

- [54] SCANNER SYSTEM HAVING ROTATING DEFLECTOR HOLOGRAM
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**Related U.S. Application Data**

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- [51] Int. Cl.<sup>5</sup> ..... **G02B 26/10; G02B 5/32**
- [52] U.S. Cl. .... **350/3.71; 350/320**
- [58] Field of Search ..... **350/3.71, 320**

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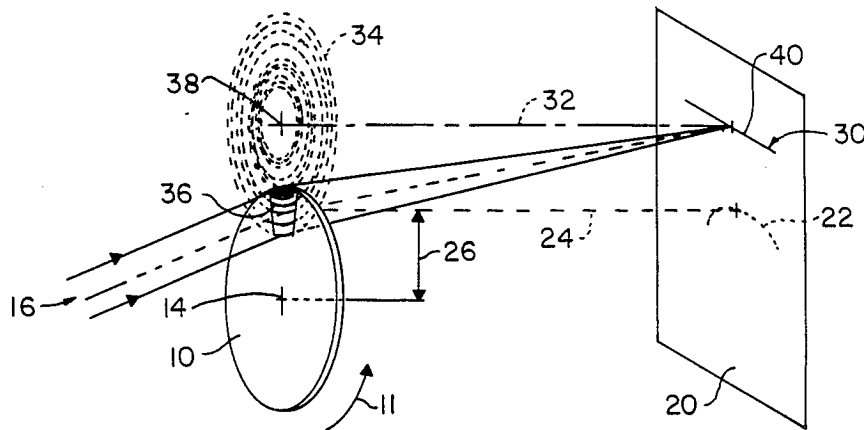
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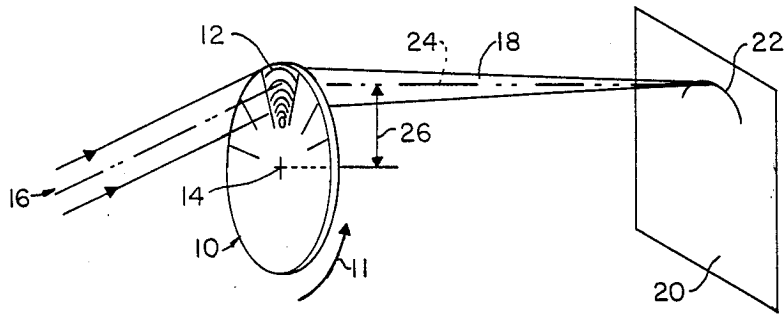
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[57] **ABSTRACT**

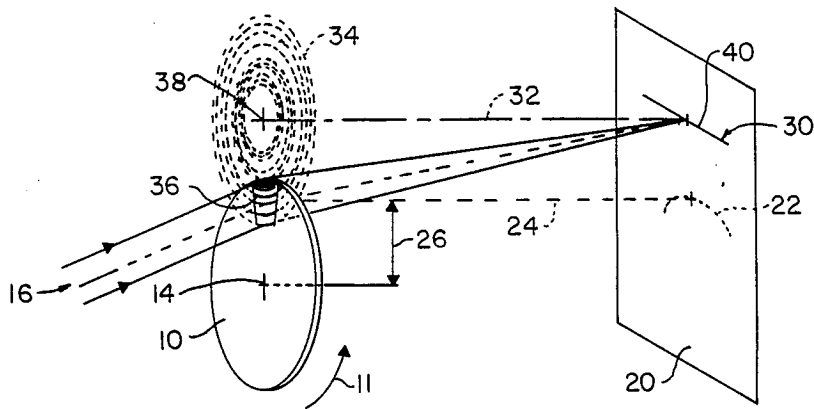
A scanner system which uses rotating, high efficiency holograms to deflect a light beam thereby achieving a linear scan. The hologram is unique in that it allows high system efficiency without requiring the input polarization to be aligned to the fringe pattern.

