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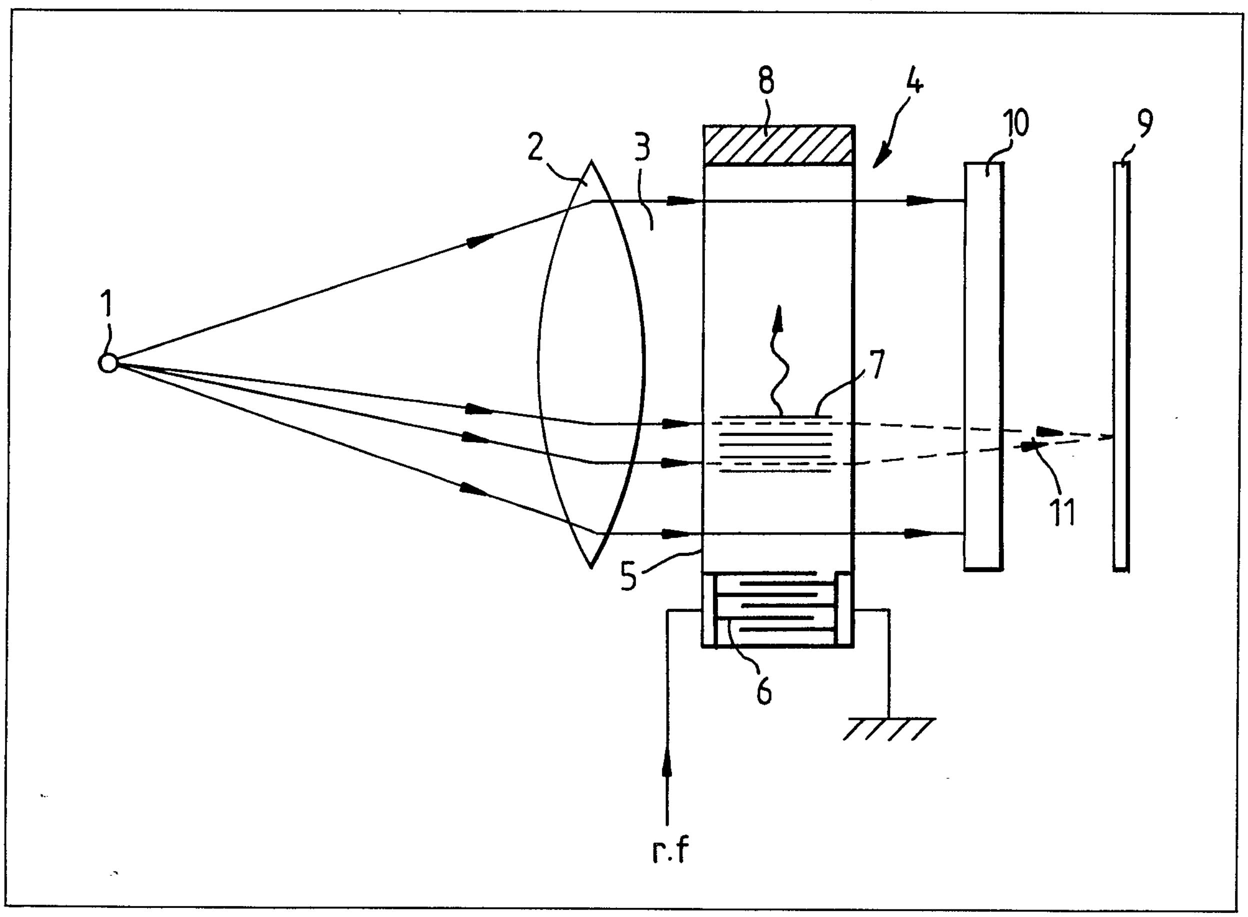
(54) Optical scanning system

(57) An optical scanning system comprises an acousto-optic diffraction device 4 with a surface acoustic wave transducer 5 energised 6 with pulses of r.f. causing narrow regions of acoustic wave energy 7 to traverse a planer light beam 3 causing localised diffraction and focussing of the light 11 which scans medium 9. Regions 7 effect frequency and polarisation shift of the light and so a polarising or optical frequency discriminating element may be used to block the undiffracted light. The system may be used in a recording or playback device.



