 4*b* in timed relation to the clock pulses of FIG. 4*a*. In prior art systems, the operation of which is depicted in FIGS. 4*a* and 4*b*, the beam is indexed to a different dot by each succeeding clock pulse. (FIG. 4*b* shows the intensity level signal which modulates the beam for the selective intensification of twelve dots. In the sequence shown the first dot is intensified, the second and third are not intensified, the fourth and fifth are intensified, the sixth is not, the seventh through ninth are intensified, the 10 and 11 are not the 12 is intensified.) Note that it is necessary for the beam to dwell on a dot

between the first two clock pulses because the dot is being intensified in that time period. However, during the interval between the second and the fourth clock pulses, for example, the beam dwells on dots for the same period of time even though the dots are not being intensified. This is a wasted time interval.

In accordance with the present invention this wasted time interval is obviated. FIG. 5b shows an intensity level signal for modulating the beam to selectively intensify 12 dots in the same sequence as previously described. The intensity level signal of FIG. 5*b* is generated in timed relationship to the relatively high speed clock pulses shown in FIG. 5*a* and generated by the clock **18** in FIG. 1. Both the clock pulses and the intensity level signal are applied to first logic circuitry which produces index pulses in time coincidence with the clock pulses when the intensity level signal is off and second logic circuitry which produces index pulses spaced by a dwell time when the intensity level signal is on. As shown in FIG. 1 the first logic circuitry includes the NAND gate **19** which passes clock pulses when the intensity level signal is off. The output of NAND gate **19** is connected to OR gate **20** which produces the index pulses at the output thereof. These index pulses are applied to counter **14** which counts the index pulses. As a result the deflection voltage for the cathode ray beam is indexed.

In order to produce index pulses which are time spaced by the dwell time, the inverting amplifier **21** in combination with the second logic circuitry comprising, NAND gate **22** and frequency dividing counter **23** are provided. During the time that the intensity level signal is on, the NAND gate **22** passes clock pulses. These are counted by counter **23**. After a series of pulses of a selected number, for example six, have been counted, the terminal stage of the counter produces an index pulse which is applied through OR gate **20** to the counter **14**. In this manner, the counter **23** acts as a frequency dividing device so as to produce an index pulse at the output thereof only a predetermined dwell time after the first clock pulse in the series is applied to the input thereof.

While a particular embodiment of the invention has been shown and described, various modifications will be apparent to those skilled in this art. For example, the counter **23** may be replaced by certain other divider circuits which will produce an index pulse a predetermined dwell time after the application of the first clock pulse to the input thereof. Monostable multivibrators are but one example of such circuits suitable for use. While the logic circuitry has been shown implemented with NAND gates, the use of of other logic elements is within the scope of this invention. The invention has been described as applicable to a cathode ray tube type of matrix character generators. There are other dot matrix character generators which do not use a cathode ray beam. Other modifications are within the true spirit and scope of the invention and the appended claims are intended to cover those modifications.

What is claimed is:

1. A matrix character generator of the type having a plurality of display locations selectively energized by a movable energy beam comprising:

means for generating an intensity level signal representing ON and OFF states of said beam;

a source of clock pulses;

OR gate means having a plurality of inputs;

counter means having an output coupled to one of said inputs of said OR gates means; and

logic circuit means coupled to said means for generating said intensity level signal and said source of clock pulses, said circuit means selectively applying clock-synchronized pulses to another of said inputs of said OR gate means so as to produce index pulses at the output of said OR gate means corresponding in frequency to said clock pulses when said intensity level signal is in the OFF state, said circuit means also selectively applying clock-synchronized pulses to said counter so as to produce index pulses at the output of said OR gate means spaced by a dwell time corresponding to a predetermined count of said clock pulses in said counter when said intensity level signal is in the ON state.

2. The matrix character generator as recited in claim **1** wherein said logic circuit means comprises:

a first coincidence circuit, said clock pulses and said intensity level signal being applied to said coincidence circuit to produce said clock-synchronized pulses at the output thereof only when said intensity level signal is off; and

a second coincidence circuit, said clock pulses and said intensity level signal being applied to said second coincidence circuit to produce said clock-synchronized pulses at the output thereof only when said intensity level signal is on.

3. The matrix character generator recited in claim **1** including a cathode ray tube having a phosphor display screen deposited on the face thereof and wherein said energy beam is a cathode ray beam movable by a deflection circuit across said phosphor display screen.

4. The matrix character generator recited in claim **3** wherein said means for generating an address signal includes a digital counter which counts said index pulses, and

a digital-to-analog converter connected to the outputs of said digital counter, said digital-to-analog converter producing a deflection signal which is applied to said deflection circuit.

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