**21 Claims, 4 Drawing Sheets**





**FIG. 1**  
PRIOR ART



**FIG. 2**

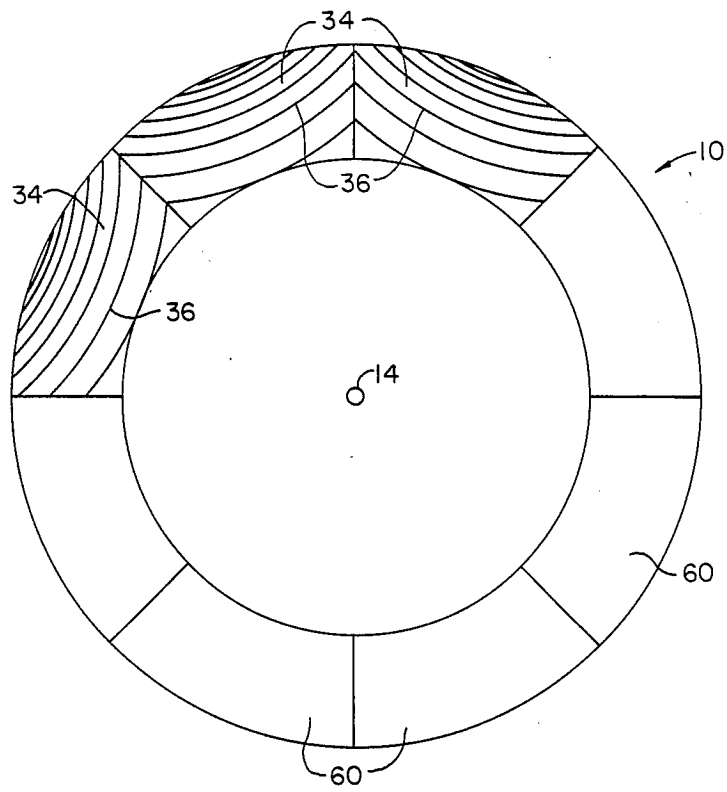


FIG. 4

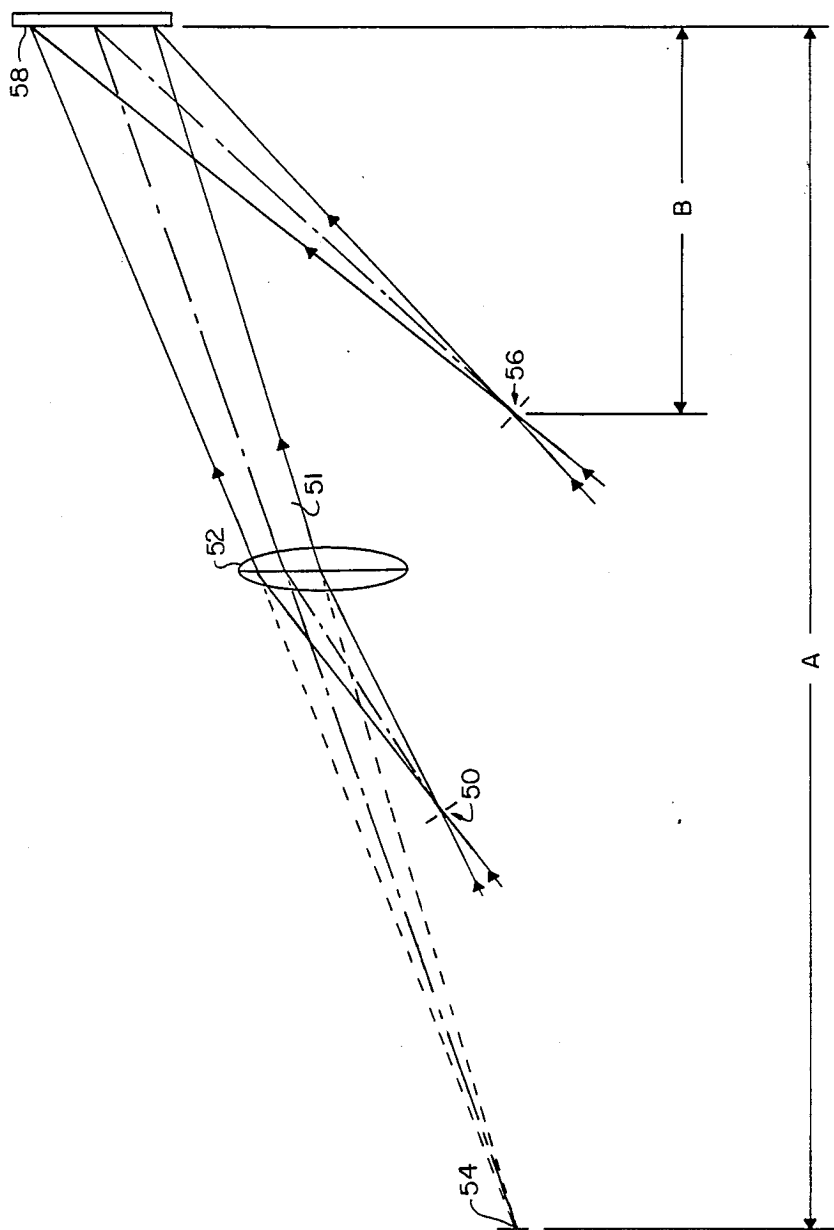


FIG. 3

non-normal angle in the portion of said segments which include said elements, and efficiently redirecting randomly polarized light received at said non-normal angle;

- D. means defining a scanning plane; and
- E. correction means, included in said elements, for enabling substantially straight line scan locus on said scanning plane as said spinner rotates.

