United States Patent [19]

Bowles

[11] **3,749,965**

[45] **July 31, 1973**

[54] **SYSTEM FOR BLANKING SELECTED AREAS OF A RASTER**

[75] Inventor: **Lloyd W. Bowles,** Lakewood, Colo.

[73] Assignee: **Computer Image Corporation,** Denver, Colo.

[22] Filed: **Oct. 22, 1970**

[21] Appl. No.: **82,942**

[52] **U.S. Cl.** **315/22**

[51] **Int. Cl.** **H01j 29/46**

[58] **Field of Search** 315/18, 19, 20, 21, 315/22

[56] **References Cited**

UNITED STATES PATENTS

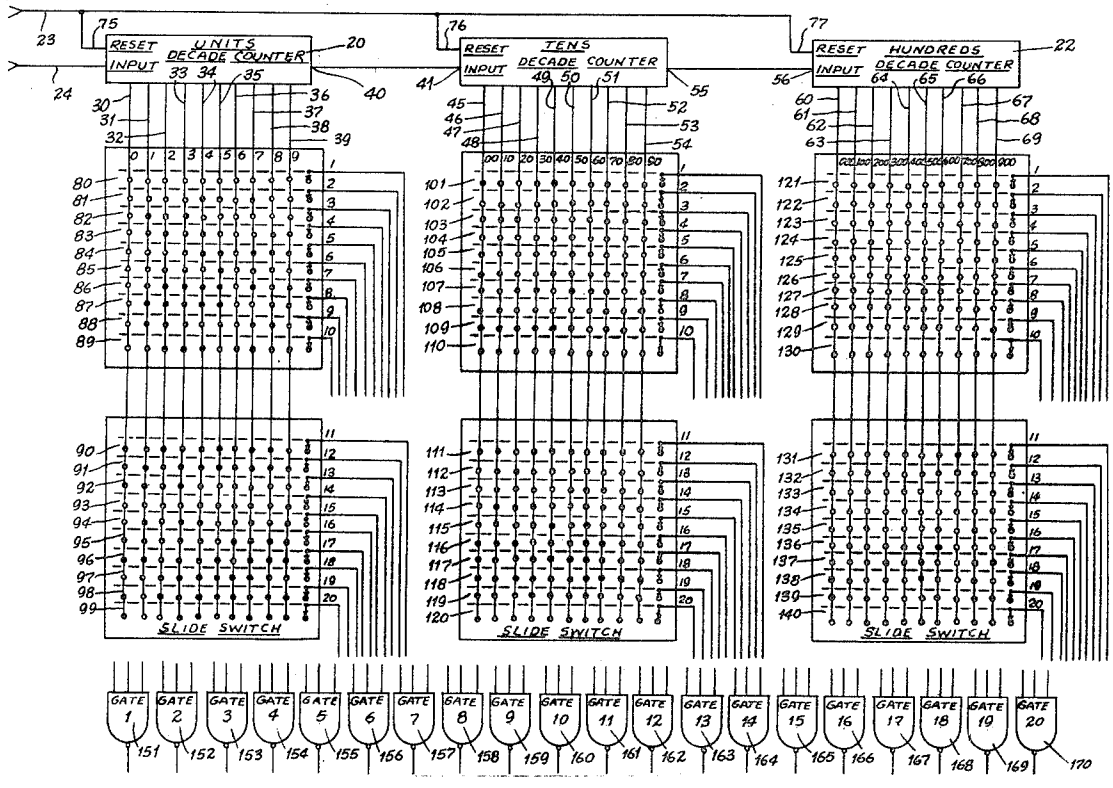
3,471,848	10/1969	Manber	315/22
3,432,845	3/1969	Douglas et al.	315/22

Primary Examiner—Carl D. Quarforth
Assistant Examiner—J. M. Potenza
Attorney—Rogers, Ezell, Eilers & Robbins

[57] **ABSTRACT**

This invention comprises a method and apparatus for electronically blanking selected parts of a raster. First, signals are generated, each representing a line of the raster. Selected ones of the first signals are gated to produce second signals corresponding to selected lines of the raster in accordance with the blanking patterns desired. Selected ones of the second signals are combined to produce third signals for de-intensifying the beam of the cathode ray tube on which the raster is displayed, thereby blanking certain areas of the raster in a single dimension. To blank areas of the raster in two dimensions delay signals are generated for modulating the beam intensity in response to other selected second signals, the widths of the delay signals being adjustable to produce blanked areas of almost any desired dimension.

