PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : G09G 3/20 — A1

(11) International Publication Number: WO 94/19788

(43) International Publication Date: 1 September 1994 (01.09.94)

(21) International Application Number: PCT/US94/01877

(22) International Filing Date: 22 February 1994 (22.02.94)

(30) Priority Data:
08/019,774 19 February 1993 (19.02.93) US

(71)(72) Applicants and Inventors: GOLD, Robert, J. [US/US]; 13006 Meehan Drive, Austin, TX 78727 (US). JENNINGS, Dan, E. [US/US]; 10616 Mellow Meadow, #10, Austin, TX 78750 (US). WEBB, Homer, L. [US/US]; 144 Bobwhite Trail, Seguin Trail, TX 78155 (US).

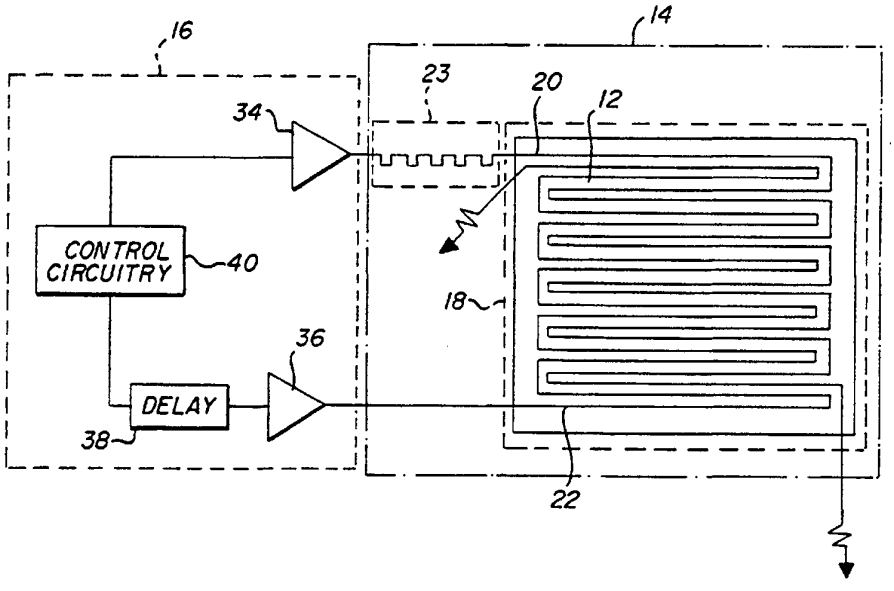
(74) Agents: KOCH, Robert, J.; Fulbright & Jaworski L.L.P., 801 Pennsylvania Avenue, N.W., Washington, DC 20004-2604 (US) et al.

(81) Designated States: AU, BB, BG, BR, BY, CA, CN, CZ, FI, HU, JP, KP, KR, KZ, LK, LV, MG, MN, MW, NO, NZ, PL, PT, RO, RU, SD, SK, UA, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: METHOD OF AND APPARATUS FOR ADDRESSING A MATRIX DISPLAY

(57) Abstract



This invention relates to an apparatus and method for creating visual images on a display area. This invention uses the selective convergence of traveling electrical signals to cause selected display locations located across a display area to illuminate or to change their visual appearances. The apparatus of the invention includes a display mechanism that either illuminates or changes its visual appearance when activated, at least one signal propagation path that directs the propagation of the signals across the display area, and signal control equipment for selectively transmitting the signals. In a preferred embodiment first and second signal propagation paths provide unique propagation paths that pass through each of the display locations across the area of the display. The signal control equipment selectively delays the transmission of the second signal relative to the first signal causing the signals to converge at a selected location to produce a change in the visual appearance of the screen at the selected location. By repeatedly altering the appearance of display locations across the display area, visual images may be produced. Requiring as few as one screen driver, the hardware requirements of the invention are minimal. The present invention also includes a method for producing visual images using the above described apparatus. Further disclosed are apparatus for continuing the display signal once activated and for better directing the electrical signals to produce an activating signal at a selected display location. Further included are apparatus and methods for selectively activating each of the plurality of display locations across the display area using signal trains made up of a plurality of selectively controlled pulses.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	**GB**	United Kingdom	**MR**	Mauritania
AU	Australia	**GE**	Georgia	**MW**	Malawi
BB	Barbados	**GN**	Guinea	**NE**	Niger
BE	Belgium	**GR**	Greece	**NL**	Netherlands
BF	Burkina Faso	**HU**	Hungary	**NO**	Norway
BG	Bulgaria	**IE**	Ireland	**NZ**	New Zealand
BJ	Benin	**IT**	Italy	**PL**	Poland
BR	Brazil	**JP**	Japan	**PT**	Portugal
BY	Belarus	**KE**	Kenya	**RO**	Romania
CA	Canada	**KG**	Kyrgystan	**RU**	Russian Federation
CF	Central African Republic	**KP**	Democratic People's Republic of Korea	**SD**	Sudan
CG	Congo			**SE**	Sweden
CH	Switzerland	**KR**	Republic of Korea	**SI**	Slovenia
CI	Côte d'Ivoire	**KZ**	Kazakhstan	**SK**	Slovakia
CM	Cameroon	**LI**	Liechtenstein	**SN**	Senegal
CN	China	**LK**	Sri Lanka	**TD**	Chad
CS	Czechoslovakia	**LU**	Luxembourg	**TG**	Togo
CZ	Czech Republic	**LV**	Latvia	**TJ**	Tajikistan
DE	Germany	**MC**	Monaco	**TT**	Trinidad and Tobago
DK	Denmark	**MD**	Republic of Moldova	**UA**	Ukraine
ES	Spain	**MG**	Madagascar	**US**	United States of America
FI	Finland	**ML**	Mali	**UZ**	Uzbekistan
FR	France	**MN**	Mongolia	**VN**	Viet Nam
GA	Gabon				

METHOD OF AND APPARATUS FOR ADDRESSING A MATRIX DISPLAY

BACKGROUND OF THE INVENTION

Cathode ray tube video displays have been the standard for many years. Cathode ray tube displays create images by selectively firing of a cathode ray or electron beam on a surface coated with an illuminating material, the surface illuminating in response to the electron beam. With this technology, however, a minimum distance between the source of the electron beam and the surface coated with illuminating material was required in order to properly control the electron beam to produce a desired image. In most cases, the cathode ray was fired substantially perpendicularly to the display screen. Therefore, displays using this technology typically required a minimum distance between the viewing surface of the display screen and the electron gun behind the display screen. Further, the technology has been criticized for emitting potentially damaging amounts of radiation from the cathode ray tube display surface.

In many applications it has been desirable to employ video displays with shorter front to back dimensions. Lap top computers, for example, require thin video displays to create a computer package of a minimal volume. One way to create a thinner video display was to discharge the cathode rays from directions that were not perpendicular to the display screen. However, when cathode rays were fired from these positions, the control of the cathode rays was much more difficult and resulted in the degradation of the video image.

A solution that overcame these problems included selectively energizing specific display locations using an electrical signal. In this

arrangement, a display screen was provided with discrete pixels of illuminating material or another material with an alterable appearance. Arranged on the display screens were a plurality of electrically conductive row traces and a plurality of electrically conductive column traces, each row and column trace extending across the screen only once. Typically, the row traces were disposed perpendicularly to the column traces. The pixels were arranged such that energizing a particular row and a particular column caused a specific pixel to illuminate. Therefore, each pixel on the display screen could be uniquely addressed by energizing a certain row and column combination.

This technology, however, required a driver for each row trace and for each column trace. In a system with one thousand rows of resolution and one thousand columns of resolution, 2000 drivers were required. Typically, only one pixel was addressed at a time requiring the individual enablement of a specific row driver and a specific column driver. In operation, an incoming video signal was converted and decoded so that the pixels could be selectively activated. However, with this technology, the required signal decoding and selective enablement of a specific row driver and a specific column driver could not be performed quickly enough to drive high resolution displays. The cost of such displays was great because of the large number of drivers required. Further, these displays were not efficient and, in a typical portable computer installation, consumed a large percentage of the available energy.

SUMMARY OF THE INVENTION

It is therefore a general object of the invention to provide an apparatus and method to overcome the above limitations and others in prior video display devices. More particularly, it is an object of the present invention to provide a thin video display that requires a

minimal number of drivers and still is capable of providing a high resolution visual image.

A video display driver and screen embodying the principles of the present invention comprises display means, transmission means, and signal control means, the combination of which provides for the selective activation of a plurality of display locations across a display area.

The display means extends throughout the plurality of display locations across the display area and produces a display signal at a selected display location among the plurality of display locations upon receipt of an activating signal at the selected display location. The display means may employ discrete pixels of illuminating material, uniformly distributed illuminating material, gas discharge illumination, liquid crystal display technology, or other means to produce the display signal at the display location.

The transmission means is associated with the display area and provides at least one continuous propagation path extending through each of the plurality of display locations across the display area. The transmission means is for directing the propagation of a first pulsed electrical signal and a second pulsed electrical signal across the display area such that the signals may converge at any of the display locations across the display area.

The signal control means is for selectively transmitting the first and the second pulsed electrical signals along the transmission means such that the first and second pulsed electrical signals converge to produce the activating signal at the selected display location. The propagation velocity of the electrical signals along the transmission means is determined by the physical construction of the transmission means. Thus, each of the signals propagates to a specific display location in a certain respective time. Therefore, by selectively delaying the transmission of the second pulsed electrical signal relative to the

first pulsed electrical signal, the signals may be controlled to converge at a selected display location.

In one embodiment of the transmission means, the first pulsed electrical signal propagates along a first trace forming a plurality of substantially parallel rows and providing a continuous propagation path that extends through each of the plurality of display locations. The second pulsed electrical signal propagates along a second trace forming a plurality of substantially parallel rows oriented substantially parallel to and intervolved with the plurality of substantially parallel rows formed by the first trace. The second trace provides a continuous propagation path that also extends through each of the plurality of display locations. The first and second traces are substantially electrically isolated from each other and facilitate the convergence of the first and second pulsed electrical signals at each of the plurality of display locations across the display area.

The transmission means includes a signal propagation delay path connected between the signal control means and the first trace. This delay path provides a signal delay equal to that of the entirety of the second trace. Therefore, when the first and second signals are transmitted from the signal control means with zero respective delay, the signals converge to produce the activating signal at a display location corresponding to a an extreme first end of the first trace and an extreme second end of the second trace. By selectively delaying the transmission of the second pulsed electrical signal, the convergence location of the electrical signals may be precisely controlled to cause an illumination at any of the plurality of display locations.

In a minimal configuration only two drivers are required lowering power consumption, software requirements, and hardware requirements. Therefore, the present invention does not suffer from the limitations associated with the prior electrical signal convergence devices. Also, because of the minimal space requirements of the transmission means and display means according to the invention, the

display screen may be thinly formed and may be constructed in a one-piece sandwiched manner. The invention further provides for the transmission and convergence of narrow pulses at physically small display locations thus providing high resolution at minimal cost. Alternatively, illuminating material may be uniformly positioned across the area of the display. With this construction, the width of the display location may be varied by varying the widths of the pulsed electrical signals. Thus, the present invention provides for a variable resolution display screen. Further, because the invention does not use cathode ray technology, less radiation is produced by the screen, reducing adverse health effects. Additionally, because the apparatus of this invention may be formed in any shape, a video display created using the principles of this invention need not be substantially flat.

These and other objects, advantages, and features of the invention will be apparent from the following description of the preferred embodiments, considered along with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1a is a diagrammatic view of a video display embodying the principles of the present invention, including a display means, a transmission means, and signal control means.

FIGURE 1b is a diagrammatic view of a first signal to be transmitted along the transmission means.

FIGURE 1c is a diagrammatic view of a second signal to be transmitted along the transmission means.

FIGURE 2 is a partial sectional diagrammatic view of the first preferred embodiment of the display area of the video display, the view showing how the first preferred embodiment of the transmission means and display means interact.

FIGURE 3a is an diagrammatic top view of the first preferred embodiment of the transmission means along with an electrical

schematic diagram of a first trace driver of the video display of the first preferred embodiment.

FIGURE 3b is an electrical schematic diagram of a second trace driver and signal delay generator of the video display of the first preferred embodiment.

FIGURE 3c is an electrical schematic diagram of a control circuit associated with the video display of the first preferred embodiment.

FIGURE 4 is a partial top diagrammatic view of a second preferred embodiment of the display means including discretely disposed illuminating pixels.

FIGURE 5 is a partial diagrammatic top view of a third preferred embodiment of the display means including discretely disposed liquid crystal display segments.

FIGURE 6 is a partial cross-sectional diagrammatic view of a fourth preferred embodiment of the display means using a gas discharge illuminating technique.

FIGURE 7a is a diagrammatic top view of a second preferred embodiment of the transmission means.

FIGURE 7b is a partial cross-sectional diagrammatic view of the second preferred embodiment of the transmission means.

FIGURE 8a is a diagrammatic top view of a third preferred embodiment of the transmission means.

FIGURE 8b is a partial cross-sectional diagrammatic view of the third preferred embodiment of the transmission means.

FIGURE 9a is a diagrammatic top view of a fourth preferred embodiment of the transmission means.

FIGURE 9b is a partial cross-sectional diagrammatic view of the fourth preferred embodiment of the transmission means.

FIGURE 10a is a diagrammatic view of a second preferred embodiment of a video display embodying the principles of the present invention, including a display means, a transmission means, and signal control means.

