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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/703,762	11/07/2003	Jennifer Shih	200313797	2716

22879 7590 07/22/2009

HEWLETT PACKARD COMPANY
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FORT COLLINS, CO 80527-2400

EXAMINER	
SMOOT, STEPHEN W	
ART UNIT	PAPER NUMBER
2813	

NOTIFICATION DATE	DELIVERY MODE
07/22/2009	ELECTRONIC

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Appeal No: 2009-013101
Application: 10/703,762
Appellant: Jennifer Shih et al.

Board of Patent Appeals and Interferences
Docketing Notice

Application 10/703,762 was received from the Technology Center at the Board on July 13, 2009 and has been assigned Appeal No: 2009-013101.

A review of the file indicates that the following documents have been filed by appellant:

Appeal Brief filed on:	January 14, 2009
Reply Brief filed on:	June 05, 2009
Request for Hearing filed on:	NONE

In all future communications regarding this appeal, please include both the application number and the appeal number.

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By order of the Board of Patent Appeals and Interferences.

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APPLICATION NO./ CONTROL NO.	FILING DATE	FIRST NAMED INVENTOR / PATENT IN REEXAMINATION	ATTORNEY DOCKET NO.
10703762	11/7/03	SHIH ET AL.	200313797

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EXAMINER
Stephen W. Smoot

ART UNIT	PAPER
2813	20090708

DATE MAILED:

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Commissioner for Patents

The reply brief filed on 05 June 2009 has been entered and considered. The application has been forwarded to the Board of Patent Appeals and Interferences for decision on the appeal.

/Stephen W Smoot/
Primary Examiner
Art Unit 2813

HEWLETT-PACKARD COMPANY
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PATENT APPLICATION

ATTORNEY DOCKET NO. 200313797-1

IN THE
UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	**Jennifer Shih et al.**	**Confirmation No.:**	**2716**
Application No.:	**10/703,762**	**Examiner:**	**SMOOT, Stephen W.**
Filing Date:	**November 7, 2003**	**Group Art Unit:**	**2813**

Title: Sealing Openings in Micro-Electromechanical Systems

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TRANSMITTAL OF REPLY BRIEF

Transmitted herewith is the Reply Brief with respect to the Examiner's Answer mailed on April 6, 2009 .

This Reply Brief is being filed pursuant to 37 CFR 1.193(b) within two months of the date of the Examiner's Answer.

(Note: Extensions of time are not allowed under 37 CFR 1.136(a))

(Note: Failure to file a Reply Brief will result in dismissal of the Appeal as to the claims made subject to an expressly stated new ground rejection.)

No fee is required for filing of this Reply Brief.

If any fees are required please charge Deposit Account 08-2025.

Respectfully submitted,
Jennifer Shih et al.

By: /Steven L. Nichols/
Steven L. Nichols
Attorney/Agent for Applicant(s)
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Date : June 5, 2009
Telephone : 801-572-8066

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the Patent Application of

Jennifer Shih et al.

Application No.: 10/703,762

Filed: November 7, 2003

For: Sealing Openings in Micro-Electromechanical Systems

Group Art Unit: 2813

Examiner: SMOOT, Stephen W.

Confirmation No.: 2716

REPLY BRIEF

Mail Stop Appeal Brief - Patents
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Alexandria, VA 22313-1450

Sir:

This is a Reply Brief under Rule 41.41 (37 C.F.R) in response to the Examiner's Answer of April 6, 2009 (the "Examiner's Answer" or the "Answer"). In Section 10, the Answer contains a response to some of the arguments made in Appellant's brief. Appellant now responds to the Examiner's Answer as follows.

Status of Claims

Claims 49-56 were withdrawn under a previous Restriction Requirement and were subsequently cancelled without prejudice or disclaimer. Claim 58 has also been cancelled previously without prejudice or disclaimer.

Claims 57 and 59-64 have been allowed and are not at issue in this appeal.

The final Office Action further indicated the presence of allowable subject matter in claims 2, 7-10, 15, 20-23, 27, 32-35 and 39-48. Accordingly, these claims are not directly at issue in this appeal, but are included here due to their dependence on finally-rejected base claims.

