Paper No. 22

THIS OPINION WAS NOT WRITTEN FOR PUBLICATION

The opinion in support of the decision being entered today (1) was not written for publication in a law journal and (2) is not binding precedent of the Board.

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 L. FREEOUF

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Appeal No. 1997-1249
Application 08/179,601

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ON BRIEF

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Before FLEMING, RUGGIERO and HECKER, ***Administrative Patent Judges***.

HECKER, ***Administrative Patent Judge.***

DECISION ON APPEAL

This is a decision on appeal from the final rejection of claims 2 through 4, 11 through 14, 16 through 20 and 22 through 27, Paper No. 10, mailed November 22, 1995 (claims 1, 5 through 10 and 15 had been canceled). Although claim 21 had been rejected in a previous rejection (Paper No. 8), no

indication of its status appears in Paper No. 10. However, the status of claim 21 is moot since it was canceled by an entered amendment after final rejection, Paper No. 12, received February 12, 1996, which paper also canceled claims 14, 16 through 20 and 22 through 26. This amendment (Paper No. 12) also added new claims 28 through 32, and amended claim 27. As a result of the amendment of Paper No. 12, claims 2 through 4, 11 through 13 and 28 through 32 stand finally rejected and claim 27 stands allowable as recited in the Examiner's Advisory Action, Paper No. 13, mailed March 14, 1996. The invention relates to a radiation detector made of solid state materials. In particular, noting Figure 1, the detector (3) is made up of a stack of absorption members (4) where each member is an intrinsic (i) layer (6,8) (of high density, high band gap semi-conductor) with a relatively thin high conductivity layer p (7) or n (5,9) layer (or a metal), that covers each entire face of the i layer and with a bias across each i layer via a pair of the p/n or metal layers.

Representative independent claim 28 is reproduced as follows:

28. A radiation detector comprising:

a plurality of planar absorption members arranged in a stack having a surface made up of the edges of said absorption members,

each said absorption member having at least one terminating edge exposed in a surface of said stack,

each said absorption member further having a center layer of high density, high band gap, semiconductor material that is intrinsic, and has a selected thickness dimension,

a first highly conductive contacting layer of only one of a high extrinsic conductivity semiconductor material and a metal,

said first contacting layer being contiguous with a first surface of said intrinsic layer, coextensive with said intrinsic layer, and having a thickness that is small relative to said selected thickness of said intrinsic layer, and,

a second highly conductive contacting layer of only one of a high extrinsic conductivity semiconductor material and a metal,

said second contacting layer being contiguous with a second and opposite surface of said intrinsic layer, coextensive with said intrinsic layer, and has a thickness that is small relative to said selected thickness of said intrinsic layer, and,

an electrical bias applied between said first and said second contacting layers, in a magnitude related to said bandgap, the carrier density and said thickness dimension of said intrinsic layer, of a magnitude sufficient for essentially full charge extraction.

The Examiner relies on the following references:

Capasso	4,486,765	Dec. 4, 1984
Doehler et al. (Doehler)	4,839,714	Jun. 13, 1989
Danos	4,891,521	Jan. 2, 1990
Yamazaki et al.(Yamazaki)	4,917,474	Apr. 17, 1990
Biefeld et al. (Biefeld)	4,947,223	Aug. 7, 1990

Claims 2 through 4, 13 and 28 through 32 stand rejected under 35 U.S.C. § 103 as being unpatentable over Capasso, Biefeld, Doehler and Yamazaki, considered together.

Claims 11[1] and 12 stand rejected under 35 U.S.C. § 103 as being unpatentable over Capasso, Biefeld, Doehler and Yamazaki, and further in view of Danos.

Rather than reiterate the arguments of Appellant and the Examiner, reference is made to the brief, reply brief and answer for the respective details thereof.

OPINION

After a careful review of the evidence before us, we will not sustain the rejection of claims 2 through 4, 11 through 13 and 28 through 32 under 35 U.S.C. § 103.

The Examiner has failed to set forth a ***prima facie*** case. It is the burden of the Examiner to establish why one having

[1] From the language of the claims, it appears that this rejection is directed to claim 4 instead of claim 11.

ordinary skill in the art would have been led to the claimed invention by the reasonable teachings or suggestions found in the prior art, or by a reasonable inference to the artisan contained in such teachings or suggestions. ***In re Sernaker***, 702 F.2d 989, 995, 217 USPQ 1, 6 (Fed. Cir. 1983). "Additionally, when determining obviousness, the claimed invention should be considered as a whole; there is no legally recognizable 'heart' of the invention." ***Para-Ordnance Mfg. v. SGS Importers Int'l.***, 73 F.3d 1085, 1087, 37 USPQ2d 1237, 1239 (Fed. Cir. 1995) (***citing W. L. Gore & Assocs. v. Garlock, Inc.***, 721 F.2d 1540, 1548, 220 USPQ 303, 309 (Fed. Cir. 1983), ***cert. denied***, 469 U.S. 851 (1984)).