FIGURE 10b is a diagrammatic view of a first signal to be transmitted along the transmission means included in the video display of FIGURE 10a.

FIGURE 10c is a diagrammatic view of a second signal to be transmitted along the transmission means included in the video display of FIGURE 10a.

FIGURE 11 is a partial cross-sectional diagrammatic view of an alternate preferred embodiment of the present invention including display continuation means.

FIGURES 12a, 12b, 12c, and 12d are partial diagrammatic views of alternate physical constructions of traces wherein the physical distance between the traces decreases at a display location.

FIGURE 13 is a partial cross-sectional diagrammatic view of a fifth preferred embodiment of the display means including a viewing screen coated with an illuminating material selectively energized by bombarding electrons.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The principles of the present invention are shown by way of illustration in FIGURES 1 through 12. A video display 10 embodying the principles of the present invention is shown in FIGURE 1a and comprises display means 12, transmission means 14 and signal control means 16.

The display means 12 extends throughout a plurality of display locations across a display area 18. The display means 12 is for producing a display signal at a selected display location among the plurality of display locations upon receipt of an activating signal at the selected display location.

The transmission means 14 is associated with the display area 18 and provides at least one continuous propagation path through each of the plurality of display locations across the display area. The transmission means 14 is for directing the propagation of a first pulsed

electrical signal and a second pulsed electrical signal across the display area.

The signal control means 16 is for selectively transmitting the first and second pulsed electrical signals along the transmission means such that the first and second pulsed electrical signals converge to produce the activating signal at the selected display location.

As shown in FIGURE 1a, the first preferred embodiment of the transmission means 14 includes a first trace 20, a second trace 22, and a signal delay path 23. The first trace 20 forms a plurality of substantially parallel rows and provides a continuous propagation path that extends through each of the plurality of display locations across the display area 18. The second trace 22 forms a plurality of substantially parallel rows oriented substantially parallel to and intervolved with the plurality of substantially parallel rows formed by the first trace 20. The second trace 22 also provides a continuous propagation path that extends through each of the plurality of display locations across the display area 18. The first trace 20 and second trace 22 are substantially electrically isolated from each other and converge at each of the plurality of display locations across the display area 18.

FIGURE 2 shows a partial sectional view of the construction of the display area 18 in a first preferred embodiment. The first preferred embodiment of the display means 12 employs an illuminating material 24 that generates visual light when electrified, a protective cover 26, an insulating substrate layer 28, and a grounded conducting layer 30. The illuminating material 24 is disposed substantially uniformly across the display area 18 as shown in FIGURE 2. The area between the first trace 20 and the second trace 22, as shown in this drawing is a display location. When the voltage between the first trace 20 and the second trace 22 becomes large enough, the illuminating material 24 conducts electricity and responsively emits visual light. The grounded conducting layer 30 ensures the uniform propagation of electrical signals along the first trace 20 and the second trace 22. The insulating

substrate layer 28 prevents the conduction of electricity from the first trace 20 or the second trace 22 to the grounded conducting layer 30.

Referring again to FIGURE 1a, the signal control means 16 comprises a first trace driver 34, a second trace driver 36, a signal delay generator 38, and control circuitry 40. Control circuity 40 selectively causes the first trace driver 34 to produce a first pulsed electrical signal 42 of a selected voltage 44 and a selected width 46 as shown in FIGURE 1b. The first pulsed electrical signal 42 propagates along the first trace 20. Control circuitry 40 also causes the second trace driver 36 to produce a second pulsed electrical signal 48 of a selected voltage 50 and a selected width 52 as shown in FIGURE 1c. Referring again to FIGURE 1a, the control circuitry 40 also causes the signal delay generator 38 to delay the transmission of the second pulsed electrical signal 48 from the second trace driver 36 by a selected interval.

In operation, neither the first 42 nor the second 48 pulsed electrical signal is of sufficient voltage to cause the conduction of electricity across the illuminating material 24. However, in combination, the pulsed electrical signals 42 and 48 produce the activating signal which causes electricity to conduct across the illuminating material 24 and resultantly causes the illuminating material to emit light from the respective display location. Because the signals only combine when they converge along the transmission means 12, a display location is selected by varying the delayed transmission of the second pulsed electrical signal 48 from the second signal driver 36 relative to the transmission of the first electrical signal 42 from the first signal driver 34.

Referring again to FIGURE 1a, the transmission means 14 includes a signal delay path 23. The signal delay path 23 introduces propagation delay equal to the time that it takes for the second pulsed electrical signal 48 to propagate along the entirety of the second trace 22. Thus, when no delay is introduced by the signal delay generator 38, the first 42 and second 48 pulsed electrical signals converge to produce

the activating signal at an extreme first end of the first trace 20 and an extreme second end of the second trace 22. The converging location preferably corresponds to the extreme upper left portion of the display area 18.

When the signal delay generator 38 delays the second pulsed electrical signal 48 by a time period equal to twice the length of time that it takes for the first pulsed electrical signal 42 to propagate along the entirety of the first trace 20, the signals 42 and 48 converge to produce the activating signal at the extreme second end of the first trace 20 and the extreme first end of the second trace 22, such location preferably corresponding to the extreme lower right portion of the display area 18. The activating signal may be produced at other selected display locations across the display area 18 by causing the signal delay generator 38 to delay the firing of the second pulsed electrical signal 48 relative to the transmission of the first signal 42. Thus, by selectively activating the plurality of display locations across the display area 18 a visual image may be produced.

Further control may be had by varying the pulse width of the first 42 and second 48 pulsed electrical signals. In the case of the substantially uniformly disposed illuminating material 24 of the first preferred embodiment as shown in FIGURE 2, pulse widths may be narrowed or widened to produce an activating signal of varying width. The width of the activating signal determines the width of the display location.

FIGURES 3a, 3b, and 3c shows in detail a first preferred embodiment of the signal control means 16 which drives the video display 10 shown in FIGURE 1a. FIGURE 3a shows control circuitry 40 which includes a microprocessor 54 for selectively controlling the first trace driver 34, the second trace driver 36, and the signal display generator 38 via Bus 57. The microprocessor 54 is preferably a Motorola 68HC0584 but could be any of a wide variety of controlling devices available. Microprocessor 54 is capable of converting analog

video input 56 to digital data and using such data to create images on the display area 18. Control circuit 40 includes additional control inputs 56 and an audio output device 58 for providing an audio signal. Many variations of this control circuit are possible as will be appreciated by one skilled in the art.

The first trace driver 34 and the second trace driver 36 comprise identical components and, although separately controlled by the microprocessor 54, function in the same manner. Referring to FIGURE 3b, the first trace driver 34 comprises a first pulse leading edge generator 62, a first pulse trailing edge generator 64, and latch counters 66, 68, 70, and 72.

Preferably, leading edge pulse generator 62 and trailing edge pulse generator 64 are AD9501 Digitally Programmable Delay Generators made by Analog Devices, Inc. These delay generators provide 10 picosecond resolution. Custom made components, however, would likely yield greater resolution than 10 picoseconds and could alternatively be used. The resolution of the pulse generators 62 and 64 determines the minimum pulse width. Using two AD9501s, a pulse width of as little as 10 picoseconds is achievable.

Latch counters 66 and 68 receive data from the microprocessor 54 over bus 57, the data on lines D0-D7 input into the latch counters when signal L0 is asserted. Other data may be input into latch counters 66 and 68 by introducing data on bus 57 and again asserting signal L0. Data held in latch counters 66 and 68 serves as input data to the leading edge generator 62. Latch counters 70 and 72 also receive data over the bus 57 in the same manner, data is latched into the latch counters by asserting signal L1 and held as input data for the trailing edge generator 64.

The leading edge generator 62 outputs a low to high edge on line PULS1 at or after signal TRIG is asserted. The time delay between receiving signal TRIG and outputting the low to high edge is determined by the input data supplied to leading edge generator 62 by

latch counters 66 and 68. Trailing edge generator 62 pulls line PULS1 from high to low at some time after receiving signal TRIG, the delay between receiving signal TRIG and pulling line PULS1 from high to low being determined by the input data supplied by latch counters 70 and 72.

Both the leading edge generator 62 and the trailing edge generator 64 are triggered by signal TRIG, and therefore the data input to the generators determines the delay in transmission and resultantly the width of signal PULS1. Because generators 62 and 64 have a 10 picosecond resolution, the generators may be programmed to produce a trailing edge 10 picoseconds after producing a leading edge. Therefore, a pulse width of 10 picoseconds is possible with the cited parts. In a normal mode of operation, the leading edge of signal PULS1 is transmitted upon receipt of signal TRIG without added delay and the output of generator 64 is delayed to produce a signal of a desired width.

Signal PULS1 drives first pulse transistor 80, causing the transistor to output a pulse of the selected height 44 and width 46. The output from first pulse transistor 80 propagates along the first trace 20.

Referring now to FIGURE 3c, the signal delay generator 38 comprises a first delay generator 84 and a second delay generator 86, both of which are also preferably model AD9501 Digitally Programmable Delay Generators made by Analog Devices, Inc. Latch counters 88 and 90 receive data over lines D0-D7 on bus 57 from the microprocessor and latch the data when signal L2 is enabled. New data may be input in latch counters 88 and 90 by again asserting signal L2. The data in latch counters 88 and 90 inputs into the first delay generator 84, causing the first delay generator to produce a signal DTRIG between 0 and 2 nanoseconds after receiving signal TRIG. Here, also, the resolution on the delay of signal DTRIG is 10 picoseconds.

The second delay generator 86 also receives data from microprocessor 54 over bus 57. Latch counters 92 and 94 latch data when signal L3 is asserted, the latched data held as input to the second delay generator 86. Other data may is input into the latch counters 92 and 94 by again asserting signal L3. Upon or after receipt of DTRIG from the first delay generator 84, the second delay generator 86 asserts signal 2TRIG. The delay in asserting DTRIG is determined by the data input to the second delay generator 86 by latch counters 92 and 94. Preferably, the second delay generator 86 is programmable for between 0 and 1 microsecond of delay in intervals of 2 nanoseconds. Therefore, the signal delay generator 38 as a whole is capable of producing signal 2TRIG after the receipt of signal TRIG with an intervening delay of between 0 and 1.002 microseconds with a resolution increment of 10 picoseconds.

Signal 2TRIG then triggers the second trace driver 36. Referring to FIGURE 3c, the second trace driver 36 is preferably identical to the first trace driver 34. The second trace driver comprises a second pulse leading edge generator 96, a second pulse trailing edge generator 98, and latch counters 100, 102, 104, and 106. Latch counters 100 and 102 receive data from the microprocessor 54 over bus 57, the data on lines D0-D7 input into the latch counters when signal L4 is asserted. Additional data may be input to the latch counters 100 and 102 by introducing data on bus 57 and again asserting signal L4. Such data is then held as input data for leading edge generator 96.

Latch counters 104 and 106 receive data over bus 57 in the same manner, the data latched by asserting signal L5. Latch counters 106 and 108 provide input data to trailing edge generator 98. Leading edge generator 96 develops a low to high signal on line PULS2 at or some time after receiving signal 2TRIG. The delay time is determined by the input data supplied to leading edge generator 96 by latch counters 102 and 104. Preferably, leading edge generator 96 asserts upon receipt of signal 2TRIG without added delay.

The trailing edge generator 98 pulls the signal on line PULS2 from high to low at some time after receiving signal 2TRIG. Data latched on latch counters 106 and 108 and input to trailing edge generator 98 determines the delay between receiving signal 2TRIG and pulling the signal PULS2 from high to low. Signal 2TRIG triggers both the leading edge generator 96 and the trailing edge generator 98, and therefore the delay of signal PULS2 is referenced to the receipt of signal 2TRIG. Because generators 96 and 98 can be programmed to a 10 picosecond resolution, signal PULS2 may be a pulse of a minimum width of 10 picoseconds.

Referring again to FIGURE 3b, signal 102 inputs into a second pulse transistor 110, enabling the transistor to transmit a pulse of the selected height 50 and width 52 along the second trace 22.

In operation, the microprocessor 54 programs the first trace driver 34 to transmit a first pulsed electrical signal 42 of a selected height 44 and width 46 along the first trace 20. The microprocessor 54 also programs the second trace driver to transmit a second pulsed electrical signal 48 of a selected height 50 and width 52 along the second trace 22. Further, the microprocessor programs the signal delay generator 38 to delay the transmission of the second pulsed electrical signal 48 by a certain delay. In this manner, the selective control of the height, width, and transmission of the pulsed electrical signals causes the convergence of the electrical signals at a selected display location along the transmission means 14. The selective convergence produces the activating signal at the selected display location and causes the display means 12 to emit light from the selected display location.

To prevent reflections on the transmission means 14, the first trace 20 and second trace 22 are terminated into terminating resistors 112 and 114 respectively. First pulsed electrical signal 42 propagates along the transmission means 14 from the first transistor 80 until it reaches a first terminating resistor 112. The first terminating resistor 112 provides a path to ground for the first pulsed electrical signal 42,

prevents reflections, and therefore prevents the inadvertent convergence of signals at undesired locations. The second terminating resistor 114 performs the same function for the second trace 22.

