

[54] **AUTOMATIC STEREOPLOTTING
APPARATUS**

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[58] Field of Search:.....**250/220 SP; 356/2**

[56] **References Cited**

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Primary Examiner—Ronald L. Wibert

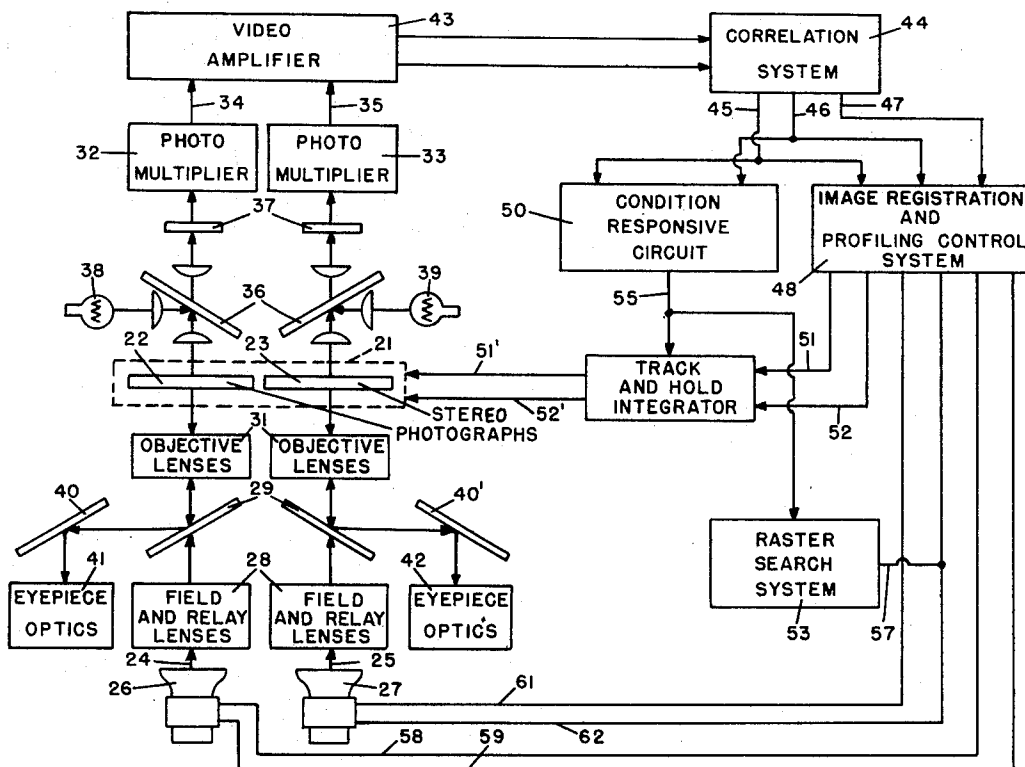
Assistant Examiner—F. L. Evans

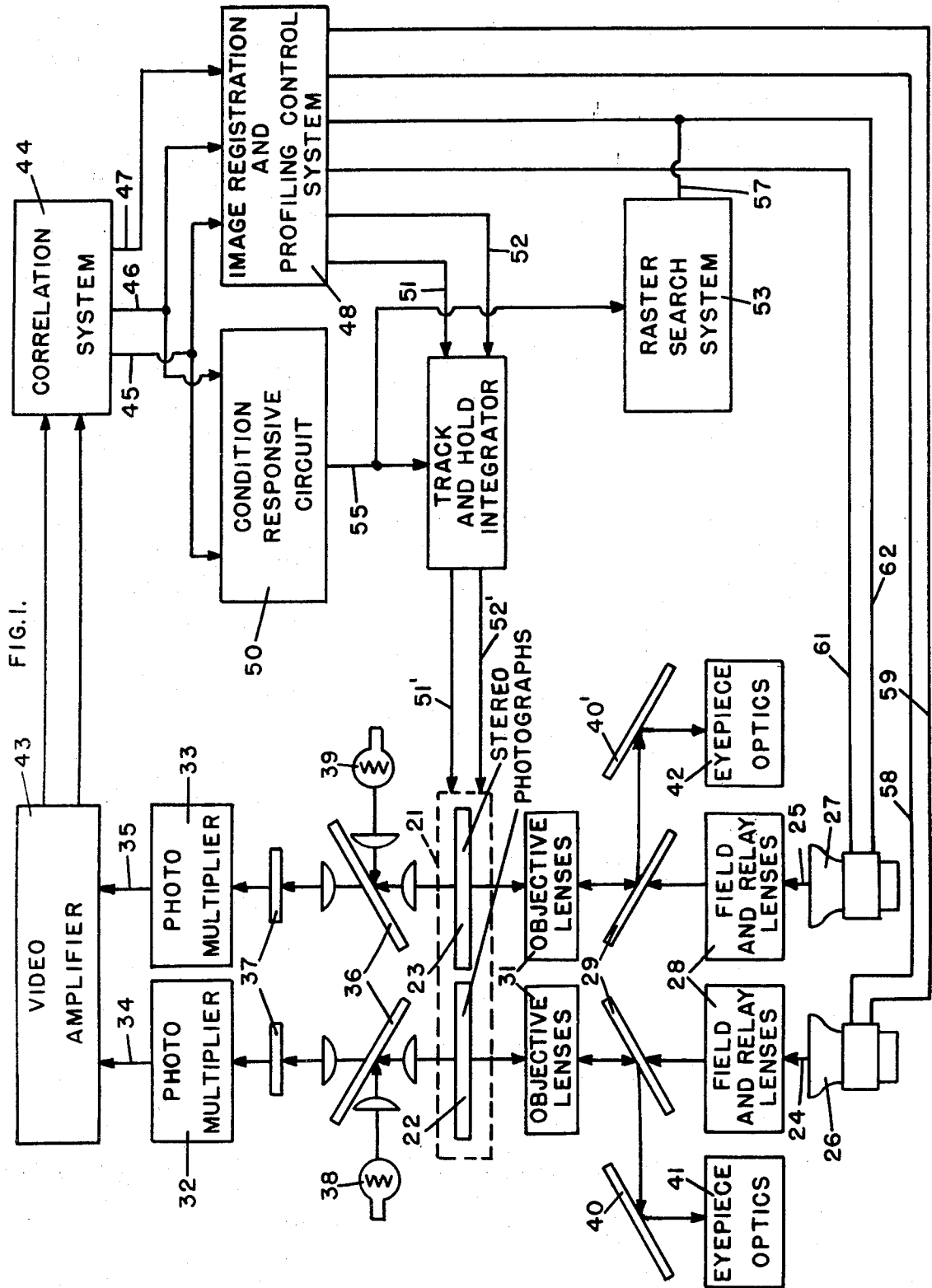
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[57] **ABSTRACT**

