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3,082,294

MOVING WINDOW DISPLAY SYSTEM

Filed May 10, 1960

3 Sheets-Sheet 1

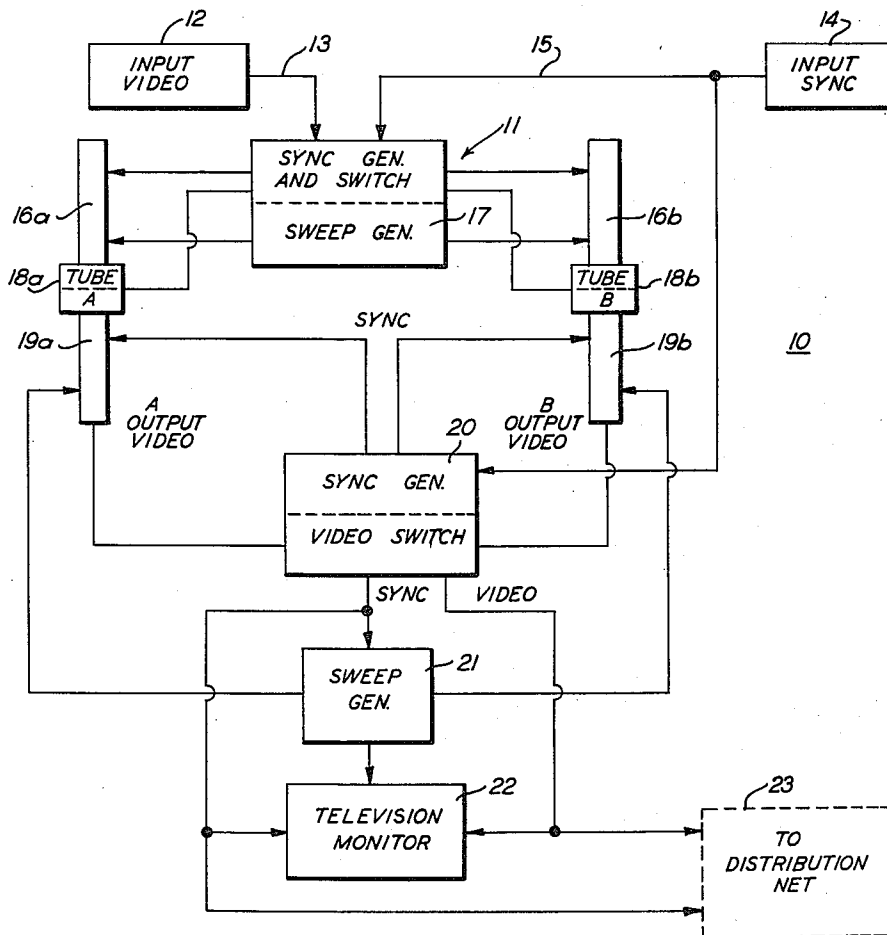


FIG. 1.

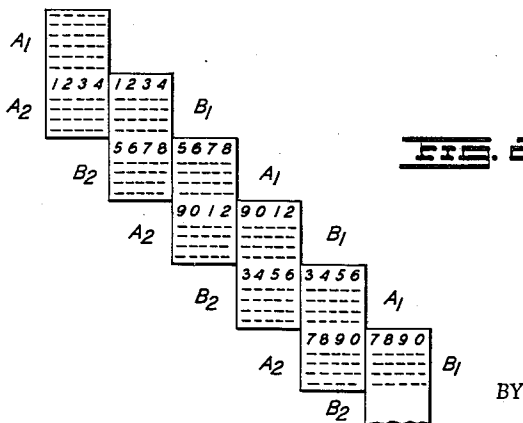


FIG. 2.