FIGURE 4 shows a second preferred embodiment of the display means 12. This embodiment of the display means 12 includes a plurality of illuminating pixel means, one of the illuminating pixel means disposed at each of the plurality of display locations, each illuminating pixel means for emitting light from its respective display location upon receipt of an activating signal at the respective display location. As shown in FIGURE 4, discretely disposed pixels 116 are located at each display location such that the first and second pulsed signals 42 and 48 may converge to produce the activating signal at the selected display location. Pixels are bounded by the first and second traces 20 and 22 and electrically insulating boundaries 118, forming discrete display location. Not shown in this view is a transparent protective layer.

With the embodiment of the display means 12 shown in FIGURE 4, a color monitor may be easily constructed. Pixels of red, blue and green illuminating material may be discretely disposed at the display locations such that the signal control means 16 selectively illuminates the pixels to create a colored visual image.

FIGURE 5 shows a third preferred embodiment of the display means 12. This embodiment of the display means 12 includes a plurality of liquid crystal display means, one of the liquid crystal display means disposed at each of the plurality of display locations. Each liquid crystal display means is for changing the visual appearance of its respective display location upon receipt of an activating signal at the respective display location. As shown in FIGURE 5, discretely disposed liquid crystal diodes 120 are located at each display location such that the first and second pulsed signals 42 and 48 may converge to produce the activating signal at each display location. The discretely disposed liquid crystal diodes 120 are bounded by the first trace 20 and

the second trace 22. In this embodiment, the display means 12 does not produce visual light, but instead, alters the visual appearance of each display location when the activating signal is produced at that respective display location.

FIGURE 6 shows a fourth preferred embodiment of the display means 12 including gas discharge illumination means associated with the display area for emitting light from the selected display location upon receipt of an activating signal at the selected display location. As shown in FIGURE 6, gas discharge illumination means includes a gas filled cavity 122, the gas in the cavity producing ultraviolet radiation when an electrical arc 124 conducts across it. Such an arc 124 is produced when the first pulsed electrical signal 42 and the second pulsed electrical signal 48 converge at the selected display location to produce the activating signal. The ultraviolet radiation, in turn, causes an illuminating pixel element 126 to produce visible light. A transparent pixel cover 128 protects the structure. A non-conducting screen base 130 contains the gas within the cavity 122 and allows the first and second traces 20 and 22 to be deposed. A mounting substrate 132 preferably provides protection and rigidity to the structure. With this embodiment as well, a color monitor could easily be constructed. Illuminating pixel elements 126 of red, blue and green colors could be discretely disposed at the display locations such that the signal control means 16 could selectively illuminate the pixels to create a colored visual image.

FIGURE 7a is a diagrammatic top view and FIGURE 7b is a diagrammatic partial cross-sectional view of a second preferred embodiment of the transmission means 14. Referring to FIGURE 7a, the second preferred embodiment of the transmission means includes a row trace 134 forming a plurality of substantially parallel rows and providing a continuous propagation path that extends through each of the plurality of display locations. This embodiment also includes a column trace 136 forming a plurality of substantially parallel columns

oriented substantially perpendicularly to the plurality of substantially parallel rows formed by the row trace 134. The column trace 136 also provides a continuous propagation path that extends through each of the plurality of display locations. The row 134 and column 136 traces are substantially electrically isolated from each other and converge at each of the plurality of display locations across the display area 18.

Referring to FIGURE 7b, the row trace 134 and the column trace 136 converge at a plurality of display locations 32. Illuminating material 24 forms a path through which electricity may conduct from the row trace 134 to the column trace 136 when the activating signal is produced at the display location. This embodiment also includes a protective cover 26, an insulating substrate layer 28, and a grounded conducting layer 30 that enables the uniform propagation of the first 42 and second 48 pulsed electric signals along the transmission means 14.

In operation, this embodiment works similarly to the first preferred embodiment. The first pulsed electrical signal 42 propagates through the signal delay path 123 and then along the first trace 20. The selectively delayed second pulsed electrical signal 48 propagates along the second trace 22. The selective delay causes the first 42 and second 48 pulsed electrical signals to converge at a selected display location to produce the activating signal. Resultantly, the display location illuminates. Here again, the selective illumination of display locations facilitates the creation of visual images on the video display 10.

FIGURE 8a is a diagrammatic top view and FIGURE 8b is a diagrammatic partial cross-sectional view of a second preferred embodiment of the transmission means 14. Referring to FIGURE 8a, the third preferred embodiment of the transmission means 14 includes a trace 138 forming a plurality of substantially parallel rows and providing a continuous propagation path that extends through each of the plurality of display locations across the display area 18. In this

embodiment, the trace 138 is unterminated such that a signal propagating along the trace will fully reflect when it reaches the end of the trace. The selective convergence of the first 42 and second 48 pulsed electrical signals, each propagating along the trace 138 produces the activating signal.

Referring again to FIGURE 8b, illuminating material 24 forms a path through which electricity may propagate from a location along the trace 138 to either a grounded propagation layer 140 or to another location along the trace depending upon the polarity of the signals propagating along the trace 138. This embodiment also preferably includes a protective cover 26, and an insulating substrate layer 28. The grounded propagation layer 140, preferably in the form of a transparent conductive grid, in addition to providing a return path for the conducted electricity also enables the uniform propagation of the first 42 and second 48 pulsed electric signals along the trace 138.

Referring to FIGURE 8a, an activating signal may be produced in one of two ways using this embodiment of the transmission means. If both the first 42 and second 48 pulsed electrical signals are of positive voltage, the signals converge at a single physical point along the trace 138, adding to produce a voltage of sufficient magnitude to conduct across the illuminating material 24 to the grounded propagation layer 140, and resultantly causing the illuminating material 24 to emit light. If the first pulsed electrical signal 42 is of a positive voltage and the second pulsed electrical signal 48 is of a negative voltage, the signals will converge to produce the activating signal when they pass near each other, each pulse at a different location along the trace 138. In this case, electricity conducts from one portion of the trace 138 to another portion of the trace through the illuminating material 24 thereby producing the activating signal.

FIGURE 9a is a diagrammatic top view and FIGURE 9b is a diagrammatic partial cross-sectional view of a fourth preferred embodiment of the transmission means 14. Referring to FIGURE 9a,

the fourth preferred embodiment of the transmission means 14 includes a trace 138 forming a plurality of substantially parallel rows and providing a continuous propagation path that extends through each of the plurality of display locations. This embodiment also includes surface propagation means 141 substantially electrically isolated from and substantially coextensive with the trace across the display area 32, the surface propagation means for enabling the second pulsed electrical signal 48 to propagate substantially uniformly across the display area 18.

As shown in FIGURE 9b, the surface propagation means 141 preferably takes the form of a transparent conductive grid. In this embodiment, the first pulsed electrical signal 42 propagates along the trace 138. The second pulsed electrical signal 48 propagates along the surface propagation means 141 such that the signals converge to produce the activating signal at the selected display location.

Illuminating material 24 forms a path through which electricity may propagate to the surface propagation means 141 when the activating signal is produced at the display location. This embodiment also includes a protective cover 26, and an insulating substrate layer 28. The surface propagation means 141, in addition to directing the second pulsed electrical signal 48, also enables the uniform propagation of the first pulsed electric signal 42 along the trace 138. The surface propagation means 141 may be constructed in such a manner so that the second pulsed electric signal 48 propagates uniformly along one dimension of the screen thereby making the selective convergence of signals easier to control.

The apparatus of the present invention also includes an alternate preferred embodiment of the signal control means 16. Referring to FIGURE 10a, this embodiment of the signal control means 16 is described in combination with the first preferred embodiment of the display means 12 and first preferred embodiment of the transmission means 14, both described above. In this embodiment, as shown in

FIGURE 10b, a first pulsed signal comprises a single pulse of a selected height and width with a selected period. A second pulsed signal, however, as shown in FIGURE 10b comprises a plurality of negative peaks, the combination of these peaks forming a second pulsed signal train.

Referring to FIGURE 10a, when the first pulsed signal and the second pulsed signal train are transmitted from the first 80 and the second 110 transistors at the same time, the first pulsed signal and the beginning of the second pulsed signal train converge at the extreme first end of the first trace 20. Then, as the first signal continues to propagate along the first trace 20 and the second pulsed signal train continues to propagate along the second trace 22, the signals continues to converge across the display area 18 and produced activating signals at various selected activating locations. Activating signals are produced at locations where the positive peak of the first pulsed signal converges with the negative peaks of the second pulsed signal train.

The second pulsed signal train is twice as long as the second trace 22. Therefore, when the first pulsed signal reaches the extreme lower right portion of the display area 18, it converges with the end of the second pulsed signal train. The width of the individual negative peaks and their location along the second pulsed signal train are selected so that selected display locations may be illuminated to produce a visual image.

In this embodiment of the signal control means 16, each display location on the display area may be updated at a rate that is dependent only upon the duration of the second pulsed signal train. For example, suppose it takes 10 microseconds for the second pulsed signal train to propagate along the entirety of the second trace. In that case, the trailing edge of the second pulsed signal train propagates to the second terminating resistor 112 approximately 20 microseconds after the leading edge of the second pulsed signal train begins to propagate along the second trace 22. Because both the first pulsed signal and the

second pulsed signal train must have exited the display area 18 before more pulses may be transmitted along the traces, the video display may be updated every 20 microseconds. A standard television screen updates approximately once every 33 milliseconds.

Referring to FIGURE 10a, a high frequency oscillator 142 produces a sine wave with a selected frequency of oscillation. The frequency of the high frequency oscillator 142 is selected so that the oscillator produces a sine wave with a narrow pulse width, preferably between 1 and 10 picoseconds. The oscillator output is input into divider 144. The divider 144 is selected such that the output of the divider is a sine wave with a period equal to twice the propagation delay along the second trace 22. The divider output is then input into a pulse generator 146, triggering the pulse generator on a negative to positive zero crossing. Responsively, the pulse generator 146 produces a narrow pulse, preferably less than 10 picoseconds, the period equal to twice the propagation delay along the second trace 22. The output from the pulse generator is then input into the first pulse transistor 80 which drives the first trace 20.

The output from the high frequency oscillator 142 is also input into a second signal modulator 148 along with an input video modulation signal. The output from the second signal modulator 148, as shown in FIGURE 10b is then input into the second pulse transistor 110, the output from which drives the second trace 22. The signal driving the second pulse transistor potentially can produce an activating signal at each of the plurality of display locations. The selective disablement by modulation of individual portions of the second pulsed signal train facilitates the selective enablement and partial enablement of each display location across the display area, thus creating a visual image.

The apparatus of the present invention also includes display continuation means for enabling the display means 12 to produce continued display signals at the respective selected display locations

after receipt of the activating signals at the selected display locations. FIGURE 11 shows a partial diagrammatic cross-section view of the third preferred embodiment of the transmission means 16 including display continuation means. At each activating location, two energized traces 150 are positioned opposite each trace 138. The energized traces 150 are energized at a voltage relative to the grounded conducting surface. The voltage on the traces 150 is below the level of the activating signal but is large enough to cause the current through the illuminating material 24 to continue to flow once the activating signal has initiated current flow through the illuminating material 24. A grounded propagation layer 149 allows current to flow from each energized trace through the illuminating material 24 until a deactivating signal is applied across that particular display location. The deactivating signal is a negative voltage signal applied to the particular display location which causes the current flow through the illuminating material at that location to cease.

The present invention also includes a feature for enhancing the operation of the display means 12 and transmission means 14 by increasing the conductivity of the paths through which electricity must pass at each display location. With the display means 12 and the transmission means 14 of the first preferred embodiment, for example, the conductivity from the first trace 20 to the second trace 22 is determined by the material separating the traces. The features demonstrated in FIGURES 12a, 12b, 12c, and 12d show how the conductivity between the traces 20 and 22 may be reduced by reducing the distance between the traces at each of the display locations. Such features facilitate simpler signal control by preventing inadvertent convergence of signals and preferred conduction paths between the traces.

Referring particularly to FIGURE 12a, the first trace 20 and the second trace 22 both include excursion points 152 that decrease the physical distance between the traces. Resultantly, the conductivity

between the two traces is enhanced between the points 152 and electricity is more likely to flow between the points 152. Resultantly, the definition of the screen may be enhanced with this arrangement.

Varying designs for enhancing the conductivity between the traces 20 and 22 may be designed to perform differing purposes. Referring to FIGURE 12b, the first trace 20 and the second trace 22 both include excursion lines 153 which enhance the conductivity at between the traces at those location. Excursion lines of this type operate to achieve softer images. As shown in FIGURE 12c and 12d, A complex design may be created that includes a multiplicity of excursion points at each display location. In this embodiment, central excursion points 154 are used to direct electrical arcs 156 from one central excursion point 154 to another central excursion point 154 when the first 42 and 48 electrical signals converge at opposing central excursion points 156. Further, lateral excursion points 155 enhance the conductivity of the display means 12 to create an electrical arc 157 from one lateral excursion point to another lateral excursion point when the signals 42 and 48 converge to produce the activating signal across lateral excursion points 155.

The apparatus of the present invention also includes a fifth preferred embodiment of the display means 12. FIGURE 13 shows a partial cross-sectional diagrammatic view of a fifth preferred embodiment of the display means 12. A viewing screen surface 162 is preferably coated with a phosphor material 160 but could be coated with another material that emits light when bombarded by electrons. The viewing screen surface 162 serves as an anode. The first trace 20 includes a low work function coating that facilitates the escape of electrons from the trace. The first trace 20 is preferably nearer the viewing screen surface 162 than is the second trace 22, the traces separated by a insulating layer 166, and the traces supported by an insulating substrate layer 28.