18 Claims, 6 Drawing Figures



PATENTED JUL 3 1 1973

3,749,965

SHEET 1 OF 3

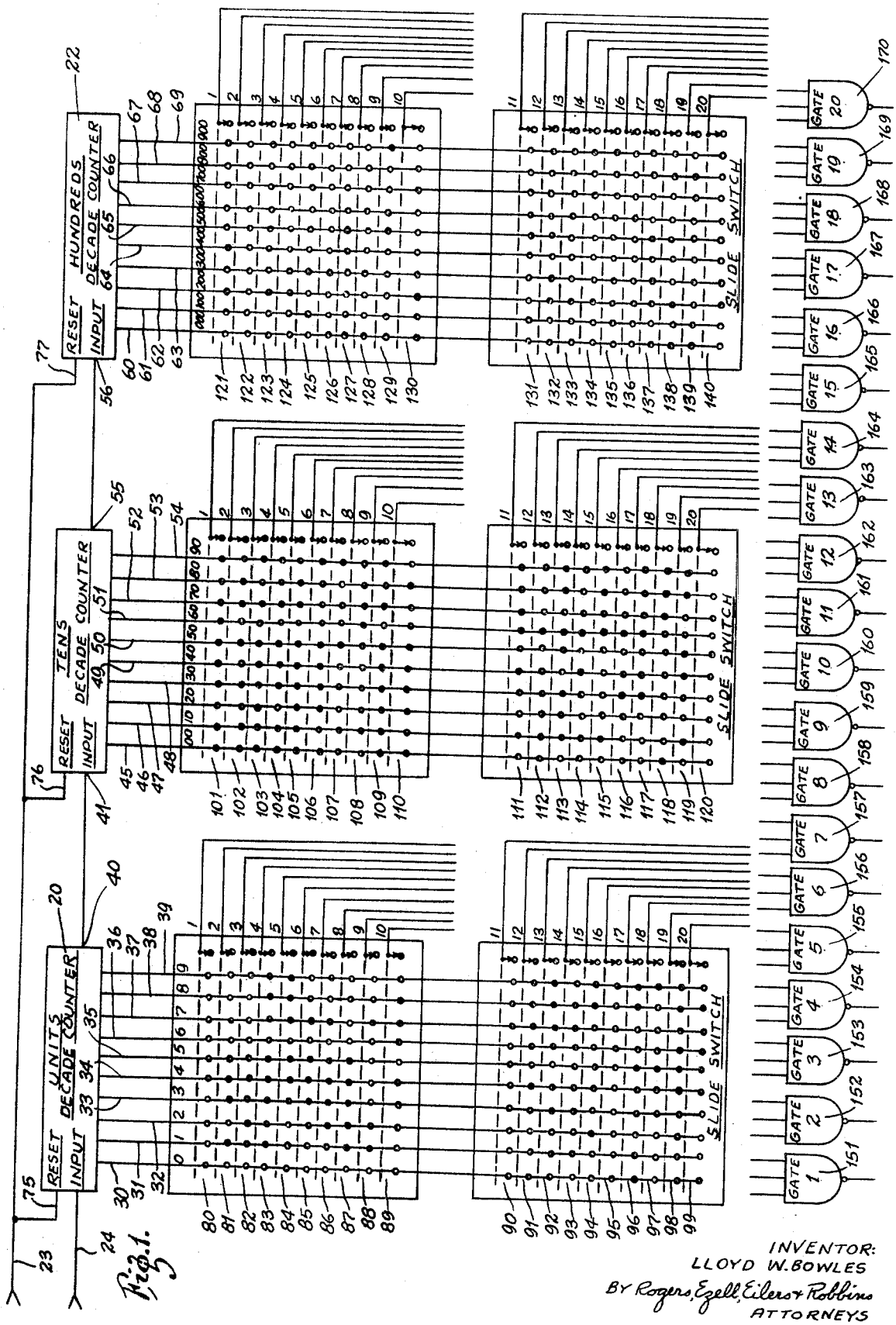


Fig. 1.

INVENTOR:
LLOYD W. BOWLES
BY Rogers, Ezell, Eilers & Robbins
ATTORNEYS

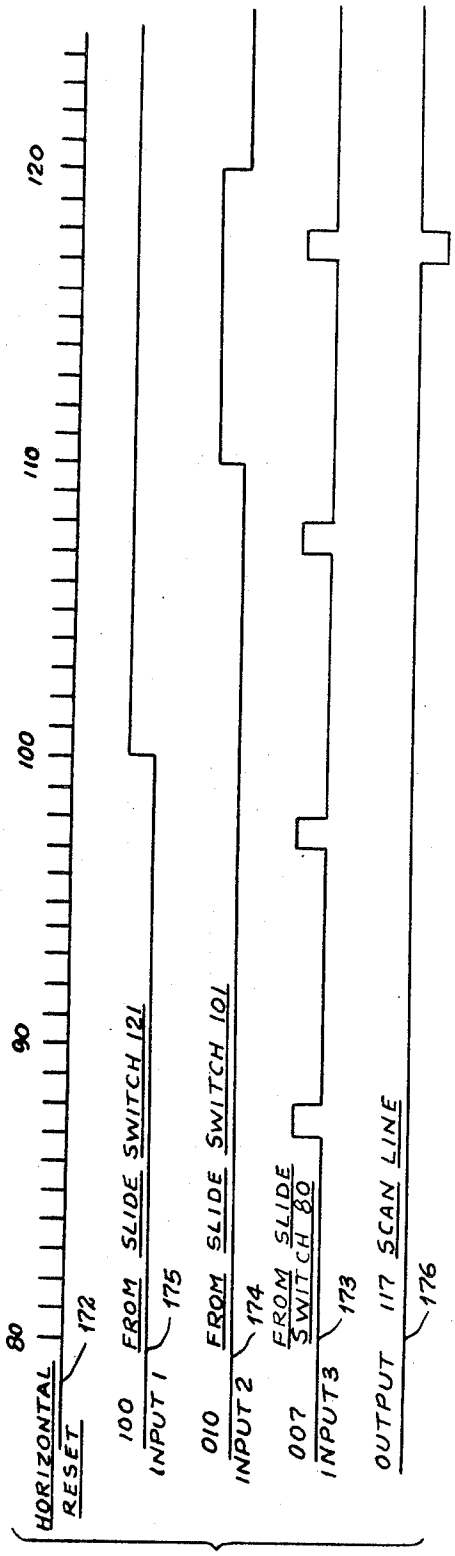


Fig. 2.