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3 Sheets-Sheet 2

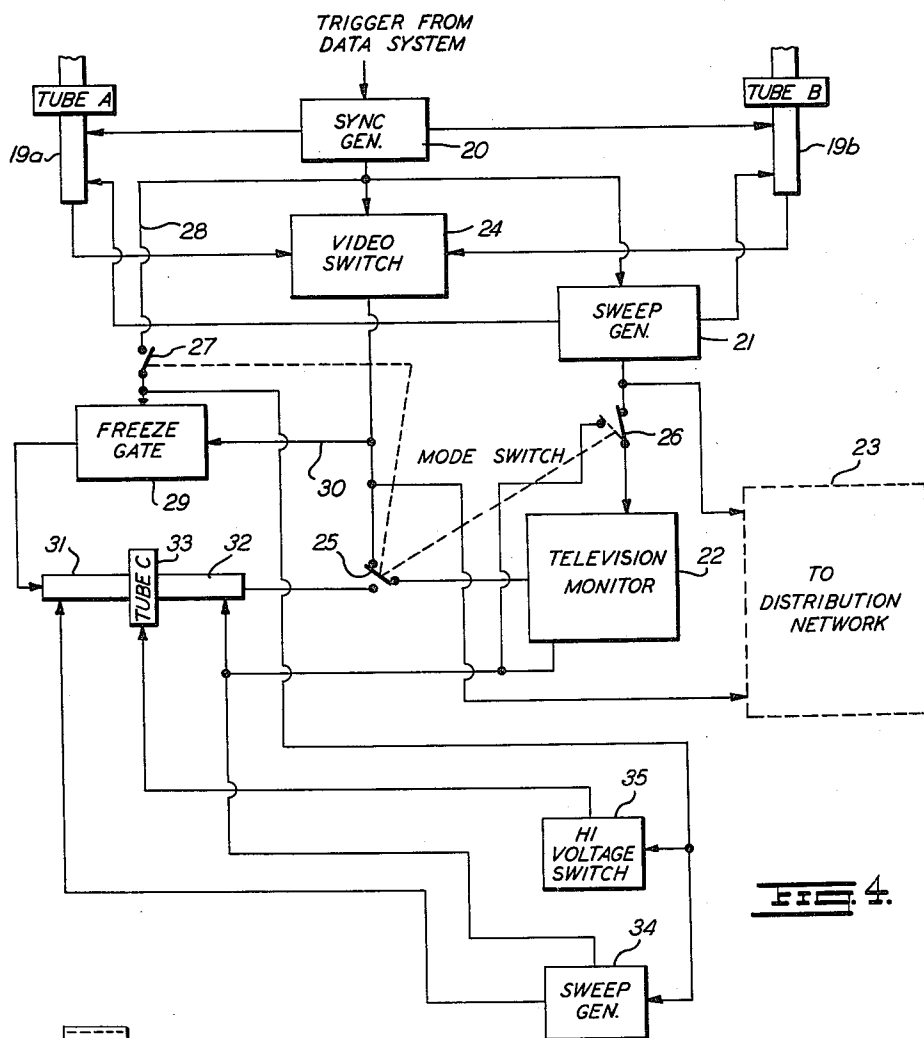


FIG. 4.

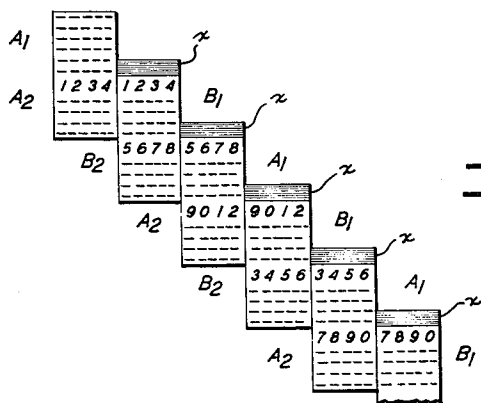


FIG. 3.

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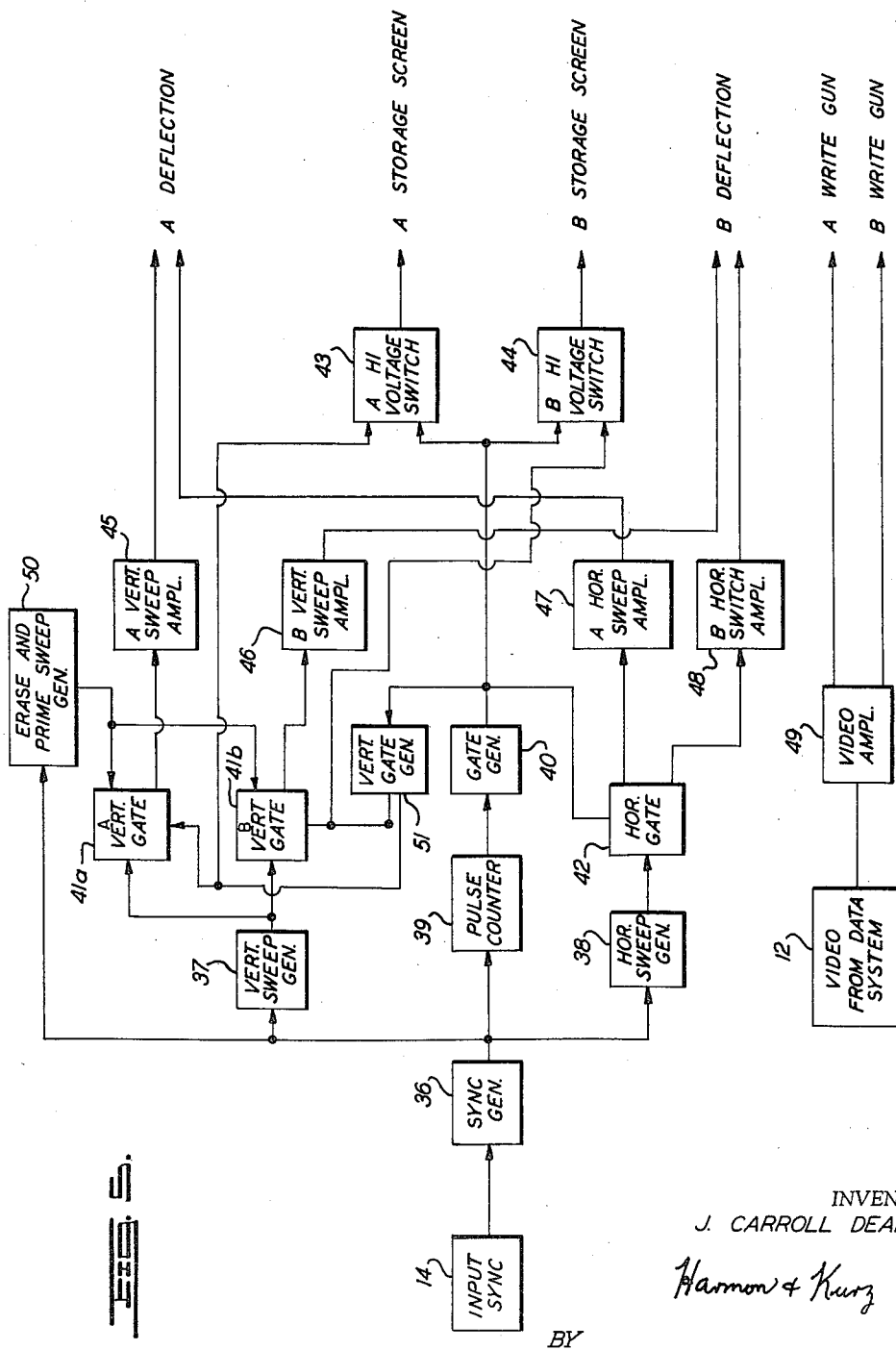
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3 Sheets-Sheet 3



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MOVING WINDOW DISPLAY SYSTEM

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15 Claims. (Cl. 178-6.8)

This invention relates to video display systems generally and more particularly to a moving window display system for presenting video information on a continuous strip basis.