This embodiment of the display means 12 is selectively activated by the convergence of a first pulse 42 of a negative polarity and a second pulse 48 of a negative polarity. When the first 42 and second 48 pulses converge at a selected location, the combined voltage on the first 20 and second 22 traces causes electrons to emit from the first trace at the selected location. The electrons are attracted by the viewing screen surface 162 which acts as an anode. Resultantly, the electrons collide with the illuminating material 160 on the viewing screen surface 162 causing the illuminating material to emit light. As will be readily appreciated by one skilled in the art, a number of variations of this apparatus using an anode and a cathode to cause the selective emission and bombardment of a screen by electrons are possible.

The present invention also includes a method for selectively activating any of a plurality of different display locations across a display area. Such method embodies the principles of the present invention. As a first step, the method includes the step of selectively transmitting a first 42 and a second 48 pulsed electrical signal along a transmission means 14. The transmission means 14 provides at least one continuous propagation path that extends through each of the display locations 32. A second step of the method is directing the propagation of the first 42 and the second 48 pulsed electrical signals along the transmission means 14 such that the first and second pulsed electrical signals converge to produce an activating signal at a selected display location. And, a third step of method is the step of producing a display signal at the selected display location upon receipt of the activating signal at the selected location.

Alternate preferred embodiments of the method of the present invention include limitations introduced by the second, third, and fourth preferred embodiments of the transmission means 14. Those limitations were previously discussed. Further alternate preferred embodiments of the method of the present invention include limitations

introduced by the second, third, and fourth preferred embodiments of the display means 12. Such limitations were also previously discussed.

The above described preferred embodiments are intended to illustrate the principles of the invention, but not to limit the scope of the invention. Various other embodiments and modifications to these preferred embodiments may be made by those skilled in the art without departing from the scope of the following claims.

CLAIMS

WE CLAIM:

1. An apparatus for selectively activating various display locations in a display area, the apparatus comprising:

(a) display means extending throughout a plurality of display locations across the display area, the display means for producing a display signal at a selected display location among the plurality of display locations upon receipt of an activating signal at the selected display location;

(b) transmission means associated with the display area and providing at least one continuous propagation path that extends through each of the plurality of display locations across the display area, the transmission means for directing the propagation of a first pulsed electrical signal and a second pulsed electrical signal across the display area; and

(c) signal control means for selectively transmitting the first and the second pulsed electrical signals along the transmission means such that the first and second pulsed electrical signals converge to produce the activating signal at the selected display location.

2. The apparatus of Claim 1 wherein:

(a) the transmission means includes:

(i) a row trace forming a plurality of substantially parallel rows and providing a continuous propagation path that extends through each of the plurality of display locations;

(ii) a column trace forming a plurality of substantially parallel columns oriented substantially perpendicularly to the plurality of substantially parallel rows and providing a continuous

propagation path that extends through each of the plurality of display locations, the column and row traces being substantially electrically isolated from each other and converging at each of the plurality of display locations across the display area; and

(b) the first pulsed electrical signal electrical propagates along the row trace and the second pulsed electrical signal propagates along the column trace such that the first and second pulsed electrical signals converge to produce the activating signal at the selected display location.

3. The apparatus of Claim 2 wherein the display means includes:

(a) a plurality of illuminating pixel means, one of the illuminating pixel means disposed at each of the plurality of display locations, each illuminating pixel means for emitting light from its respective display location upon receipt of an activating signal at the respective display location.

4. The apparatus of Claim 2 wherein the display means includes:

(a) illuminating means substantially uniformly disposed across the display area, the illuminating means for emitting light from the selected display location upon receipt of an activating signal at the selected display location.

5. The apparatus of Claim 2 wherein the display means includes:

(a) gas discharge illumination means associated with the display area for emitting light from the selected display location upon receipt of an activating signal at the selected display location.

6. The apparatus of Claim 2 wherein the display means includes:

(a) a plurality of liquid crystal display means, one of the liquid crystal display means disposed at each of the plurality of display locations, each liquid crystal display means for changing the visual appearance of its respective display location upon receipt of an activating signal at the respective display location.

7. The apparatus of Claim 1 wherein:

(a) the transmission means includes:

(i) a first trace forming a plurality of substantially parallel rows and providing a continuous propagation path that extends through each of the plurality of display locations;

(ii) a second trace forming a plurality of substantially parallel rows oriented substantially parallel to and intervolved with the plurality of substantially parallel rows formed by the first trace and providing a continuous propagation path that extends through each of the plurality of display locations, the first and second traces being substantially electrically isolated from each other and facilitating the convergence of the first and second pulsed electrical signals at each of the plurality of display locations across the display area; and

(b) the first pulsed electrical signal propagates along the first trace and the second pulsed electrical signal propagates along the second trace such that the first and second pulsed electrical signals converge to produce the activating signal at the selected display location.

8. The apparatus of Claim 7 wherein the display means includes:
(a) a plurality of illuminating pixel means, one of the illuminating pixel means disposed at each of the plurality of display locations, each illuminating pixel means for emitting light from its respective display location upon receipt of an activating signal at the respective display location.

9. The apparatus of Claim 7 wherein the display means includes:
(a) illuminating means substantially uniformly disposed across the display area, the illuminating means for emitting light from the selected display location upon receipt of an activating signal at the selected display location.

10. The apparatus of Claim 7 wherein the display means includes:
(a) gas discharge illumination means associated with the display area for emitting light from the selected display location upon receipt of an activating signal at the selected display location.

11. The apparatus of Claim 7 wherein the display means includes:
(a) a plurality of liquid crystal display means, one of the liquid crystal display means disposed at each of the plurality of display locations, each liquid crystal display means for changing the visual appearance of its respective display location upon receipt of an activating signal at the respective display location.

12. The apparatus of Claim 1 wherein:
(a) the transmission means includes a trace forming a plurality of substantially parallel rows and providing a

continuous propagation path that extends through each of the plurality of display locations; and

(b) the first and second pulsed electrical signals each propagate along the trace such that the first and second pulsed electrical signals converge to produce the activating signal at the selected display location.

13. The apparatus of Claim 12 wherein the display means includes:

(a) a plurality of illuminating pixel means, one of the illuminating pixel means disposed at each of the plurality of display locations, each illuminating pixel means for emitting light from its respective display location upon receipt of an activating signal at the respective display location.

14. The apparatus of Claim 12 wherein the display means includes:

(a) illuminating means substantially uniformly disposed across the display area, the illuminating means for emitting light from the selected display location upon receipt of an activating signal at the selected display location.

15. The apparatus of Claim 12 wherein the display means includes:

(a) gas discharge illumination means associated with the display area for emitting light from the selected display location upon receipt of an activating signal at the selected display location.

16. The apparatus of Claim 12 wherein the display means includes:

(a) a plurality of liquid crystal display means, one of the liquid crystal display means disposed at each of the plurality of display locations, each liquid crystal display

means for changing the visual appearance of its respective display location upon receipt of an activating signal at the respective display location.

17. The apparatus of Claim 1 wherein:

(a) the transmission means includes:

(i) a trace forming a plurality of substantially parallel rows and providing a continuous propagation path that extends through each of the plurality of display locations;

(ii) surface propagation means substantially electrically isolated from and substantially coextensive with the trace across the display area, the surface propagation means for enabling the second pulsed electrical signal to propagate substantially uniformly across the display area; and

(b) the first pulsed electrical signal propagates along the trace and the second pulsed electrical signal propagates across the surface propagation means such that the first and second pulsed electrical signals converge to produce the activating signal at the selected display location.

18. The apparatus of Claim 17 wherein the display means includes:

(a) a plurality of illuminating pixel means, one of the illuminating pixel means disposed at each of the plurality of display locations, each illuminating pixel means for emitting light from its respective display location upon receipt of an activating signal at the respective display location.

19. The apparatus of Claim 17 wherein the display means includes:

(a) illuminating means substantially uniformly disposed across the display area, the illuminating means for emitting light from the selected display location upon receipt of an activating signal at the selected display location.

20. The apparatus of Claim 17 wherein the display means includes:
(a) gas discharge illumination means associated with the display area for emitting light from the selected display location upon receipt of an activating signal at the selected display location.

21. The apparatus of Claim 17 wherein the display means includes:
(a) a plurality of liquid crystal display means, one of the liquid crystal display means disposed at each of the plurality of display locations, each liquid crystal display means for changing the visual appearance of its respective display location upon receipt of an activating signal at the respective display location.

22. The apparatus of Claim 1 further comprising:
(a) display continuation means for enabling the display means to produce a continued display signal at the selected display location after receipt of the activating signal at the selected display location.

23. The apparatus of Claim 1 wherein:
(a) the transmission means is constructed to provide a plurality of electrically conductive paths through the display means, such paths decreasing in length at a multiplicity of the display locations.

24. The apparatus of Claim 2 wherein:

(a) the distance between the row trace and the column trace decreases at a multiplicity of the display locations.

25. The apparatus of Claim 7 wherein:

(a) the distance between the first trace and the second trace decreases at a multiplicity of the display locations.

26. The apparatus of Claim 12 wherein:

(a) the distance between the trace and a grounded surface that is associated with the display decreases at a multiplicity of the display locations.

27. The apparatus of Claim 12 wherein:

(a) the distance between two of the plurality of substantially parallel rows formed by the trace decreases at a multiplicity of the display locations.

28. The apparatus of Claim 17 wherein:

(a) the distance between the trace and the surface propagation means decreases at a multiplicity of the display locations.

29. An apparatus for selectively activating various display locations in a display area, the apparatus comprising:

(a) display means extending throughout a plurality of display locations across the display area, the display means for producing a plurality of display signals at respective selected display locations among the plurality of display locations upon receipt of activating signals at the selected display locations;

(b) transmission means associated with the display area and providing at least one continuous propagation path that extends through each of the plurality of display locations across the display area, the transmission means for directing the propagation of a first pulsed electrical signal and a second pulsed electrical signal across the display area; and

(c) signal control means for selectively transmitting the first and the second pulsed electrical signals along the transmission means such that the first and second pulsed electrical signals converge to produce the activating signals at the selected display locations.

30. The apparatus of Claim 29 further comprising:

(a) display continuation means for enabling the display means to produce continued display signals at the respective selected display locations after receipt of the activating signals at the selected display locations.

31. A method for selectively activating any of a plurality of different display locations across a display area, the method comprising the steps of:

(a) selectively transmitting a first and a second pulsed electrical signal along a transmission means that provides at least one continuous propagation path that extends through each of the display locations;

(b) directing the propagation of the first and the second pulsed electrical signals along the transmission means such that the first and second pulsed electrical signals converge to produce an activating signal at a selected display location; and

(c) producing a display signal at the selected display location upon receipt of the activating signal at the selected location;

32. The method of Claim 31 wherein the step of directing the propagation of the first and the second pulsed electrical signals along the transmission means includes:

(a) directing the first pulsed electrical signal along a row trace, the row trace forming a plurality of substantially parallel rows and providing a continuous propagation path that extends through each of the plurality of display locations; and

(b) directing the second pulsed electrical signal along a column trace, the column trace forming a plurality of substantially parallel columns oriented substantially perpendicularly to the plurality of substantially parallel rows formed by the row trace and providing a continuous propagation path that extends through each of the plurality of display locations, the column and row traces being substantially electrically isolated from each other and converging at each of the plurality of display locations across the display area.

33. The method of Claim 31 wherein the step of directing the propagation of the first and the second pulsed electrical signals along the transmission means includes:

(a) directing the first pulsed electrical signal along a first trace, the first trace forming a plurality of substantially parallel rows and providing a continuous propagation path that extends through each of the plurality of display locations; and

(b) directing the second pulsed electrical signal along a second trace, the second trace forming a plurality of substantially parallel rows oriented substantially parallel to and intervolved with the plurality of substantially parallel rows formed by the first trace and providing a continuous propagation path that extends through each of the plurality of display locations, the first and second traces being substantially electrically isolated from each other and converging at each of the plurality of display locations across the display area.

34. The method of Claim 31 wherein the step of directing the propagation of the first and the second pulsed electrical signals along the transmission means includes:

(a) directing the propagation of both the first and second pulsed electrical signals along a trace, the trace forming a plurality of substantially parallel rows and providing a continuous propagation path that extends through each of the plurality of display locations.

35. The method of Claim 34 wherein the step of selectively transmitting a first and a second pulsed electrical signal along a transmission means includes:

(a) transmitting the first pulsed electrical signal along the trace from a first end of the trace; and

(b) transmitting the second pulsed electrical signal along the trace from a second end of the trace.

36. The method of Claim 34 wherein the step of selectively transmitting a first and a second pulsed electrical signal along a transmission means includes:

(a) transmitting the first pulsed electrical signal along the trace from a first end of the trace; and

(b) transmitting the second pulsed electrical signal along the trace from the first end of the trace such that the first and the second electrical pulsed signals converge to produce the activating signal after the first pulsed electrical signal has reflected from a second end of the trace.

37. The method of Claim 31 wherein the step of directing the propagation of the first and the second pulsed electrical signals along the transmission means includes:

(a) directing the first pulsed electrical signal along a trace, the trace forming a plurality of substantially parallel rows and providing a continuous propagation path that extends through each of the plurality of display locations;

(b) propagating the second pulsed electrical signal along a surface propagation means, the surface propagation means substantially electrically isolated from and substantially coextensive with the trace across the display area, the surface propagation means for enabling the second pulsed electrical signal to propagate substantially uniformly across the display area.