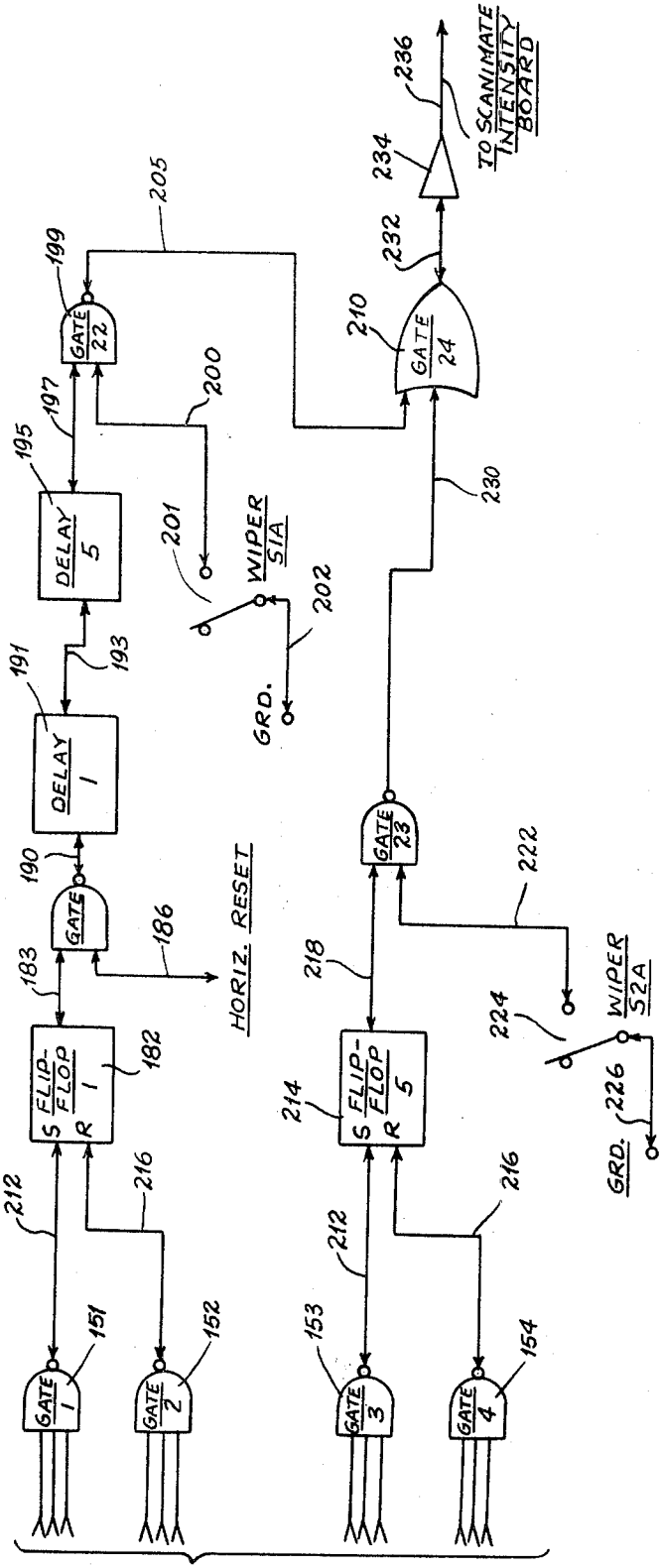


Fig. 3.

INVENTOR:
LLOYD W. BOWLES
BY Rogers, Ezell, Eilers & Robbins
ATTORNEYS

PATENTED JUL 31 1973

3,749,965

SHEET 3 OF 3

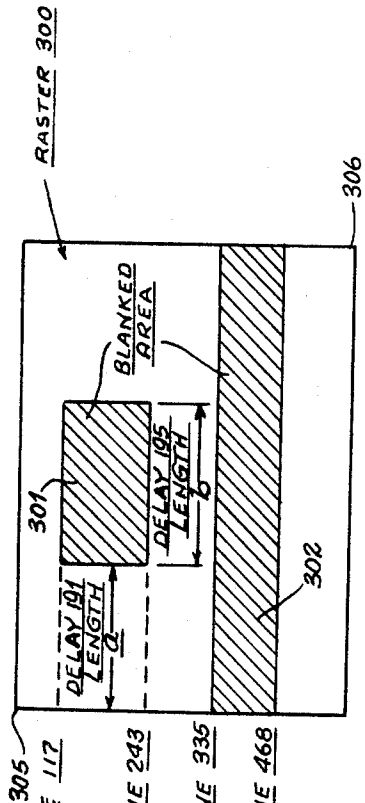


Fig. 4.

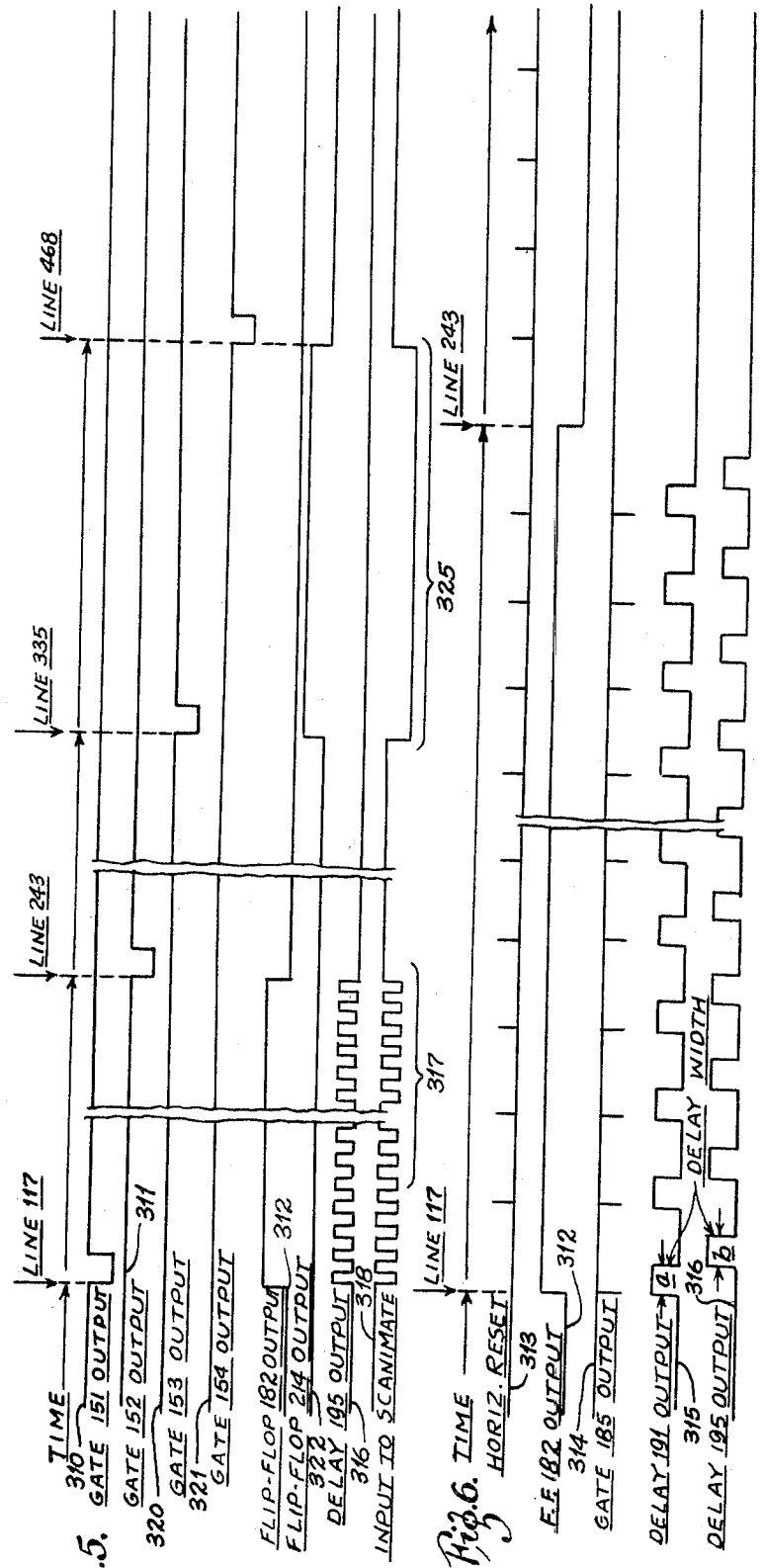


Fig. 5.

