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International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 4 : H04N 9/31	A1	(11) International Publication Number: WO 88/ 01823 (43) International Publication Date: 10 March 1988 (10.03.88)

(21) International Application Number: PCT/US87/01960

(22) International Filing Date: 13 August 1987 (13.08.87)

(31) Priority Application Number: 900,211

(32) Priority Date: 25 August 1986 (25.08.86)

(33) Priority Country: US

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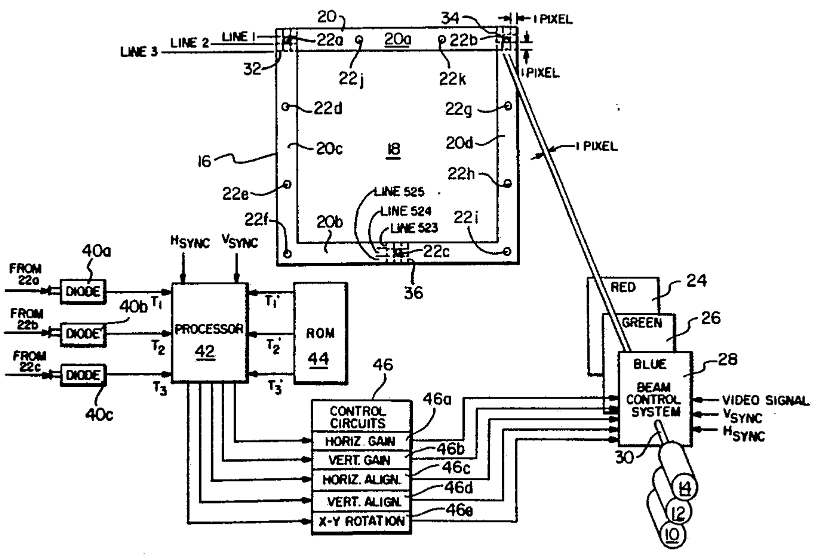
(81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE (European patent), FR (European patent), GB (European patent), IT (European patent), LU (European patent), NL (European patent), SE (European patent).

Published
With international search report
With amended claims.

Date of publication of the amended claims:
21 April 1988 (21.04.88)

(54) Title: VIDEO PROJECTOR WITH OPTICAL FEEDBACK



(57) Abstract

Geometric distortion in a scanning beam video laser projector, or the like, is corrected by comparing the time of arrival of the projection beam at a selected pixel on the projection screen with a predetermined time of arrival, and computing therefrom the changes in beam control required to remove the distortion. A peripheral portion (20) of the projected video field (18) is blank, being reserved for projection of bright beam alignment fiducials (32, 34) comprising selected pixels of the peripheral field portion. An optical sensor (22) is placed on the screen periphery so as to receive one pixel of each projected fiducial, its output being applied (through a light sensitive diode (400) to a beam control processor (42). Geometric distortion or a change in projector alignment shifts the beam time of arrival at the sensor (22). The processor (42) compares the time of arrival of the projector beam at each sensor (22) with a look-up table (44) and, from this comparison, determines the beam control corrections required to remove geometric distortion.

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AMENDED CLAIMS

[received by the International Bureau on 23 March 1988 (23.03.88); original claims 1-9 replaced by amended claims 1-8 (4 pages)]

1. (FIG. 1) A video beam projector system which automatically corrects beam misalignment during operation, said system comprising:

at least one beam generator (14) adapted to generate an illuminating beam;

a projection viewing screen (16);

control means (28) for modulating said beam in synchronism with an incoming video signal, and for deflecting said beam so as to raster-scan said screen (16) with a projected video image field on at least a portion (18) of said screen (16), the remaining portion (20) of said screen being a periphery which is scanned by said beam at least nearly contemporaneously with the time-boundaries of respective vertical and horizontal blanking intervals of said video signal;

opto-electronic means (22) for sensing the actual time of arrival of said beam at particular points on said screen (16), said particular points being located in said periphery (20) of said screen, whereby said actual times of arrival of said beam are at least nearly contemporaneous with the time boundaries of respective horizontal and vertical blanking intervals of said video signal, wherein said opto-electronic means (22) comprises a plurality of optical fibers, one end of each of said fibers being connected at a respective one of said particular points on said screen so as to propogate along its length radiation from said beam sensed at said one particular point on said screen;

means (40, 42, 44) connected to the other end of each of said optical fibers for comparing said actual beam arrival time at each of said screen points with a predetermined beam arrival time;

means (46) connected to said beam control means (28) for re-aligning said projected video image with respect to said screen in response to said comparing means so as to reduce any differences between said actual and predetermined beam arrival times, wherein said optical fibers are of the same length whereby the propogation time through said plurality of optical fibers from each of said particular points on said screen to said means for comparing is the same, so as to reduce beam misalignment errors otherwise attributable to the different locations of said particular points on said screen.

2. The video projector system of Claim 1 wherein said opto-electronic sensing means (22) comprises a plurality of optical receivers (22) characterized by a diameter about equal to the diameter of said beam.

3. The video projector system of Claim 2 wherein said beam deflection control means (28) causes said beam to illuminate individual alignment areas (32, 34) in said periphery (20) of said screen surrounding individual ones of said optical receivers (22), while preventing said beam from illuminating the remainder of said periphery (20) of said screen, whereby each of said optical receivers (22) generates an output pulse upon the arrival of said beam at said receiver, wherein a spatial shift in said projected video image field with respect to said screen causes a corresponding shift in said beam arrival time at a given one of said sensors.

4. (FIGS. 1 and 9) The video projector system of Claim 3 wherein:

said optical receivers (22) are each located in separate segments on said screen;

said beam deflection control means (28) comprises separate scan generators (50a) corresponding to said separate screen segments, each one of said scan generators producing a portion of a saw-tooth-like voltage waveform characterized by a particular slope associated with said one of said scan generators; and

said comparing means (42a) separately compares said beam arrival times corresponding to each of said segments with predetermined numbers and transmits different correction signals to corresponding ones of said separate scan generators, whereby the individual slopes associated with the individual ones of said scan generators are individually changed in response to corresponding ones of said different correction signals.

5. (FIG. 10) The video projector of Claim 3 wherein said beam control means comprise a light valve matrix (28') having a plurality of cells, each of said cells corresponding to an individual image pixel on said screen, said matrix further comprising cells (32', 34', 36') corresponding to said optical receivers (22) on said screen (16).

6. (FIG 1) The video projection system of Claim 3 wherein:

said plurality of optical receivers comprise at least two receivers (22a, b) located near the top of said screen (16) in right and left respective corners of said screen; and

said individual alignment areas comprise two square illuminated areas (32, 34, 36) having a height of at least three horizontal video lines and symmetrically surrounding said two receivers.

7. The video projector system of Claim 3 wherein said beam control means (28) determines the

size of said individual alignment areas and adaptively varies said size whenever necessary so that said alignment areas are in registration with said optical receivers even in the presence of large beam misalignments.

8. The video projector of Claim 1 wherein said beam control means (28) further comprises means (44) for storing said predetermined beam arrival times, and wherein said predetermined arrival times stored in said storing means (44) were derived by illuminating said screen with a calibration beam known to be in alignment with said screen and noting the actual arrival times of said calibration beam at each of said particular points on said screen, so as to enable said system to eliminate beam misalignment errors otherwise attributable to inaccurate placement of said opto-electronic means on said screen.