Thus, claims 1, 3-6, 11-14, 16-19, 24-26, 28-31 and 36-38 are currently pending in the application and stand finally rejected. Accordingly, Appellant appeals from the final rejection of claims 1, 3-6, 11-14, 16-19, 24-26, 28-31 and 36-38, which claims are presented in the Appendix of the Brief.

Grounds of Rejection to be Reviewed on Appeal

The Answer maintains the following grounds of rejection.

(1) Claims 1, 3, 5, 11-14, 16, 18, 24 and 25 were rejected under 35 U.S.C. § 102(e) as anticipated by U.S. Patent No. 7,008,812 to Carley ("Carley").

(2) Claims 4, 6, 17 and 19 were rejected under 35 U.S.C. § 103(a) over the combined teachings of Carley and U.S. Patent App. Pub. No. 2002/0157475 to Onose et al. ("Onose").

(3) Claims 26, 28, 30 and 36 were rejected under 35 U.S.C. § 103(a) over the combined teachings of Carley and U.S. Patent No. 6,099,598 to Yokoyama et al. ("Yokoyama").

(4) Claims 29 and 31 were rejected under 35 U.S.C. § 103(a) over the combined teachings of Carley, Yokoyama and Onose.

(5) Claims 37 and 38 were rejected under 35 U.S.C. § 103(a) over the combined teachings of Carley and U.S. Patent No. 6,323,834 to Colgan et al. ("Colgan").

According, Appellant hereby requests review of each of these grounds of rejection in the present appeal.

Argument

(1) Claims 1, 3, 5, 11-14, 16, 18, 24 and 25 are patentable over Carley:

Claim 1:

Claim 1 recites: "A method of sealing a micro-electromechanical system (MEMS), said method comprising successively depositing and etching a sealing material to seal an opening in said MEMS." In contrast, Carley utterly fails to teach or suggest this subject matter.

As Appellant has previously noted, Carley teaches deposition, without etching, of a single seal layer (26) that seals the holes (20) into the MEMS cavity (22). (Carley, col. 5, lines 21-22). Thus, Carley clearly fails to teach or suggest "successively depositing and etching a sealing material to seal an opening in said MEMS."

In response, the Answer argues as follows.

> Carley applies a seal layer (26) to seal holes (20), thereby effectively sealing a MEMS structure (14) in a cavity (22), and then etch the seal layer (26) to expose a contact pad (6). The appellant dismisses this reasoning as being irrelevant to the claimed method as set forth in claim 1. The examiner disagrees because claim 1 is open to embodiments that feature depositing one layer of sealing material to seal a MEMS and successively etching the sealing material provided that the MEMS remains sealed.

(Answer, p. 10).

Appellant respectfully disagrees.

Claim 1 clearly recites that ***both*** the depositing and etching steps are used to produce the result of sealing the opening, i.e., "successively depositing and etching a sealing material *to seal an opening in said MEMS*." (Claim 1). Thus, the language of claim 1 clearly indicates that the opening is not sealed until at least one etching has been performed.

In contrast, as stated in the Answer, "Carley applies a seal layer (26) to seal holes (20), thereby effectively sealing a MEMS structure (14) in a cavity (22)." (Answer, p. 10). Thus, the structure is sealed following deposition of the seal layer and *without any etching step*.

As the Answer further makes clear, any subsequent etching taught by Carley has nothing to do with sealing the MEMS structure. Rather, Carley teaches "etch[ing] the seal layer (26) *to expose a contact pad* (6)." (Answer, p. 10) (emphasis added).

Thus, Carley clearly does not teach or suggest the claimed method in which ***both*** the depositing and etching steps are used to produce the result of sealing the opening, i.e., "successively depositing and etching a sealing material *to seal an opening in said MEMS*." (Claim 1).

