

Aug. 7, 1956

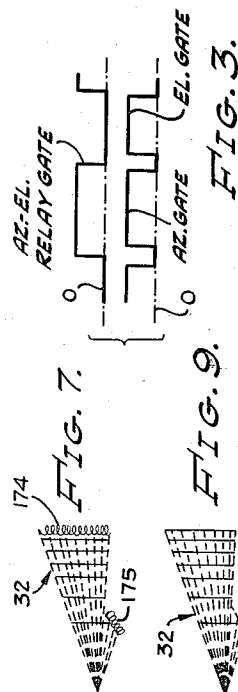
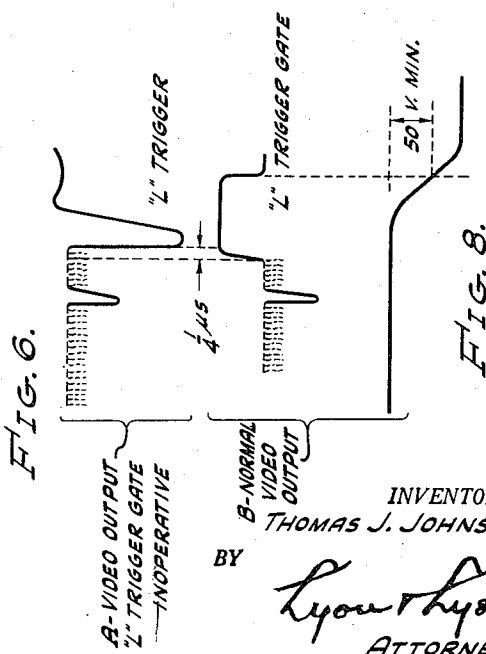
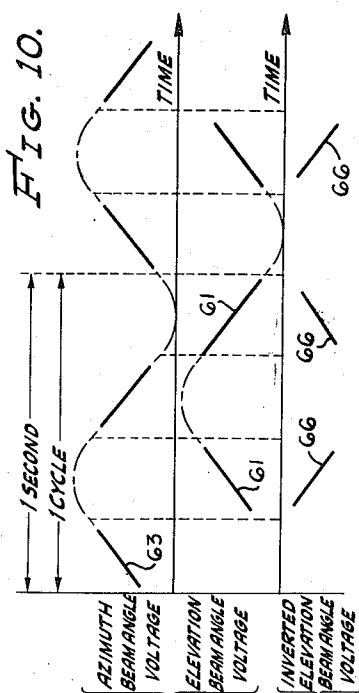
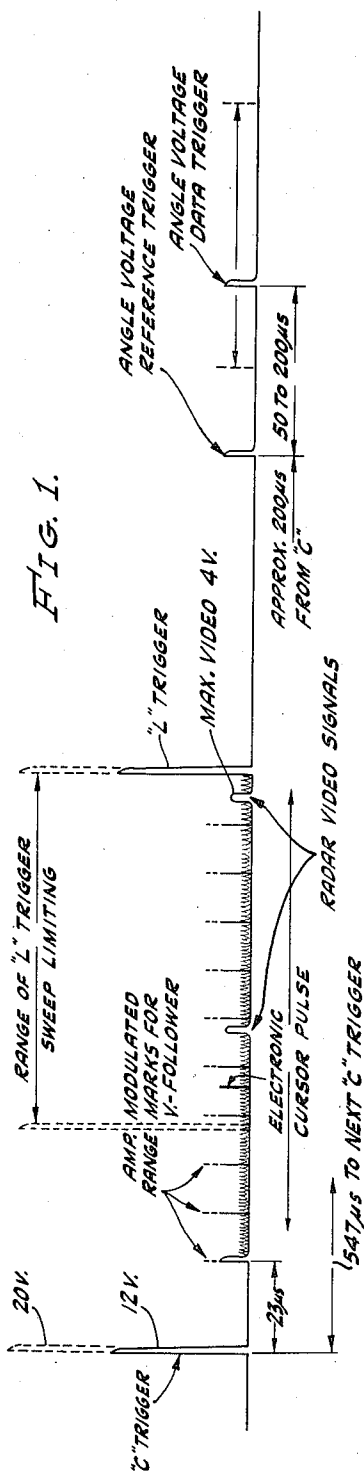
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2,758,247

