Paper No. 22

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte RIFAT A.M. HIKMET,
WILLEM G. OPHEY and JOSEPHUS J.M. BRAAT

Appeal No. 96-1368
Application 08/080,891[1]

ON BRIEF

Before MARTIN, BARRETT, and TORCZON, Administrative Patent Judges.

MARTIN, Administrative Patent Judge.

DECISION ON APPEAL

This is an appeal under 35 U.S.C. § 134 from the examiner's final rejection of claims 1-16.[2] The examiner's

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[1] Application for patent filed June 22, 1993.

[2] Final Office action, paper No. 9.

Answer indicates (at 1) that claims 7 and 8 are allowed and (at 2) that several grounds of rejection applied to claims 1-16 have been rendered moot by the abandonment of Appellants' Application 08/074,179. Although the Answer states that the appeal now involves claims 1-6 and 9-16, the only claims which stand rejected in the Answer are claims 1-3, 5, 6, 11, 13, 14, and 16, which are rejected under 35 U.S.C. § 103 for obviousness over the prior art.[3] We affirm.

The invention is a polarization-sensitive beam splitter as defined in claim 1, which reads as follows:

> 1. A polarization-sensitive beam splitter comprising at least one transparent wedge-shaped element of a birefringent material, characterized in that the wedge-shaped element comprises a polymerized uniaxially oriented liquid crystalline monomer composition.

Appellants' Figures 6 and 7 show two embodiments of Wollaston prisms using such wedge-shaped elements.

The references relied on by the examiner are:

Rogers et al. (Rogers)	4,525,413	Jun. 25, 1985
Takayanagi et al. (Takayanagi)	4,810,433	Mar. 7, 1989

[3] Inasmuch as the Answer does not include a rejection of dependent claims 4, 9, 10, 12, and 15, these claims are presumably objected to for depending from rejected claims.

Tatsuno et al. (Tatsuno) 4,822,151 Apr. 18, 1989

Iwanaga et al. (Iwanaga) 4,951,274 Aug. 21, 1990

De Vaan et al.[4] (De Vaan) 0 428 213 A1 May 22, 1991
(European Patent Office)

Murty et al. (Murty), Liquid Crystal Wedge as a Polarizing Element and Its Use in Shearing Interferometry, 19 Optical Engineering 113-15 (Jan./Feb. 1980).

The references have been applied against the claims as follows:[5]

(a) Claim 1: Rogers in view of Takayanagi;

(b) Claims 2, 3, 5, and 11: Rogers in view of Takayanagi and Tatsuno;[6]

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[4] The first-named inventor is actually Broer. We will refer to this reference as De Vaan to be consistent with the examiner and Appellant.

[5] The level of skill in the art is represented by the references. In re Oelrich, 579 F.2d 86, 91, 198 USPQ 210, 214 (CCPA 1978) ("the PTO usually must evaluate both the scope and content of the prior art and the level of ordinary skill solely on the cold words of the literature"). In re GPAC Inc., 57 F.3d 1573, 1579, 35 USPQ2d 1116, 1121 (Fed. Cir. 1995)(Board did not err in adopting the approach that the level of skill in the art was best determined by the references of record).

[6] Although this rejection is described as based on Rogers in view of Tatsuno (final Office action at 7; Answer at 6), it is apparent from the discussion of the rejection that these references are relied on in combination with Takayanagi.

(c) Claim 1: Murty in view of De Vaan;[7]

(d) Claims 2, 3, 5, and 11: Murty in view of De Vaan and Tatsuno;

(e) Claim 6: Iwanaga in view of Murty, Rogers, and De Vaan; and

(f) Claims 13, 14, and 16: Iwanaga in view of Murty, Rogers, De Vaan, and Tatsuno.

1. The rejections based on Rogers

Rogers discloses molecularly highly birefringent polymer material for making a variety of optical devices, including the beam splitter shown in Figure 8 and a Wollaston prism (col. 30, lines 56-57). However, as Appellants note, the examiner is incorrect to state that Rogers suggests forming the birefringent polymer material into a wedge-shaped element.

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[7] The last Office action (paper No. 9, at 5) and the Answer (at 5) incorrectly state that this rejection is based on Rogers in view of Takayanagi, repeating the stated ground for the first rejection of claim 1 under 35 U.S.C. § 103 (Answer at 3; final Office action at 3). However, it is apparent from the discussion of the references that the second rejection of claim 1 is based on Murty in view of De Vaan. This is also apparent from the fact that claims 2, 3, 5, and 11 are rejected as unpatentable over Murty and De Vaan, as applied to claim 1, further in view of Tatsuno (Final Office action at 6; Answer at 6).