Disclosed in an automatic stereoplotter in which terrain elevation indicating x -parallax corrections are held in response to the absence of a given minimum level of correlatable image detail. This prevents inaccurate, noise responsive x -parallax corrections when traversing image areas such as water bodies having low correlatable information content. To insure a timely restoration of normal operations, a search system responds to a hold of x -parallax correction by systematically searching the stereo model in the x -direction for image areas retaining a sufficient level of correlatable image detail.

16 Claims, 6 Drawing Figures





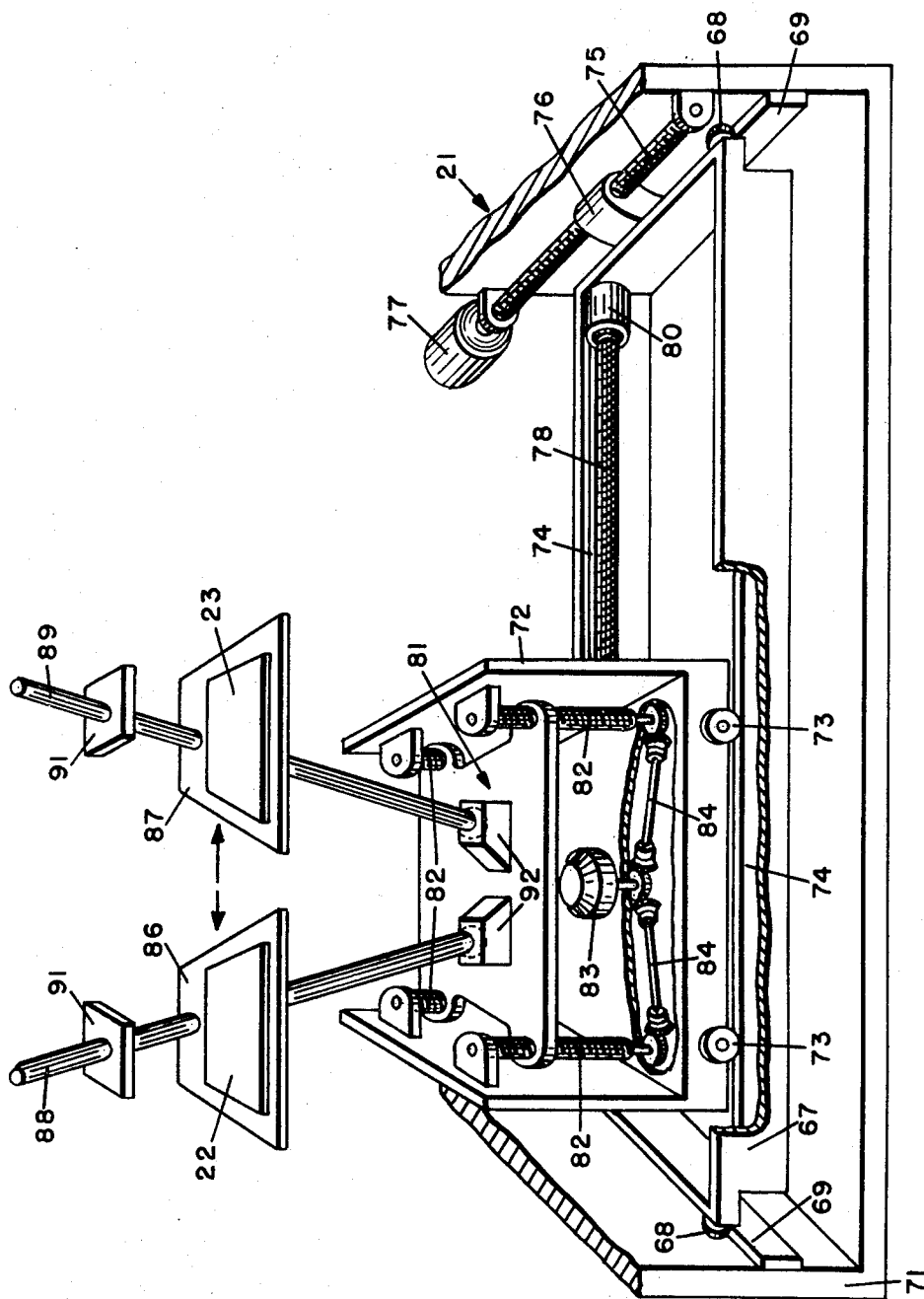
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FIG. 2.