A moving window display is a display system that gives a viewer the impression that he is looking through a window moving past some scene. A display device of this type may be utilized to great advantage with data systems which present video information on a continuous strip basis. Any data system, regardless of other excellent characteristics, is limited by its readout device. A moving window display system is of particular value when used as a readout device with some type of strip mapping equipment such as IR reconnaissance gear, side-looking radar, or any other type of equipment that takes information within some temporarily defined width and a temporarily undefined length.

In spite of the large dollar volume of strip mapping equipment presently in the field, there are serious limitations in the associated display systems and readout devices now in existence. Previous strip-type video displays have often required dark adaptation and the display equipment utilized has had pronounced phosphoric decay characteristics. Previous systems have also experienced excessive presentation delay and disturbing frame or flop-over rates, and many of these systems are not able to present a complete picture at all times. Consequently, it is only after considerable indoctrination and experience that a viewer can adequately interpret the display presented by these systems.

In order to alleviate some of the disadvantages which are inherent in existing video display systems, some of the presently employed readout devices utilize a fast film processing technique. By this technique, data received from a data system is recorded on film, processed, and then used. In general, these devices are cameras first and a display second, and thus great expenditures of film are necessary to merely present a transient display. Also, in these photographic systems, the traverse rate ratios of the presentation are limited and the access times are large in proportion to the traverse rates.

A primary object of this invention is to provide a moving window display system for the display of video information which will require a minimum of viewer conditioning, experience, or familiarity in order to obtain maximum information with maximum speed and accuracy and minimum fatigue.

Another object of this invention is to provide a moving window display system for the display of video information which will provide a transient display of transient data with no requirement of dark adaptation.

It is a further object of this invention to provide a moving window display system for the display of video information which has no visible frame or flop-over rates and which always presents a complete picture to the viewer.

Another object of this invention is to provide a moving window display system for the display of video information which experiences no access delay and which has no reasonable limits on traverse presentation rates or ratios.

A further object of this invention is to provide a moving window display system for the display of video information which permits the freezing of a particular scene for concentrated examination.

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Another object of this invention is to provide a moving window display system for the display of video information which is completely electronic and includes no mechanical moving parts.

5 A further object of this invention is to provide a moving window display system for the display of video information which permits multiple simultaneous viewing of a video presentation via ordinary television remoting networks.

10 Another object of this invention is to provide a moving window display system for the display of video information which utilizes a plurality of television monitors to permit the simultaneous viewing of a transient display of data and a frozen scene taken therefrom.

15 A further object of this invention is to provide a method for displaying video information from a data system as a continuous transient display.

Another object of this invention is to provide a method for displaying video information from a data system as a continuous transient display utilizing a single storage tube.

20 A still further object of this invention is to provide a method for displaying video information from a data system as a continuous transient display from which particular scenes may be frozen for concentrated examination.

25 With the foregoing and other objects in view, the invention resides in the following specification and appended claims, certain embodiments and details of construction of which are illustrated in the accompanying drawings, in which:

30 FIGURE 1 is a block diagram of a two tube moving window display readout device of the present invention;

FIGURE 2 shows a chart illustrating a switching sequence within the readout device of the present invention;

35 FIGURE 3 shows a chart illustrating a switching sequence with erase time for the readout device of the present invention;

FIGURE 4 discloses the moving window display device of the present invention in which means are provided to freeze a particular scene for prolonged examination; and

40 FIGURE 5 is a block diagram of a combination sweep generator and synchronization generator with switch which may be used with the present invention.

Referring now to FIG. 1, the moving window display device of the present invention indicated generally at 10 comprises a synchronization pulse generator and switching unit 11 which receives input video signals from a data system 12 by means of a video input 13. The synchronization pulse generator and switching unit 11 also receives input synchronization signals from a synchronization signal source 14 by means of an input lead 15. The synchronization pulses from source 14 are timed in relation to the input video signals from the data system 12 so that the input video will be accepted by the synchronization generator and switching unit 11. Synchronization pulse generator 11 provides video plus synchronization pulses to the input sides 16a and 16b of two dual gun CRT storage tubes A and B, of which the Raytheon tube QK703 is an example, and also to a sweep generator 17. The synchronization pulse generator and switching unit 11 also acts as a mode switch to alternately prime storage screens 18a and 18b of the storage tubes A and B to condition them for the reception of video material. Time constants proportional to the rate at which the video signal is received from the data system 12 are set within the synchronization pulse generator and switching unit 11 to control the time period during which either the screen 45 18a or 18b is energized.

The input sections 16a and 16b of the CRT storage tubes A and B include the deflection plates or coils and

write guns (not shown) which are usually provided in tubes of this type, while the output sections 19a and 19b of the storage tubes A and B include the normal deflection plates or coils and readout guns (not shown). The write guns in the input sections 16a and 16b receive the video plus synchronization signals from the synchronization generator and switching unit 11, while the deflection plates or coils in the input sections 16a and 16b receive horizontal and vertical sweep signals from the sweep generator 17. The write guns transcribe the video signals upon the tube screens 18a and 18b in accordance with the sweep signals received from sweep generator 17. The read guns in output sections 19a and 19b sweep the screens 18a and 18b and provide the read video output signal to a combined synchronization pulse generator and video switch 20. In return the read guns receive a synchronization signal from the synchronization pulse generator and video switch 20. Combined unit 20 receives synchronization pulses from input synchronization pulse source 14 and in turn provides synchronization pulses to control a sweep generator 21 which furnishes the sweep signals to the deflection plates in output sections 19a and 19b, as well as to a television monitor 22. Synchronization signal generator and video switch 20 also provides video and synchronization signals to the television monitor 22 and to a distribution network 23.