In applying Carley, the Answer is essentially taking the position that claim 1 recites depositing material to seal a MEMS structure and then etching for some other purpose, like exposing a contact pad. This is *not* what claim 1 recites. Consequently, it is simply incorrect for the Examiner to argue that Carley's teaching of a single deposition which alone seals the MEMS is within the scope of claim 1. Carley clearly and inescapably does not teach or suggest "successively depositing and etching a sealing material to seal an opening in said MEMS." (Claim 1) (emphasis added).

Moreover, "[t]The prior art reference—in order to anticipate under 35 U.S.C. § 102—must not only disclose all elements of the claim within the four corners of the document, but must also disclose those elements 'arranged as in the claim.'" *NetMoneyIn v. Verisign*, (Fed. Cir. 2008) (quoting *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542 (Fed. Cir. 1983)). Additionally, "[t]he materials on which a process is carried out must be accorded weight in determining the patentability of a process. *Ex parte Leonard*, 187 USPQ 122 (Bd. App. 1974)." (See MPEP § 2116).

Under these applicable standards, Carley clearly fails to teach or suggest anything like the method recited in claim 1. "A claim is anticipated [under 35 U.S.C. § 102] only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 2 U.S.P.Q.2d 1051, 1053 (Fed. Cir. 1987). See M.P.E.P. § 2131. Therefore, for at least the reasons explained here, the rejection based on Carley of claim 1 and its dependent claims should not be sustained.

Claim 13:

Claim 13 recites:

> A method of forming a micro-electromechanical system (MEMS), said method comprising:
> forming a cavity in a material;
> forming components of said MEMS in said cavity; and
> successively depositing and etching a sealing material to seal an opening into said cavity.

In contrast, as demonstrated above with regard to claim 1, Carley only teaches depositing, *without etching*, a single seal layer (26) to seal the holes (20) into the MEMS cavity (22). (Carley, col. 5, lines 21-22). Thus, Carley does not and cannot teach or suggest the method of claim 13 including "successively depositing and etching a sealing material to seal an opening into said cavity." There is no such teaching or suggestion in Carley.

"A claim is anticipated [under 35 U.S.C. § 102] only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 2 U.S.P.Q.2d 1051, 1053 (Fed. Cir. 1987). See M.P.E.P. § 2131. Therefore, for at least the reasons explained here, the rejection based on Carley of claim 13 and its dependent claims should not be sustained.

(2) Claims 4, 6, 17 and 19 are patentable over Carley and Onose:

This rejection should not be sustained for at least the same reasons given above in favor of the patentability of claims 1 and 13.

(3) Claims 26, 28, 30 and 36 are patentable over Carley and Yokoyama:

Claim 26 recites:

> A method of in-fab packaging of a micro-electromechanical system (MEMS), said method comprising:
> fabricating said MEMS at a fabrication facility; and,
> at said fabrication facility, *successively depositing and etching a sealing material to seal an opening in said MEMS.*

(Emphasis added).

In contrast, as demonstrated above with regard to claim 1, Carley does not teach or suggest a method including "successively depositing and etching a sealing material to seal an opening in said MEMS." Carley only teaches depositing, *without etching*, a single seal layer (26) to seal the holes (20) into a MEMS cavity (22) containing the MEMS microstructure (14). (Carley, col. 5, lines 21-22). For at least this reason, the rejection of claim 26 should not be sustained.

Additionally, Carley clearly does not teach or suggest the claimed method of claim 26 including expressly performing the step of successively depositing and etching a sealing material to seal an opening in said MEMS "*at said fabrication facility*' were the MEMS structure was fabricated. There is no such teaching or suggestion in Carley. Consequently, the final Office Action and Answer cite to the teachings of Yokoyama on this point. Specifically, the Office Action cites Yokoyama as teaching "a transporter (101), which implies that the entire fabrication system is housed within the same fabrication facility." (final Office Action of September 22, 2008, p. 6).

This appears to be an argument that Yokoyama *inherently* teaches the claimed fabrication of a MEMS and sealing of an opening in the MEMS in the same fabrication facility. As such, this argument is clearly insufficient to establish unpatentability.