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FIG. 3.

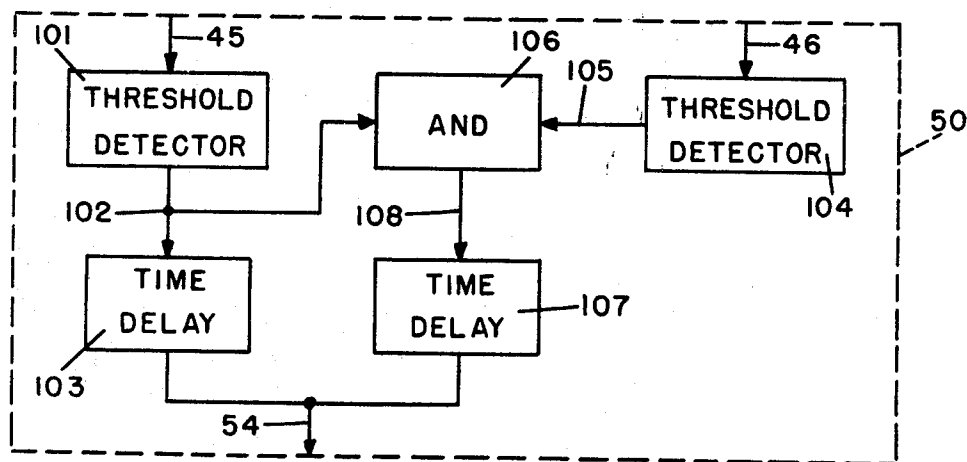


FIG. 3a.

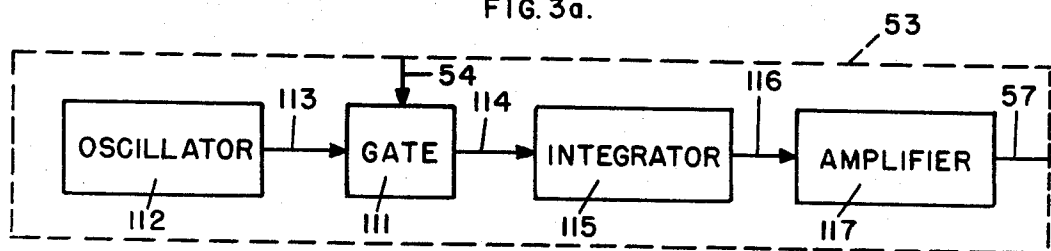
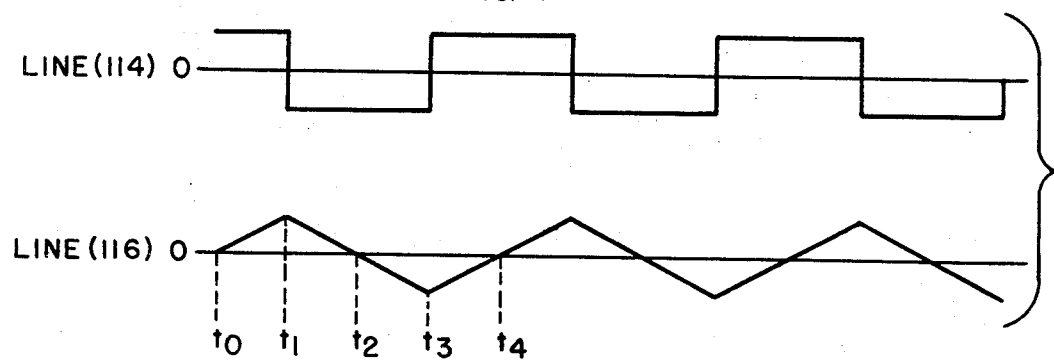
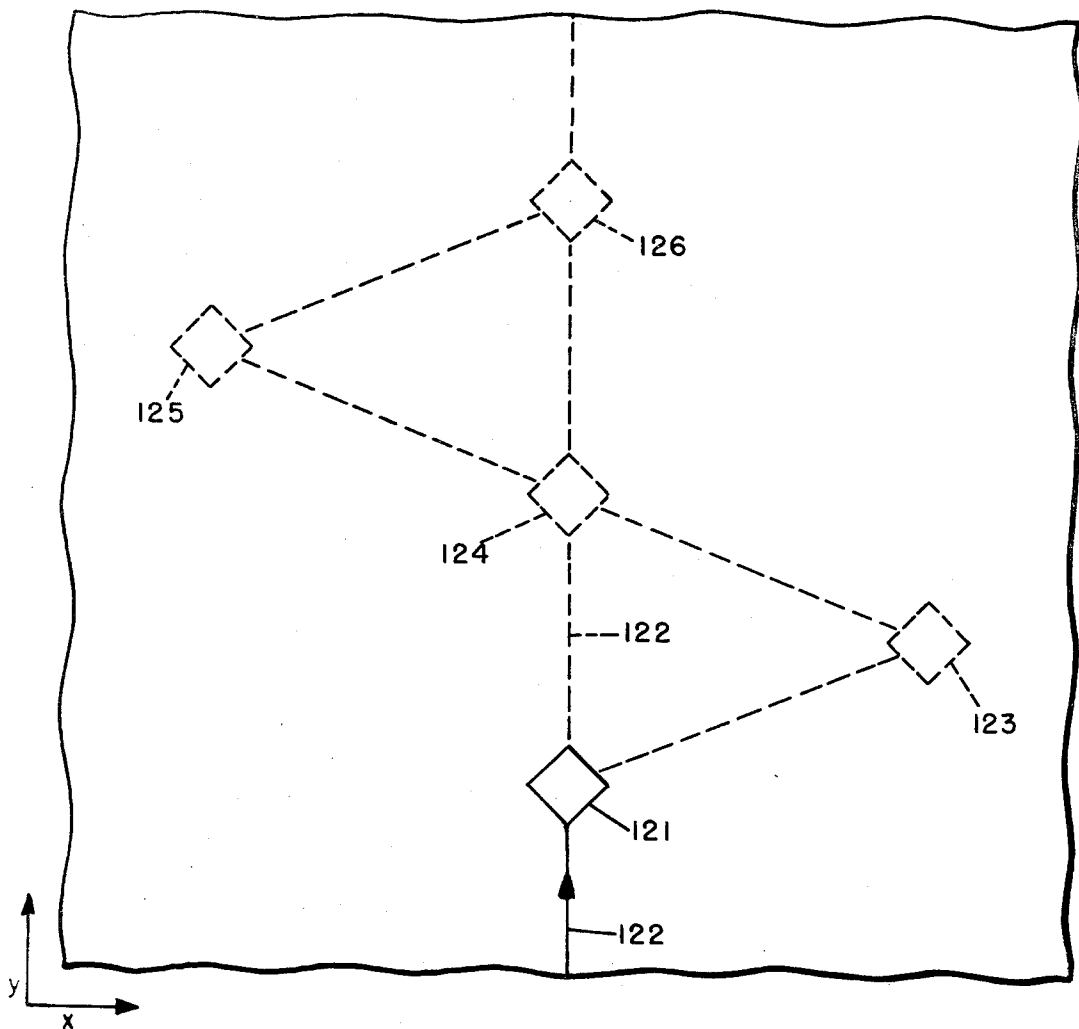