The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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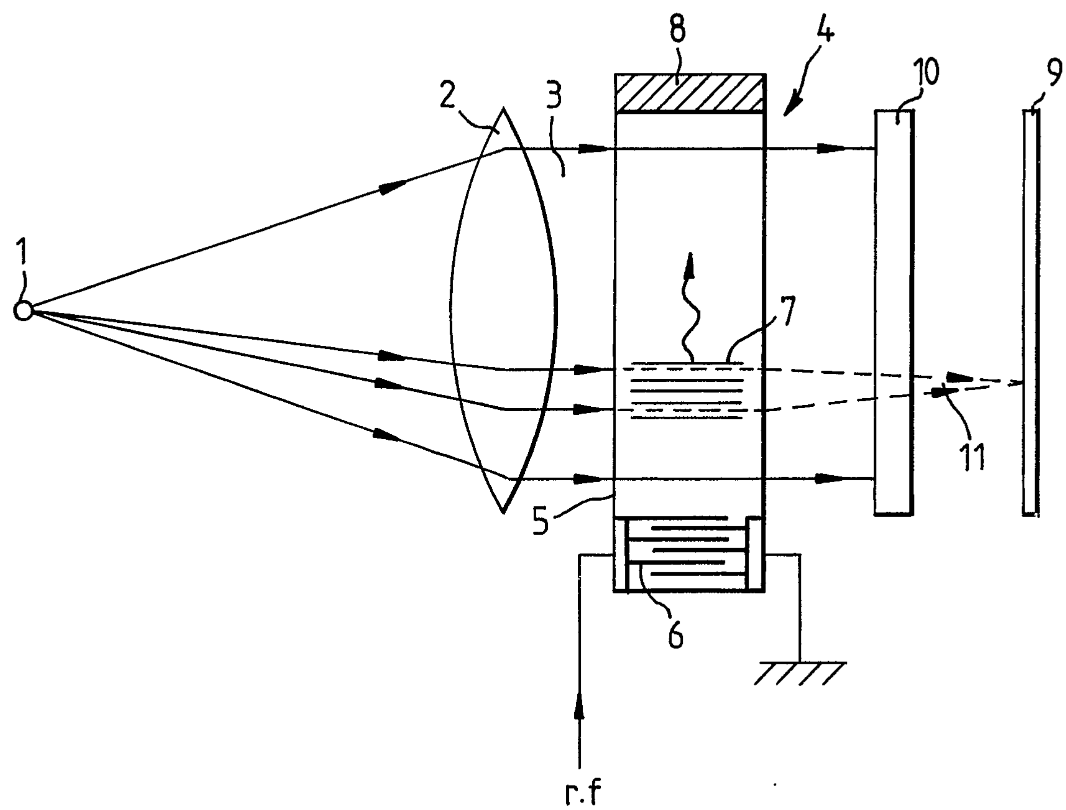

SPECIFICATION

Optical scanning system

This invention relates to an optical scanning system having no moving parts, such as may be used in a recording arrangement or an image forming arrangement.

Known prior art optical scanning systems use, for instance, mirrors or prisms which are oscillated or rotated to cause a modulated and focussed beam of light to scan a medium. Such systems often involve precision moving parts and complex beam forming optics. Mechanical scanning systems have inherent speed limiting characteristics and reliability problems.

A system having no mechanical moving parts can provide a fast and high resolution scanner with a reduction in the complexity of its beam forming optics.

According to the present invention there is provided an optical scanning system comprising a light source, means for focussing light from the source into a substantially parallel planar beam, an acoustic-optic device having adjacent one surface a planar acousto-optic interaction region traversed by said planar beam, means for launching into the acoustic-optic interaction region a surface acoustic wave pulse propagating in a direction orthogonal to the direction of the light beam whereby the wave pulse causes the interaction region material to effect diffraction and focussing of light traversing the region, and means for discriminating the diffracted and focussed beam of light emerging from the acousto-optic interaction region.

