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opinion in support of the decision being entered today (1) was not written for publication in a law journal and (2) is not binding precedent of the Board.

Paper No. 24

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

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Ex parte MIKE F. CHANG and FWU-IUAN HSHIEH and
SZE-HON KWAN and KING OWYANG

_____

Appeal No. 95-5110
Application 07/918,954

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ON BRIEF

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Before HAIRSTON, KRASS and FLEMING, ***Administrative Patent Judges***.

FLEMING, ***Administrative Patent Judge***.

DECISION ON APPEAL

This is a decision on appeal from the final rejection of claims 2 through 7 and 10 through 12. Claims 1, 8 and 9 have been canceled. An amendment filed after the final rejection canceling claims 5 and 6 has been entered into the record.

Therefore, claims 2 through 4, 7 and 10 through 12 are pending and stand rejected.

The invention is directed to field effect transistors in which the transistor gate is located in a trench in a substrate having a lightly doped epitaxal layer at the principal surface of the substrate. Appellants disclose on pages 4 and 5 of the specification that Figure 2 shows a cross section of a field effect transistor in accordance with the invention. In particular, Figure 2 shows a conventional heavily doped N+ substrate 40 being a drain region, a first epitaxial layer 42 of a N doped conductivity type formed on the substrate 40, a second layer 46 of a N- doped conductivity type formed on the first layer 42, a trench 54 in the second layer 46 extending to within 0.5 Fm of the first layer 42, a source region 52 of a N+ doped conductivity type formed in the second layer 46 and a body region of a P doped conductivity typed extending from the principle surface of the second layer 46 down to and into at least an upper portion of the first layer 42 and being spaced apart from the lower portion of the trench 54.

Independent claim 7 is reproduced as follows:

7. A field effect transistor comprising:

a substrate of a first conductivity type being a drain region;

a first layer of the first conductivity type formed on the substrate and having a doping level less than that of the substrate;

a second layer of the first conductivity type formed on the first layer and having a doping level about 50% of that of the first layer;

a trench defined in only the second layer and extending to within about 0.5 Fm of the first layer, the trench being at least partially filled with a conductive gate electrode;

a source region of the first conductivity type formed in the second layer and extending to a principal surface of the second layer and lying adjacent to the sidewalls of the trench; and

a body region of a second conductivity type extending from the principal surface of the second layer down to and into at least an upper portion of the first layer and being spaced apart from the lower portion of the trench, wherein two portions of the body region lying respectively on two sides of the trench define a lateral extent of the second layer.

The references relied on by the Examiner are as follows:

Katou (Japan)	56-58267	May 21, 1981
Tsuzuki et al. (Japan)	62-176168	Aug. 01, 1987

Claims 2 through 4, 7 and 10 through 12 stand rejected under 35 U.S.C. § 103 as being unpatentable over Tsuzuki and Katou.

Rather than repeat the arguments of Appellants or the Examiner, we make reference to the briefs[1] and the answer for the details thereof.

OPINION

After a careful review of the evidence before us, we do not agree with the Examiner that claims 2 through 4, 7 and 10 through 12 are properly rejected under 35 U.S.C. § 103 as being unpat-entable over Tsuzuki and Katou.

The Examiner has failed to set forth a ***prima facie*** case. It is the burden of the Examiner to establish why one having ordinary skill in the art would have been led to the claimed invention by the express teachings or suggestions found in the prior art, or by implications 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

[1]Appellants filed an appeal brief on December 28, 1994. We will refer to this appeal brief as simply the brief. Appellants filed a reply appeal brief on July 10, 1995. We will refer to this reply appeal brief as the reply brief. The Examiner stated in the Examiner's letter dated August 4, 1995 that the reply brief has been entered and considered but no further response by the Examiner is deemed necessary.

whole; there is no legally recognizable 'heart' of the invention." ***Para-Ordnance Mfg. v. SGS Importers Int'l, Inc.***, 73 F.3d 1085, 1087, 37 USPQ2d 1237, 1239 (Fed. Cir. 1995), ***citing W. L. Gore & Assocs., Inc. v. Garlock, Inc.***, 721 F.2d 1540, 1548, 220 USPQ 303, 309 (Fed. Cir. 1983), ***cert. denied***, 469 U.S. 851 (1984).

In the answer, the Examiner argues that Tsuzuki teaches all of the limitations of the claims except for the limitations

directed to a trench type insulate gate electrode structure. The Examiner then points to Figure 1 of Katou and argues that Katou teaches a trench type insulated gate electrode structure. The Examiner argues that those skilled in the art would have reason to modify Tsuzuki by providing a trench type insulated gate electrode because the modification would result in a reduction of the size of the device. The Examiner further argues that those skilled in the art would have extended the trench to within 0.5 Fm of the n type layer 3

shown in Tsuzuki's Figure 1 because the distance between the n type layer and the bottom of the trench depends upon the depth of the trench and the breakdown voltage of the device.

Appellants argue on pages 3-5 of the brief that one of ordinary skill in the art would not have a reason to use the Katou trench in the Tsuzuki transistor because Tsuzuki is concerned with providing an arbitrary avalanche breakdown voltage at the bottom of the deep body P region in order to prevent punch-through while in contrast Katou is concerned with decreasing the concentration of an electric field and increasing dielectric resistance. Furthermore, on pages 2 and 3 of the reply brief, Appellants argue that the Examiner has failed to show a suggestion or reason that if the trench was employed in the Tsuzuki transistor that the trench would only extend into the N- region 4.

Upon a closer reading of the reference, we fail to find that the prior art provides any evidence that suggests the Examiner's modification. 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., Inc. v. Garlock, Inc.***, 721 F.2d at 1551, 1553, 220 USPQ at 311, 312-13. We note that the Examiner has not shown that the prior art would have suggested to one of ordinary skill in the art to use a trench structure in the Tsuzuki transistor. Furthermore, even if there is such a suggestion, we fail to find any suggestion in the cited prior art to those skilled in the art to provide a trench that is defined in only the upper layer and extending to within a predetermined distance of the lower layer as claimed.

In view of the foregoing, the decision of the Examiner rejecting claims 2 through 4, 7 and 10 through 12 is reversed.

REVERSED

KENNETH W. HAIRSTON Administrative Patent Judge	)	
ERROL A. KRASS Administrative Patent Judge	)	BOARD OF PATENT APPEALS AND INTERFERENCES
MICHAEL R. FLEMING Administrative Patent Judge	)	

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