38. A method for selectively activating a plurality of different display locations across a display area, the method comprising the steps of:

(a) selectively transmitting a first and a second pulsed electrical signal along a transmission means that provides at least one continuous propagation path that extends through each of the display locations;

(b) directing the propagation of the first and the second pulsed electrical signals along the transmission means such that the first and second pulsed electrical signals converge to produce activating signals at respective selected display locations; and

(c) producing display signals at the selected display locations upon receipt of the activating signals at the respective selected display locations;

Fig. 1a

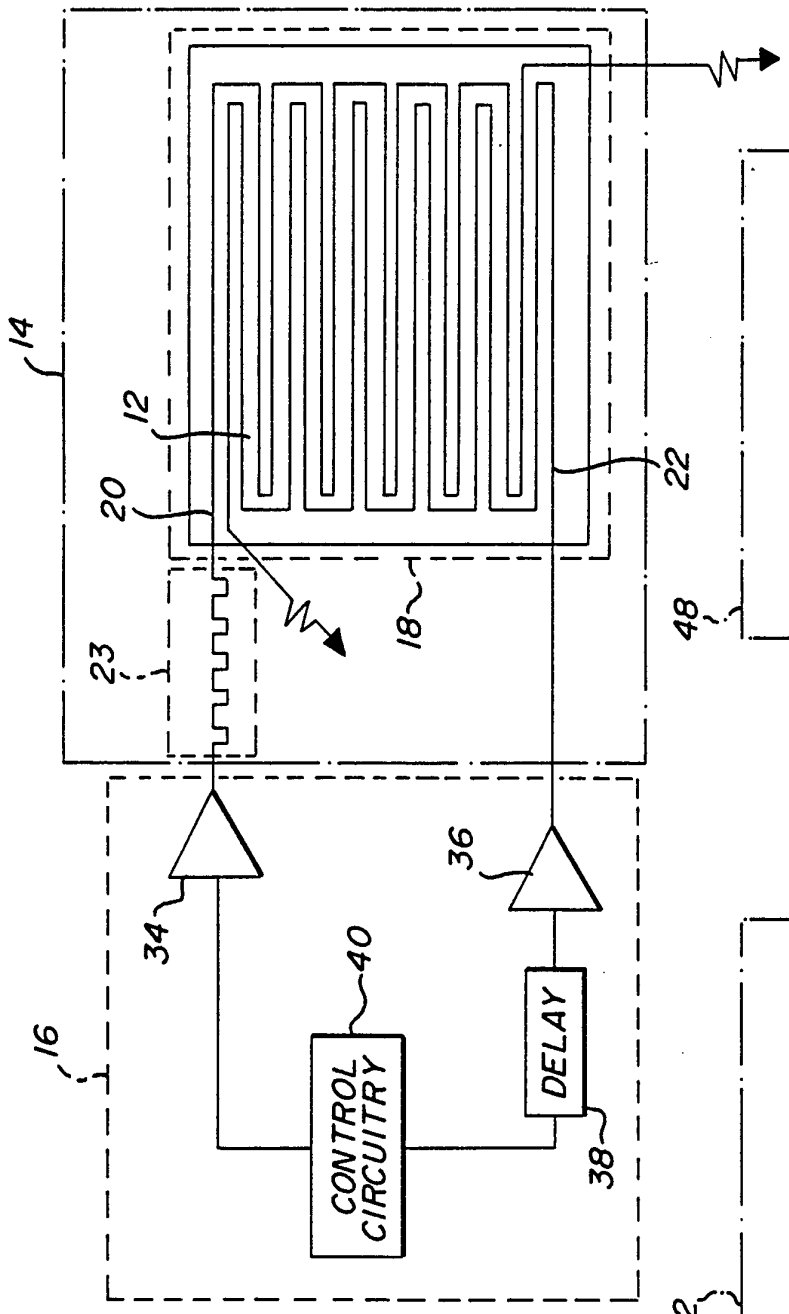


Fig. 1c

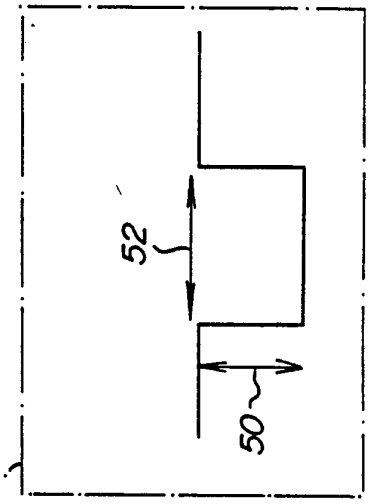
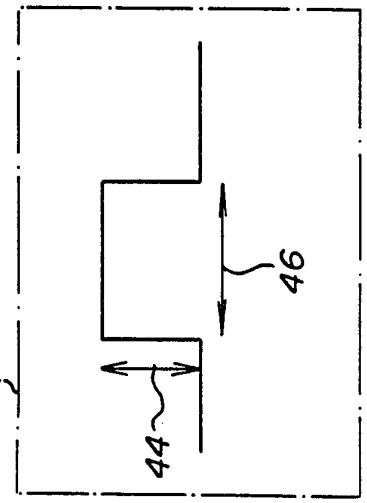


Fig. 1b



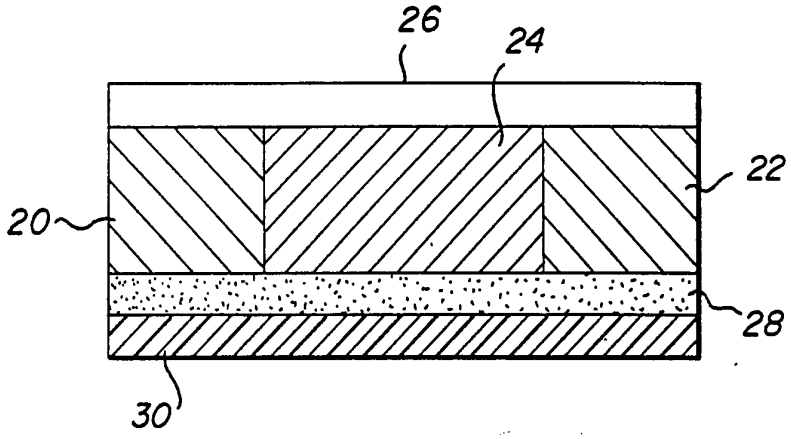


Fig. 2

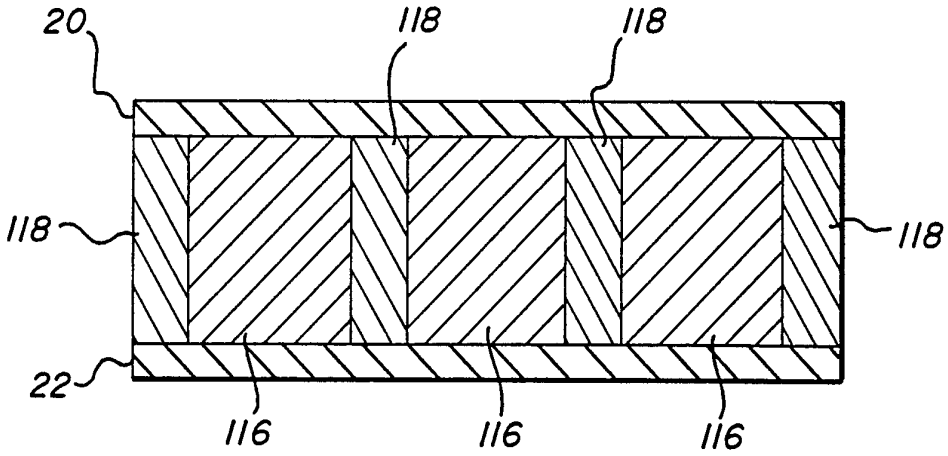


Fig. 4

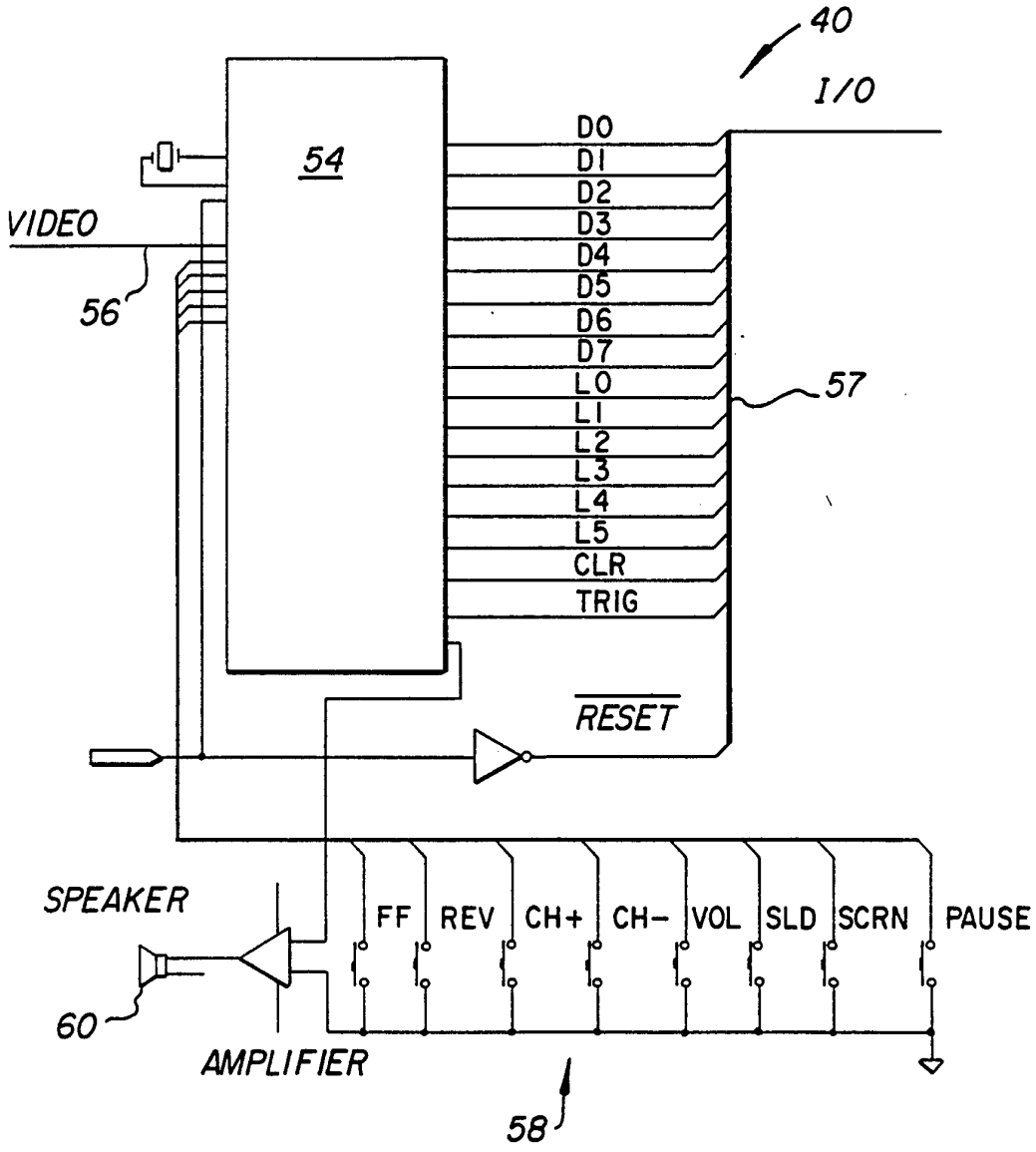

40
I/O
54
VIDEO
56
D0
D1
D2
D3
D4
D5
D6
D7
L0
L1
L2
L3
L4
L5
CLR
TRIG
57
RESET
SPEAKER
60
AMPLIFIER
FF
REV
CH+
CH−
VOL
SLD
SCRN
PAUSE
58

