

The opinion in support of the decision being entered  
today  
was **not** written for publication and is **not** binding  
precedent of the Board.

Paper No.

27

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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Ex parte JOHN R. WOTTON, GARRY WALDMAN,  
and DAVID L. HOLDER

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Appeal No.1999-0360  
Application No.08/810,591

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ON BRIEF

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Before URYNOWICZ, JERRY SMITH, and BARRY, Administrative  
Patent Judges.

URYNOWICZ, Administrative Patent Judge.

Decision on Appeal

This appeal is from the final rejection of claims 2-10, 12, 14-21, 23-29 and 33-39. In his answer, the examiner withdrew the rejection of claims 2-10, 12, 14-21, 23-29 and 33-39 as unpatentable under 35 U.S.C. § 112, second paragraph, and acknowledged that claim 36 is allowable.

The invention pertains to a method of producing the desired optical characteristics of an optical system. Claim 33 is illustrative and reads as follows:

33. A method for affecting the desired optical characteristics of an optical system using phase active diffractive optics comprising:

directing incident light onto a material whose index of refraction is continuously and spatially variable over a surface area of the material, passage of the incident light through the material affecting the phase and amplitude of the light waveform;

determining an optical map for said surface of said material, said map comprising variations in the index of refraction over the surface of said material, and said map representing any of a range of refractive, diffractive, or composite optical elements whereby said material emulates a selected optical element; and,

continuously controlling the phase of said incident light across a wavefront of said light waveform by dynamically writing said map onto said material to map said material such that said incident light's passage through said material corresponds to the passage of said light through the optical element currently being emulated by said material, the phase of said waveform being continuously controllable from a phase depth of zero to a phase depth substantially greater than  $2\pi$ , whereby emergent light from the material has similar amplitude and phase characteristics as if the incident light had passed through said refractive, diffractive, or composite optical element being emulated, the controlling operations and the determining of said optical mapping implement the optical transfer function:

$$M(\vec{f}) = e^{(i\pi(m+1)\lambda z \vec{f}^2)} \int_{-\infty}^{+\infty} T^*(\vec{w} - \lambda z \vec{f}) \cdot T(\vec{w}) e^{(-2\pi i(m+1)\vec{w} \cdot \vec{f})} d\vec{w}$$

where:

$M = z/z'$  is the image distance / the object distance;

$\lambda$  is the wavelength;

$\vec{w} = \lambda z \vec{\mu}$  is the wavelength  $\times$  image distance  $\times$  two dimensional spatial frequency

variable of integration;

$T$  is the amplitude transmission function for the aperture;

$\vec{f}$  is the two dimensional spatial frequency.

The references relied upon by the examiner are:

Buchan et al. (Buchan) 1974	3,806,897	Apr. 23,
Azusawa et al. (Azusawa) 1990	4,952,034	Aug. 28,
Grinberg et al. (Grinberg) 1992	5,151,814	Sep. 29,

Claims 33, 2, 3 and 9 stand rejected under 35 U.S.C. § 102(b) as anticipated by Grinberg.

Claims 37-39 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Grinberg.

Claims 4, 5, 8, 14-19, 23-27, 34 and 35 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Grinberg in view of Buchan.

Claims 6, 7, 10, 12, 20, 21, 28 and 29 are rejected under 35 U.S.C. § 103(a) as unpatentable over Grinberg in view of Buchan and Azusawa.<sup>1</sup>

The respective positions of the examiner and the appellants with regard to the propriety of these

rejections are set forth in the final rejections (Paper Nos. 7 and 19), and the examiner's answer (Paper No. 24) and the appellants' brief and reply brief (Paper Nos. 23 and 25).

Appellants' Invention

The invention is as summarized at pages 7 and 8 of the brief.