"To establish inherency, the extrinsic evidence 'must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill.' 'Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.'" *In re Robertson*, 49 USPQ2d 1949, 1950 (Fed. Cir. 1999) (citations omitted). "[T]he examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic *necessarily* flows from the teachings of the applied prior art." *Ex parte Levy*, 17 USPQ2d 1461, 1464 (BPAI 1990) (emphasis in original); see also, MPEP § 2112 (quoting Levy).

In response, the Answer argues that "Yokoyama et al. are completely silent with respect to the need or requirement for more than one facility to contain their fabrication system." (Answer, p. 12). This argument clearly does not establish that Yokoyama *necessarily* teaches the claimed method of performing MEMS fabrication and sealing in the same facility.

To the contrary, the Answer is clearly not aware of the current and traditional practice in this industry. Appellant's specification states the following.

> [0003] Typically, MEMS are fabricated at one facility and then moved to another location or another facility for packaging. Packaging MEM systems is costly and complex and is currently not done in fabrication facilities. This two-location process, however, dramatically increases the expense of the product.

(Appellant's specification, paragraph 0003).

It is specifically because of Appellant's novel approach to sealing the MEMS that fabrication and sealing can more readily be performed in a single facility.

> [0048] As described, the in-fab packaging methodology described herein incorporates a deposition-etch-deposition sequence to seal the chamber without bridging. The purpose of the initial deposition and etch is to reduce the diameter of the opening to be sealed without leaving any substantial deposition on the surface of the pixel plate or the exposed bottom capacitor plate. The second deposition seals the reduced opening and passivates the device.

(Appellant's specification, paragraph 0048).

The Answer further argues that "the transporter (101) specifically disclosed by Yokoyama et al. is an oval-shaped conveyor belt with a circumference of 60 meters as indicated in column 13, lines 31-35, which would also imply the use of the same fabrication facility (e.g. the same factory, the same plant, the same worksite, the same mailing address, etc.)." (Answer, p. 12). Appellant respectfully disagrees. It is unclear how the use of a conveyor belt implies that, contrary to the usual practice in the art, fabrication and sealing of the MEMS taught by Carley are *necessarily* being performed in the same facility as claimed.

Clearly, the final Office Action and Answer have not established that Yokayama "*necessarily*" teaches one of skill in the art the claimed fabrication of a MEMS and sealing of an opening in the MEMS in the same fabrication facility. For at least this additional reason, no *prima facie* case of unpatentability as to claim 26 has yet been made.

The Supreme Court recently addressed the issue of obviousness in *KSR Int'l Co. v. Teleflex Inc.*, 127 S.Ct. 1727 (2007). The Court stated that the *Graham v. John Deere Co. of Kansas City*, 383, U.S. 1 (1966), factors still control an obviousness inquiry. Under the analysis required by *Graham v. John Deere*, 383 U.S. 1 (1966) to support a rejection under § 103, the scope and content of the prior art must first be determined, followed by an assessment of the differences between the prior art and the claim at issue in view of the ordinary skill in the art.

In the present case, the scope and content of the prior art, as evidenced by Carley and Yokoyama, clearly did not include the claimed method 26 including "at said fabrication facility, *successively depositing and etching a sealing material to seal an opening in said MEMS*." (Emphasis added). Moreover, Carley and Yokoyama have not been shown to necessarily teach or suggest the claimed fabrication of a MEMS and sealing of an opening in the MEMS in the same fabrication facility.

These differences between the cited prior art and claimed subject matter are significant because the technique discovered and disclosed by Applicant, and its advantages, were not available in the cited prior art. Consequently, the cited prior art will not support a rejection of claim 26 under 35 U.S.C. § 103 and *Graham*.

(4) Claims 29 and 31 are patentable over Carley, Yokoyama and Onose:

This rejection should not be sustained for at least the same reasons given above in favor of the patentability of claim 26.

(5) Claims 37 and 38 are patentable over Carley and Colgan:

Claim 37 recites:

> A method of forming a micro-electromechanical system (MEMS) comprising a Digital Light Device (DLD), said method comprising:
> forming a cavity in a material;
> forming a pixel plate and a bottom capacitor plate of said DLD in said cavity; and
> successively depositing and etching a sealing material to seal an opening into said cavity.