GATED VIDEO AMPLIFIER CIRCUITRY

Filed Sept. 21, 1951

3 Sheets-Sheet 1



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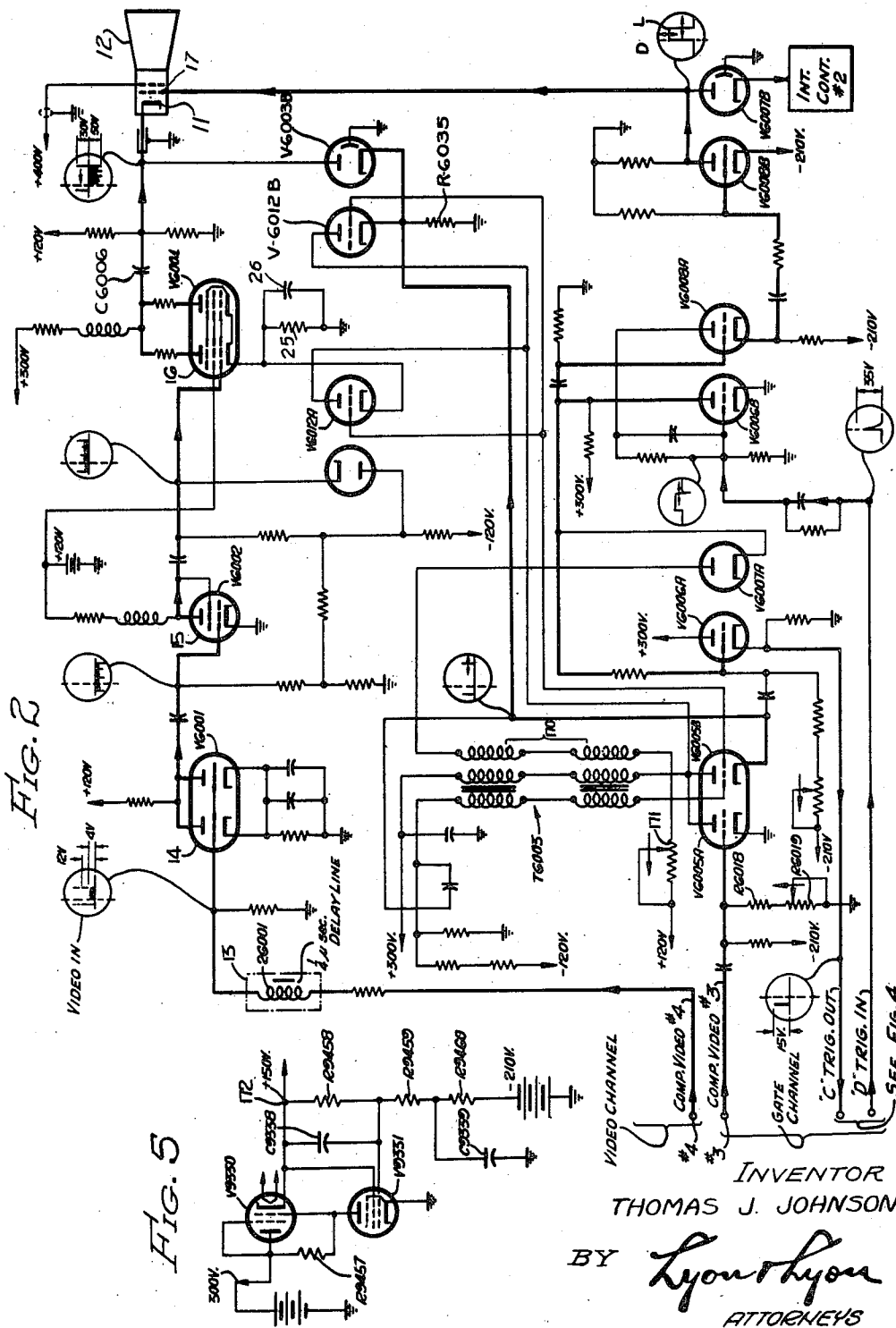
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GATED VIDEO AMPLIFIER CIRCUITRY