Although the synchronization pulse generator and video switch 20 receives the input synchronization pulses from source 14, as does the synchronization pulse generator 11, generators 11 and 20 are each free running with respect to the other. The pulse generator 11 operates at a rate governed by the associated data system 12 and in turn causes the write guns in the input sections of storage tubes A and B to transcribe the data line by line on the storage screens 18a and 18b of the storage tubes. The pulse generator 20 may operate at a much faster rate than does the pulse generator 11, thus causing the read guns in the output sections of the storage tubes to scan the screens 18a and 18b very rapidly. The read scan may be so rapid that it appears that the information is being flashed on the screen instantaneously instead of being written line by line. The synchronization pulses from source 14 are fed to the generator 20 merely to insure that it is in operation when video information is being received by the storage tubes A and B.

The video switching section of the synchronization generator and video switch 20 acts in much the same manner as does the timed switch in the synchronization generator and switching unit 11, and periodically switches between the output sections of tubes A and B so that video readout signals are received in succession from the output section of first one tube and then the other.

The operation of the readout device shown by FIGURE 1 requires that the input video and the output video be switched sequentially from tube A to tube B in order that a physical traverse movement may be produced. This switching operation, which is controlled by the switching sections of units 11 and 20, in itself does not produce the traverse movement necessary for a moving window display. In order to explain the basic operation of the display device of FIGURE 1, only the input (write) and output (read) modes of the dual gun storage CRT tubes A and B will be initially considered. If the moving window display device has been in operation for some length of time, the input or write gun in input section 16a of storage tube A will have laid upon the storage screen 18a of this tube by a line-by-line scan, a raster A1, as shown graphically in FIGURE 2. The line scan rate and the traverse rate, which is the rate at which one line follows another, are both determined by the associated data system 12. The output of the read gun in the output section 19a of storage tube A develops a read raster of the same physical size as the raster A1 developed by the write gun in input section 16a, and the entire out-

put raster moves down the storage screen at the traverse rate of the input gun.

Referring to the switching sequence diagram of FIGURE 2, with the raster A1 on the screen 18a of storage tube A, the output or read raster starts with its upper edge indexed on the upper edge of A1 and moves downward. However, as the raster A1 of the write gun and the raster of the read gun are of the same physical size, as soon as the output moves down one line, it no longer contains a complete rasterful of information and thus A2 must be started as a continuation of A1. Simultaneous with the writing of the first line of A2 by the write gun of the input section 16a, the first line of B2 must be written with the identical information on the screen 18b by the write gun of input section 16b of tube B. As the writing of A2 is continued and followed by the A output or read raster, B1 is also written as evidenced by the diagram of FIGURE 2. Thus when A2 is complete and the A output raster has traversed to the bottom of A2, i.e., the bottom line of the output raster is indexed with the bottom line of A2, a complete scene has become available on the B tube at raster B1 and the video presentation is now switched and taken from the B output gun. The cycle is then repeated by simultaneously and identically writing the first line of B2 and a new A1, and the B output raster, which is indexed on B1, then traverses down to enclose B2. When the B output raster reaches the bottom of B2, switching again takes place and the A output, indexed at A1, is sampled. Thus the A input gun lays a scene on the storage screen 18a that is the same width but twice as long as the A output or read raster. The A output raster moves down the scene to its physical extremity and in the meantime the B input gun has developed enough of its scene so that the B output raster can be turned on and moved over the B scene which is a continuation of the A scene. This switching and reading procedure between tubes A and B continues until the whole video scene from the data system 12 has been presented in one continuous sequence. This video scene is passed from combined unit 20 to a television monitor 22 and to a distribution system 23. Distribution system 23 may incorporate a large number of auxiliary television monitors so that the video scene can be viewed at numerous points.

In the description of the basic operation of the system of FIGURE 1 as graphically illustrated by the diagrams of FIGURE 2 it will become apparent that no time has been allowed in which to accomplish the erasure of screens 18a and 18b. This time is made available by letting the input guns of tubes A and B write a few more lines so that a raster is produced which is slightly more than exactly twice the physical size of the output rasters. Thus during the time in which the B output is reading the extra lines at the bottom of B1, and A screen is being erased and primed or conditioned. Then the A screen is prepared for writing with the first lines of B2. This mode of operation is shown graphically in FIGURE 3 where sections marked X indicate graphically the time in which the conditioning of each raster takes place. This time could also be shown graphically at the bottom of A2 and B2, as it does not matter electrically where it occurs as long as sufficient extra reading time and information is provided. The sections marked X do not physically appear on the storage screens 18a and 18b but are merely utilized to graphically illustrate the raster erasure period. It will be noted that the addition of extra information lines to the rasters of A and B requires a proportionate increase in time for conditioning, but this conditioning time is small compared to the traverse rate of the presentation. The total conditioning time may be expressed mathematically as an asymptotically converging series, the approximate value of which can be increased by 50-100% with no loss in video output duty cycle.