Fig. 6.

INVENTOR:
LLOYD W. BOWLES
BY Rogers, Ezell, Eilers & Robbins
ATTORNEYS

SYSTEM FOR BLANKING SELECTED AREAS OF A RASTER

BACKGROUND OF THE INVENTION

In certain applications where images are generated on a raster such as in those for producing animated images on a cathode ray tube, it is desirable to blank certain selected portions of the image. For example, in the generation of animated images by the system disclosed in co-pending Lee Harrison III et al. patent application Ser. No. 882,125 entitled Computer Animation Generating System, dated Dec. 4, 1969, it is necessary in producing certain effects, to blank out one or more parts of the image being generated.

Previous to this invention, blanking was accomplished manually by placing a cover over those portions of the art work to be blanked. The displayed image was then recorded on film or videotape after which the covering was removed and other parts of the art work covered and recorded. This sequence was repeated, each time requiring covering and uncovering various parts of the art work. The recording of each pass was then edited to produce the animation sequence desired. Editing is especially difficult with video-tape.

A simliar technique was used in producing color recordings of the displayed images. Each part of the displayed image was assigned a color and all parts of the same color recorded in one pass, the other parts being covered with tape. As many passes were required as there were colors. The old blanking techniques were not only time consuming, but awkward to work with. Once certain parts of the art work were covered, the registration of the image could not be checked. Where the registration was not correct the entire sequence had to be repeated.

With this invention all blanking is accomplished electronically by simply setting switches and delay circuits to produce the desired blanking pattern. Selected parts of the image can be blanked or unblanked with the flick of the switch, making it possible to check image registration very quickly and record an animation sequence in a single pass.

SUMMARY OF THE INVENTION

The raster blanking system of this invention includes a counter for counting the lines of the raster for each raster frame. As an example, the counter reset and counter input might be connected to the vertical and horizontal reset pulses, respectively, generated by the network of FIG. 1 in the above-referenced copending patent application. In this way, the counter is reset to zero at the beginning of each raster frame to count the raster lines generated in each frame. Signals are produced at outputs of the counter corresponding to each line count, which signals are fed to a plurality of slide switches. The slide switches are set to positions for identifying certain horizontal lines of the raster depending on the blanking patterns desired, it being possible to blank out any one or more raster lines or portions thereof to produce the desired blanking pattern. Signals are generated in accordance with the positions of the slide switches which are gated to flip-flops for generating further signals for modulating the intensity of the beam and hence, blanking the beam to produce the desired pattern. Where the blanked area is to extend the entire width of the raster, the flip-flop output signal is used for modulating the CRT beam. Where the blanked area is to be less than the raster width, one or more delay circuits are provided for producing delay signals responsive to the flip-flop output signal and raster line reset signals for modulating the CRT beam. Various switches, gates, flip-flops, and delay circuits can be combined to produce a wide variety of blanking patterns and produce them simultaneously.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic of the raster lines identification and selection network of this invention;

FIG. 2 is a timing chart showing the waveform of certain signals for the identification of a selected raster line;

FIG. 3 is a schematic diagram illustrating networks for generating two selected types of blanking patterns;

FIG. 4 is a drawing showing the two types of blanking patterns generated by the network of FIG. 3 and is also used in describing an example of a particular blanking program;

FIG. 5 is a timing chart for the blanking program of FIG. 4; and

FIG. 6 is a timing chart for a portion of the blanking program of FIG. 4 and also showing the waveforms generated by the delay network of FIG. 3.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The nature of this embodiment of the invention is such as to include a basic gating circuit for identifying the generation of any one or more lines that make up the raster on which an image is to be generated, and numerous types of module networks which can be selectively combined and patched together with the basic raster line identifying circuit. With the examples of combinations which will be hereinafter described, it will become evident that many other combinations can be used to produce various raster blanking effects. It will not be necessary to describe all of these many combinations in detail as they utilize the same principles as the embodiments hereinafter described.

Referring to FIG. 1 of the drawing there is shown the basic raster line identification network of this invention including decade counters 20, 21 and 22. These decade counters count the raster lines in sequence as they are generated. The decade counter 20 represents the units digit; the decade counter 21 represents the tens digit; and the decade counter 22 represents the hundreds digit. The units decade counter 20 has an input 24 connected to the horizontal reset of the raster generating network (not shown) and ten outputs 30 through 39. It is to be understood that the raster generating network (not shown) is of a standard type commonly known in the art for generating a raster such as a TV raster or the like, and includes a vertical reset for initiating each raster frame and a horizontal reset for initiating each horizontal line of the raster. The counter 20 also has an output 40 which is connected to an input 41 of the tens decade counter 21. The tens decade counter 21 has ten outputs 45 through 54 and an output 55 connected to an input 56 of the hundreds decade counter 22. The hundreds decade counter 22 also has ten outputs 60 through 69. The decade counters 20 through 22 have reset inputs 75, 76 and 77, respectively, connected to the vertical reset pulse from the raster generating network. The sets of outputs 30 through 39 of the units decade counter 20, 45 through 54 of the tens decade

counter 21, and 60 through 69 of the hundreds decade counter 22 each represents the numbers 0 – 9. As the raster generating network generates vertical and horizontal reset pulses and other signals to generate the display raster the decade counters 20 through 22 count the number of horizontal reset pulses which is equivalent to a count of the number of horizontal lines in the raster. At the beginning of each raster frame, the vertical reset pulse from the raster generating network resets the counters 20 through 22 to zero to begin counting the horizontal lines for the next frame. When the units decade counter 20 gets to a count of 9, it triggers the tens decade counter 21 which in turn triggers the hundreds decade counter 22 at a count of 99. With the three decade counters 20 through 22 connected as shown in the drawing a maximum number of 999 lines can be counted.

The output signals from the decade counters 20 through 22 are such that when a signal appears at a given output corresponding to a count or series of counts it will remain until the next output receives a signal at which time the preceding output will drop to zero. Hence, an output of the units decade counter 20 will hold a signal for the duration of a horizontal line of the raster and will receive such a signal every 10 lines. An output of the tens decade counter 21 will hold a signal for the duration of 10 horizontal lines and will receive such a signal every hundred lines. An output of the hundreds decade counter 22 will hold a signal for the duration of 100 lines.