An embodiment of the invention will now be described with reference to the accompanying drawing which illustrates an optical scanning system in diagrammatic form only.

A light source 1, typically a semiconductor laser, has its output focussed by beam forming optics 2 into a collimated planar beam 3. An acoustic-optic device 4 is placed in the path of the beam 3. The device comprises a planar electro-optic and piezoelectric substrate 5, e.g. lithium niobate, into the surface region of which a planar optical waveguide interaction structure is formed by means of thermal indiffusion of metal (e.g. titanium or by ion implantation). Formed on the substrate surface is a surface acoustic wave (SAW) transducer 6, e.g. an interdigitated metal electrode pattern. Energisation of the transducer with an r.f. signal of a suitable frequency causes a surface acoustic wave 7 to propagate across the interaction region. The far end of the SAW path is provided with an acoustic absorbtion pad 8. If the transducer 6 is driven with a short pulse of r.f. energy, e.g. a so-called "chirp" pulse, then the SAW energy is propagated as a short pattern 7. Therefore the effective interaction between the acoustic energy and the beam of light is confined to a narrow region which moves across the collimated beam of light. The acosto-optic device is configured as a Bragg cell deflector in which the travelling acoustic wave pattern acts as a travelling optical grating simulaneously to diffract and focus a narrow portion of the collimated beam and to scan the focussed portion 11 across a recording medium 9. The acoustic-optic device employs birefringent diffraction to change the optical polarisation of the scanning portion of the beam whilst the rest of the beam remains undiffracted. An optical polarisation filter 10 placed between the device 4 and the medium 9 effectively blocks the undiffracted light whilst the narrow scanning portion, the polarisation of which has been changed, can pass through the filter to reach the medium.

As an alternative to the polarisation filter it is possible to use an optical frequency discrimination element since besides changing the polarisation the diffraction grating also effects a frequency shift on the diffracted light. Hence, if the source 1 is monochromatic a simple frequency filter will effectively discriminate between the diffracted and the undiffracted light.

In a recording arrangement the scanning system is used to scan a signal-modulated beam of light across the recording medium 9.

In addition to using the scanning system to record it can also be used to read pre-recorded media. If the recording is in the form of a mask, e.g. a photographic plate with binary encoded information on it, the narrow diffracted portion can be scanned along a line of binary bits, with a photodetection means (not shown) behind the mask. Alternatively, for a reading system, the polarising or frequency discriminating filter 10 can be placed behind the record medium 9, between the medium and the photodetector means.

CLAIMS

1. An optical scanning system comprising a light source, means for focussing light from the source into a substantially parallel planar beam, an acoustic-optic device having adjacent one surface a planar acousto-optic interaction region traversed by said planar beam, means for launching into the acoustic-optic interaction region a surface acoustic wave pulse propagation in a direction orthogonal to the direction of the light beam whereby the wave pulse causes the interaction region material to effect diffraction and focussing of light traversing the region, and means for discriminating the diffracted and focussed beam of light emerging from the acousto-optic interaction region.

2. A system according to claim 1, including means for modulating the light source with an information signal.

3. A system according to claim 1 or 2, wherein the diffracted light is focussed on a recording medium.

4. A system according to claim 1, wherein the diffracted light is focussed on a pre-recorded medium.

5. A system according to any preceding claim, wherein the discrimination means comprises a polarising filter arranged to block undiffracted light.

6. A system according to any one of claims 1 to 4, wherein the discrimination means comprises a frequency filter arranged to block light at the optical frequency of the source.

7. A system according to claim 5 or 6, wherein the filter is placed between the diffraction means and the recording or pre-recorded medium.

8. A system according to any preceding claim, wherein the light source is a laser.

9. An optical scanning system substantially as described with reference to the accompanying drawing.

10. A method of scanning a beam of light across a surface including the steps of focussing light from a source into a substantially parallel planar beam, directing said planar beam into an acousto-optic diffraction means, energising said diffraction means with a burst of r.f. energy, whereby a narrow acoustic-optic interaction region is caused to traverse the optical beam to diffract the light in the beam and focus the diffracted light and filtering said diffracted and focussed light to discriminate it from the undiffracted light.

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