Fig. 3A

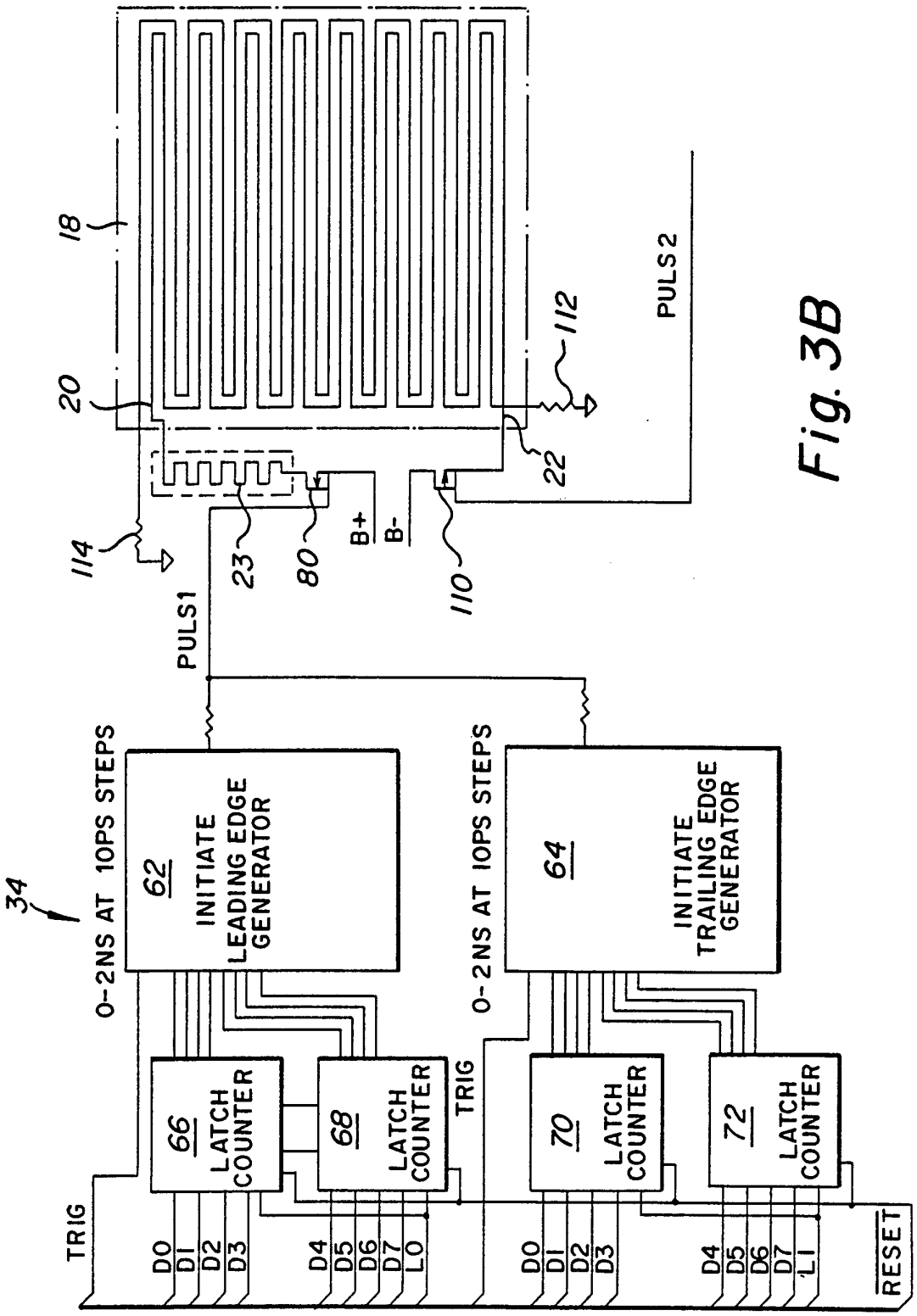

18
20
112
PULS2
22
114
23
80
B+
B-
110
PULS1
34
0-2NS AT 10PS STEPS
62
INITIATE LEADING EDGE GENERATOR
64
INITIATE TRAILING EDGE GENERATOR
66
LATCH COUNTER
68
LATCH COUNTER
70
LATCH COUNTER
72
LATCH COUNTER
TRIG
D0
D1
D2
D3
D4
D5
D6
D7
L0
L1
RESET

Fig. 3B

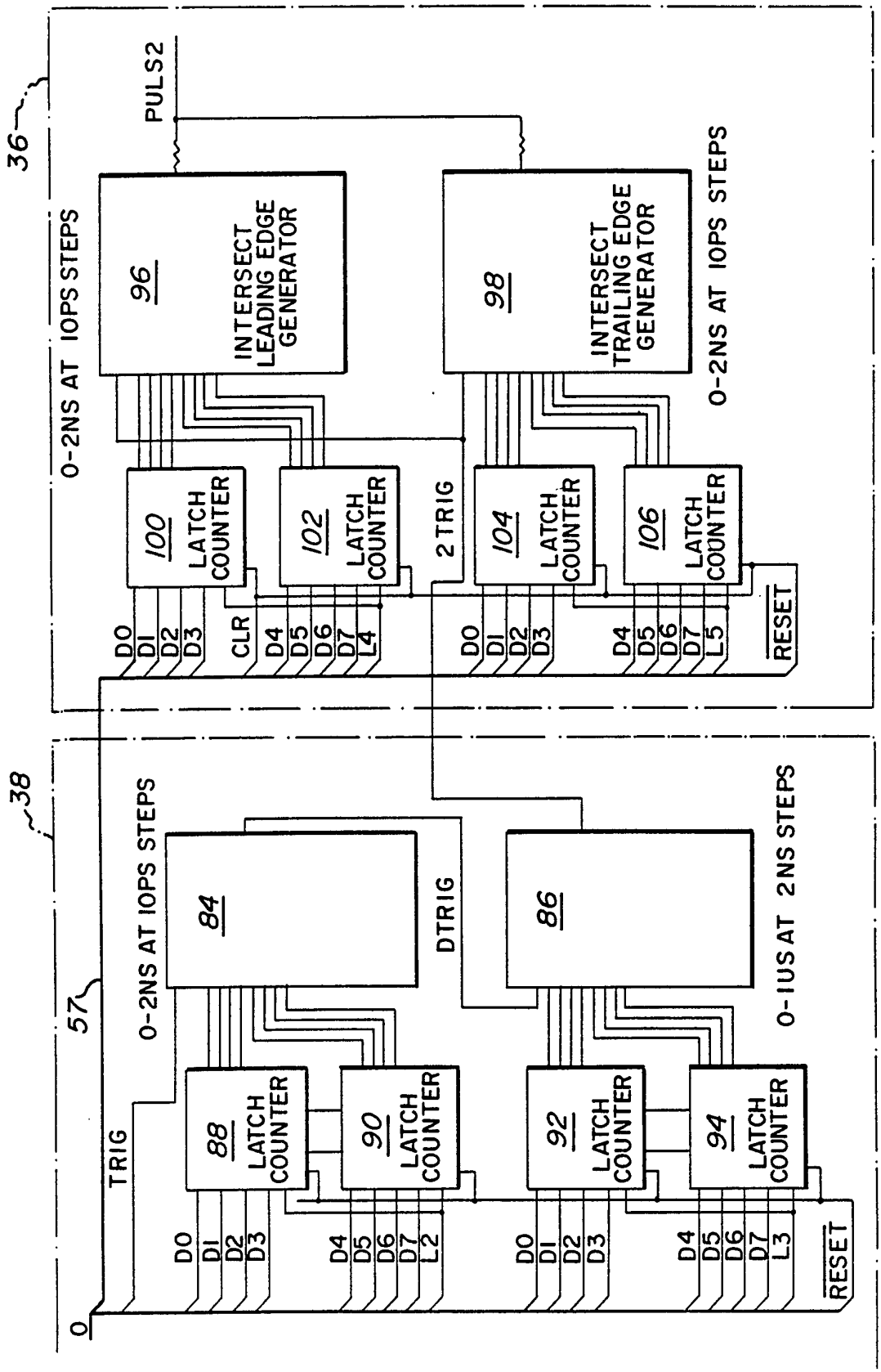

36
PULS2
0-2NS AT 10PS STEPS
96
INTERSECT LEADING EDGE GENERATOR
98
INTERSECT TRAILING EDGE GENERATOR
0-2NS AT 10PS STEPS
100 LATCH COUNTER
102 LATCH COUNTER
2 TRIG
104 LATCH COUNTER
106 LATCH COUNTER
D0 D1 D2 D3 CLR D4 D5 D6 D7 L4
D0 D1 D2 D3 D4 D5 D6 D7 L5 RESET
38
57
0-2NS AT 10PS STEPS
84
DTRIG
86
0-1US AT 2NS STEPS
TRIG
88 LATCH COUNTER
90 LATCH COUNTER
92 LATCH COUNTER
94 LATCH COUNTER
D0 D1 D2 D3 D4 D5 D6 D7 L2
D0 D1 D2 D3 D4 D5 D6 D7 L3 RESET
0