FIGURE 5 shows a block diagram of a typical syn-

chronization generator and switch combined with a sweep generator unit which might be utilized in the circuit of FIGURE 1 as the synchronization generator and switch 11 and the sweep generator 17, to provide the switching sequence described in connection with FIGURES 2 and 3. In the system illustrated by FIGURE 5, synchronization pulses are furnished from the synchronization pulse source 14 to a synchronization generator 36. Output pulses from synchronization generator 36 are in turn fed to the vertical sweep generator 37, a horizontal sweep generator 38, a pulse counter 39, and an erase and prime sweep generator 50. The pulse counter 39 acts as a timing unit, and after receiving a specified number of pulses from the synchronization generator 36, it furnishes an output pulse to a gate generator 40. Gate generator 40 may include any suitable generator for producing a pulse output upon the reception of an input pulse. Generator 40 controls the sweep signals which are sent to the storage tubes A and B, and it also actuates two high voltage switches 43 and 44 which control the potential upon the screens of the storage tubes A and B. The output from the gate generator 40 is sent to a vertical gate generator 51 and to a horizontal gate circuit 42, as well as to the two high voltage switches 43 and 44. The vertical gate generator 51 is connected to two vertical gate circuits 41a and 41b, the control input to the vertical gate 41a from the vertical gate generator 51 is coupled to the high voltage switch 43, while the control input from the vertical gate generator 51 to the vertical gate 41b is coupled to the high voltage switch 44. The vertical gate circuits 41a and 41b also receive an input signal from the erase and prime sweep generator 50. The vertical gates 41a and 41b and the horizontal gate 42 are each composed of any suitable gating circuit which, upon the reception of a control signal from either the gate generator 40 or the vertical gate generator 51, will selectively pass an output signal to one or two output systems. Vertical gates 41a and 41b selectively provide either a vertical sweep signal from the vertical sweep generator 37, or an erase and prime signal from the erase and prime generator 50, to a vertical sweep amplifier 45 for the A CRT storage tube or to a vertical sweep amplifier 46 for the B CRT storage tube. The horizontal gate 42 selectively provides a horizontal sweep signal from the horizontal sweep generator 38 to a horizontal sweep amplifier 47 for the A CRT storage tube or to a horizontal sweep amplifier 48 for the B CRT storage tube. The vertical sweep amplifier 45 and the horizontal sweep amplifier 47 provide sweep signals to the deflection plates or coils in the input section 16a of the dual gun storage tube A, while the vertical sweep amplifier 46 and the horizontal sweep amplifier 48 provide sweep signals to the deflection plates or coils in the input section 16b of the dual gun storage tube B. High voltage switches 43 and 44 are selectively controlled by the pulses from the gate generator 40 so that a potential is furnished to the screen of the CRT storage tube which is receiving the sweep signals from the selected sweep amplifiers. The video signals from the data system 12 are fed to a video amplifier 49, which amplifies them and then directs them to the write guns in the input sections 16a and 16b of the CRT storage tubes A and B.

In the operation of the combined synchronization generator, switch, and sweep generator of FIGURE 5, synchronization pulses are received from the synchronization pulse source 14 and are fed to the synchronization generator 36, which in turn directs them to the vertical sweep generator 37, the horizontal sweep generator 38, the pulse counter 39, and the erase and prime sweep generator 50. Pulse counter 39 is set to provide an output pulse after the duration of the period of time required to produce a complete video scene upon the screen of either of the CRT storage tubes A or B. The output pulse from the pulse counter 39 is directed to the gate

generator 40, which in turn controls the switching sequence of the horizontal gate 42 and the two high voltage switches 43 and 44, and provides control pulses to the vertical gate generator 51. Upon receipt of the control pulses from the gate generator 40, the vertical gate generator 51 operates to provide control pulses to the vertical gates 41a and 41b. The vertical gates 41a and 41b receive vertical sweep signals from the vertical sweep generator 37, and also erase and prime signals from the erase and prime sweep generator 50. The control signals from the vertical gate generator 51 cause the vertical gates 41a and 41b to selectively provide either an erase and prime signal from the erase and prime sweep generator 50 or a vertical sweep signal from the vertical sweep generator 37 to the A vertical sweep amplifier 45 or to the B vertical sweep amplifier 46. Thus when the vertical sweep signal from the vertical sweep generator 37 is passed through the vertical gate 41b to the B vertical sweep amplifier 46 and then to the deflection plates or coils in the input section of the B CRT storage tube, an erase and prime signal is being passed from the erase and prime sweep generator 50 through the vertical gate 41a to the A vertical sweep amplifier 45 and then to the deflection plates or coils in the input section of the A CRT storage tube. Upon the reception of a control pulse by the gate generator 40 from the pulse counter 39, a pulse is furnished to the vertical gate generator 51 to enable it to provide a control pulse to the vertical gate circuits 41a and 41b causing a switching operation which permits the vertical sweep signal from the vertical sweep generator 37 to pass through the vertical gate 41a, while the erase and prime sweep signal from the erase and prime sweep generator 50 is now permitted to pass through the vertical gate 41b. The control signal from the vertical gate generator 51 is applied to the vertical gate 41b, the high voltage switch 44, the vertical gate 41a and the high voltage switch 43, so that the high voltage switches 43 and 44 may selectively provide erase, prime, or write potentials to the storage screens of the A or B CRT storage tubes in accordance with the sweep signals fed to the deflection plates or coils of the A and B CRT storage tubes from the vertical sweep amplifiers 45 or 46. It may therefore be seen that while vertical sweep signals are being furnished so that information may be reproduced upon the screen of one of the CRT storage tubes A or B, the screen of the remaining tube is receiving erase signals from the erase and prime sweep generator 50. Upon the reception of a synchronization pulse from the synchronization generator 36, the erase and prime generator 50 becomes free running and provides high frequency sweep signals which, when fed to the deflection plates or coils in the input section of either the A or B CRT storage tube, cause the input or write guns in this input section to write rapidly over the storage screen of the tube to remove the information contained thereon.

Upon the reception of a control pulse from the gate generator 40, the horizontal gate 42 selectively sends a horizontal sweep signal from the horizontal sweep generator 38 to either the horizontal sweep amplifier 47 or the horizontal sweep amplifier 48. The horizontal sweep amplifiers 47 and 48 in turn send the horizontal sweep signals to the deflection plates or coils in the input sections of either the A or B CRT storage tubes.

Video data is continuously fed from the data system 12 through the video amplifier 49 to the input sections of storage tubes A and B, but this data cannot be reproduced upon the screen of either storage tube unless such screen has been primed by a potential from the respective one of the high voltage switches 43 or 44. Thus the gate generator 40 controls both the switching sequence and the sweep signals so that the video scene is selectively reproduced in sequence upon the screens of the CRT storage tubes A and B.

In the moving window display system shown by FIGURE 1, more dual gun storage tubes may be employed if necessary in order to provide very fast traverse rates. The number of storage tubes utilized will depend upon the requirements of the associated data system 12.