In contrast, as demonstrated above with regard to claim 1, Carley does not teach or suggest a method including "*successively depositing and etching a sealing material to seal an*

opening into [a MEMS] cavity." Carley only teaches depositing, *without etching*, a single seal layer (26) to seal the holes (20) into a MEMS cavity (22) containing the MEMS microstructure (14). (Carley, col. 5, lines 21-22). Consequently, Carley clearly does not teach or suggest the claimed method of claim 37 including "successively depositing and etching a sealing material to seal an opening into said cavity." There is no such teaching or suggestion in Carley.

The teachings of Colgan do not remedy this demonstrated deficiency of Carley. Moreover, the Answer does not argue that Colgan teaches or suggests this subject matter, relying solely on the misreading of Carley addressed above.

Under the analysis required by *Graham v. John Deere*, 383 U.S. 1 (1966) to support a rejection under § 103, the scope and content of the prior art must first be determined, followed by an assessment of the differences between the prior art and the claim at issue in view of the ordinary skill in the art. In the present case, the scope and content of the prior art, as evidenced by Carley and Colgan, clearly did not include the claimed method 37 including "successively depositing and etching a sealing material to seal an opening into said cavity." This difference between the cited prior art and claimed subject matter is significant because the technique discovered and disclosed by Applicant, and its advantages, were not available in the cited prior art. Consequently, the cited prior art will not support a rejection of claim 37 under 35 U.S.C. § 103 and *Graham*.

In view of the foregoing, it is submitted that the final rejection of the pending claims is improper and should not be sustained. Therefore, a reversal of the Rejection of September 22, 2008 is respectfully requested.

Respectfully submitted,

DATE: June 5, 2009

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Electronic Acknowledgement Receipt

EFS ID:	5467435
Application Number:	10703762
International Application Number:	
Confirmation Number:	2716
Title of Invention:	Sealing openings in micro-electromechanical systems
First Named Inventor/Applicant Name:	Jennifer Shih
Customer Number:	22879
Filer:	Steven L. Nichols/Rebecca Schow
Filer Authorized By:	Steven L. Nichols
Attorney Docket Number:	200313797
Receipt Date:	05-JUN-2009
Filing Date:	07-NOV-2003
Time Stamp:	18:59:12
Application Type:	Utility under 35 USC 111(a)

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New International Application Filed with the USPTO as a Receiving Office

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10/703,762	11/07/2003	Jennifer Shih	200313797	2716

22879 7590 04/06/2009

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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/703,762
Filing Date: November 07, 2003
Appellant(s): SHIH ET AL.

Steven L. Nichols
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed on 14 January 2009 appealing from the Office action mailed on 22 September 2008.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

No amendment after final has been filed.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

7,008,812 B1	Carley	Mar. 2006
2002/0157475 A1	Onose et al.	Oct. 2002
6,099,598	Yokoyama et al.	Aug. 2000
6,323,834 B1	Colgan et al.	Nov. 2001

(9) Grounds of Rejection

The following grounds of rejection are applicable to the appealed claims:

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 3, 5, 11-14, 16, 18, 24-25 are rejected under 35 U.S.C. 102(e) as being anticipated by Carley (US 7,008,812 B1).

Referring to Figs. 1-9 and column 3, line 20 to column 5, line 47, Carley discloses a method of manufacturing a MEMS structure (14) that includes forming holes (20) in a first seal layer (18) to facilitate the removal of sacrificial layers (12, 16) and thereby forming a cavity (22) around the MEMS structure (14) as shown in Figs. 6-7. A second seal layer (26) is then applied over the first seal layer (18) to seal the holes (20) as shown in Fig. 8 and as described in column 5, lines 21-22. When the second seal layer (26) is an insulator, a portion can be etched to expose an underlying contact pad (6) as shown in Fig. 9 and as described in column 5, lines 24-27.

These are all of the limitations as set forth in claims 1, 13 of the appellant's invention.