FIG. 4.



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FIG. 5.



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AUTOMATIC STEREOPLOTING APPARATUS

BACKGROUND OF THE INVENTION

This invention relates generally to dual image registration systems and, more specifically, to an automatic stereoplotting instrument for use in the production of topographic maps.

According to well-known techniques in the field of photogrammetry, stereo perception is employed to obtain elevation and position measurements of terrain imaged on a pair of stereographic photographs. The stereo photographs are positioned in a stereoplotting machine that produces for an operator a stereographic presentation of a particular area of the terrain imaged on the photographs. By inducing appropriate relative displacement of the photographs in a direction corresponding to the direction of separation between the positions from which the photographs were taken, the operator registers image detail and eliminates zero order distortion in the stereo presentation. The magnitude of displacement required to eliminate the distortion, commonly called parallax, is proportional to the relative elevation of the actual terrain imaged on the viewed area of the photographs and is automatically recorded by the stereoplotting machine. Simultaneously recorded for the viewed area is its position in the photographs which identifies the relative position of the actual terrain. Thus, by continuously maintaining registration of the individually viewed image areas, while systematically traversing the entire surface of the two photographs, relative elevation and position information is obtained for all the terrain imaged on the photographs.

Typically, the systematic traversal is accomplished by moving the photographs on an x-y carriage relative to the optical viewing system. While controlling movement of the x-y carriage, the operator continuously adjusts the horizontal displacement between the photographs so as to maintain image registration. Generally the operator is guided during the procedure by the well-known "floating-mark". This mark comprises some indicia such as light spots located at the optical axes of the stereo viewing system and when fused into a single spot in the stereo presentation appears to lie on the surface of the stereo terrain model only when the images are properly registered.

Even with the most modern instruments, manual stereoplotting is a tedious and time consuming operation. The time required to manually profile a typical stereo model is between 2 and 4 hours, depending on the roughness of the terrain. When functioning to adjust the apparent height of the floating mark by means of a hand or foot wheel, a human operator becomes part of a closed loop feedback system and is subject to some basic limitations. For example, his response, i.e., the time delay between the perception of an error in the height of the floating mark and its subsequent correction by means of the hand wheel, has a definite minimum value making it necessary to reduce traversing speed in rough terrain.

A number of automatic stereoplotting systems have been developed for simplifying the dual image registration procedure. Basically, most such systems scan homologous sections of the two photographs and convert the scanned graphic data into a pair of electrical video signals. By various correlation and analysis techniques, the video signals are used to produce error signals representing certain types of distortion existing between the scanned image sections. The scanned sections are then rendered congruent by image detail transformations produced in response to the derived error signals. Usually, the x-parallax error signal indicative of terrain elevation is applied to a servomechanism that corrects zero order distortion by producing appropriate relative movement between the stereo photographs or height adjustments of a viewing surface that intercepts a projection of the images. As noted above, the magnitude of required x-parallax correction is directly related to the relative elevation of the actual terrain and provides the contour information necessary for topographic maps.

Automatic stereoplotting machines, given suitable input, can respond more quickly than a human operator and consequently can substantially reduce the time required to profile a stereo model, particularly one involving rapid fluctuations of terrain height. Conversely, automatic systems encounter various operating problems the most serious of which result from the fact that in the aerial photographs used to create a stereo model, the structure and spatial frequency content of the images differ from point to point. For this reason, the quality of correlation which is dependent upon the quantity of correlatable image detail present changes as the photographs are traversed. To reduce the problems associated with variable correlation quality, some prior automatic systems have employed a so-called cross-correlation signal with a value dependent upon both the quality of correlation and the degree of image registration to control various system parameters including scanning raster sizes and model traversing velocity. Also disclosed in U.S. application, Ser. No. 839,940 of John W. Hardy et al., filed July 8, 1969 is the use of a cross-correlation signal to deactivate the x-parallax correction mechanism when correlation quality falls below a predetermined level. This is a desirable feature because correlation quality is frequently lost while traversing bodies of water which have inherently low correlatable information content. It is obviously desirable to maintain a given elevation indicating position of the x-parallax correction mechanism while traversing the flat surfaces of such bodies. However, in the event that correlation is lost while profiling a mountain top or a valley bottom, a deactivation of the x-parallax correction mechanism can prevent the machine from finding homologous image areas in the two photographs. Thus correlation quality will remain below the predetermined hold level and extended periods of inaccurate output will result.