2. A system as in claim 1 wherein said correction means includes a substantially circular pattern of holographically recorded diffractive lenses, the center of which is outside the periphery of said spinner.

3. A system as in claim 2 wherein said center is a substantially different distance from the axis of rotation of said spinner than is the periphery of said spinner.

4. A system as in claim 2 wherein the spacing between successive fringes of said pattern of diffractive lenses increases with increasing distance from said center.

5. A system as in claim 1 wherein said elements are holographically recorded so as to remove aberrations otherwise produced during readout of such system.

6. A system as in claim 5 wherein said holographic recording is accomplished by use of a correcting lens.

7. A system as in claim 1 wherein said elements are holographically recorded such that there is a spatial distribution of fringes in the segments causing the segments during readout by the system to have the property of a lens with barrel distortion in the amount required to reduce curvature in the scanned line to a negligible value.

8. A system as in claim 1 further comprising means for reducing diffraction efficiency polarization dependence by recording with those parameters that dependence by recording with those parameters that enable a hologram to have substantially jointly maximized efficiencies in the p and s directions.

9. A system as in claim 1 wherein each of said portions of said segments are transmissive.

10. A system as in claim 1 wherein each of said portions of said segments are reflective.

11. A scanning system according to claim 1, wherein said elements are recorded so as to remove aberration otherwise present during readout of said system by recording using an object beam formed by a lens having a barrel distortion property opposite in sense to line curvature caused by rotation of said spinner.

12. A scanning system according to claim 11, wherein said elements are recorded by recording a first set of elements using an object beam formed by a lens having a barrel distortion property calculated to substantially remove line curvature caused by rotation of said spinner, and by operating a first spinner incorporating said first set of elements so as to observe aberrations of said first spinner due to receiving a light beam at non-normal incidence, and thereafter figuring said lens to remove the observed aberrations and re-recording a further set of elements using an object beam formed by said figured lens, said further set of elements being incorporated as the elements of said spinner.

13. A holographic spinner having a plurality of hologram sectors for diffracting light along a scan path as the spinner is rotated about a central spinner axis,

wherein the hologram sectors are recorded with a fringe pattern which diffracts with a barrel distortion property substantially equal and opposite to the scan line bow caused by rotation of the spinner, so as to produce substantially linear scan line upon rotation of the spinner, and wherein the hologram sectors are recorded with recording beams arranged to provide a hologram fringe pattern which efficiently transforms light when illuminated at non-normal incidence with randomly polarized light.

14. A spinner according to claim 13, wherein the hologram sectors include hologram fringes recorded so as to have substantial diffractive efficiency for both s and p polarized light.

15. A spinner according to claim 13, wherein the hologram sectors include fringes recorded so as to have substantial diffractive efficiency of light of a selected polarization.

16. A spinner according to claim 13, wherein the hologram sectors are recorded and are positioned about the spinner so as to have the focusing properties of a large aperture lens with a central lens axis intersecting the plane of rotation of said spinner outside of the perimeter of the spinner.

17. A spinner according to claim 16, wherein the distance from the perimeter of the spinner to said central spinner axis is substantially less than the distance of said central lens axis to said central spinner axis.

18. A method of making a holographic spinner for performing high efficiency scanning of a linear scan locus by the rotation of the spinner, such method comprising the steps of

- A. recording an initial set of hologram segments of said spinner using an object beam formed by a correction lens such that each initial segment has a focusing property for substantially correcting line bow induced by spinner rotation,
- B. incorporating the initial set of segments into a said spinner and illuminating the spinner with a reconstruction beam so as to observe scan line aberrations,
- C. figuring the correction lens and recording a further set of segments with the figures correction lens such that an observed scan line aberration decreases when said further set of segments is incorporated in a said spinner, and
- D. incorporating said further set of segments in said spinner thereby making a holographic spinner for scanning a linear scan focus.

19. A method according to claim 18, further including repeating steps A-C to iteratively correct aberrations in said further set of segments.

20. A method according to claim 18, wherein the aberrations include scan aberrations induced by illumination of said spinner with a non-normal reconstruction beam.

21. A method according to claim 18 wherein the aberrations include scan aberrations induced by illumination with a reconstruction beam of a different wavelength than light used in recording said set or further set of segments.

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