Regarding claims 3, 16, the etching of the second seal layer (26) to expose the contact pad (6) as shown in Fig. 9B is clearly a vertical etch, which implies that it is anisotropically etched.

Regarding claims 5, 18, the seal layers (18, 26) can be insulators (i.e. dielectric material) as described in column 4, lines 44-47.

Regarding claims 11-12, 24-25, the second sealing layer (26) in combination with an underlying silicon nitride layer (4) completely encloses the MEMS structure (14), as shown in Fig. 9, and is therefore capable of functioning as a passivation layer as well as capable of hermetically sealing the holes (20).

Regarding claim 14, the sacrificial layers (12, 16) are removed by an etching process, as described in column 4, line 65 to column 5, line 10, which is impliedly

isotropic because the formation of the cavity (22) clearly involves undercutting of the first seal layer (18) as shown in Fig. 7C.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 4, 6, 17, 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Carley (US 7,008,812 B1) as applied to claims 1, 5, 13, 18 above, respectively, and further in view of Onose et al. (US 2002/0157475 A1).

As shown above, Carley anticipates claims 1, 5, 13, 18 of the appellant's invention. However, Carley lacks the further limitation to claims 1, 13 as set forth in claims 4, 17, respectively, which is to deposit the sealing material by chemical vapor deposition (CVD). Also, Carley lacks the further limitation to claims 5, 18 as set forth in claims 6, 19, respectively, which is to deposit a sealing material that includes depositing oxide. Onose et al. teach that CVD oxide can be used as a hermetic sealing material (see paragraph [0038]).

Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to combine the teachings of Carley and Onose et al. in order to use CVD oxide, as taught by Onose et al., as the sealing material for Carley's

method because Onose et al. recognize that CVD oxide can be used in hermetic sealing applications.

Claims 26, 28, 30, 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Carley (US 7,008,812 B1) in view of Yokoyama et al. (US 6,099,598).

Referring to Figs. 1-9 and column 3, line 20 to column 5, line 47, Carley discloses a method of manufacturing a MEMS structure (14) that includes forming holes (20) in a first seal layer (18) to facilitate the removal of sacrificial layers (12, 16) and thereby forming a cavity (22) around the MEMS structure (14) as shown in Figs. 6-7. A second seal layer (26) is then applied over the first seal layer (18) to seal the holes (20) as shown in Fig. 8 and as described in column 5, lines 21-22. When the second seal layer (26) is an insulator, a portion can be etched to expose an underlying contact pad (6) as shown in Fig. 9 and as described in column 5, lines 24-27. These are limitations as set forth in claim 26 of the appellant's invention.

Regarding claim 28, the etching of the second seal layer (26) to expose the contact pad (6) as shown in Fig. 9B is clearly a vertical etch, which implies that it is anisotropically etched.

Regarding claim 30, the seal layers (18, 26) can be insulators (i.e. dielectric material) as described in column 4, lines 44-47.

Regarding claim 36, the second sealing layer (26) in combination with an underlying silicon nitride layer (4) completely encloses the MEMS structure (14), as

shown in Fig. 9, and is therefore capable of functioning as a passivation layer as well as capable of hermetically sealing the holes (20).

However, Carley does not expressly indicate that the fabrication of the MEMS structure along with the sealing of the opening are performed at the same fabrication facility, which is a requirement of claim 26.

Referring to Fig. 1 and column 13, lines 1-12, Yokoyama et al. teach a fabrication system that is capable of performing all of the process steps used by Carley to manufacture his MEMS structure (for example, metal deposition, insulator deposition, lithography, metal etching, and insulator etching). The various apparatuses (102, 103, 104, 106, 107) used to perform these processes are connected to each other by a transporter (101), which implies that the entire fabrication system is housed within the same fabrication facility.

Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to combine the teachings of Carley and Yokoyama et al. in order to use the fabrication system of Yokoyama et al. for performing the various process steps of Carley's method for fabricating MEMS structures. Yokoyama et al. recognize that their fabrication system advantageously simplifies the scheduling of the various process steps (see abstract).