Instead, the birefringent polymer material in Figure 8 is layer 74, which is located between elements 72a and 72b,[8] which are formed of glass or other isotropic material (col. 30, lines 18-25). This is consistent with Rogers's statement that "[t]he polymeric materials utilized in the devices of the present invention can be variously formed or shaped into films, sheets, coatings, layers, fibrils, fibers or the like" (col. 21, lines 3-6).[9] As a result, Rogers's suggestion of using polymeric birefringent material in a Wollaston prism (col. 30, lines 39-60) appears to be a suggestion to use a layer of such material between isotropic wedge-shaped elements. Rogers also fails to disclose that the birefringent

[8] Element 72b is incorrectly labeled 72 in the figure.

[9] The birefringent polymer material used in the other disclosed embodiments is likewise in the form of a layer or film. Specifically, in the light polarizing sheet shown in Figure 5, the birefringent material is in the form of a lenticular layer 16 between isotropic layers 14 and 18 (col. 25, lines 7-11 and 38-44). In the headlamp of Figure 6, a prismatic birefringent polymer layer 42 abuts a prismatic isotropic layer 44 (col. 28, lines 1-6). Figure 7 shows a multilayer polarizing sheet 50 having alternating layers of birefringent polymer material 54 and isotropic material 56 (col. 28, lines 35-38).

polymer material can be in the form of a liquid crystal monomer, as is necessary to satisfy claim 1.

Takayanagi discloses a process for producing from two or more liquid crystal monomers a highly uniaxially oriented film that is free from pinholes, strain or unevenness and is excellent in optical transparency (Abstract). Among the uses for these films are as phase contrast films or polarizing films dyed with dichromatic dyes, and optical filters (col. 1, lines 7-16). In the "Example" described at column 13, line 61 to column 14, line 19, a mixture of two liquid crystal monomers identified as 5H and 6H (synthesized in the manner described in col. 12, line 66 to col. 13, line 59) is supported between two glass plates and exposed to heat and light to cause it to polymerize, after which the glass plates are removed to obtain a birefringent film. The examiner contends it would have been obvious to employ such a film in the device of Rogers for the benefit of the advantages of being free from pinholes, strain or unevenness and excellence in optical transparency. Assuming for the sake of argument that it would have been obvious for these reasons to replace the birefringent polymer material in Rogers's Figure 8 beam

splitter or Wollaston prism with Takayanagi's polymerized liquid crystal material, the result would be a film of polymerized liquid crystal material formed on or between one or more wedge-shaped isotropic elements, not a wedge-shaped element formed of polymerized liquid crystal material, as required to satisfy claim 1. For this reason, the rejection of claim 1 as unpatentable for obviousness over Rogers in view of Takayanagi is reversed.

Tatsuno, which is additionally relied on with respect to dependent claims 2, 3, 5, and 11 as showing a Wollaston prism 23 including three wedge-shaped elements 24-26, does not cure the above-noted deficiency. As a result, the rejection of those dependent claims as unpatentable for obviousness over Rogers in view of Takayanagi and Tatsuno is also reversed.

2. The rejections based on Murty

Murty discloses a liquid crystal wedge which is formed by encapsulating a liquid crystal material such as MBBA[10] in a wedge-type cell (Abstract) formed between two glass plates. The glass plates are rubbed parallel to the apex of the wedge

[10] MBBA is N-(p-Methoxy Bezylidene)-p-Butyl Aniline) (Murty at 113 n.*).

before the liquid crystal material is introduced into the cell (Murty at 1). After a while, the liquid crystal material starts crystallizing and when the crystallization is complete, it acts like a polarizing prism (id.). The resulting cell can be used to separate two orthogonally polarized component of a light beam and in this sense is equivalent to a Rochon or Wollaston prism (id.). Murty does not disclose the use of a polymerized liquid crystal material.

De Vaan describes a different type of prior art liquid crystal beam splitter, its associated problems, and the objects of his invention as follows (col. 1, lines 10 to 51):

> According to the state of the art a polarisation-sensitive beam splitter can be manufactured in the form of a Wollaston prism as described in McGraw-Hill Encyclopedia of Science and Technology, vol. 10, page 499 (1960). To avoid the use of birefringent prisms, a polarisation-separating layer which is interposed between two transparent elements can be used in known manner, said elements may be composed of ordinary glass or of a synthetic resin having the same single refractive index, see United States Patent Specification US 4,702,557. In said specification, the polarisation-separating birefringent layer consists of a liquid-crystalline layer having a thickness of 5 to 10 Fm. One of the refractive indices of said layer must be equal to the refractive