The outputs from the decade counters 20 through 22 are fed into slide switches on buses that extend across the switches. Hence, the outputs 30 through 39 of the units decade counter 20 are fed into slide switches 80 through 99; the outputs 45 through 54 of the tens decade counter 21 are fed into slide switches 101 through 120; and the outputs 60 through 69 of the hundreds decade counter 22 are fed into slide switches 121 through 140. Referring to FIG. 1 of the drawing each slide switch has 10 positions, 0 through 9. The buses are shown by solid lines through the terminals of the switches and the slide of each switch is shown by a small arrow with dashed lines to show the path of the slide.

Also shown in FIG. 1 are NAND gates 151 through 170, each having three inputs. The slides or wiper arms of the slide switches 80 through 99 are connected by suitable conductors to first inputs to the gates 151 through 170. Hence, the wiper arm of the slide switch 80 is connected to a first input of the gate 151; the wiper arm of the slide switch 81 is connected to a first input of the gate 152; and so on, to the wiper arm of the slide switch 99 which is connected to a first input of the gate 170. The wiper arms of the slide switches 101 through 120 are connected by suitable conductors to second inputs to the gates 151 – 170. Hence, the wiper arm of the slide switch 101 is connected to a second input of the gate 151; the wiper arm of the slide switch 102 is connected to a second input of the gate 152, and so on, to the wiper arm of the slide switch 120 which is connected to a second input of the gate 170. In like manner, the wiper arms of the slide switches 121 through 140 are connected to third inputs to the gates 151 through 170. Hence, the wiper arm of the slide switch 121 is connected to a third input of the gate 151; the wiper arm of the slide switch 122 is connected to a third input of the gate 152, and so on, to the wiper arm of the slide switch 140 which is connected to a third input of the gate 170. To enable one of the gates 151 through 170, all three of its inputs must be at a 1 level. With the 20 NAND gates as shown in the figure, a total of 20 different counts and, hence, 20 different horizontal raster lines can be detected.

FIG. 2 shows the signals generated by the network of FIG. 1 for scan line 117. Suppose for example, that the count 117 is to be detected by a signal at the output of gate 151. For this to occur the slide switch 80 is set to position 7, the slide switch 101 is set to position 1, and the slide switch 121 is set to position 1. The waveform 172 shows the horizontal reset pulses counted by the counters 20 – 22. Each time the units digit of the count is a 7, a signal will appear at the output 37 of the units decade counter 20. With the slide switch 80 in position 7, these signals, as shown by the waveform 173, are fed to the first input of the gate 151. Each time the tens digit of the count is a 1, a signal appears at the output 46 of the tens decade counter 21. With the slide switch 101 set in position 2, these signals, as shown by the waveform 174, are fed to the second input of the gate 151. Each time the hundreds digit of the count is a 1, a signal appears at the output 61 of the hundreds decade counter 22. With the slide switch 121 set in the second or 100 position, these signals, as shown by the waveform 175, are fed to the third input of the gate 151. As can be seen by the waveforms of FIG. 2, the only time all three inputs to the gate 151 are enabled is at the count 117 to produce at the output of the gate 151 a signal corresponding to the count 117 as shown by the waveform 176.

At this point, it should be explained that all of the gates 151 – 170 are not necessarily used at one time. Any number in combination of these gates may be used depending on the blanking requirements. Therefore, only the four gates 151 through 154 will be used in explaining the remainder of this embodiment of the invention.

Referring to FIG. 3, there is shown a blanking network 180 for a typical blanking requirement. The four gates 151 through 154 are again shown for convenience. As will be explained, the inputs and outputs of many of the components used in this system are fed to patch boards so that they can be patched together as the requirements dictate. Therefore, the lines with arrows at each end denote a patched connection. The output of the gate 151 representing a horizontal line of the raster as identified by the settings of slide switches 80, 101, and 121, is patched to the SET input of a flip-flop 182, and the output of the gate 152 representing a horizontal line of the raster as identified by the settings of slide switches 81, 102 and 122 is patched to the RESET input of the flip-flop 182. The output signal from the flip-flop 182 is a 1 level signal beginning at the leading edge of the SET input pulse and ending at the leading edge of the RESET input pulse. This signal is fed through a conductor 183 to one input of a NAND gate 185. The NAND gate 185 has another input 186 connected to the horizontal reset pulse from the raster generating network. The output of the NAND gate 185 is a series of 0 level pulses identical in width and frequency to the horizontal reset pulses and beginning at a time determined by the output pulse from the NAND gate 151 and ending at a time determined by the output pulse from the NAND gate 152. This series of pulses is fed through a conductor 190 to the input of a delay cir-

cuit 191. When triggered by a pulse from the gate 185, the delay circuit 191 generates a 1 level pulse of a width that can be varied from a fraction of a microsecond to about 40 microseconds which is longer than one horizontal scan line. In other words, the width of the output pulse from the delay 191 can be made to vary between a very narrow pulse and one of greater duration than the time between horizontal reset pulses. A delay pulse is generated for each horizontal reset pulse and has a leading edge corresponding in time to the horizontal reset pulse. A delay pulse from the delay network 191 is fed through a patch connection 193 to the input of a delay network 195. The delay network 195 is similar in function to the delay network 191 in that it produces at its output a 1 level pulse of variable width beginning at the trailing edge of the pulse from the delay network 191. Therefore, the pulse at the output of the delay network 195 is of a selected width which occurs at a selected duration of time after each horizontal reset pulse.

The delay pulse from the delay network 195 is fed through a patch connection 197 to a first input of a NAND gate 199. The NAND gate 199 has a second patch connection 200 connected to the closed terminal of a switch 201. The wiper of the switch 201 is connected by a patch connection 202 to ground. The output from the NAND gate 199, which is present only when the switch 201 is open, and which is a 0 level pulse otherwise identical to the 1 level delay pulse from the output of the delay network 195, is fed through a patch connection 206 to a first input of a NOR gate 210.