Claims 29, 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Carley (US 7,008,812 B1) and Yokoyama et al. (US 6,099,598) as applied to claims 26, 30 above, respectively, and further in view of Onose et al. (US 2002/0157475 A1).

As shown above, the combination of Carley and Yokoyama et al. has all of the limitations as set forth in claims 26, 30 of the appellant's invention. However, Carley lacks the further limitation to claim 29 as set forth in claim 26, which is to deposit the sealing material by chemical vapor deposition (CVD). Also, Carley lacks the further limitation to claim 30 as set forth in claims 31, which is to deposit a sealing material that includes depositing oxide. Onose et al. teach that CVD oxide can be used as a hermetic sealing material (see paragraph [0038]).

Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to combine the teachings of Carley, Yokoyama et al., and Onose et al. in order to use CVD oxide, as taught by Onose et al., as the sealing material for Carley's method because Onose et al. recognize that CVD oxide can be used in hermetic sealing applications.

Claims 37-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Carley (US 7,008,812 B1) in view of Colgan et al. (US 6,323,834 B1).

Referring to Figs. 1-9 and column 3, line 20 to column 5, line 47, Carley discloses a method of manufacturing a MEMS structure (14) that includes forming holes (20) in a first seal layer (18) to facilitate the removal of sacrificial layers (12, 16) and thereby forming a cavity (22) around the MEMS structure (14) as shown in Figs. 6-7. A second seal layer (26) is then applied over the first seal layer (18) to seal the holes (20) as shown in Fig. 8 and as described in column 5, lines 21-22. When the second seal layer (26) is an insulator, a portion can be etched to expose an underlying contact pad (6) as

shown in Fig. 9 and as described in column 5, lines 24-27. These are limitations as set forth in claim 37 of the appellant's invention.

Regarding claim 38, the sacrificial layers (12, 16) are removed by an etching process, as described in column 4, line 65 to column 5, line 10, which is impliedly isotropic because the formation of the cavity (22) clearly involves undercutting of the first seal layer (18) as shown in Fig. 7C.

However, Carley lacks the steps of forming a pixel plate and a bottom capacitor plate in the cavity, which are limitations of claim 37.

Referring to Figs. 23-31 and column 12, line 38 to column 13, line 38, Colgan et al. teach a MEMS structure that features a pixel with a deformable mirror (218 in Fig. 29) and a plated metal layer (206 in Figs. 30-31) that corresponds to a portion of a capacitor (207). The MEMS structure can be sealed within a cavity (also see Figs. 20-21 and column 12, lines 4-22).

Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to combine the teachings of Carley and Colgan et al. in order to use the fabrication method of Carley for sealing the MEMS structure of Colgan et al. because Carley recognizes that his method is applicable to the release of a wide variety of encapsulated microstructures (see column 3, lines 20-23), and the MEMS structure taught by Colgan et al. is one such microstructure that utilizes a deformable mirror for selectively reflecting light (see column 7, lines 41-61).

(10) Response to Argument

Claims 1, 3, 5, 11-14, 16, 18, 24-25 are anticipated by Carley (US 7,008,812 B1).

Regarding independent claim 1, the appellant argues that Carley lacks the claim requirements of "successively depositing and etching a sealing material to seal an opening in said MEMS". However, as indicated above and referring to Figs. 7-9, Carley applies a seal layer (26) to seal holes (20), thereby effectively sealing a MEMS structure (14) in a cavity (22), and then etch the seal layer (26) to expose a contact pad (6). The appellant dismisses this reasoning as being irrelevant to the claimed method as set forth in claim 1. The examiner disagrees because claim 1 is open to embodiments that feature depositing one layer of sealing material to seal a MEMS and successively etching the sealing material provided that the MEMS remains sealed. The embodiment taught by Carley includes applying the seal layer (26) and, in a successive step, etching the seal layer (26) to expose the contact pad (6) without breaking the seal that protects the MEMS structure (14) (i.e. the MEMS structure (14) remains sealed). Accordingly, Carley anticipates the claim requirement of "successively depositing and etching a sealing material to seal an opening in said MEMS".