With regard to the rejection of claims 28 and 31, grouped together by both the Examiner (answer-page 5) and Appellant (brief-page 6), the Examiner reasons that Doehler teaches a photodetector with the claimed layered structure (Figures 3A and 3B), except that the intrinsic (i) layers are shown as the same thickness as the n and p layers. The Examiner then cites Yamazaki for its photodetector with n and p layers thinner

than the i layer. Thus, the Examiner states, it would have been obvious to make the i layers of Doehler thicker than its n and p layers, as taught by Yamazaki, "to increase the volume of i-type material available to absorb light, in order to increase the sensitivity of the device to incident light." (Answer-page 3.)

Appellant argues that there is no motivation for the combination of references (brief-page 8). We agree. The Examiner's reasoning that increasing the volume of the i layer will increase detector sensitivity is not supported by Yamazaki, and without more, is mere speculation. Also, an increase in volume could be achieved by increasing the area without increasing the thickness. In addition, even if Yamazaki taught increased sensitivity with increased i layer thickness, we see no reason to use this teaching in Doehler. The i layer of Doehler does not contribute to sensitivity. Doehler states at column 1 lines 42-66:

> A doping superlattice consists of an alternating sequence of n and p doped layers in a semiconductor. These doped layers **may, but need not, be separated by layers of undoped (intrinsic) semiconductor material**. The doping superlattice is also referred to as a NIPI superlattice because of the alternating

> n-doped, intrinsic, p-doped and intrinsic layers in such a superlattice.
>
> The recombination of electrons from the n-type layers with holes from the p-type layers results in a periodic charge variation in the superlattice that produces a periodic variation in the bottom of the conduction band and in the top of the valence band, thereby producing a periodic array of potential wells as in a compositional superlattice. This also results in a separation between the holes and the electrons so that the recombination time for excess holes and electrons is greatly increased. When excited optically or electrically, a large number of excess holes and electrons are created that flatten the periodic potential and increase the effective band gap (defined as the distance between a minimum in the bottom of the conduction band and a maximum in the top of the valence band) of the superlattice. Therefore, the electrical and optical properties can be varied by varying the number of excess holes and electrons in the superlattice. (Emphasis added.)

Thus, the i layer of Doehler is not required, and does not contribute to its optical properties. Therefore, increasing the thickness of the i layer would not increase sensitivity in Doehler, even if it would have increased sensitivity in Yamazaki.

The Federal Circuit states that "[t]he mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification." ***In***

re Fritch, 972 F.2d 1260, 1266 n.14, 23 USPQ2d 1780, 1783-84 n.14 (Fed. Cir. 1992), ***citing In re Gordon***, 733 F.2d 900, 902, 221 USPQ 1125, 1127 (Fed. Cir. 1984). "Obviousness may not be established using hindsight or in view of the teachings or suggestions of the inventor." ***Para-Ordnance Mfg. v. SGS Importers Int'l.***, 73 F.3d at 1087, 37 USPQ2d at 1239, ***citing W. L. Gore & Assocs. v. Garlock, Inc.***, 721 F.2d at 1551, 1553, 220 USPQ at 311, 312-13.

The Examiner cites Biefeld (Figures 5 and 6), Doehler (Figure 4) and Capasso (Figure 1) as redundantly teaching "contacts" (answer-page 4). However, Appellant's disclosed contacts are not even recited in the claims.

Appellant notes that Danos "is the one reference directed to general radiation detection." (Brief-page 12.) Appellant contends that his claims distinguish over Danos "by the fact that the conductive layers [of Appellant] are coextensive with the intrinsic region so as to extend to the edge . . . . In Danos in contrast, the conductive layers 5 in Fig. 2, are neither coextensive nor do they extend to the edges." (Brief-pages 12 and 13.) However, we note that in Figure 2 (as well

as Figure 1), Danos is not "coextensive" with the layers because region C is reserved for an integrated circuit with a buffer and amplifier (column 2, lines 62-64). An alternate arrangement of Figure 3 places the integrated circuit in a separate chip 18, off the detector region. Thus, in Figure 3 of Danos, the layers are "coextensive" (column 3, lines 34+). However, Danos also lacks the claimed limitation of making the p and n layers (or metal layers 5) thinner than the i layer.

Since there is no evidence in the record that the prior art suggested the desirability of a radiation detector with a p-i-n structure and the p and n layers "having a thickness that is small relative to said selected thickness of said intrinsic layer" as claimed in both independent claims 28 and 31, we will not sustain the Examiner's rejection of these claims.

The remaining claims on appeal also contain the above limitations discussed in regard to claims 28 and 31 and thereby, we will not sustain the rejection as to these claims.[2]

[2] We note that claims 2 and 3 recite "said at least one absorption member(s)", and claim 4 (continued...)

We have not sustained the rejection of claims 2 through 4, 11 through 13 and 28 through 32 under 35 U.S.C. § 103.

Accordingly, the Examiner's decision is reversed.

REVERSED

Michael R. Fleming Administrative Patent Judge	)	
Joseph F. Ruggiero Administrative Patent Judge	)	BOARD OF PATENT APPEALS AND INTERFERENCES
Stuart N. Hecker Administrative Patent Judge	)	

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[2](...continued)
recites “said at least one intrinsic layer”. This language should be corrected to be consistent with the new independent claim from which they depend.

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