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3 Sheets--Sheet 2



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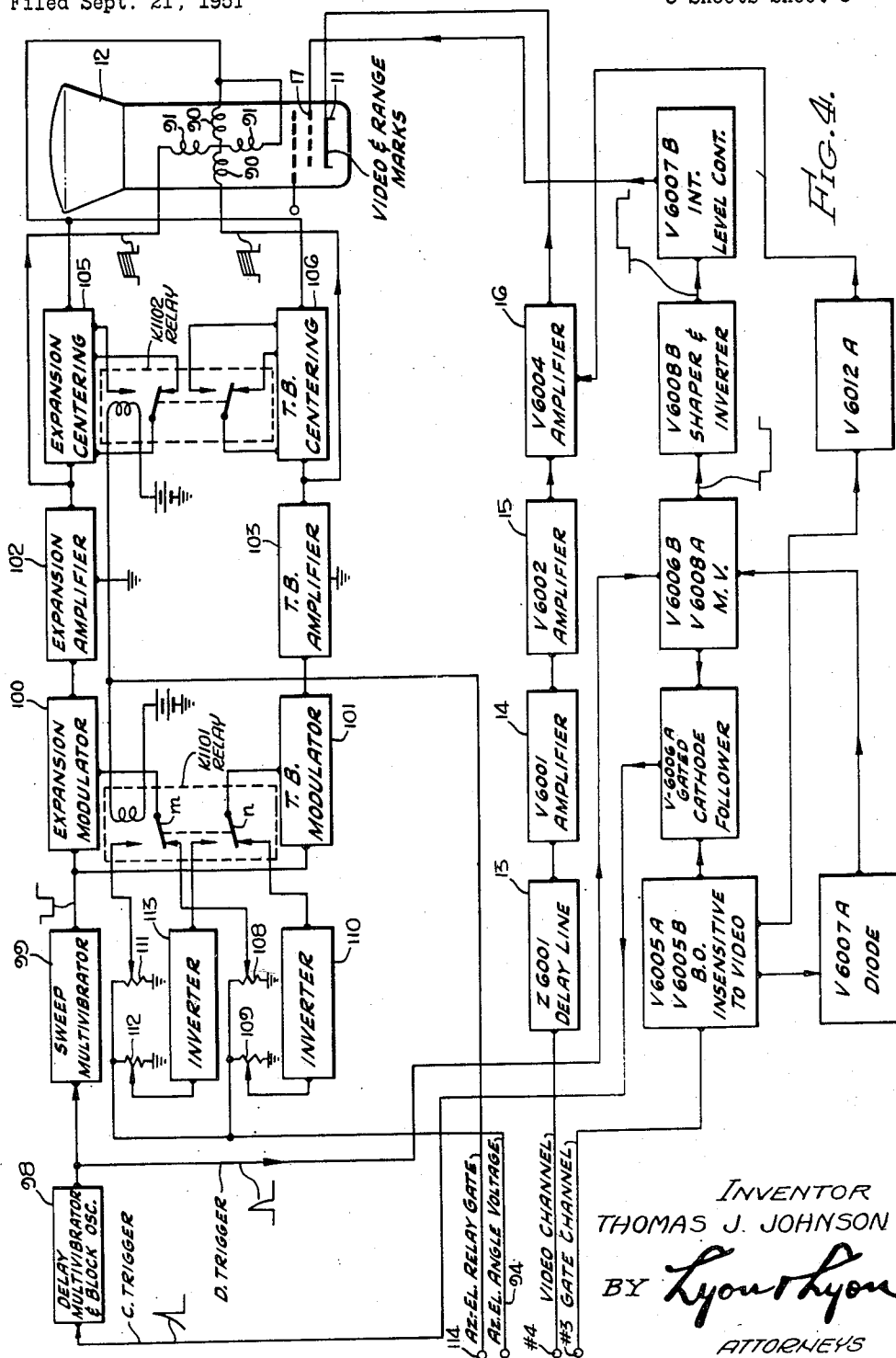
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GATED VIDEO AMPLIFIER CIRCUITRY

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3 Sheets-Sheet 3



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2,758,247

GATED VIDEO AMPLIFIER CIRCUITRY

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Application September 21, 1951, Serial No. 247,614

8 Claims. (Cl. 315—22)

The present invention relates to improved techniques and means particularly useful in cathode ray tube indicators of the type such as found in the so-called precision section of G. C. A. (ground control approach) radar aircraft landing systems, but of course is not necessarily limited to use in such equipment.

More specifically, the present invention is directed to certain features of the apparatus described in my co-pending patent application with Landee et al., Serial No. 247,616, filed September 21, 1951, and assigned to the same assignee.

In such co-pending application a selected portion of a composite video train is developed for application to an intensity control electrode of a cathode ray tube for producing visible indications on the face of the tube. Such selected portion of the composite video train is bracketed by a pair of time spaced so-called C and L triggers. These C and L triggers are used in forming a gate which, when present and applied to a second intensity controlling electrode of the cathode ray tube, is effective to render the tube fully operative for producing visible indications.

The present application is directed to the use of the L trigger to stop or define the trailing edge of an intensity gate in such a manner as to prevent so-called "blooming" along the extremity of the resulting cathode ray tube display.

The application is also directed to other related features of the circuit used in producing the aforementioned results.

Other objects and advantages of the present invention may be ascertained from the disclosure in the aforementioned co-pending application, which disclosure is incorporated herein by this reference thereto.

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. This invention itself, both as to its organization and manner of operation, together with further objects and advantages thereof, may be best understood by reference to the following description taken in connection with the accompanying drawings in which:

Figure 1 shows the time relationship between various triggers, range marks, cursor pulses and echo signals developed by the apparatus described in the above mentioned copending application Serial No. 247,616, and which are applied as composite video train to designated terminals of the apparatus shown in the succeeding figures;

Figure 2 is a schematic representation showing in more detailed form some of the apparatus indicated in block form in Figure 4;

Figure 3 illustrates sequential development of azimuth and elevation unblanking voltages in relationship to the relay gating voltage as applied to the designated terminals of the apparatus in Figures 2 and 4;

Figure 4 shows a block diagram of apparatus which embodies features of the present invention;

Figure 5 shows a voltage regulating circuit for compensating for load circuits and serves essentially to main-

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tain substantially constant a voltage of 105 volts derived from a 300 volt uncompensated source, the regulating circuit functioning to produce compensatory effects for load changes;

Figure 6 represents a portion of the composite video train near and at the time of appearance of the L trigger when features of the present arrangement are not incorporated;

Figure 7 serves to show the resulting "blooming" at the outline of the display, either azimuth or elevation, when the video train shown in Figure 6 is used;

Figure 8 represents the same condition as is shown in Figure 6, but with features of the present invention outlined;

Figure 9 represents the absence of "blooming" in the display when the video output developed as shown in Figure 8 is utilized; and

Figure 10 shows the cyclical variation of azimuth and elevation beam angle voltages in relationship to the related position of the corresponding radiated azimuth and elevation antenna beams, such variation being preferably linear.