The output signal from the NAND gate 153 representing a horizontal raster line as identified by the settings of the slide switches 82,103 and 123 is fed through a patch connection 212 to the SET input of a flip-flop 214. The output signal from the NAND gate 154, representing a horizontal raster line as identified by the settings of the slide switches 83,104 and 124 is fed through a patch connection 216 to the RESET input of the flip-flop 214. The flip-flop 214 is identical in operation to the flip-flop 182 producing at its output a 1 level pulse which begins at the leading edge of the pulse from the gate 153 and ends at the leading edge of the pulse from the gate 154. The pulse from the flip-flop 214 is fed through a patch connection 218 to a first input of a NAND gate 220. The NAND gate 220 has a second input connected by a patch connection 222 to the closed terminal of a switch 224. The wiper of the switch 224 is connected by a patch connection 226 to ground. The output from the NAND gate 220, which is present only when the switch 222 is open is a 0 level pulse otherwise identical to the 1 level pulse at the output of the flip-flop 214. This 0 level pulse is fed through a patch connection 230 to a second input of the NOR gate 210. The NOR gate 210 is enabled when either of its inputs is enabled. The output signal from the NOR gate 210 is fed through a patch connection 232, an inverter 234, and a patch connection 236 where it is used to modulate the intensity of the cathode ray tube beam made to scan in the raster pattern. Whenever either of the inputs to the NOR gate 210 is at a 0 level, the signal at the output of the inverter 234 is at a 0 level, and the raster will be blanked for the duration of the signal.

Therefore, the signal on the conductor 205 will blank a rectangular pattern with an upper vertical limit selected by the switches 80, 101 and 121 and a lower limit selected by the switches 81, 102 and 122 and side limits selected by the variable delays 191 and 195. The signal on the conductor 230 will blank all of the raster between the lines selected by the switches 82, 103 and 123 and the switches 84, 104 and 124.

The two blanking circuit configurations illustrated in FIG. 3 are examples of the kinds of networks that can be constructed by patching together various circuit components to produce the desired blanking pattern. The actual system might include eight delay circuits such as the delay circuit 195, four flip-flops such as the flip-flop 214, six 2 input gates such as the NAND gates 199 and 220, six switches such as the switches 201 and 224, and two gates such as the NOR gate 210 — one having eight inputs and the other having 10 inputs — so that as many as 10 different blanking pulses may be NORed together. The inputs and outputs of each of these components are brought to a patch board. Also brought to the patch board are the outputs from the NAND gates 151 – 170, and the horizontal and vertical reset pulses from the raster generating network. For convenience certain of the components might be hard wired together with the inputs and outputs of the hard wired packages brought to the patch board. For example, four such packages, each including a flip-flop such as the flip-flop 182, a gate such as the NAND gate 185, and a delay circuit such as the delay circuit 191, might be included in the system. The numbers of such components or packages of components given are meant only as examples; obviously, any number of these components can be used to produce a great variety of blanking patterns and to produce these patterns simultaneously.

OPERATION

In explaining the operation of this embodiment of the invention, the operation of the network of FIG. 3 will be explained in producing the blanking pattern of FIg. 4. There is shown in FIG. 4 a raster 300 and blanked areas 301 and 302. The raster 300 is generated in a typical fashion beginning at a point 305 at the upper left hand corner of the raster and ending at a point 306 at the lower right hand corner of the raster, although a raster generated in some other manner, such as one having vertical lines, could also be used. Hence, for the purposes of this embodiment, the vertical reset pulses reset the cathode ray tube beam to begin generating each frame of the raster from the point 305, and the horizontal reset pulses reset the beam to the left edge of the raster to generate each horizontal line. For the purposes of this example, assume that two areas of the raster are to be blanked: The first area 301 having a width *b*, and a height equal to the distance between the horizontal raster lines 117 and 243, and located a distance *a* from the left side of the raster; and the second blanked area 302, extending the full width of the raster with a height equal to the distance between the horizontal raster lines 335 and 468.

To produce these blanking patterns, the slide switch 81 is set to position 7, the slide switch 101 is set to position 1, and the slide switch 121 is set to position 1 to detect the horizontal raster line 117; the slide switch 81 is set to position 3, the slide switch 102 is set to position 4, and the slide switch 122 is set to position 2 to detect the horizontal raster line 243; the slide switch 83 is set to position 5, the slide switch 103 is set to position 3, and the slide switch 123 is set to position 3 to detect the

horizontal raster line 335; and, the slide switch 83 is set to position 8, the slide switch 104 is set to position 6, and the slide switch 124 is set to position 4 to detect the horizontal raster line 468. Upon generation of the vertical reset pulse by the raster generating network each of the decade counters 20 through 22 are reset to 0 and begin counting the horizontal reset pulses from the raster generating network. When the 117th horizontal reset pulse is counted, a signal appears at the output 37 of the units decade counter 20 which is fed to terminal 7 of the slide switch 80. With the slide switch 80 in position 7, this signal is fed to the first input of the gate 151. A signal also appears at the output 46 of the tens decade counter 21 which is fed to terminal 1 of the slide switch 101. With the slide switch 101 in position 1, the signal at the output 46 is fed to the second input of the gate 151. A signal also appears at the output 61 of the hundreds decade counter 22 which is fed to terminal 1 of the slide switch 121. With the slide switch 121 in position 1, the signal at the output 61 is fed to the third input of the gate 151 enabling the gate and producing at its output a signal as shown by the waveform 176 of FIG. 2 and again by the waveform 310 of FIG. 5. This signal, representing the generation of the 117th horizontal line of the raster, is fed through a suitable patch connection to the SET input of the flip-flop 182 (see FIG. 3).

When the 243rd horizontal reset pulse from the raster generating network is detected a signal appears at the output 33 of the units decade counter 20 which is fed to terminal 3 of the slide switch 81. With the slide switch 81 set in position 3, the signal at the output 33 is fed to the first input of the gate 152. A signal also appears at the output 49 of the tens decade counter 21 which is fed to terminal 4 of the slide switch 102. With the slide switch 102 in position 4, the signal at the output 49 is fed to the second input of the gate 152. A signal also appears at the output 62 of the hundreds decade counter 22 which is fed to terminal 2 of the slide switch 122. With the slide switch 122 set in position 2, the signal at the output 62 is fed to the third input of the gate 152 enabling the gate 152 to produce at its output a signal like that shown by the waveform 176 of FIG. 2, but, representing the horizontal raster line 243 as shown by the waveform 311 of FIG. 2. This signal is fed through a suitable patch connection to the RESET input of the flip-flop 182. Therefore, referring to FIG. 5, the signal at the SET input of the flip-flop 182 is shown by the waveform 310 and the signal at the RESET input of the flip-flop 182 is shown by the waveform 311. The leading edge of the set input signal triggers the flip-flop to a 1 level output, and the reset input signal resets the flip-flop 182 to a zero level output as shown by the waveform 312. Hence, the signal at the output of the flip-flop 182 begins with the generation of the 117th horizontal line and ends with the generation of the 243rd horizontal line of the raster.