The object of the invention, therefore, is to provide an improved automatic stereoplotting instrument that alleviates the problems noted above.

CHARACTERIZATION OF THE INVENTION

The invention is characterized by the provision of an automatic stereoplotting system including an x-y carriage for supporting a pair of stereographic photographs. A pair of fixed cathode ray tubes produces scanning beams which are directed through and modulated by image detail retained in distinct areas of the stereographic photographs and drive motors selectively move the carriage in orthogonally related directions so as to change simultaneously and uniformly the areas being scanned. Image detail information extracted by the scanning beams is converted into video signals which are correlated and analyzed according to conventional techniques producing an x-parallax error signal indicative of x-parallax existing between the image areas being scanned. The x-parallax error signal is applied to a servomechanism that produces relative movement between the stereographic photographs in a sense required to effect registration of the scanned image areas therein.

Also produced by multiplication of the video analog signals is a cross-correlation signal having an amplitude dependent upon the level of correlatable image detail in the scanned areas. The cross-correlation signal is applied to a hold circuit that deactivates the x-parallax correction mechanism when correlation quality falls below a given predetermined level. In response to this condition, a search circuit is activated to produce oscillating relative movement in the x-direction between the scanning patterns on the stereographic photographs. This action continues until the scanning patterns are directed onto scan areas having enough correlatable image detail to raise the amplitude of the cross-correlation signal above the predetermined hold value. At that time the hold circuit is again deactivated and normal operation of the x-parallax correction mechanism resumes. Because of the scanning raster search, a resumption of normal profiling operation is assured regardless of where correlation is lost in the stereo model.

According to one feature of the invention the search circuit comprises an integrator, the triangular wave output of which is applied to the x-deflection coil of one of the cathode ray tubes. The triangular wave introduces the desired oscillation of the scanning pattern in the x-direction. Preferably, the integrator is provided with a relatively long time constant so that after correlation is restored, the oscillating scanning pattern will drift slowly back to its original x-position. During this period correlation is maintained by the x-parallax correction mechanism that induces appropriate relative movement between the photographs in the x-direction.

DESCRIPTION OF THE DRAWINGS

These and other objects and features of the invention will become more apparent upon a perusal of the following description taken in conjunction with the accompanying drawings wherein:

FIG. 1 is a general block diagram illustrating the functional relationship of the main components of the apparatus;

FIG. 2 is a schematic perspective view of the transformation mechanism shown in FIG. 1;

FIG. 3 is a block diagram illustrating in greater detail the condition responsive circuit shown in FIG. 1;

FIG. 3a is a general block diagram illustrating in greater detail the search network shown in FIG. 1;

FIG. 4 is a graph showing a plurality of signal waveforms plotted against time; and

FIG. 5 is a diagrammatic representation illustrating operation of the search network shown in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1 there is shown in diagrammatic form an image transformation mechanism 21 retaining a pair of stereo photographic transparencies 22 and 23. Scanning beams 24 and 25 produced by, respectively, cathode ray tubes 26 and 27 are directed toward the transparencies 22 and 23 by field and relay lens assemblies 28, dichroic beam splitters 29 and objective lenses 31. After passing through the transparencies 22 and 23 the scanning beams 24 and 25 are received by photomultipliers 32 and 33 that produce on lines 34 and 35, respectively, video analog signals representing the variable detail retained by the photographs. Between the transparencies 22 and 23 and the photomultipliers 32 and 33 the scanning beams pass through lens systems including dichroic mirrors 36 and blue light filters 37.

Also reflected through the transparencies 22 and 23 by the dichroic mirrors 36 is yellow light produced by light sources 38 and 39. After being modulated by the transparencies 22 and 23, the yellow light is directed to a pair of eyepiece optical assemblies 41 and 42 by the objective lenses 31, the dichroic beam splitters 29 and a pair of mirrors 40 and 40'. The eyepiece optical assemblies 41 and 42 provide for a viewer in conventional manner a stereo presentation of the image detail retained by the transparencies 22 and 23.

A correlation system 44 receives the analog signals on lines 34 and 35 after amplification in a video amplifier 43. The correlation system 44 correlates the video signals producing on lines 45 and 46, respectively, x- and y-cross-correlation signals proportional to the levels of correlatable image detail being scanned in the orthogonally related x and y directions in the photographs 22 and 23. Also produced on line 47 is an orthogonal correlation signal proportional to the degree of relative image detail misregistration existing between the scanned paths. The correlation system 44 does not, per se, form a part of this invention. However, circuits suitable for this application are disclosed in U.S. Pat. Nos. 2,964,644 and 3,145,303 and in above noted U.S. application, Ser. No. 839,940 of John W. Hardy et al. filed July 8, 1969.