The present invention is directed to improved means and techniques whereby information on a composite video train of the character shown in Figure 1 may be visibly displayed on the cathode ray tube 12 shown in Figures 2 and 4. More specifically, the present invention is directed to improved means and techniques whereby only those cursor pulses, video signals and amplitude modulated range marks included between the C and L triggers may be visibly displayed without transfer by the C and L triggers themselves or by interference from the angle voltage reference triggers and angle voltage data triggers. The composite video train shown in Figure 1 is developed in accordance with the means and techniques described in the above mentioned copending application of Landee et al., Serial No. 247,616, and it is assumed for the present purposes, that such composite video train is applied to the terminals designated No. 3 and No. 4 in both Figures 2 and 4. Further it is assumed that the relay gate shown in Figure 3 is applied to the lead 114 in Figure 4 and that the azimuth and elevation beam angle voltages represented, respectively, as the variations 63 and 61, in Figure 10, are applied sequentially as indicated to the lead 94. Briefly, such relay gates and angle voltages are developed by the means and techniques described in the aforementioned Landee et al., application, S. N. 247,616. The duration of the relay gate is commensurate with the time required for the azimuth antenna beam to scan through its sector while developing the corresponding voltage 63. During the time that the elevation antenna is scanning through its sector, the corresponding voltage variation 61 is developed and the relay gate shown in Figure 3 is not present. The voltage variations 63 and 61 represent by their magnitude, the angular position of the corresponding radiated azimuth and elevation antenna beams. The cathode ray tube displays are two in number and only the azimuth display is shown herein and is represented in Figure 9. The corresponding elevation display is displaced on the cathode ray tube from the azimuth display so that both may be rendered visible at the same time, although the two displays are presented on a time sharing basis with a sufficiently high repetition rate in relationship to the memory time of the fluorescent material in the cathode ray tube to render both visible.

This composite video includes, as shown in Figure 1: (1) The returning radar echo signals; (2) the range marks which are essentially aligned vertical lines in the azimuth and elevation displays; (3) intelligence in the form of amplitude modulation on the range marks for developing so-called V-follower lines in both azimuth and

elevation displays, the V-follower lines in the azimuth display in Figure 1 serving to indicate the position in azimuth of the elevation antenna, and conversely the V-follower lines in the elevation display serving to indicate the position in elevation of the azimuth antenna; and (4) cursor pulses for producing electronically the predetermined safe glide path course line in the elevation display and the corresponding runway course line in the azimuth display. It is noted that this aforementioned train of information, i. e., composite video train, in the form of signals and pulses, is bracketed between so-called C and L triggers.

Briefly, as described in greater detail hereinafter, the C trigger is used to initiate the start of a gating voltage, and the L trigger terminates such gating voltage. Such gating voltage is applied to an intensity control electrode, i. e., the grid of the cathode tube, so as to condition or allow the cathode tube to produce visible indications in accordance with the various voltages which comprise the composite video. In other words, it is intended that the components of the composite video should be insufficient in themselves to produce visible indications on the cathode ray tube viewing surface, but requires the presence of such gating voltage on the first anode of the cathode tube for producing visible indications; this gating voltage being derived from information in the composite video train, namely the C and L trigger.

It is observed that the composite video signals shown in Figure 1 do not, as such, include a designation of the V-follower voltages for producing the aforementioned V-follower lines, since such V-follower voltages are used in the present system to modulate, i. e., either to intensify or alternatively to de-intensify range marks.

It is evident that other periodically appearing voltages may be included in the composite video which is in the form of a train of signals having a length or time duration measured by the spacing between the C and L triggers, and therefore the present invention in its application is not limited specifically to voltages for producing the specific information described herein, but finds application in other systems wherein the composite video may include other intelligence denoting voltages or pulses. One of the important features of the present invention is that such composite video train is applied and effective to produce visible indications only during the duration of an established gating voltage. This gating voltage may be of constant duration for each cathode beam sweep, or may, as described herein, be of varying duration for purposes of obtaining tailored azimuth and elevation displays whereby most efficient use may be made of the cathode ray tube viewing surface.

The L trigger is initiated by the C trigger but occurs with variable time delay after the C trigger, as indicated by the arrow on the L trigger in Figure 1, for purposes of limiting, clipping, or tailoring the Az-El display. The L trigger is produced in a map generator, the circuitry and techniques involved in the same being shown and claimed in the copending application of Landee et al., Serial No. 247,616. As alluded to before, the L trigger determines when the intensity gating voltage applied to the control grid is stopped. The amplitude of the L trigger is the same as the amplitude of the C trigger during the azimuth and elevation presentations.