Fig. 3C

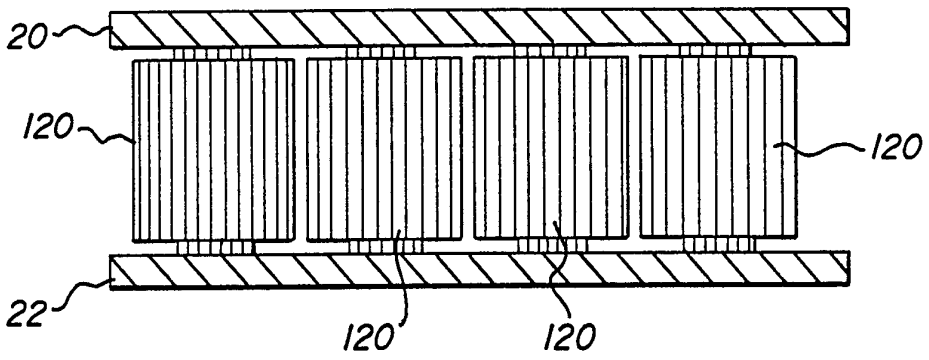


Fig. 5

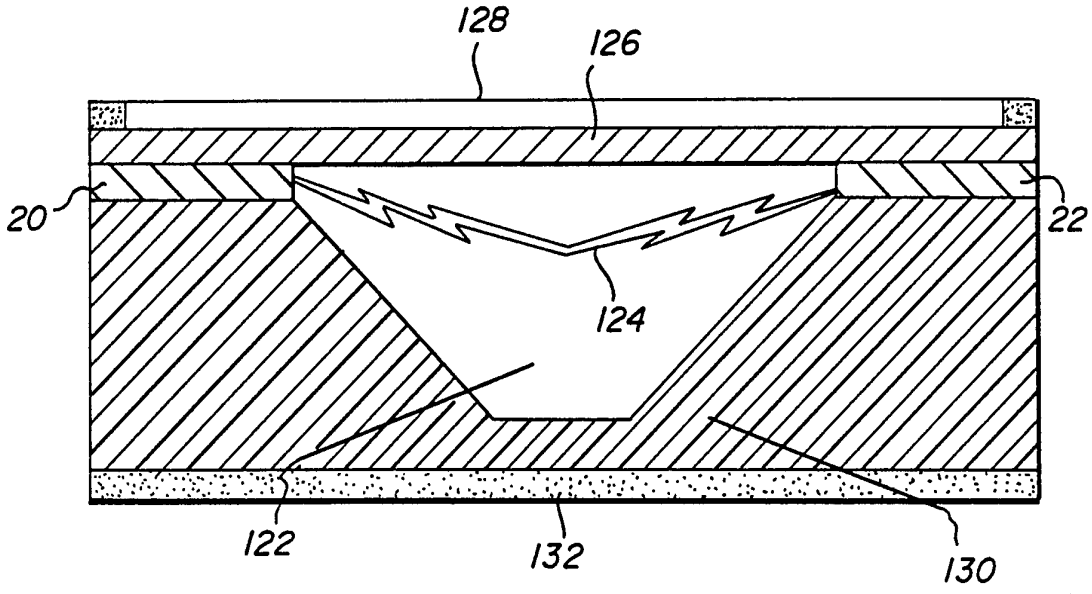


Fig. 6

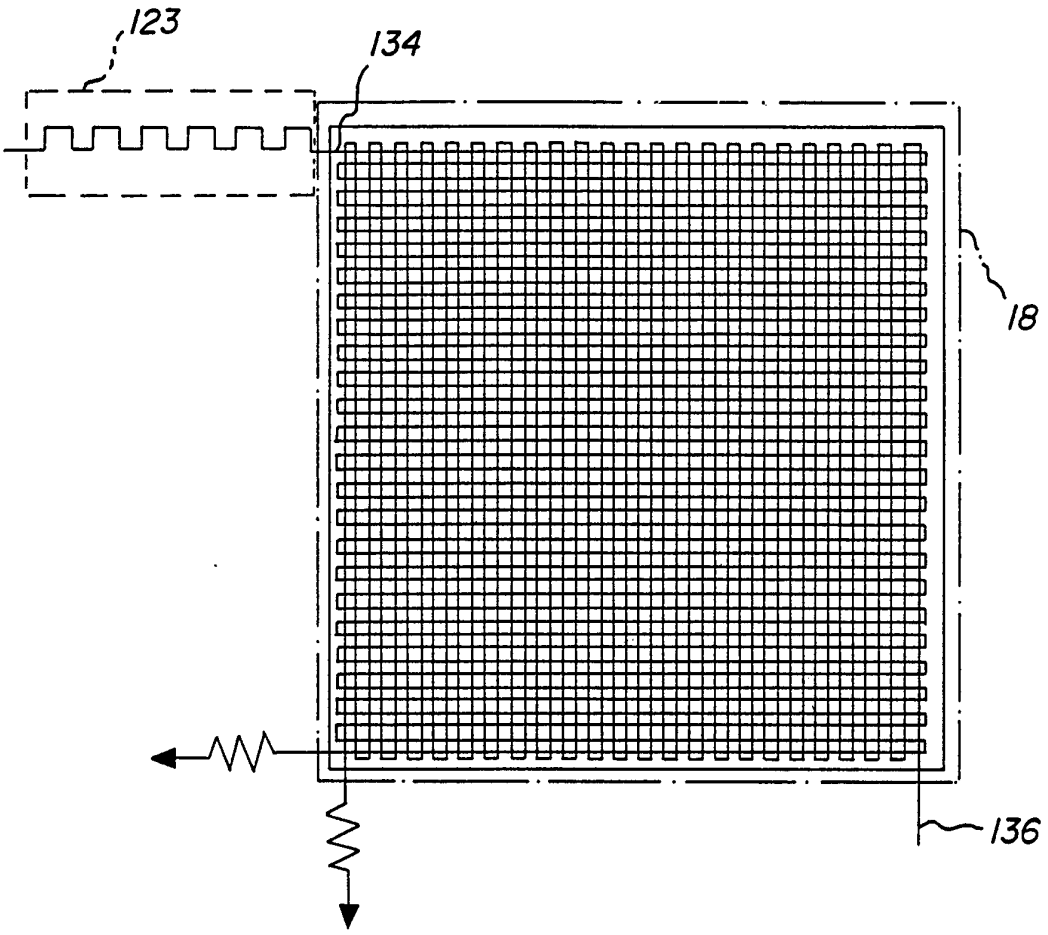


Fig. 7a

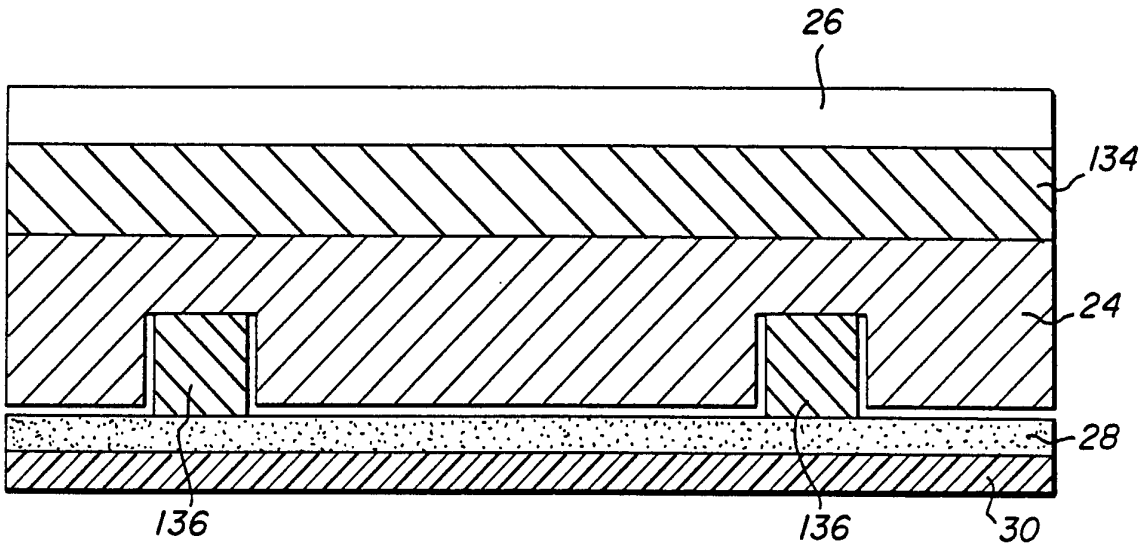


Fig. 7b

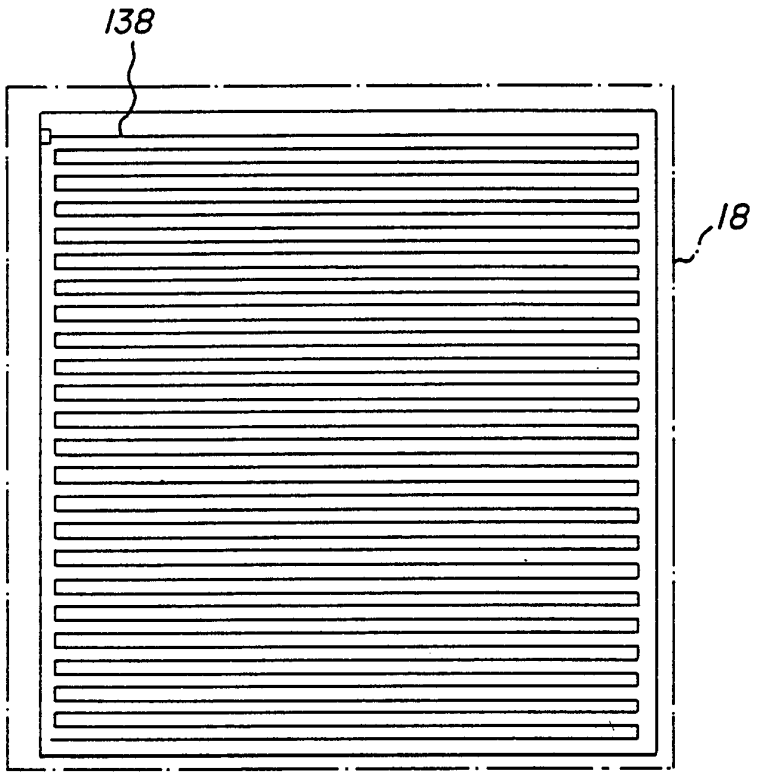


Fig. 8a

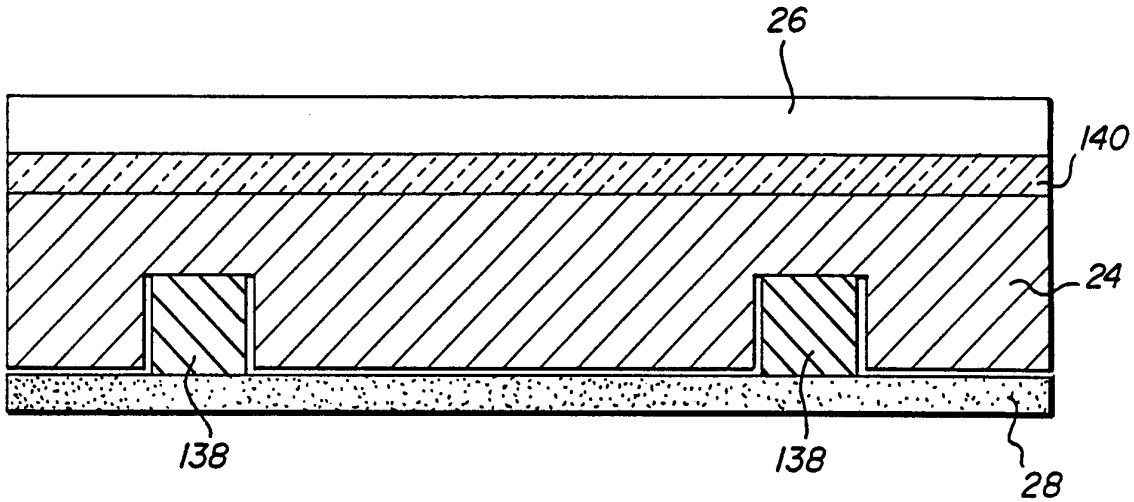


Fig. 8b

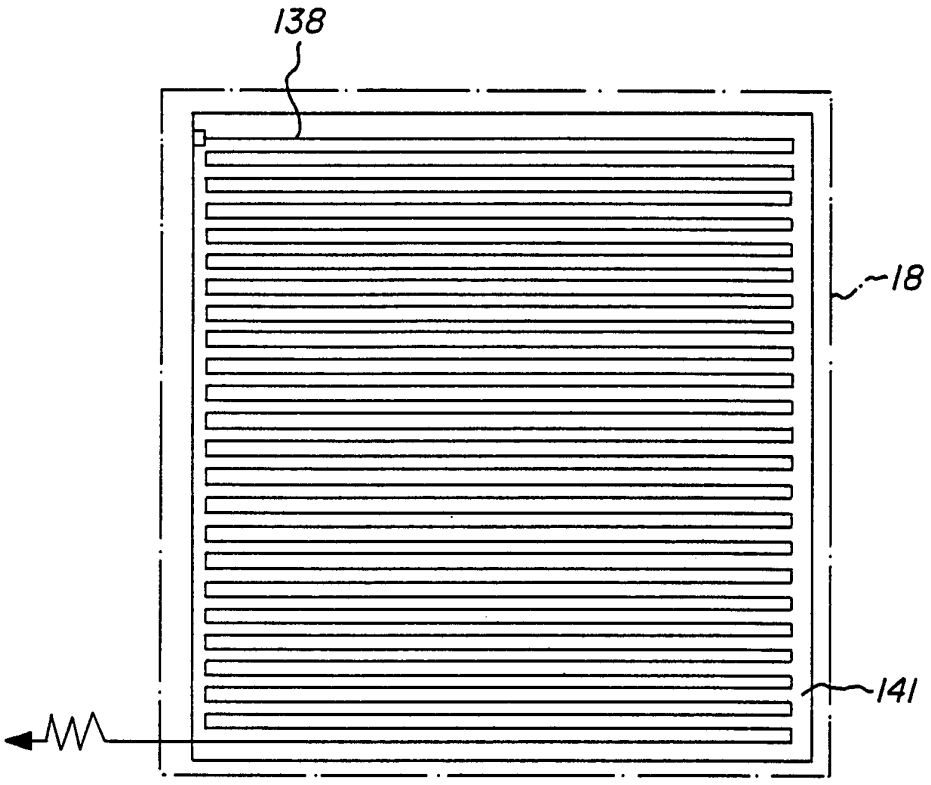


Fig. 9a

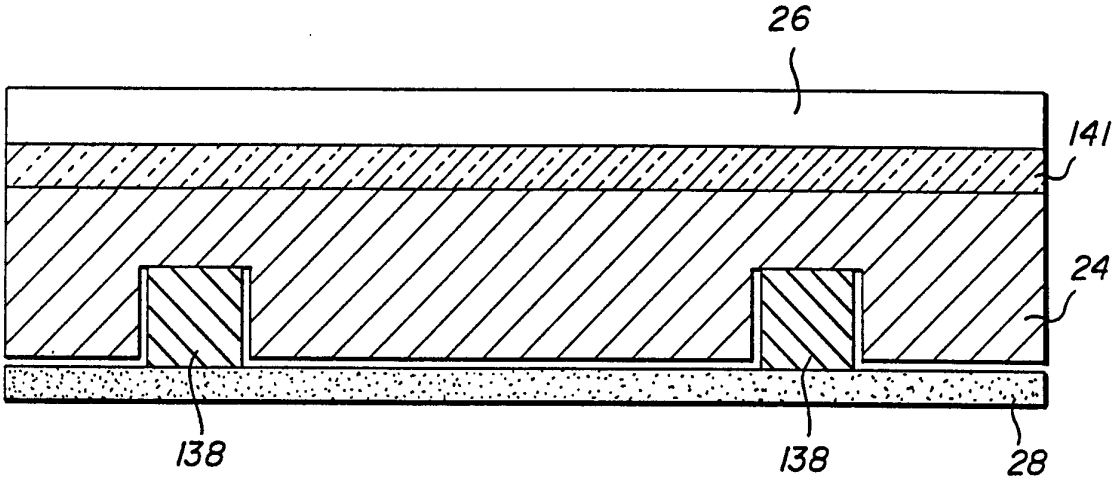


Fig. 9b

Fig. 10a

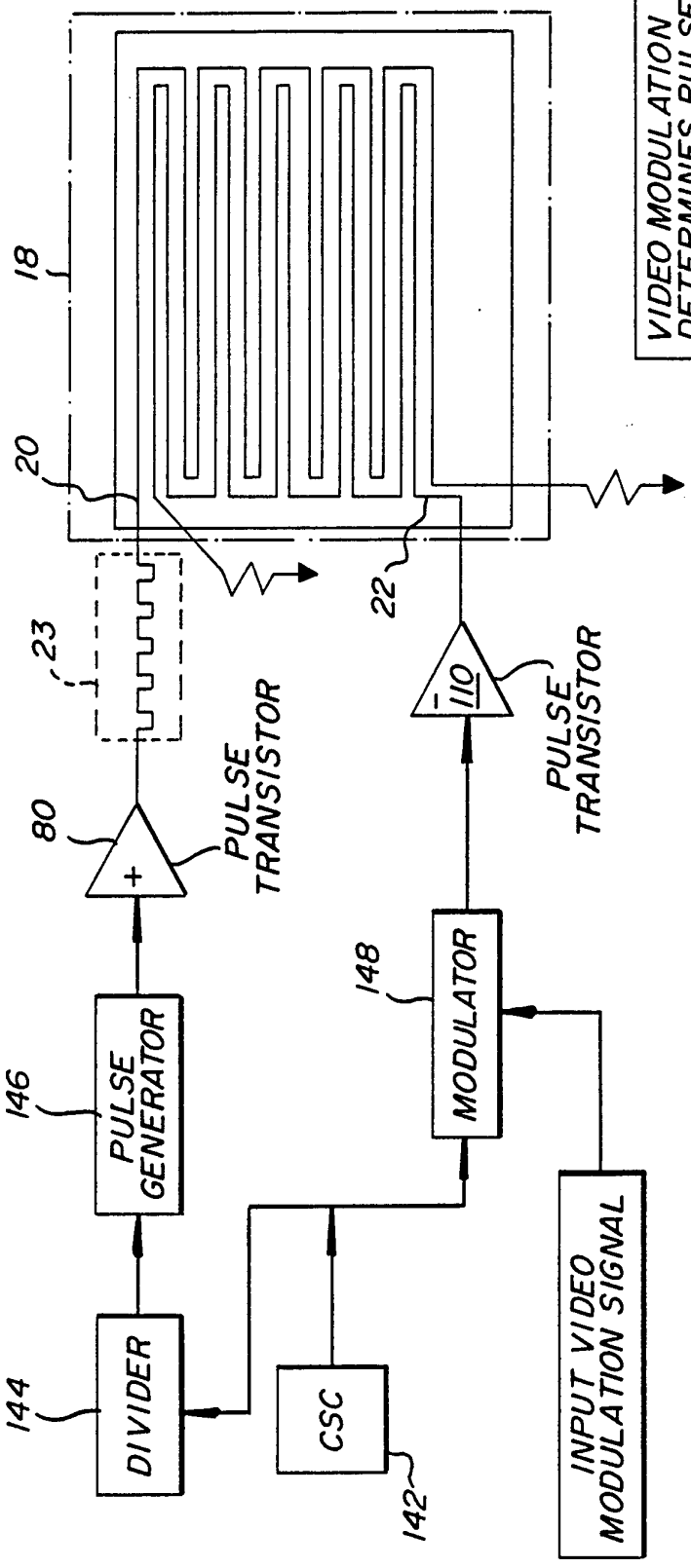


Fig. 10c

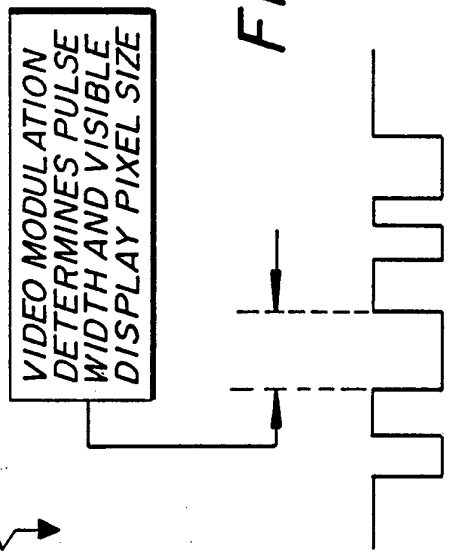
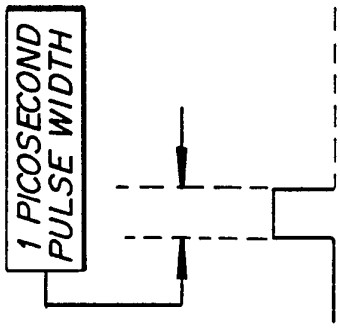