> index of said elements and the other refractive index must be smaller than the refractive index of said elements.
>
> According to the state of the art, a thin liquid-crystalline layer is applied between two substrates (the transparent elements) by means of capillary forces. Means for sealing the thin layer from the environment must be provided. Further, it is necessary to position and secure the two substrates at a fixed distance from each other. A further disadvantage of the known devices is the difficulty of providing suitable liquid-crystalline materials having the above-described refractive indices. Moreover, the temperature resistance of liquid-crystalline layers is generally small.
>
> One of the objects of the invention is to provide a polarisation-sensitive beam splitter of a simpler construction. In this connection an object of the invention is to provide means to atune the refractive indices of the polarisation-separating layer and the transparent elements to each other in a simple manner. Another object of the invention is to provide a beam splitter which is little temperature dependent and which is also temperature resistant. Yet another object of the invention is to provide a simple and efficacious method of manufacturing a polarisation-sensitive beam splitter.

Specifically, De Vaan uses as the birefringent layer a "curable synthetic resin composition which comprises liquid-crystalline monomers or oligomers, the molecules in the

curable synthetic resin composition being uniaxially oriented after which the synthetic resin composition is cured" (col. 2, lines 22-27). Figure 1 shows a polarization-sensitive beam splitter 10 which is composed of two glass prisms 11 and 12 separated by a birefringent adhesive layer 13, whose molecules are uniaxially oriented in the direction perpendicular to the direction of the drawing (col. 3, line 51 to col. 4, line 6).

The examiner also asserts, and Appellants do not dispute, it was known in the art that a cured liquid crystal composition has the advantages of requiring no support substrates and being stable (final Office action at 6: Answer at 5).

With respect to claim 1, the examiner contends it would have been obvious to replace the uncured liquid crystal material in Murty's polarization device with a cured (i.e., polymerized) liquid crystal monomer composition of the type disclosed by De Vaan in order to obtain "the benefits of temperature independence, not requiring supporting substrates and being stable" (Answer at 5). We additionally note that using a polymerized liquid crystal material apparently will also avoid another problem discussed by De Vaan, which is the

need to seal the liquid crystal material from the environment.

Appellants have not specifically addressed the rejection of claim 1 over Murty in view of De Vaan. The only rejections they discuss that are based on Murty are the rejection of dependent claims 2, 3, 5, and 11 over Murty in view of De Vaan and Tatsuno (Brief at 8-9) and the rejection of dependent claim 6 over Iwanaga in view of Murty, Rogers, and De Vaan (Brief at 10-11). However, in discussing those claims Appellants make one argument that is also applicable to claim 1, which is that Murty's liquid crystal material "is not polymerized [n]or is it uniaxially oriented" and that the De Vaan patent fails to cure this deficiency because its wedge-shaped elements are formed of glass rather than of an oriented polymerized liquid crystal monomer (Brief at 9). This argument fails because it is well settled that a rejection based on a plurality of references cannot be overcome by attacking the references individually; the test for combining references is not what individual references themselves suggest but rather what the combination of disclosures taken as a whole would suggest to one of ordinary skill in the art.

In re Merck, 800 F.2d 1091, 1097, 231 USPQ 375, 380 (Fed. Cir. 1986) (citing In re Keller, 642 F.2d 413, 425, 208 USPQ 871, 881 (CCPA 1981)). As Appellants have failed to explain why the artisan would not have been motivated to combine the reference teachings in the manner proposed by the examiner, we are affirming the rejection of claim 1 as unpatentable for obviousness over Murty in view of De Vaan.

Turning now to the rejection of claims 2, 3, 5, and 11 over Murty in view of De Vaan and Tatsuno, the examiner, noting that Tatsuno discloses a three-wedge Wollaston beam splitter (Fig. 4) that can deflect an incident beam under larger angles than a two-component Wollaston prism (col. 6, lines 47-58), contends it would have been obvious to employ the device of Murty as modified in view of De Vaan as the wedge-shaped elements in Tatsuno's three-wedge Wollaston prism in order to produce a beam splitter that permits the incident beams to have large angles. We also note, as mentioned previously, that Murty (at 113, 2d col.) explains his wedge-shaped liquid crystal cell is equivalent to a Wollaston prism. Appellants respond to this rejection with the argument discussed above in connection with claim 1, i.e., that Murty's

liquid crystal material is not polymerized or uniaxially oriented and that the De Vaan patent fails to cure this deficiency because its wedge-shaped elements are formed of glass rather than of an oriented polymerized liquid crystal monomer (Brief at 9). Again, this argument is unconvincing because it fails to address the collective teachings of those references. Furthermore, Appellants' additional argument that the Tatsuno patent fails to disclose or suggest making its wedge-shaped elements of a uniaxially oriented polymerized crystalline monomer composition is unresponsive to the rejection, which relies collectively on only Murty and De Vaan for this teaching. We note that Appellants do not contend that in the event Murty and De Vaan do collectively teach wedge-shaped elements of such material, it nevertheless would have been unobvious to use such material to form the wedge-shaped elements in Tatsuno's three-wedge Wollaston prism.