While, for purposes of describing certain aspects of the present invention, the C and L triggers may have the same amplitude during the presentations of both the elevation and azimuth displays, they are shown as being modulated in amplitude to indicate the manner in which the present system described herein is adapted for the transmission of the video information to a remote location. When the present system is connected for remote operation, information as to the angular position of the radiated antenna beam is conveyed to such remote location in the form of a pair of triggers, i. e., a so-called reference trigger and a data trigger, and such reference

and data triggers shown in Figure 1 are included herein for reference purposes.

The cathode ray tube 12 in Figure 4 is for producing the display and has a pair of magnetic deflection coils 90, 91, so arranged as to deflect the associated electron beam substantially parallel to two mutually perpendicular axes, the so-called "time base" axis which is generally, although not exactly, horizontal as viewed by the operator, and the so-called "expansion" axis which is generally vertical. In general, each system trigger developed in the system synchronizer is made to initiate a current wave of sawtooth form through the time base deflection coil 90, and a current wave of similar form through the associated expansion deflection coil 91, the current in each coil expanding approximately linearly with time and then returning rapidly to zero. Instead of a linear variation, this variation may be logarithmic in character, as described in the copending patent application of Homer G. Tasker et al., Serial No. 175,168, filed July 21, 1950, and assigned to the same assignee.

The repetition rate of such sawtooth currents is, of course, the same as the pulse repetition rate of the transmitted pulses, and occurs during the expectant period of resulting echo signals. It will be understood that electrostatic deflection of the cathode ray beam may be used instead of electromagnetic deflection, appropriate modifications being made in other parts of the equipment.

Such sawtooth currents applied to the deflection coils 90, 91, however, are "modulated" at a slow rate by currents of much lower periodicity which are produced by voltages, i. e., the beam angle voltages which are produced in accordance with the scanning movement of the antenna beam, and which are shown graphically in heavy lines in Figure 10. Those portions of the voltage indicated in heavy lines in Figure 10 only are used to modulate the sweep voltages on a time sharing basis.

These voltages, as represented by the curves 61 and 63, may vary from plus two volts at one extreme of the scanning range to plus fifty-two volts at the other end. These particular antenna beam angle voltages, as mentioned previously, are used in effect to "modulate" the amplitude of the sawtooth voltage waves developed in the sweep amplifier shown in Figure 4 and applied at a much higher repetition rate to the expansion coil 91, for purposes of obtaining unidirectional or unidimensional magnification in the cathode ray display in accordance with principles set forth in the copending patent application of Homer G. Tasker, Serial No. 680,604, filed July 1, 1946, and assigned to the same assignee as the present application. On the other hand, the amplitude of the sawtooth voltage waves developed in the sweep amplifier and applied to the other quadraturely acting time base coil 90 is likewise modulated to a much smaller degree and in a different manner, for purposes of orientation as described later.

Thus, the amplitude of the currents supplied to coil 91 is automatically varied in accordance with antenna beam angle voltage, so that the angle which any particular cathode ray beam makes, corresponds, on an expanded scale, to the antenna beam angle.

The tube 12 is rendered fully operative for producing visible indications only when a suitable intensifying voltage is applied to its grid 17, bringing the tube approximately to cut-off condition. A relatively small additional video signal applied to the cathode 11 then strengthens the cathode beam, making it momentarily visible on the screen as a dot, the position of which is determined by the currents flowing at that particular moment in the set of deflection coils 90, 91.

For purposes of developing the aforementioned suitable deflecting currents in the cathode ray deflection coils 90 and 91, the sweep generating circuit shown in Figure 4 is supplied with C triggers which appear in timed relationship and as a result of triggers developed in the system synchronizer (not shown) and applied to terminal

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3 in Figure 4, which is connected to the B. O. (blocking oscillator) stage V6005A, V6005B. An output of the last-mentioned stage is applied to the gated cathode follower stage V6006A which supplies the C trigger to stage 98. Such C triggers are applied in Figure 4 to the delay multivibrator and blocking oscillator stage 98, the output of which is fed to the sweep generating multivibrator stage 99. A negative gating voltage is generated in the stage 99 and fed to the expansion and time base modulator stages 100 and 101, respectively, and from them in modulated form through expansion and time base amplifiers 102 and 103. The output of amplifiers 102 and 103, in the form of essentially trapezoidal waves of appropriate amplitude, are applied to the expansion deflection coil 91 and the time base deflection coil 90, respectively, causing current pulses of linear sawtooth form in the coils. Expansion and time base centering circuits 105 and 106 are also connected to the deflection coils. The modulator stages 100 and 101, for purposes of modulation, receive Az-El antenna beam angle voltages via switches *m* and *n*, respectively, of relay K1101.