An enlarged view of the waveform 312 is shown in FIG. 6 with a waveform 313 representing the horizontal reset pulses from the raster generating network. The horizontal reset pulses are fed through the conductor 186 to one input of the gate 185, with the signal shown by the waveform 312 fed to the other input of the gate 185. The output of the NAND gate 185 is a series of pulses shown by the waveform 314 of FIG. 6. These pulses are fed into the delay circuit 191. Therefore, pulses like the horizontal reset pulses only of opposite polarity are fed as inputs to the delay circuit 191 at the beginning of each horizontal line of the raster between the lines 117 and 243. For each input pulse to the delay circuit 191, a 1 level pulse is produced at its output of a pre-selected width as shown by the waveform 315. In this example, the width is selected to equal the length *a* of FIG. 4. The output pulses from the delay circuit 191 are patched to the delay circuit 195 to produce a series of 1 level pulses, each pulse beginning at the trailing edge of an output pulse from the delay circuit 191 and of a selected width as shown by the waveforms 316 of FIGS. 5 and 6. In this example, the width of each output pulse from the delay circuit 195 is set to equal the length *b* of the blanked area 301. With the switch 201 open, a series of 0 level pulses are produced at the output of the gate 199, as shown by the signal portion 317 of the waveform 318 of FIG. 6, otherwise identical to the output pulses from the delay circuit 195, which are fed through the gate 210 and the inverter 234 to modulate the intensity of the cathode ray tube beam on which the raster is displayed. Because the pulses at the output of the NAND gate 199 are generated only between the horizontal lines 117 and 243, and because the generation of each pulse is delayed by length *a* and the pulse is of a width *b*, an area will be blanked identical to the area 301 for each raster frame. The blanking is produced instantaneously by simply opening the switch 201.

When the 335th horizontal reset pulse is detected by the counters 20 through 22, a signal appears at the output 35 of the units decade counter 20 which is fed to terminal 5 of the slide switch 82. With the slide switch 82 in position 5, the signal at the output 35 is fed to the first input of the gate 153. A signal also appears at the output 48 of the tens decade counter 21 which is fed to terminal 3 of the slide switch 103. With the slide switch 103 in position 3, the signal at the output 48 is fed to the second input of the gate 153. A signal also appears at the output 63 of the hundreds decade counter 22 which is fed to terminal 3 of the slide switch 123. With the slide switch 123 set in position 3, the signal at the output 63 is fed to the third input of the gate 153 enabling the gate 153 to produce at its output a signal like that shown by the waveform 176 of FIG. 2, but representing the 335th horizontal line as shown by the waveform 320 of FIG. 5. This signal is fed through a suitable patch connection to the SET input of the flip-flop 214.

When the 468th horizontal reset pulse is detected by the counters 20 through 22, a signal appears at the output 38 of the units decade counter 20 which is fed to terminal 8 of the slide switch 83. With the slide switch 83 in position 8, the signal at the output 38 is fed to the first input of the gate 154. A signal also appears at the output 51 of the tens decade counter 21 which is fed to terminal 6 of the slide switch 104. With the slide switch 104 in position 6, the signal at the output 51 is fed to the second input of the gate 154. A signal also appears at the output 64 of the hundreds decade counter 22 which is fed to terminal 4 of the slide switch 124. With the slide switch 124 in position 4, the signal at the output 64 is fed to the third input of the gate 154 enabling the gate 154 and producing at its output a signal like that shown by the waveform 176 of FIG. 2, but representing the horizontal raster line No. 468 as shown by the waveform 321 of FIG. 5. The signal from the output of the gate 154 is fed through a suitable

patch connection to the RESET input of the flip-flop 214. Therefore, referring to FIG. 5, the signal at the SET input of the flip-flop 214 is shown by the waveform 320, and the signal at the RESET input of the flip-flop 214 is shown by the waveform 321. The signal at the SET input of the flip-flop 214 triggers the flip-flop to a 1 level output, and the signal at the RESET input of the flip-flop 214 resets the flip-flop to a zero level output as shown by the waveform 322, to begin with the generation of the 335th horizontal line and end with the generation of the 468th horizontal line. With the switch 224 open, the flip-flop 214 output signal is fed through the gate 210 and inverter 234 to modulate the intensity of the cathode ray tube beam. The result is the blanking pattern 302 of FIG. 4 extending the full width of the raster with vertical limits between the horizontal lines 335 and 468. The blanking is produced instantaneously by simply opening the switch 222. The intensity modulating signal for the blanking area 302 is shown by the signal portion 325 of the waveform 318 of FIG. 5. The entire waveform 318 represents the beam modulation signals for both blanked areas 301 and 302.

This same generation sequence is repeated for each raster frame to produce the blanking patterns of this example. Obviously, other blanking patterns can be produced by using others of the slide switches, gates, and delay circuits and/or by increasing the number of these components in the system. For example, with the system herein described, there can be at least ten different blanking patterns on the screen at one time, each of a different size and shape. Also various effects can be obtained such as by applying a ramp function to vary the delay time of the delay circuit 195 to produce a wiping type blanking of a particular section of the raster.

Various changes and modifications may be made within this invention as will be readily apparent to those skilled in the art. Such changes and modifications are within the scope and teaching of this invention as defined by the claims appended hereto.

What is claimed is:

1. A method of blanking certain areas of a raster drawn on the face of a cathode ray tube in accordance with a desired blanking pattern where at least two opposite sides of each blanked area are determined by lines of the raster comprising the steps of counting the lines of the raster for each raster frame, generating a first set of sigals, each signal of the first set of signals corresponding to a line determining a side of at least one of the blanked areas, generating a second set of signals from selected pairs of signals of the first set of signals, each pair selected to represent opposite sides of at least one of the blanked areas, generating delay signals in response to the generation of the raster lines within selected ones of the areas to be blanked, the delay signals setting the boundaries of the other sides of these blanked areas, and modulating the beam intensity of the cathode ray tube in response to the second set of signals and the delay signals to blank portions of the raster.