In many instances it might become desirable to freeze the particular scene from the storage tubes A or B for prolonged examination. FIGURE 4 discloses the use of an additional freezing storage tube C, which is normally inactive, in conjunction with the moving window display system of FIGURE 1. The addition of dual gun storage tube C permits the switching sequence to be modified so that a tube containing the scene of interest can be removed from sequential operation. In the freeze system illustrated by FIGURE 4, the combined synchronization generator and video switch 20 of FIGURE 1 has been divided into an independent synchronization generator 20 and a video switch 24, for clarity of illustration. However, the individual units 20 and 24 operate in the same manner described in connection with the combined unit 20 of FIGURE 1. The freeze sequence is instigated by means of a mode switching unit which includes two position switches 25, 26, and 27. Switch 25 is provided in the circuit between video switch 24 and the television monitor 22, and removes television monitor 22 from its normal operating connection with video switch 24, and connects it to dual gun storage tube C. Switch 25 is coupled by suitable mechanical or electrical linkage to the switch 26 which is positioned in the circuit between the sweep generator 21 and television monitor 22, and to the switch 27 which is provided in the circuit 28 which connects the synchronization generator 20 to a freeze gate 29. Freeze gate 29 is also connected to the output of video switch 24 by means of a lead 30. The freeze gate may include any suitable timed gating circuit, many of which are known to the art, which utilizes a timing unit such as a pulse counter or a charging condenser to cause the gate to pass a signal for a predetermined time before it again opens and blocks the signal.

The output video signal from freeze gate 29 is fed to the dual gun storage tube C, which includes an input or write section 31, an output or read section 32, and a screen 33. The input and output sections 31 and 32 contain the usual read and write guns and deflection plates or coils which are commonly employed in the CRT storage tubes known to the art. The read or output section of tube C is directly coupled to the television monitor 22 when the switch 25 is in the freeze position.

When the switch 27 is closed, the output pulses from the synchronization generator 20 are fed to the freeze gate 29 causing it to open and pass video signals from the video switch 24 to the input section 31 of CRT storage tube C. Pulses from synchronization generator 20 are also fed to a high voltage switch 35 which controls the potential upon the screen 33 of the tube C and to a sweep generator 34 which provides sweep signals to the write section 31 and read section 32 of dual gun storage tube C. Sweep generator 34 also feeds sweep signals to the television monitor 22 via switch 26.

In the operation of the freeze system shown by FIGURE 4, the actuation of the switch 25 from the normal to the freeze position causes switch 27 to close and switch 26 to move to the dotted line position in FIGURE 4. Thus, television monitor 22 is no longer connected to video switch 24 or to sweep generator 21, but is instead connected to the output 32 of storage tube C and also to the sweep generator 34, while the freeze gate 29 is connected to the output of the synchronization generator 20. If, for example, the scene on storage tube A is the one to be studied, the video signal from the readout section 19a of the tube A is now fed to the video switch 24 and then to the freeze gate 29 by means of the lead 30 instead of to the television monitor 22 as described in connection with the operation of the circuit in FIGURE 1. The synchronization pulses from the synchronization

generator 20 cause the freeze gate 29 to open long enough to pass a complete scene of video from the video switch 24 to the input or write section 31 of the storage tube C. The synchronization pulses from the synchronization generator 20 also actuate the sweep generator 34 so that sweep signals are fed to the write section 31 and the read section 32 of storage tube C, as well as to the television monitor 22. The write guns within input section 31 of the storage tube C write the video information upon screen 33, while the read guns in the output section 32 read the information from screen 33 and pass it to the television monitor 22. In contrast to the CRT storage tubes A and B of FIGURE 1, the input and output sections of the storage tube C, as well as the television monitor 22, receive sweep signals from a single sweep generator 34. Thus the input or write gun of tube C operates at TV rates in contrast to the inputs of tubes A and B which operate at rates set by the data system 12. At the present U.S. TV rates, the frozen scene would be written upon the screen 33 of tube C in approximately $\frac{1}{40}$ second which is, for this purpose, practically instantaneous. The output or read section 32 of tube C also operates at TV rates in the same manner as do the output sections 19a and 19b of tubes A and B.

After the complete scene from storage tube A has been reproduced upon the screen of storage tube C, the previously mentioned counting mechanism within the freeze gate 29 causes the gate to close so that no more video signals may be received from the output 19a of tube A. The scene from tube A, which has been reproduced upon the screen 33 of tube C, will now be maintained until the screen 33 is erased by a suitable D.C. voltage. This erasure is accomplished by the high voltage switch 35 which includes a two state electrical switching circuit of any suitable known type. When the switch 27 is closed, the high voltage switch 35 receives synchronization pulses from the synchronization generator 20 which cause it to switch to a mode which prepares the screen 33 of CRT storage tube C for the writing and reading operation. When switch 27 is opened, the synchronization pulses are removed from the high voltage switch 35 causing it to switch to a second mode to provide an erasing and priming potential to the screen 33 of the CRT storage tube C.

It should be noted that with the freeze system of FIGURE 4, one observer can study the frozen scene from the tube C on the television monitor 22 which has been removed from the normal system, while another observer can continue to view the normal moving display upon additional monitors in the distribution network 23. When the observation of the frozen scene is completed and the system is returned to normal operation, a completed scene will be available on the screen of one of the remaining storage tubes. Although some of the data coming into the system is irretrievably lost when the scene is frozen if only one monitor is used, the effect upon the accuracy of the complete presentation will prove to be almost negligible, as data is also lost during the observation due to the human fixations of the observer.