With the relay unactuated (as shown) the elevation beam angle voltage appearing on the potentiometer resistance 108 is applied through switch *m* to the expansion modulator 100; and through potentiometer resistance 109 and inverter 110 and switch *n* to the time base modulator 101. After completion of the elevation scan, relay K1101 is actuated by a switch synchronized with operation of the antenna beam scanning mechanism breaking the elevation beam angle voltage connections just described, and connecting the azimuth beam angle voltage through potentiometer 111 and switch *m* to the expansion modulator 100; and through potentiometer 112, inverter 113 and switch *n* to the time base modulator 101.

Thus, the degree of modulation of sweep current, and hence the degree of angle expansion of the display, may be separately regulated for the azimuth display by adjustment of the potentiometer 111, and for the elevation display by adjustment of potentiometer 108; and the degree of modulation of the time base sweep current, and hence the apparent angle between the range marks and the time base, may be separately regulated for the azimuth display by adjustment of potentiometer 112, and for the elevation display by adjustment of the potentiometer 109.

The centering circuits 105 and 106 in Figure 4 are individually capable of two separate adjustments, one effective when relay K1102 is actuated (azimuth display) and one when the relay is unactuated (elevation display) to determine the positions of the different points from which the cathode ray sweeps originate in the production of the azimuth and elevation displays. Thus, the origins of azimuth and elevation displays are separately adjustable, the centering circuits automatically responding to one or other set of adjustments according to the energized condition of relay K1102.

The following description, in relationship to Figures 2 and 4, serves to fully describe the manner in which, first, the video bracketed by the C and L triggers is applied as a negative going signal to the cathode 11 of the cathode ray tube 12, and, second, the manner in which the gate channel connected to terminal No. 3 develops a positive going gating voltage for application to the control grid 17 of tube 12, the boundaries of such gating voltage being determined by the D and L triggers, respectively. It is observed that the video channel connected to terminal No. 4, which includes the delay line 13 and amplifiers 14, 15 and 16, is alluded to above.

The video amplifying channel in general is conventional, but of importance is the manner in which the final amplifier stage 16 is controlled in accordance with certain triggers for purposes of preventing "blooming" at the extremities of the cathode ray tube display. Such triggering voltage is transferred to the amplifier stage 16 through tube V-6012A, which has its cathode connected

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to the cathode of tube 16 as shown in Figure 2. The manner in which the tube 16 is thus controlled by variations of potential on a cathode of tube V-6012A will be more clear from the following description of the gate channel which includes terminal No. 3. In general this gate channel, including Terminal No. 3, the blocking oscillator tube V-6005A, B, diode V-6007A, cathode follower V-6006A, multivibrator stage including tubes V-6006B and V-6008A, shaper and inverter tube V-6008B, level control tube V-6007B and tube V-6012A. This gate channel selects information from the composite video train to form the intensity gate and serves also to gate off the video channel, i. e., the video amplifier tube 16 and triggers above certain specified amplitude.

In the operation of this gate channel, the composite video train is applied to the control grid of the first blocking oscillator tube V-6005A, which serves as the trigger tube. Resistance R-6018, which is serially connected with resistance R-6019, serves to determine the intensity at which the blocking oscillator tube V-6005A is triggered and this resistance is adjusted so that the blocking oscillator stage is fired by all C and L triggers, but does not fire on any video signals. It is noted in this respect that the C and L triggers are always of much greater amplitude than the video signals bracketed by such C and L triggers.

It is desired to separate the C and L triggers and this is accomplished as follows: Consider the fact that any trigger which passes through the gated cathode follower tube V-6006A is delayed approximately 22 microseconds by the circuitry in the sweep amplifier and is returned as a D trigger. The manner in which the C trigger is delayed in time to form the D trigger is indicated in Figure 4 wherein the delay multivibrator 98 serves to impart such delay. The D trigger is applied to the multivibrator stage comprising tubes V-6006B and V-6008A. The D trigger initiates operation of this multivibrator stage V-6006B, V-6008A, which, in turn, gates off the cathode follower tube V-6006A. Thus, while initially the C trigger causes the gated cathode follower stage V-6006A to become conductive, the subsequently developed D trigger serves to return the cathode follower stage V-6006A to its normally nonconducting condition and any subsequent trigger then is not passed through the cathode follower stage V-6006A until after the multivibrator stage V-6006B and V-6008A is returned to its normal condition.

After the last mentioned multivibrator stage is started, it may be stopped by any subsequent trigger on the composite video train, i. e., by the L trigger. This is accomplished by applying the blocking oscillator pulse developed in the winding 170 of the blocking oscillator transformer T-6003 through diode V-6007A to the anode of tube V-6006B. The intensity of this pulse for accomplishing this purpose may be adjusted by the so-called gate stop adjusting resistance 171, which is serially connected with winding 170.