2. A system for blanking selected areas of a raster drawn on the screen of a cathode ray tube in accordance with a desired blanking pattern comprising means for generating a frame reset pulse for initiating the drawing of each frame of the raster, means for generating a line reset pulse for initiating the drawing of each line of the raster within each raster frame, counter means responsive to the frame and line reset pulses for repeatedly counting the raster lines for each raster frame, the counter means having outputs at which signals are generated corresponding to each raster line count, means for gating selected ones of the output signals from the counter means corresponding to selected lines of the raster, means for generating a plurality of second signals from selected combinations of the gated output signals, means for modulating the intensity of the cathode ray tube beam in response to selected ones of the second signals, means for gating selected other of the second signals with the line reset pulses to generate series of pulses, each series beginning with one signal of a selected pair of the gated output signals and ending with another signal of the selected pair, a variable delay means for generating, in response to each pulse in the series, a delay signal of a selected width and delayed a selected amount from the pulse, and means for modulating the intensity of the cathode ray tube beam in response to the delay signal.

3. The system of claim 2 wherein the gating means includes sets of switches selected ones of which are set to the selected raster line counts, the switches having terminals connected to the outputs of the counter means, a plurality of gates, and means connecting each set of switches to the inputs of a gate.

4. The system of claim 2 wherein the variable delay means includes a first variable delay means and a second variable delay means, the first variable delay means generating a first delay signal of a selected width in response to each pulse in the series, the second variable delay means generating a second delay signal of a selected width in response to the first delay signal from the first variable delay means, and means for modulating the intensity of the cathode ray tube beam in response to the second delay signal.

5. The system of claim 4 wherein the leading edge of the second delay signal is generated at the trailing edge of the first delay signal, whereby the second delay signal is generated at a time after the raster line reset pulse as determined by the width of the first delay signal.

6. A system for blanking selected areas of a raster drawn on the screen of a cathode ray tube in accordance with a desired blanking pattern comprising means for generating first signals, each of the first signals representing an area between selected lines of the raster, means for generating a series of pulses during selected ones of the first signals, each pulse in a series of pulses representing the generation in a raster line of a given area, for each pulse in a series of pulses means for generating a delay signal in response to the pulse, the width of the delay signal being selectively variable, and means for modulating the intensity of the cathode ray tube beam in response to the delay signals.

7. The system of claim 6 wherein the delay signal generating means includes means for generating a first delay signal in response to each pulse of a series of pulses the width of the first delay signal being selectively variable, means for generating a second delay signal of a selectively variable width in response to each first delay signal, and means for modulating the intensity of the cathode ray tube beam in response to the second delay signals.

8. The system of claim 7 wherein the leading edge of the second delay signal is generated at the trailing edge of the first delay signal, whereby the second delay sig-

nal is generated after the generation of the raster line is initiated as determined by the width of the first delay signal.

9. The system of claim 6 including means for instantaneously producing or eliminating selected ones of the blanked areas.

10. The system of claim 9 wherein the last named means includes a switch means for gating the delay signals for use in modulating the intensity of the cathode ray tube beam.

11. The system of claim 6 including ramp function generating means, and means for varying the width of selected ones of the delay signals in response to ramp function signals from the ramp function generating means.

12. A system for identifying a plurality of counted pulses, the pulses being sequentially generated comprising counter means for counting each of the pulses as they are sequentially generated, the counter means producing output signals corresponding to each pulse count, the number of the signals for each pulse count equalling the number of digits in the highest pulse count, a plurality of switch means, the number of switch means being equal to the maximum number of pulses to be identified, the terminals of each of the switch means being connected to the outputs of the counter means, a plurality of gating means, the number of gating means equalling the total number of counts to be identified, and means for setting selected ones of the switch means in accordance with pulse counts to be identified for switching the signals from the outputs of the counter means corresponding to each pulse count to be identified to the inputs of one of the gating means.

13. A system for blanking selected areas of a raster drawn on the screen of a cathode ray tube in accordance with a desired blanking pattern comprising a plurality of gated outputs, a patch board, means for connecting each of the gated outputs to the patch board, means for generating first signals at selected ones of the gated outputs corresponding to the generation of selected lines of the raster, the raster lines selected in accordance with the blanking pattern desired, a plurality of flip-flops, each of the flip-flops having input and output terminals, means for connecting the input terminals of each of the flip-flops to the patch board, means for patching selected pairs of first signals at the gated outputs to the inputs of the flip-flops for generating at the output of the flip-flops second signals, and means for modulating the intensity of the cathode ray tube beam in response to the second signals.

14. The system of claim 13 including a plurality of delay means, means for connecting selected second outputs to the inputs of selected ones of the delay means for producing delay signals for modulating the intensity of the cathode ray tube beam.

15. A system for blanking selected areas of a raster drawn on the screen of a cathode ray tube in accordance with a desired blanking pattern comprising means for generating a frame reset pulse for initiating the drawing of each frame of the raster, means for generating a line reset pulse for initiating the drawing of each line of the raster within each raster frame, counter means responsive to the frame and line reset pulses for repeatedly counting the raster lines for each raster frame and for producing output signals corresponding to each count, a plurality of switches, the switches having terminals connected to the outputs of the counter means, a plurality of gates, means for setting selected ones of the switches in accordance with raster lines to be identified for switching the signals from the outputs of the counter means corresponding to each line to be identified to the inputs of the gates, means for generating first signals from selected ones of the gated signals, and means for modulating the intensity of the cathode ray tube beam in response to the first signals.

16. The system of claim 15 further comprising means for generating a series of pulses between the generation of selected gated signals, each pulse in the series of pulses representing the generation of a raster line between a selected pair of raster lines, for each pulse in the series of pulses means for generating a delay signal in response to each pulse, the width of the delay signal being selectively variable, and means for modulating the intensity of the cathode ray tube beam in response to the delay signals.

17. The system of claim 16 wherein the delay signal generating means includes means for generating a first delay signal in response to each pulse of the series of pulses, the width of the first delay signal being selectively variable, means for generating a second delay signal of a selectively variable width in response to each first delay signal, and means for modulating the intensity of the cathode ray tube beam in response to the second delay signals.

18. The system of claim 17 wherein the leading edge of the second delay signal is generated at the trailing edge of the first delay signal, whereby the second delay signal is generated after the generation of the raster line is initiated as determined by the width of the first delay signal.

* * * * *