Regarding independent claim 13, the appellant argues that Carley lacks the claim requirements of "successively depositing and etching a sealing material to seal an opening into said cavity". The examiner disagrees for the same reasons indicated above with regards to claim 1. The appellant further argues that Carley lacks the claim

limitations as set forth in claim 13 of “forming a cavity in a material” and “forming components of said MEMS in said cavity”. The examiner disagrees because claim 13 does not require the cavity to be formed prior to the step of forming the components of the MEMS in the cavity. The method taught by Carley includes the removal of sacrificial layers (12, 16) to form a cavity (22) in a layer (18) and to simultaneously form a MEMS structure (14) in the cavity (22) as shown in Figs. 6-7. Note that it is considered that the MEMS structure (14) is not "formed" until the sacrificial material (12), located below the structure (14), is removed. The MEMS structure must be able to move vertically before it can operate as intended (see col. 5, lines 11-14). Therefore, prior to that material removal, structure (14) it is not yet a MEMS component. Accordingly, Carley anticipates the claim limitations of “forming a cavity in a material” and “forming components of said MEMS in said cavity” because claim 13 is open to embodiments that perform these steps simultaneously.

Claims 4, 6, 17, 19 are unpatentable over Carley (US 7,008,812 B1) as applied to claims 1, 5, 13, 18 above, respectively, and further in view of Onose et al. (US 2002/0157475 A1).

Regarding dependent claims 4, 6, 17, 19, the appellant argues that these claims are patentable for the same reasons given above with respect to independent claims 1, 13. The examiner disagrees because, as indicated above, Carley anticipates the claim requirements as set forth in independent claims 1, 13 of “successively depositing and etching a sealing material to seal an opening in said MEMS”, and Carley further

anticipates the claim limitations as set forth in claim 13 of "forming a cavity in a material" and "forming components of said MEMS in said cavity".

Claims 26, 28, 30, 36 are unpatentable over Carley (US 7,008,812 B1) in view of Yokoyama et al. (US 6,099,598).

Regarding independent claim 26, the appellant argues that the combination of Carley and Yokoyama et al. lack the claim requirements of "successively depositing and etching a sealing material to seal an opening in said MEMS". The examiner disagrees for the same reasons indicated above, with regards to independent claims 1, 13, because it has been shown that Carley discloses an embodiment that includes these claim requirements. The appellant further argues that the combination of Carley and Yokoyama et al. lack the claim requirement as set forth in independent claim 26 of fabricating the MEMS and sealing an opening in the MEMS at the same fabrication facility. However, as indicated above, the use of the transporter (101), as taught by Yokoyama et al., within the same fabrication facility is implicit to the combination of Carley and Yokoyama et al. because Yokoyama et al. are completely silent with respect to the need or requirement for more than one facility to contain their fabrication system. It is further noted that the transporter (101) specifically disclosed by Yokoyama et al. is an oval-shaped conveyor belt with a circumference of 60 meters as indicated in column 13, lines 31-35, which would also imply the use of the same fabrication facility (e.g. the same factory, the same plant, the same worksite, the same mailing address, etc.).

Claims 29, 31 are unpatentable over Carley (US 7,008,812 B1) and Yokoyama et al. (US 6,099,598) as applied to claims 26, 30 above, respectively, and further in view of Onose et al. (US 2002/0157475 A1).

Regarding dependent claims 29, 31, the appellant argues that these claims are patentable for the same reasons given above with respect to independent claim 26. The examiner disagrees because, as shown above, the combination of Carley and Yokoyama et al. has all of the claim limitations as set forth in independent claim 26.

Claims 37-38 are unpatentable over Carley (US 7,008,812 B1) in view of Colgan et al. (US 6,323,834 B1).

Regarding independent claim 37, the appellant argues that the combination of Carley and Colgan et al. lack the claim requirements of "successively depositing and etching a sealing material to seal an opening into said cavity". The examiner disagrees for the same reasons indicated above, with regards to independent claims 1, 13, 26, because it has been shown that Carley discloses an embodiment that includes these claim requirements.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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