The correlation signals on lines 45-47 are fed into an image registration and profiling control system 48 also not a part, per se, of this invention but described in detail in above noted U.S. application, Ser. No. 839,940. Also receiving the x- and y-cross-correlation signals is a condition responsive circuit 50

that supplies on line 55 a control signal to a raster system 53. The control system 48 produces on lines 51 and 52, respectively, x-parallax error and traversing velocity control signals that are applied to a track and hold integrator 56 also controlled by the signal on line 55. The integrator provides inputs to the carriage system 21 on lines 51' and 52'. Also produced are signals that are applied on lines 58 and 59 to deflection coils of cathode ray tube 26 and on lines 61 and 62 to deflection coils of cathode ray tube 27. The output of the raster search system 53 on line 57 is added to the signal on line 62.

Shown in FIG. 2 is the image transformation system 21 shown in FIG. 1. The transformation system 21 provides controlled movement of the photographic transparencies 22 and 23 in orthogonally related x- and y-coordinate directions. A y-carriage 67 is mounted on rollers 68 for movement along parallel y-tracks 69 supported by a frame 71. Similarly, an x-carriage 72 is mounted on rollers 73 for movement along x-tracks 74 supported by the y-carriage 67. Movement of the y-carriage 67 is produced by rotation of a y-lead screw 75 that engages the internally threaded collar 76. Rotation of the lead screw 75 is controlled by a y-servo motor 77 energized by the velocity control signal on line 52' (FIG. 1). Similarly, movement of the x-carriage 72 along tracks 74 is produced by rotation of an x-lead screw 78 also driven by a suitable x-servo motor 80.

A z-carriage 81 is mounted for vertical movement on z-lead screws 82 supported by the x-carriage 72. Controlled vertical movement of the z-carriage 81 is produced by z-servo motor 83 energized by the x-parallax error signal on line 51' (FIG. 1) and coupled to the z-lead screws 82 by drive shaft and bevel gear assemblies 84. The photographic transparencies 22 and 23 are mounted, respectively, in photo carriages 86 and 87. Slidably engaging the photo carriage 86 and 87 and providing mechanical coupling thereof to the z-carriage 81 are space rods 88 and 89. Opposite ends of the space rods 88 and 89 terminate, respectively, in pivot connections 91 and ball joint assemblies 92 mounted on the z-carriage 81. The connections 91 and 92 permit oppositely directed arcuate movement of rods 88 and 89 in response to vertical movement of the z-carriage 81. This in turn produces relative rectilinear motion between the transparencies 22 and 23 in the x-coordinate direction defined by x-rails 74 and of a sense determined by the direction of z-carriage 81 movement. The image transformation mechanism 21 is a conventional unit marketed under the trade name Planimat by the Carl Zeiss Company, of Oberkochen, Wurttemberg, Germany. The device is also related to similar transformation systems disclosed in the above noted U.S. Pat. Nos. 2,964,644 and 3,145,303.

In response to appropriate energization of y-motor 77 the photo transparencies 22 and 23 move simultaneously with the y-carriage 67 in either a plus or minus y-coordinate direction defined by y-tracks 69. The speed and direction of movement is determined by the velocity control signal on line 52'. Similarly, energization of x-lead screw 78 produces simultaneous movement of the transparencies in either a plus or minus x-direction defined by the x-tracks 74. Thus, the mechanism 21 provides selective uniform two dimensional movement of the transparencies 22 and 23 relative to their respective scanning beams 24 and 25 illustrated in FIG. 1. Conversely, vertical movement of the z-carriage 81 in response to energization of z-servo motor 83 results in relative movement between themselves as well as between the transparencies and the scanning beams 24 and 25. The z-servo motor responds to the x-parallax signal on line 51' by moving the transparencies 22 and 23 so as to align discrete image areas retaining homologous image detail with the system's optical axes. In this way, image detail registration is attained in the display provided by the eyepieces 41 and 42 as well as between the image areas being scanned by the beams 24 and 25. As is well known in the map making field, the relative elevation of the z-carriage 81 required to produce this registration is directly related to the actual elevation of the terrain imaged on the sections of the stereo photos being scanned.

In typical operation, the system shown in FIG. 1 is used to profile a stereo model represented by the stereographic transparencies 22 and 23. For example, to profile automatically in the y-coordinate direction, y-motor 77 is driven at a predetermined velocity giving rectilinear motion to y-carriage 67 and the transparencies 22 and 23 relative to the scanning beams 24 and 25. The x-motor 80 forms a part of a positioning servo, that holds the x-carriage 72 rigidly in the x-coordinated direction. The system is thereby constrained to trace out a straight profile in the y-direction and the x-position is selected by an automatic stepping system (not shown) controlled, for example, by a conventional limit switch operated when the y-carriage 67 reaches one edge of the stereo model. In response to actuation of the limit switch, the direction of rotation of y-motor 77 also would be reversed to thereby reverse the traversal direction of the y-carriage 67. Obviously, a reversal in roles of the x- and y-motors would result in the tracing of profiles in the x-direction. As a profile is being traced, the z-motor 83 continuously responds to the x-parallax error signal on line 51' by producing appropriate vertical movement of the z-carriage 81. This adjusts the relative positions of transparencies 22 and 23 in the x-direction to eliminate x-parallax and thereby provide a direct indication of terrain elevation. Simultaneously, y-parallax and other first order distortions are corrected by controlled relative distortion of the scanning rasters produced by cathode ray tubes 26 and 27. These corrections are achieved by combining appropriate error signals in the control system 48 and applying them to deflection signal lines 58, 59, 61 and 62 as disclosed in U.S. Pat. No. 3,432,674 of Gilbert L. Hough issued Mar. 11, 1969.