For the foregoing reasons, the rejection of claims 2, 3, 5, and 11 as unpatentable for obviousness over Murty in view of De Vaan and Tatsuno is affirmed.

3. The rejections based on Iwanaga

Claim 6, which depends on claim 1, stands rejected under § 103 as unpatentable for obviousness over Iwanaga in view of Murty, Rogers, and De Vaan. Claim 6 recites a device which includes a light source for supplying a scanning beam, an optical system for directing the scanning beam onto an information plane of a record carrier, a photosensitive detection system in the path of the scanning beam from the record carrier, and a polarization-sensitive beam splitter as claimed in claim 1 arranged in the path before the detection system. Figure 6 of Iwanaga shows a device including all of these elements except for a beam splitter that satisfies claim 1: a source 1 for generating a scanning laser beam, optical elements 2, 4 and 5 for directing the laser beam to the recording medium 6, a photodetectors 11 for receiving laser light from the recording medium, and a polarization-sensitive beam splitter 19 (a Wollaston prism) in the light path leading to the photodetectors. The wedge-shaped elements of Iwanaga's Wollaston prism are made of crystal (col. 5, lines 34-35) rather than a polymerized liquid crystal monomer.

The examiner cites Rogers (col. 1, lines 9-21) as evidence that birefringent crystals suitable for use in Wollaston prisms are expensive to make and contends that with this fact in mind it would have been obvious in view of Murty and De Vaan to replace Iwanaga's crystal Wollaston elements with elements made of a polymerized liquid crystal monomer "for the benefit of avoiding the cost of a birefringent crystal" (Answer at 8). Appellants respond by arguing that Iwanaga, like each of the other cited references, fails to suggest forming a beam splitter of transparent wedge-shaped polymers formed of polymerized uniaxially oriented liquid crystalline monomer material. This argument fails to address the collective teachings of the references and is also unresponsive to the rejection, which relies collectively on Rogers, Murty, and De Vaan for this teaching. We note Appellants do not argue that in the event Rogers, Murty, and De Vaan collectively teach wedge-shaped elements of polymerized uniaxially oriented liquid crystalline monomer material, it nevertheless would have been unobvious to use such material to make the wedge-shaped elements in Iwanaga's Wollaston prism 10 (Fig. 4). The rejection of claim 6 for

obviousness over Iwanaga in view of Murty, Rogers, and De Vaan is therefore affirmed.

In rejecting dependent claims 13, 14, and 16 for obviousness over Iwanaga in view of Murty, Rogers, De Vaan, and Tatsuno, the examiner contends, as he did with respect to claims 2, 3, 5, and 11, that it would have been obvious to employ the device of Murty as modified in view of De Vaan as the wedge-shaped elements in Tatsuno's three-wedge Wollaston prism in order to produce a beam splitter that permits the incident beams to have large angles. With respect to this rejection, Appellants rely on the arguments made with respect to the claims on which they depend (i.e., claims 1-3 and 5, which arguments we considered unpersuasive for the reasons given supra. The rejection of claims 13, 14, and 16 for obviousness over Iwanaga in view of Murty, Rogers, De Vaan, and Tatsuno is therefore affirmed.

4. Summary

The following § 103 rejections have been reversed:

(a) the rejection of claim 1 based on Rogers in view of Takayanagi; and

(b) the rejection of claims 2, 3, 5, and 11 based on Rogers in view of Takayanagi and Tatsuno.

The following § 103 rejections have been affirmed:

(i) the rejection of claim 1 based on Murty in view of De Vaan;

(ii) the rejection of claims 2, 3, 5, and 11 based on Murty in view of De Vaan and Tatsuno;

(iii) the rejection of claim 6 based on Iwanaga in view of Murty, Rogers, and De Vaan; and

(iv) the rejection of claims 13, 14, and 16 based on Iwanaga in view of Murty, Rogers, De Vaan, and Tatsuno.

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

AFFIRMED

JOHN C. MARTIN Administrative Patent Judge	)
LEE E. BARRETT Administrative Patent Judge	) BOARD OF PATENT) APPEALS AND) INTERFERENCES
RICHARD L. TORCZON, JR. Administrative Patent Judge	)

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