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(54) Title: VARIABLE AND SERRATED SCANNING IN LASER PROJECTORS

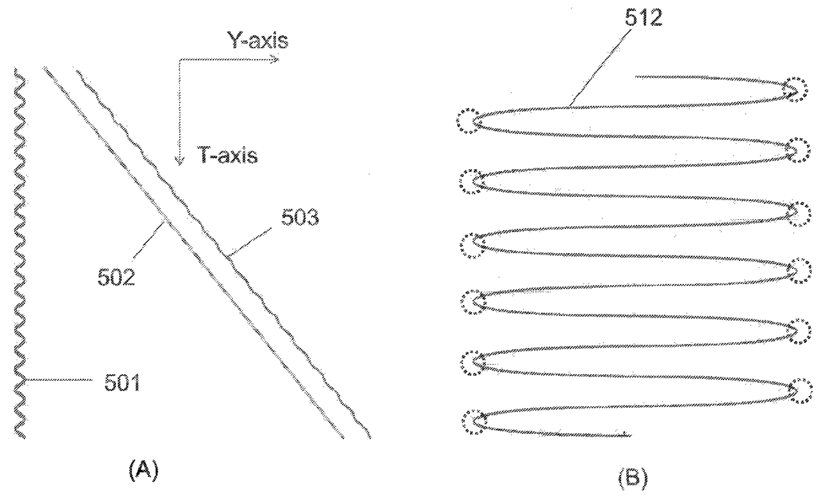

Figure 5

(57) Abstract: A miniature projector is provided that comprises: a means for providing at least three different light beams of different color; and a means for scanning the light beams; wherein the scanning means is adapted to scan the light beams according to a pattern from a first edge to an ending edge in the screen to form an image, the pattern being a wave pattern of scan lines such that amplitudes oscillates along a first axis as the beams progressively scan along a second axis, the second axis being perpendicular to the first axis, and wherein the wave pattern is a composite of a vertical scan profile and horizontal scan profile and the vertical scan profile has a cyclic wobulation corresponding to the amplitudes.

WO 2012/166536 A4

AMENDED CLAIMS
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1. A method comprising the steps of:
receiving image data for an image to scan;
generating light beams responsive to the image data;
forming a horizontal scan profile to direct the light beams, the horizontal scan profile comprises cycles having oscillating amplitudes that are substantially parallel to a first axis and substantially perpendicular to a second axis;
forming a cyclic wobulation responsive to the cycles;
forming a vertical scan profile that includes the cyclic wobulation; and
scanning the light beams according to a wave pattern that is a composite of the vertical scan profile and the horizontal scan profile to form the image such that the light beams are driven vertically parallel to the second axis from a first edge to an ending edge while oscillating horizontally parallel the first axis;
wherein a variable scan velocity values are employed in the second axis.

2. The method of claim 1 comprising
generating a baseline vertical scan profile of motion along the second axis as a function of time;
providing or selecting a cyclic wobulation profile of motion along the second axis versus time, wherein the cyclic wobulation profile comprises individual wobulation cycles in which one wobulation cycle corresponds to one half of a single wave of a wave pattern and another wobulation cycle corresponds to a second half of the single wave; and
adding the cyclic wobulation profile to the baseline vertical scan profile to obtain the vertical scan profile.

3. The method of claim 2 wherein the baseline vertical scan profile is a linear function.

4. The method of claim 1 wherein the wave pattern comprises a series of single waves and the single waves comprise a first half having a first half amplitude that oscillating in one direction along the first axis and a second half having a second

half amplitude that oscillates in a second direction along the first axis that is opposite the one direction.

5. The method of claim 4 wherein the first half and second half of individual single waves are symmetric about the second axis.

6. The method of claim 5 comprising

providing a baseline vertical scan profile of motion along the second axis as a function of time;

providing or selecting a cyclic wobulation profile of motion along the second axis versus time, wherein the cyclic wobulation profiles comprise individual wobulation cycles in which one wobulation cycle corresponds to the first half of the single wave of the wave pattern and another wobulation cycle corresponds to the second half of the single wave; and

adding the cyclic wobulation profile to the baseline vertical scan profile to obtain the vertical scan profile.

7. The method of claim 6 wherein the baseline vertical scan profile is a linear function.

8. The method of claim 1 comprises adding a second harmonic wave pattern to a baseline vertical scan profile to make the vertical scan profile, wherein the second harmonic wave pattern is responsive to the horizontal scan profile.

9. The method of claim 2 comprising incorporating a second harmonic of the horizontal scan profile into the cyclic wobulation profile.

10. The method of claim 6 wherein the cyclic wobulation profile includes a second harmonic of the horizontal scan profile.

11. The method of claim 4 wherein complete horizontal sweeps of the light beams on a viewing surface form scan lines and the scan lines have an average absolute angle with respect to the first axis that is less than the an average

absolute angle with respect to the first axis of scan lines that would correspond to scanning the beams using the baseline vertical scan profile.

12. The method of claim 2 comprising employing at least three laser beams of different colors to generate the light beams.

13. The method of claim 2 comprising employing at least three light emitting diodes to generate the light beams of different colors.

14. The method of claim 12 comprising employing at least one scanning mirror to scan the three laser beams of different colors to generate the light beams.

15. The method of claim 1 comprising assigning scan velocity values that are responsive to brightness levels required for the image data.

16. The method of claim 1 comprising:

forming scan lines on a viewing surface from complete horizontal sweeps of the light beams; and

setting the scan velocity values to be inversely related to a total brightness levels required for complete scan lines that are oriented along the second axis.

17. The method of claim 1 comprising:

forming scan lines on a viewing surface from complete horizontal sweeps of the light beams; and

assigning scan line spacing values responsive to brightness level required for the image data.

18. A miniature projector comprises:

a means for providing at least three different light beams of different color; and

a means for scanning the light beams;

wherein the scanning means is adapted to scan the light beams according to a pattern from a first edge to an ending edge in the screen to form an image, the pattern being a wave pattern of scan lines such that amplitudes oscillates along a first axis as the beams progressively scan along a second axis, the second axis being perpendicular to the first axis,

wherein the scanning means is further adapted to employ a variable scan velocity values in the second axis, and

wherein the wave pattern is a composite of a vertical scan profile and horizontal scan profile and the vertical scan profile has a cyclic wobulation corresponding to the amplitudes.

19. The miniature projector of claim 18, wherein the scanning means is adapted to add a second harmonic wave pattern to a baseline vertical scan profile to make the vertical scan profile, wherein the second harmonic wave pattern is responsive to the horizontal scan profile.