Though the freeze system shown in FIGURE 4 is the preferred way to perform the freeze operation, it is also possible to use a freeze method which would work on the combined basis of substitution and time sharing. This system would also utilize three dual gun storage tubes A, B and C, but tube C in this system, instead of being a separate free tube, would perform in rotation with tubes A and B in the normal mode of operation. When the freeze mode is initiated, whichever of the three tubes A, B, or C, which is being read, would stop its vertical read traverse and continue to readout its field of view in that fixed position. The write line of this tube would continue in its usual routine until the bottom of the screen is reached, at which time it will switch to the next tube in the normal manner. The system will now continue to write in the usual two tube sequence with the frozen tube held out. When the freeze mode is terminated, the tube

that had been frozen will return to the normal sequence at the next point of the write switching between tubes. Although this sequence of operation would be advantageous because all three tubes would operate on a time sharing plan and have approximately the same electrical age in deterioration, extreme switching techniques would be required to accomplish the complete sequence of operation.

The characteristics of the data collection system will determine the number of storage tubes required. For the sake of simplicity, the moving window display system herein described has consisted of two tubes for normal operation and three tubes for the normal plus freeze operation. It is possible, however, within the above philosophy to operate more than the two or three tubes, or to utilize a single CRT storage tube to perform the normal switch sequences as well as the freeze operation. If a single tube is utilized, the screen of this tube would be divided into sectors, each sector performing the function of one of the CRT storage tubes shown in the circuits of FIGURES 1 and 4. It is obvious that if a single CRT tube is utilized for the moving window display system, a plurality of input and output guns will be required for the normal and freeze operations, and the number of individual screen sectors provided will be limited by the size and capacity of the tube utilized. The number of individual screen sectors provided within the single tube will determine the traverse rate at which the video information from the data system can be reproduced upon a screen sector of the storage tube.

It will be readily apparent to those skilled in the art that the present invention provides a novel and improved moving window display system which is capable of presenting a transient display of video information with maximum speed and accuracy. The arrangement and types of components utilized within this invention may be subject to numerous modifications well within the purview of this inventor who intends only to be limited to a liberal interpretation of the specification and appended claims.

I claim:

1. A moving window display system for use as a readout unit for a data system comprising a plurality of dual gun CRT storage tubes, said tubes including a storage screen, an input section having means for writing a complete scene of data upon said storage screen, and an output section having means for reading the data from said storage screen, input control means connected to the input sections of said storage tubes, said input control means including a sweep generator to provide sweep signals to the input sections of said storage tubes, a synchronization generator for providing synchronization pulses to the input sections of said storage tubes, a pulse generating means for providing a priming potential, and a switching means to direct said priming potential to the screens of said storage tubes and being timed to sequentially switch between said plural storage tubes whereby the priming potential is provided to the screen of each individual CRT storage tube for the duration of time required for the input section to produce a complete scene of data upon said storage screen, a source of input synchronization pulses connected to said input control means, means to supply a video signal from the data system to said input control means, output control means connected to the output section of said CRT storage tubes and to said input synchronization pulse source and operating in conjunction with said input control means to cause the scenes from the screens of said plural dual gun CRT storage tubes to be removed in sequence, and a visual display means connected to receive said sequential data scenes from said output control means, said output control means including a sweep generator for providing sweep signals to the output sections of said dual gun CRT storage tubes and also to said visual display means, and a combined synchronization generator and video switch which provides synchronization pulses to the output sections of said stor-

age tubes and also to said sweep generator and visual display means, said synchronization generator and video switch receiving output video signals from the output sections of said sequentially operated plural CRT storage tubes and in turn directing said video signals to said display means.

2. A moving window display system of claim 1 in which the synchronization generator of said input control means provides synchronization pulses at a rate determined by said data system, while the synchronization generator of said output control means provides synchronization pulses at a rate greater than that determined by said data system whereby the read means in the output sections of said plural CRT storage tubes operate more rapidly than do the writing means in the input sections of said plural storage tubes.

3. A moving window display system of claim 1 in which said visual display means includes a plurality of interconnected television monitors.

4. A moving window display system for use as a readout unit for a data system comprising a plurality of CRT dual gun storage tubes, means to supply a video signal from the data system to said storage tubes to produce a scene of data information thereon, means to direct output signals from said storage tubes to a visual display means, switching means to cause the output signals from said plural storage tubes to be individually supplied in sequence to said display means, and means to direct certain output signals from said plural storage tubes to an individual freeze system, said freeze system including a freeze gate connected to receive the output signals directed from said storage tubes, a normally inactive dual gun CRT storage tube to receive the scene of data to be frozen, said storage tube including a storage screen, an input section having means for writing a complete scene of data upon said storage screen, and an output section having means for reading the data from said storage screen, said input section being connected to said freeze gate and said output section being connectable to said visual display means, and control means connected between said freeze gate and said normally inactive dual gun CRT storage tube, said control means furnishing control signals to the input section, output section and screen of said normally inactive CRT storage tube.

5. A moving window display system of claim 4 in which the freeze gate includes a timed gating circuit which permits the passage of the output signals from said plural CRT storage tubes for a time equal to the time required for the writing means in the input section of the normally inactive CRT storage tube to produce a complete scene of data information on the screen thereof.

6. A moving window display system for use in readout unit for a data system comprising a plurality of dual gun CRT storage tubes, said tubes including a storage screen, an input section having means for writing a complete scene of data upon said storage screen, and an output section having means for reading the data from said storage screen, input control means connected to the input section of said storage tubes, a source of input synchronization pulses connected to said input control means, means to supply a video signal from the data system to said input control means, output control means connected to supply control signals to the output sections of said plural storage tubes and to in turn receive video signals from said output sections, said output control means including an independent synchronization generator which receives synchronization pulses from the synchronization pulse source, visual display means including a plurality of television monitors connected to said output control means to receive video signals therefrom, an independent freeze system connected to said output control means, and means to direct selected video signals from said output control means causing the scenes

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from said plural dual gun CRT storage tubes to be individually supplied in sequence to said display means.