As described in above noted U.S. application, Ser. No. 839,940, loss of either x- or y-direction correlation, as indicated by, respectively, the amplitudes of the x- and y-cross-correlation signals on lines 45 and 46, results in various track and hold actions by control system 48. For example, x-direction distortions of the cathode ray tube's scanning rasters are held in response to a low x-cross-correlation signal value and y-direction raster distortions are held in response to a low y-cross-correlation signal value. Also, as described below in connection with FIG. 3 the circuit 50 responds to low cross-correlation signal values by producing a hold control signal on line 55. In response to this signal the integrator network 56, which normally transmits the signal values on lines 51 and 52 to lines 51' and 52', eliminates signal output on line 51' and maintains an existing signal value on output line 52'. Thus, any traversing velocity being produced by y-drive motor 77 (FIG. 2) and any existing position of the x-servo motor 83 (FIG. 2) are maintained in response to decreases in the amplitudes of the x- and y-cross-correlation signals to below predetermined minimum levels as described more fully below.

It is this last named holding of x-parallax corrections by z-servo motor 83 that introduces problems in the event that the desired level of correlation is lost while profiling either high or low points in the stereo model as described above. In response to holding action of x-parallax corrections, however, the search circuit 53 shown in FIG. 1 introduces a raster search procedure that facilitates a timely restoration of desired correlation levels and a return to normal operation. The function of the search circuit 53 also is described below in connection with FIG. 3a.

As shown in FIGS. 3 and 3a, a threshold detector 101 receives the x-cross-correlation signal on line 45 and provides an output on line 102 to a time delay circuit 103. Another threshold detector 104 receives the y-cross-correlation signal on line 46 and produces an output on line 105. This output and the output of threshold detector 101 on line 102 are fed into an AND gate 106 that provides an input to another time delay circuit 107 on line 108. The outputs of time delay circuits 103 and 107 are combined on line 54 and applied to a gate 111 that also receives the output of an oscillator 112 on line 113. Integration of the gated output on line 114 by an integrator 115 provides an integrated signal on line 116 that is amplified in an amplifier 117 and applied on line 57 to the x-deflection signal line 62 shown in FIG. 1.

The threshold levels of the threshold detectors 101 and 104 are the same as those utilized in the profiling system 48 to indicate correlation loss and to activate the above mentioned track and hold actions. Thus, in response to loss of x-direction correlation, the output of the threshold detector 101 is applied to the gate 111 after a time delay determined by the delay circuit 103. This opens the gate 111 which transmits onto output line 114 the signal waveform (shown in FIG. 4) produced by the oscillator 112. After integration in the integrator 115 the signal on line 116 with the waveform illustrated in FIG. 4 is amplified in the amplifier 115 and applied to the x-deflection signal line 62.

Similarly, in response to loss of y-direction correlation, the threshold detector 104 applies an output signal to the AND gate 106 which, however, produces an output only upon reception of signals from both the threshold circuits 101 and 104. After delay in the time delay circuit 107 that produces a shorter time delay than that produced by the time delay circuit 103, the output of AND gate 106 is also effective to open the gate 111. Thus, the triangular waveform illustrated in FIG. 4 is applied after a predetermined time delay to the x-deflection coil of right cathode ray tube 27 in response to a loss of x-direction correlation, and after a shorter time delay period in response to the more serious loss of both x- and y-direction correlation. The time delay periods provided by circuits 103 and 107 prevent inadvertent operation of the search system in response to transients in the cross-correlation signals on lines 45 and 46.

The raster search procedure induced by activation of the search circuit 53 is diagrammatically illustrated in FIG. 5. Assume that the right scanning raster 121 is moving relative to the right photograph 23 in a y-direction path 122 when either x-correlation or both x- and y-correlation are lost. After the predetermined delay period established by either of the time delay circuits 103 or 107 the triangular waveform shown in FIG. 4 is applied at time t_0 to the x-deflection coil of cathode ray tube 27. The effect of this signal during time period t_0-t_1 is to deflect the scanning raster in a positive x-direction to the dotted position 123 and then to return the scanning raster to its original y-axes at dotted position 124 during time period t_1-t_2 . Then during time period t_2-t_3 the scanning raster is deflected in a negative x-direction to dotted position 125 and again returned to the original y-axes at dotted position 126 during time period t_3-t_4 . Activation of search circuit 53, therefore, produces oscillating movement in the x-direction of the scanning raster produced by the right cathode ray tube 27. Conversely, the stationary scanning raster produced by left cathode ray tube 26 traces on the traversing left photograph 22 a rectilinear path parallel to path 122 shown in FIG. 5. Thus, the right scanning beam 25 and right photograph 23 experience a different sense of relative movement in the x-direction than do the left scanning beam 24 and the left photograph 22.

Obviously, an analogous effect would be produced by oscillation of the left scanning raster in cathode ray tube 26 or by simultaneous oscillation of both scanning patterns in opposite x-directions or at different velocities. It should be noted that the relative sizes of the scanning rasters depicted in FIG. 5 were arbitrarily selected for reasons of clarity. In actual practice the size of the scanning raster is much larger than shown with respect to the extent of its oscillations.