Fig. 10b



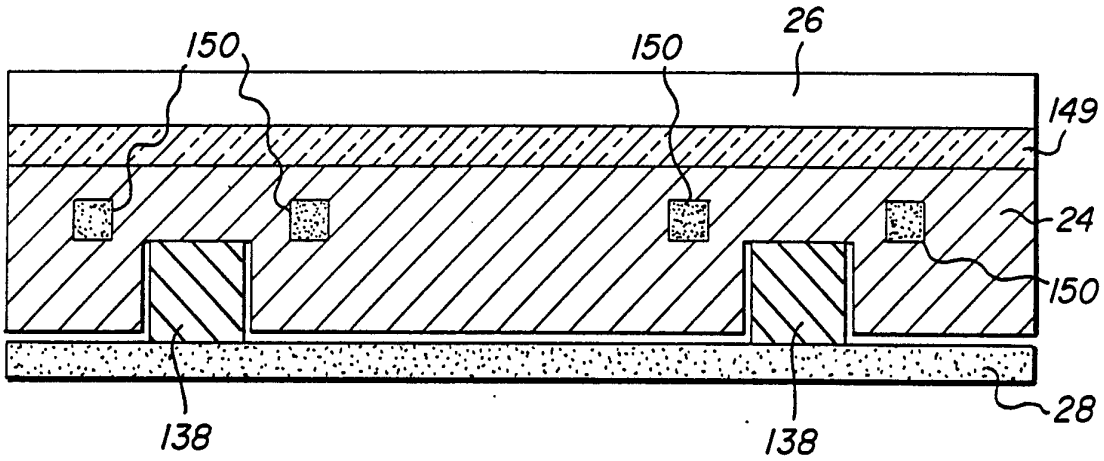


Fig. 11

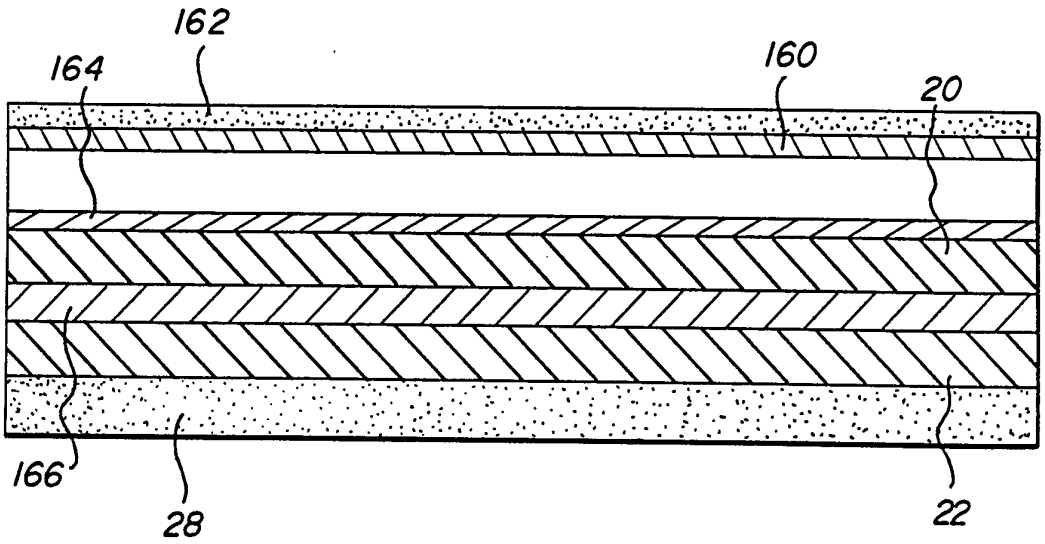


Fig. 13

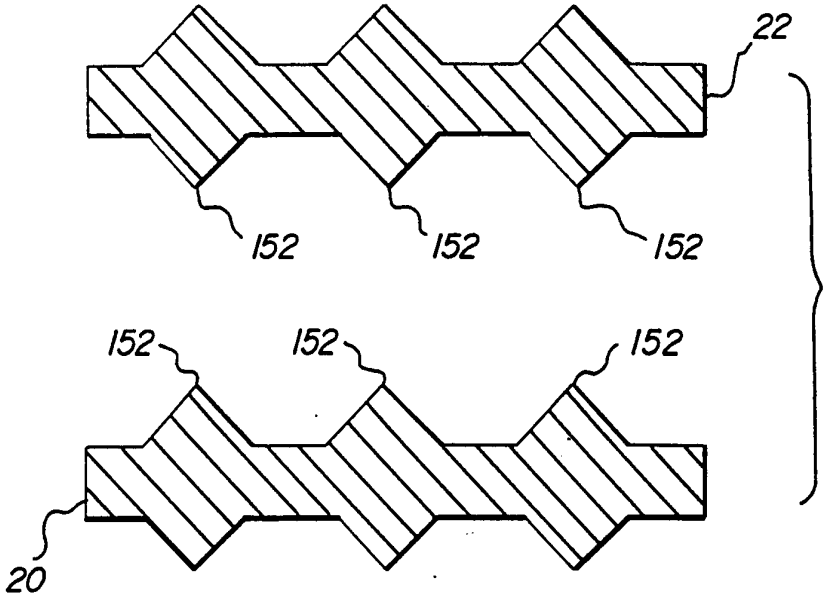


Fig. 12a

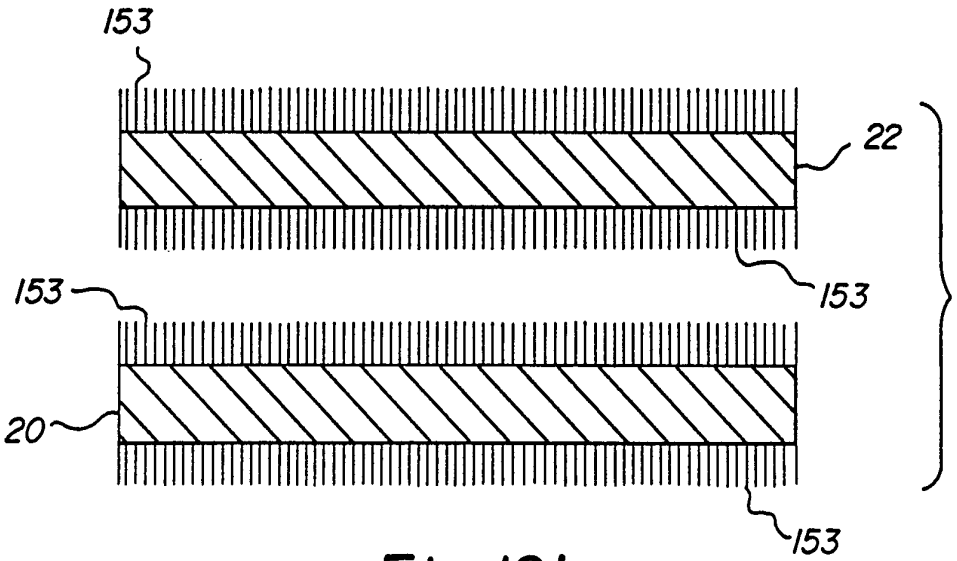


Fig. 12b

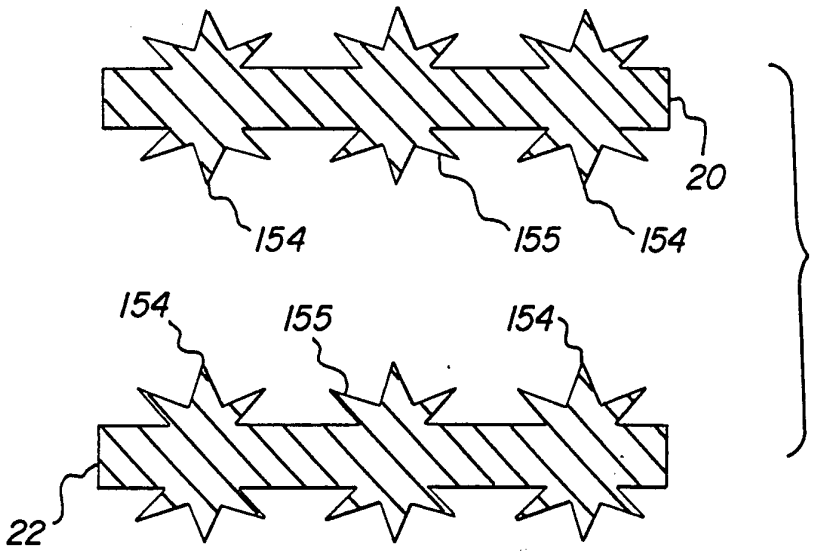


Fig. 12c

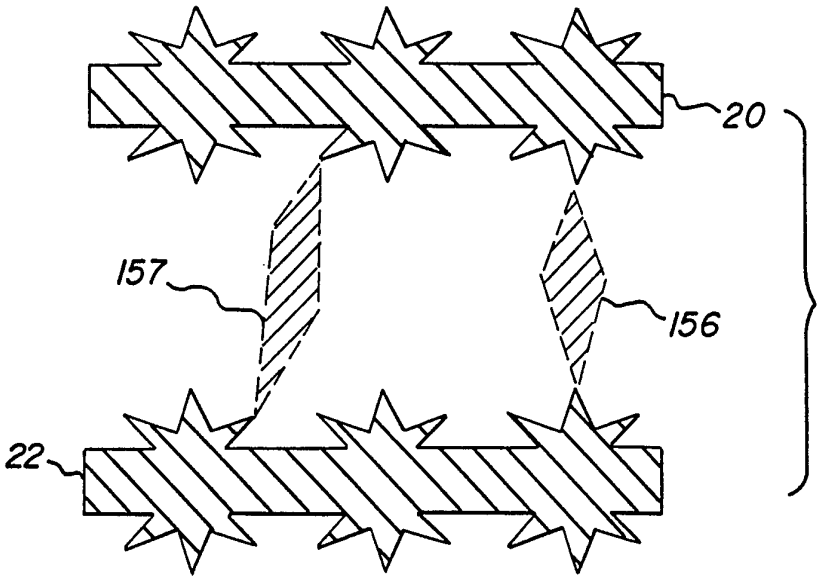


Fig. 12d

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 94/01877

A. CLASSIFICATION OF SUBJECT MATTER
IPC 5 G09G3/20

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 5 G09G G02F

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE,A,27 48 149 (VUKSANOVIC) 3 May 1979	1,7,11, 29,31, 33,38
Y	see page 4, line 8 - page 6, line 17 see page 7, line 7 - page 8, line 12 see page 12, line 16 - page 13, line 8 see figures 1-5	8-10,25

X	FR,A,1 334 553 (LABORATOIRE D' ELECTRONIQUE DT D' AUTOMATION DAUPHINOIS LEAD) 1 July 1963	1,23,29, 31,38
Y	see page 2, right column, line 24 - line 48 see page 3, left column, line 23 - page 4, left column, line 27 see figures 1-6	7,10,25

	-/--	

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
8 July 1994	04.08.94

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Farricella, L

Form PCT/ISA/210 (second sheet) (July 1992)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	EP,A,0 154 662 (WERBA H.) 18 September 1985 see page 2, line 14 - page 6, line 4 see page 7, line 17 - page 11, line 29 see page 12, line 28 - page 13, line 11 see page 24, line 23 - page 26, line 20 see figures 1-5 -----	1,22, 29-31,38 7-9

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/US 94/01877

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-A-2748149	03-05-79	NONE	
FR-A-1334553		NONE	
EP-A-0154662	18-09-85	NONE	