7. The moving window display system of claim 6, in which the individual freeze system includes a freeze gate, a normally inactive dual gun CRT storage tube including a storage screen, an input section having means for writing a complete scene of data upon said storage screen, and an output section having means for reading the data from said storage screen, the input section of said storage tube being connected to said freeze gate, control means connected between said freeze gate and said normally inactive CRT storage tube, said control means furnishing control signals to the storage screen and input and output sections of said normally inactive CRT storage tube, and mode switching means to selectively connect said freeze gate to the output control means of said plural dual gun CRT storage tubes while concurrently connecting the output section of said normally inactive CRT storage tube to said visual display means.

8. A moving window display system of claim 7 in which said mode switching means disconnects one of the plural television monitors of said visual display means from said output control means and concurrently connects said individual television monitor to the output section of said normally inactive CRT storage tube, said mode switch also concurrently connecting said freeze gate to said output control means whereby said freeze gate receives both video and synchronization signals therefrom.

9. The moving window display system of claim 8 in which the freeze gate includes a timed gating circuit, said gating circuit being actuated upon the reception of synchronization pulses from said output control means to pass video signals from said output control means to the input section of said normally inactive dual gun CRT storage tube for a time equal to the time required by the writing means within said input section to produce a complete scene of data information upon the screen of said normally inactive dual gun CRT storage tube.

10. The moving window display system of claim 8 in which the control means connected between said freeze gate and normally inactive CRT storage tube of the freeze system includes a high voltage switch connected to the screen of said normally inactive CRT storage tube, and a sweep generator, said sweep generator receiving synchronization pulses from the synchronization generator of said output control means and furnishing sweep signals to the input and output sections of said normally inactive CRT storage tube and also to the television monitor connected to the output section of said normally inactive CRT storage tube.

11. The moving window display system of claim 10 in which the sweep generator of said freeze system causes the input and output sections of said normally inactive CRT storage tubes to both operate at a common standard television rate.

12. The moving window display system of claim 11 in which the freeze gate includes a source of priming potential, said source of priming potential being connected to said high voltage switch and being controlled thereby to provide a priming potential to the screen of said normally inactive CRT storage tube.

13. A moving window display system for use as a readout unit for a data system comprising a single CRT dual gun storage tube having a storage screen divided into a freeze portion and a plurality of normally active storage portions, an input section and an output section, said input section including means for writing a scene of data upon said normally active portions of said storage screen and freeze writing means for writing a scene of data upon said freeze portion of the storage screen, said output section including means for reading data from said normally active storage screen portions and freeze reading means for reading data from said freeze portion of the storage screen, input means to supply a video sig-

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nal from the data system to the input section of said storage tube, output means to direct a signal from the output section of said storage tube to a visual display means, switching means to cause said write and read means in the storage tube to operate sequentially on the individual normally active portions of said storage screen to obtain a continuous moving presentation on said display means, and means to selectively direct certain output signals from the output section of said storage tube to the freeze writing means in the input section of said storage tube, means to cause said freeze writing means to provide a complete scene of data upon the freeze portion of said storage screen, means to disconnect said freeze writing means from the output of said storage tube after a complete data scene has been provided on said freeze portion of the storage screen, means to cause said freeze reading means to read the data scene from the freeze portion of said storage screen, and means to direct said data scene to a visual display device, whereby said scene is frozen for prolonged examination.

14. A moving window display system for use as a readout unit for a data system comprising; input means to supply electrical data signals from a data system, electrical signal storage means having an input section including means for transcribing an electrical signal upon said storage means, and an output section having means for reading the electrical signal from said storage means, input control means connected between the input section of said storage means and said input means, said input control means providing control pulses to said input section whereby said transcribing means is caused to transcribe, line by line at a given scan and traverse rate, a complete raster of input data from said data system upon said storage means, output control means connected to the output section of said signal storage means, said output control means operating independently of said input control means to provide control pulses to said output section, whereby said reading means is caused to develop a read raster of a size equal to the raster developed by said transcribing means and, simultaneously with the operation of said transcribing means, to move said read raster, line by line, down said storage means at a traverse rate equal to that of said transcribing means while scanning at a scan rate greater than that of said transcribing means so as to continuously remove and supply a changing data signal from said storage means to said output control means, and visual display means connected to receive the data signals from said output control means, said visual display means being synchronized by said output control means with the read means in the output section of said signal storage means, whereby said changing output data signals are caused to provide a moving presentation upon said visual display means.

15. A moving window display system for use as a readout unit for a data system comprising; data input means to supply electrical data signals from a data system, a plurality of dual gun CRT storage tubes, each said tube including a storage screen, an input section having means for transcribing a complete scene of data upon said storage screen, and an output section having means for reading the data from said storage screen, input control means connected between the input sections of said storage tubes and said data input means, said input control means including switching means and means to provide control pulses to said input sections whereby said transcribing means are caused to transcribe, line by line, at a given scan and traverse rate, a complete raster of input data from said data system upon said storage screen, a source of input synchronization pulses connected to said input control means, said synchronization pulse source producing pulses timed in relationship to said input data signals, output control means including switching means connected to the output sections of said CRT storage tubes and to said source of input synchronization pulses, said output control means operating independently of

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said input control means to provide control pulses to said output section whereby said reading means is caused to develop a read raster of a size equal to the raster developed by said transcribing means and, simultaneously with the operation of said transcribing means, to move said read raster, line by line, down said storage screen at a traverse rate equal to that of said transcribing means while scanning at a scan rate greater than that of said transcribing means so as to continuously remove and supply a changing data signal from said storage screen to said output control means, and visual display means connected to receive the data signals from said output control means, said visual display means being synchronized by said output control means with the read-

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ing means in the output section of said signal storage means, the switching means in said input and output control means acting to cause the changing data signals from from said dual gun CRT storage tubes to be supplied to said visual display means in sequence from the individual storage tubes, whereby a moving presentation is provided upon said visual display means.

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