Recapitulating, the C trigger causes the blocking oscillator stage V-6005A, B to fire. The resulting signal passes through cathode follower V-6006A and is delayed approximately 22 microseconds by the delay in multivibrators 98 (Figure 4) to form the so-called D trigger. Multivibrator stage V-6006B, V-6008A is started by this D trigger which, in turn, shuts off the cathode follower tube V-6006A. The L trigger, which follows the C trigger on the composite video train a variable time in the order of 30 to 140 microseconds, causes the blocked oscillator stage V-6005A, B to fire. The blocked oscillator signal resulting from this L trigger, fed to the anode of tube V-6006B, causes the multivibrator stage V-6006B, V-6008A to return to its normal position. A negative gate as a result is available at the cathode of tube V-6008A, which is the same length as the spacing between the D and L triggers. After this negative gate is

shaped and inverted by stage V-6008A, it is coupled to the grid of the cathode ray tube as an intensifying gate. The intensity level of this gate is set by adjusting the clipping level of tube V-6007B by the time base intensity control. Since the same trigger which stops the intensity gate, i. e., the L trigger, appears in the video channel at several times normal video amplitude, it is desired that some precaution be taken to prevent "blooming" at the outline of the different azimuth and elevation displays. This is accomplished by applying the blocked oscillator pulse appearing on the cathode of tube V-6012A to the cathode of the video output tube V-6004 of stage 16.

It is observed that the stage 16 is normally effective as an amplifier but, upon the application of the block oscillator pulse to the control grid of tube V-6012A, the voltage developed across the common cathode resistance 25 is sufficient to cause the cathode of tube 16 to become sufficiently positive with respect to its control grid whereby stage 16 is rendered ineffective as an amplifier. The resistance 25 is shunted by condenser 26.

It is observed further that during this time the cathode ray tube 12 is also rendered ineffective by applying a relatively large positive voltage to its cathode 11 by means which include the tube V-6012B and clamp tube V-6003B. The tube V-6012B is connected essentially as a cathode follower so as to develop a relatively large positive voltage on its cathode, i. e., across the cathode load resistance R-6035 upon application of the aforementioned positive going block oscillator pulse to the control grid of tube V-6012B. The voltage thus developed in the cathode of tube V-6012B is applied to the cathode of the clamp tube V-6003B, which has its anode connected directly to the cathode 11. Thus, by this means upon the screens of the blocking oscillator pulse, the cathode 11 is driven sufficiently positive with respect to its control grid as to render the tube 12 ineffective during the critical time previously mentioned.

It is noted, as previously described, that the composite video train in the video channel is delayed by the delay line 13 a time in the order of 1/4 microsecond to thereby allow time for the blocked oscillator V-6005A, V-6005B to fire and cut off tube V-6004 during the C and L trigger times. In this respect it is noted that the control grid of tube V-6012A is connected to the control grid of the blocked oscillator tube V-6005B. This result is shown graphically in Figures 6, 7, 8 and 9.

Figure 6 shows in enlarged form a portion of the composite video in the L trigger time. Figure 7 represents the output if the L triggers were allowed to pass through. In such case objectional "blooming" at the outlines 174, 175, for example, of the elevational display 32, would result. However, Figure 9, in comparison to Figure 7, represents the actual conditions existing at or near L trigger time. In Figure 9 the positive going L trigger gate in the outputs actually defines the outline of the azimuth display, the time base intensity gate being dropped sufficiently so that the cathode tube remains deintensified after the L trigger gate.

Also considered of importance in this present arrangement is the 150-volt regulated power supply shown in Figure 5. In Figure 5 a regulated voltage of 150 volts is obtained using a series regulator tube V-9330 and control tube V-9331. A 300-volt voltage source has its ungrounded positive terminal connected to the anode of tube V-9330 and to the anode of tube V-9331 through the series resistance R-9457. The plate-cathode voltage drop of tube V-9330 establishes a positive voltage of 150 volts on the cathode of tube V-9330 through the voltage divider and amplifier circuit comprising tube V-9331 and resistors R-9458, R-9459 and R-9460, which are connected to the ungrounded negative terminal of the -210 volt source. Any load changes causing voltage variations on the 150-volt output terminal 172 creates an opposing conductance condition in amplifier tube V-9331 which,

in turn, varies the conductance level of tube V-9330, thereby compensating for the load change. Also any change in the -210 volt bias source will cause a compensatory change in the level of the +150 supply thereby stabilizing circuits such as V-6001 which operate between these two sources of supply.

While the particular embodiments of the present invention have been shown and described, it will be obvious to those skilled in the art that changes and modifications may be made without departing from this invention in its broader aspects and, therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of this invention.

I claim:

1. In a system of the character described, a source of video trains, each train comprising video signals bracketed by a pair of time spaced control triggers, a cathode ray tube having an intensity control electrode, a gated video channel for coupling said source to said intensity control electrode, delay means in said video channel whereby said control triggers and video signals are delayed a relatively small amount, said control triggers having amplitudes substantially larger than said video signals, gate forming means coupled to said source of video trains, said gate forming means incorporating means insensitive to said relatively small intensity video signals but sensitive to said relatively large amplitude control triggers, said gate forming means including delay means whereby the first of said control triggers is delayed in a greater amount than it is delayed in the video channel so as to produce a delayed control trigger, said gate forming means including means for developing a gating voltage which starts substantially contemporaneously with said delayed control trigger and which terminates substantially contemporaneously with the second control trigger, and means applying said gating voltage to an intensity control means of said cathode ray tube.