If at any time during the raster search procedure the oscillating scanning raster becomes aligned with an area of the right photograph 23 retaining image detail sufficiently correlatable with the image detail in the left photograph 22 aligned with its scanning raster, the amplitudes of the cross-correlation signals on lines 45 and 46 increase to above the threshold levels of the threshold circuits 101 and 104. This removes the signal from line 54 and results in closing of the gate 111. Consequently, the depicted waveform (FIG. 4) is removed from line 116 and the right scanning raster returns to a position of the original traversing path 122 shown in FIG. 5. As an additional consequence of the return of correlation, track and hold action in the integrator network 56 (FIG. 1) is

discontinued and the z-servo motor 83 is again effective to produce appropriate relative movement between the photographs 22 and 23 in response to the x-parallax error signal on signal line 51'. The resumption of x-parallax correction by the z-servo motor 83 compensates for the affect produced by the returning right scanning pattern so as to maintain the level of correlation above that required to activate the threshold circuits 101 and 104. Preferably, the integrator 115 (FIG. 3) possesses a relatively long time constant so as to provide a relatively slow return to position by the right scanning raster. A slow raster return reduces the response requirement of z-servo motor 83 in maintaining the level of correlation by appropriate displacement of the photographs 22 and 23 during the return period. Upon return of the scanning raster to its original y-axis in right cathode ray tube 27, the stereoplotting system resumes normal profiling operations. Thus, the search circuit 53 assures a timely return to normal operation regardless of the terrain image being scanned at the time correlation is lost.

Obviously, many modifications and variations of the present invention are possible in light of the above teachings. It is to be understood, therefore, that the invention can be practiced otherwise than as specifically described.

What is claimed is:

1. Automatic stereoplotting apparatus comprising:

frame means for retaining first and second stereographic images,

a first extraction means for extracting image detail information retained by a first discrete area in said first stereographic image and a second extraction means for extracting image detail information retained by a second discrete area in said second stereographic image,

correlation means for receiving said extracted image detail information and producing therewith an orthogonal correlation signal dependent upon the degree of misregistration existing between the image detail in said first and second discrete areas and a cross-correlation signal dependent upon the level of correlatable image detail information extracted by said first and second extraction means,

profiling drive means for producing a given sense of relative movement between said first stereographic image and said first extraction means and the same sense of relative movement between said second stereographic image and said second extraction means so as to continuously and simultaneously change in each of said first and second images said discrete areas from which information is extracted,

registration means receiving said orthogonal correlation signal and producing in response thereto a different sense of relative movement between said first stereographic image and said first extraction means than between said second stereographic image and said second extraction means,

condition responsive means for inactivating said registration means in response to a given level of said cross-correlation signal condition,

and search means activated by said condition responsive means to produce a different sense of relative movement between said first stereographic image and said first extraction means than between said second stereographic image and said second extraction means.

2. Automatic stereoplotting apparatus according to claim 1 wherein said search means produces oscillating relative movement between said first stereographic image and said first extraction means.

3. Automatic stereoplotting apparatus according to claim 1 wherein said given sense of relative movement produced by said profiling drive means is rectilinear and said senses of relative movement produced by both said registration means and said search means are both rectilinear and transverse to said given sense of relative movement.

4. Automatic stereoplotting apparatus according to claim 1 wherein said first and second extraction means comprise first and second scanning beams directed through said first and second stereographic images by beam producing means, and said first and second discrete areas comprise the scanning patterns generated on said first and second images by said beam producing means.

5. Automatic stereoplotting apparatus according to claim 4 wherein said search means produces oscillating relative movement between said first stereographic image and said first extraction means.

6. Automatic stereoplotting apparatus according to claim 5 wherein said given sense of relative movement produced by said profiling drive means is rectilinear and said senses of relative movement produced by both said registration means and said search means are both rectilinear and transverse to said given sense of relative movement.

7. Automatic stereoplotting apparatus according to claim 4 wherein said profiling drive means comprises an x-y carriage supporting said first and second stereographic images and adapted for movement in orthogonally related x and y directions to produce said given sense of relative movement between said stereographic images and said scanning beams, and said registration means comprises image displacement means for inducing displacement between said first and second images in response to said orthogonal correlation signal.

8. Automatic stereoplotting apparatus according to claim 7 wherein said search means responds to said condition responsive means by inducing relative movement between said first and second scanning beams.

9. Automatic stereoplotting apparatus according to claim 8 wherein the relative movements produced by both said image displacement means and said search means coincide with one of said x and y directions.

10. Automatic stereoplotting apparatus according to claim 9 wherein said search means produces oscillating relative movement between said first and second scanning beams.

11. Automatic stereoplotting apparatus according to claim 10 wherein said cross-correlation means further produces an signal comprises an x-cross-correlation signal dependent upon the level of correlatable image detail detected in said first and second discrete areas by said first and second scanning beams while scanning in said x-direction, and said condition responsive means activates said search means in response to the absence of a given minimum level of correlatable image detail as indicated by said x-cross-correlation signal.

12. Automatic stereoplotting apparatus according to claim 11 wherein the relative movements produced by both said image displacement means and said search means coincide with said x-direction.

13. Automatic stereoplotting apparatus according to claim 12 wherein said search means comprises waveform generator means for generating a triangular waveform, said beam producing means comprise deflection means for producing deflection of said scanning beams in said x and y directions, and said search means applies said triangular waveform to said deflection means so as to produce said relative movement between said first and second scanning beams.

14. Automatic stereoplotting apparatus according to claim 13 wherein said condition responsive means comprises first time delay means for delaying the activation of said search means for a given predetermined period after detection of said given minimum level of correlatable image detail in said x-direction.

15. Automatic stereoplotting apparatus according to claim 14 wherein said correlation means further produces a y-cross-correlation signal dependent upon the level of correlatable image detail detected in said first and second discrete areas by said first and second scanning beams while scanning in said y-direction, and said condition responsive means comprises a second time delay means for activating said search means after a delay period less than said given predetermined period