The Rejection under 35 U.S.C. § 102(b)

Claims 33, 2, 3 and 9

The answer indicates that the basis for this rejection

<sup>1</sup> At page 4, line 4, of the examiner's answer, "20" (first occurrence) should read "10".

is set forth in the prior Office action identified as Paper No. 7 at pages 3 and 4.

After consideration of the positions and arguments presented by both the examiner and the appellants, we have concluded that this rejection should be sustained. We agree in general with the comments made by the examiner; we add the following discussion for emphasis.

Appellants' only arguments with respect to this rejection are that Grinberg does not teach (1) the use of other than coherent light, (2) n-dimensional beam deflection, (3) a phase substantially greater than  $2\pi$ , and (4) capabilities of optical mapping of a "range of refractive, diffractive, or composite optical elements."

We agree with the examiner's responses to these arguments at page 5 of his answer, and adopt them as our own. Further, with respect to item (4), above, appellants acknowledge at page 13 of the brief that Grinberg's apparatus discloses the equivalent to an optical wedge with a variable wedge angle. These equivalents of variable wedge angle taught by Grinberg comprise a "range of refractive, diffractive, or composite optical elements." These equivalents exist in Grinberg because the effective liquid crystal birefringence for the liquid crystal elements 10 of the beam deflection array 2 is a function of the voltage applied across the liquid crystal, and various values or degrees of birefringence will emulate wedges of different geometries.

The Rejection of Claims 37-39 under 35 U.S.C.

§ 103(a) as Unpatentable over Grinberg

Appellants set forth only two arguments with respect to the rejection of claims 37-39 as unpatentable over Grinberg.

The first argument is that Grinberg is specifically designed for use with highly coherent incident light beams and the device is incapable of proper operation with incoherent, partially-coherent or polychromatic light. The other argument is that the device disclosed in Grinberg is only capable of deflecting a beam in a

single plane. Appellants contend that to produce independent deflection in two planes requires two such devices, stacked orthogonally.

We are not persuaded by appellants' arguments and will sustain the rejection of claims 37-39. It is true that Grinberg is concerned with the deflection of optical beams of relatively large diameter and high energy in high power laser communications and weapons systems and, thus, is concerned with maintaining high phase coherence and low beam scattering. Nevertheless, there is no evidence or rationale set forth by appellants to support their bare conclusion that Grinberg is incapable of proper operation with incoherent, partially-coherent or polychromatic light. To the contrary, both appellants and Grinberg utilize the same kind of apparatus, liquid crystal birefringent material, to form their light steering apparatus. Such being the case, it is to be expected that both appellants' device and that of Grinberg would exhibit the same operational capabilities.

With respect to the second argument, it is unquestioned that Grinberg's two arrays 2 and 30 of Figure 2 cooperate to produce deflection in two planes. Collectively, the two arrays are a device, which produces independent deflection in two planes.

The Rejections under 35 U.S.C. § 103(a)  
of Claims 4, 5, 8, 14-19, 23-27, 34 and 35  
over Grinberg and Buchan, and of Claims 6, 7, 10,

12, 20, 21, 28 and 29 over Grinberg, Buchan and Azisawa

The only argument presented by appellants with respect to these rejections, arguably not set forth earlier in the brief as to other claims, appears at page 25 of the brief. It is argued that claims 34 and 35, the only independent claims in the above two groups of claims, are directed to the generation of any phase front including, but not limited to emulation of geometric optical shapes such as wedges, lenses, refractive, diffractive, and combination optical elements.

We will sustain the above rejections. Appellants' argument is not persuasive because, as noted above, Grinberg teaches various wedge equivalents (wedges of different geometric shapes), and these wedge equivalents represent "any of a plurality of refractive, diffractive, and composite optical elements" as recited in claim 34 and "one of a plurality of discrete refractive, diffractive, or composite optical components" as recited in claim 35.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 CFR § 1.136(a).

AFFIRMED

Appeal No. 1999-0360  
Application No. 08/810,591

STANLEY M. URYNOWICZ JR. )  
Administrative Patent Judge )  
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