2. In a system of the character described, a source of video trains each train comprising video signals bracketed by a pair of time spaced control triggers, a cathode ray tube having an intensity control electrode, a gated video channel for coupling said source to said intensity control electrode, delay means in said video channel, whereby said control triggers and video signals are delayed a relatively small amount, said control triggers having amplitudes substantially larger than said video signals, gate forming means coupled to said source of video trains, said gate forming means incorporating means insensitive to said relatively small intensity video signals but sensitive to said relatively large amplitude control triggers, said gate forming means including delay means whereby the first of said control triggers is delayed in a greater amount than it is delayed in the video channel so as to produce delayed control triggers, said gate forming means including means for developing a gating voltage which starts substantially contemporaneously with said delayed control trigger and which terminates substantially contemporaneously with said second control trigger, and means applying said gating voltage to intensity control means of said cathode ray tube, and means coupled between said gate forming means and said video channel for rendering said video channel ineffective during the occurrence of the second control trigger.

3. In a system of the character described, a source of video trains each train comprising video signals bracketed by a pair of time spaced control triggers, a cathode ray tube having an intensity control means, a video channel coupling said source to said intensity control means, means rendering said video channel ineffective during the occurrence of said control triggers, and means deriving from said control triggers an intensifying gate voltage having a duration commensurate with the time spacing of said control triggers and means for applying said intensifying voltage to said intensifying means.

4. In a system of the character described, a source of

video trains, each train comprising video signals bracketed by a pair of time spaced control triggers, a cathode ray tube having an intensity control electrode, a video channel for coupling said source to said intensity control electrode, an amplitude responsive means coupled to said source for deriving from said control triggers an intensifying voltage having a duration commensurate with time spacing of said control triggers, and means applying said intensifying gating voltage to said intensifying means.

5. In an arrangement of the character described, a source of video trains, each train comprising video signals bracketed by a pair of time spaced control triggers, a cathode ray tube having intensity control means, a video channel coupling said source to said intensity control means, said video channel comprising delay means and amplifying means, whereby said control triggers and video signals are amplified and delayed a relatively small amount, said control triggers having amplitudes substantially large than said video signals, intensifying voltage forming means coupled to said source of video trains, said forming means being insensitive to said relatively small intensity video signals but being sensitive to said relatively large amplitude control triggers, said forming means including delay means whereby the first of said control triggers is delayed in a greater amount than it is delayed in the video channel so as to produce a delayed control trigger, said forming means including means for developing an intensifying voltage which starts substantially contemporaneously with said delayed control trigger and which terminates substantially contemporaneously with said second control trigger, means applying said intensifying voltage to said intensity control means, and means rendering said amplifying means in said video channel ineffective during occurrence of both of said control triggers.

6. In an arrangement of the character described, a source of video trains, each train comprising video signals bracketed by a pair of time spaced control triggers, a cathode ray tube having intensity control means, a video channel coupling said source to said intensity control means, delay means in said video channel whereby said control triggers and video signals are amplified and delayed a relatively small amount, said control triggers having amplitudes substantially larger than said video signals, intensifying voltage forming means coupled to said source of video trains, said forming means being insensitive to said relatively small intensity video signals but being sensitive to said relatively large amplitude control triggers, said forming means including: a blocking oscillator insensitive to said video signals, a gated cathode follower stage coupled to said blocking oscillator, a multivibrator stage, second delay means coupling said cathode follower stage to said multivibrator stage for producing a gating voltage, the leading edge of which corresponds to the first control trigger but delayed by said second delay means an

amount greater than the delay encountered by the first control triggers in the video channel, means coupling said blocking oscillator stage to said multivibrator stage for terminating the gating voltage at a time substantially commensurate with the appearance of the second control trigger, means coupling said multivibrator stage to said intensity control means for controlling the intensity of the cathode ray beam in accordance with said gating voltage, and means coupled between said blocking oscillator stage and video channel for rendering said video channel ineffective during the occurrence of said second control trigger.

7. An arrangement set forth in claim 6 in which said multivibrator stage is coupled to said cathode follower stage for returning said cathode follower stage to its normal condition upon operation of said multivibrator stage.

8. In a system of the character described, a source of video trains, each train comprising video signals bracketed by a pair of time spaced control triggers, a cathode ray tube having intensity control means, a video channel coupling said source to said intensity control means, a first delay means in said video channel whereby said control triggers and video signals are delayed a relatively small amount, said control triggers having amplitudes substantially larger than said video signals, intensifying voltage forming means coupled to said source of video trains, said forming means being insensitive to said relatively small intensity video signals but being sensitive to said relative large amplitude control triggers, said forming means including a multivibrator stage, second delay means, means including said second delay means for coupling said multivibrator stage to said source, said coupling means controlling said multivibrator stage to form an intensifying voltage which has a duration contemporaneous with and commensurate with the time spacing of said control triggers, and means rendering said video channel ineffective during occurrence of said second control trigger.

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