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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte MICHAEL T. BRIGHAM,
CHRISTOPHER V. JAHNES, CAMERON E. LUCE,
JEFFREY C. MALING, WILLIAM J. MURPHY,
ANTHONY K. STAMPER, and ERIC J. WHITE

Appeal 2018-006489
Application 14/837,024
Technology Center 2800

Before ADRIENE LEPIANE HANLON, MICHAEL P. COLAIANNI, and
BRIAN D. RANGE, *Administrative Patent Judges*.

HANLON, *Administrative Patent Judge*.

DECISION ON APPEAL

A. STATEMENT OF THE CASE

The Appellant¹ filed an appeal under 35 U.S.C. § 134(a) from an Examiner's decision finally rejecting claims 1–4 and 7–20 under 35 U.S.C. § 102(a)(1) as

¹ We use the word “Appellant” to refer to “applicant” as defined in 37 C.F.R. § 1.42. Appellant identifies the real party in interest as International Business Machines Corporation. Appeal Brief dated February 7, 2018 (“App. Br.”), at 2.

anticipated by or, in the alternative, under 35 U.S.C. § 103 as obvious over Dang et al.^{2,3} We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

The claims on appeal are directed to a structure comprising a cavity and a cantilevered beam formed within the cavity, wherein an upper cavity portion is formed over the cantilevered beam. A lid is formed over the upper cavity portion and includes at least two vent holes. The cantilevered beam also includes a recess.

The cavity and the recess are formed by removing tungsten material and silicon material through a venting process. The first and second vents holes are located directly over the silicon material and the tungsten material, respectively. During the venting process, all of the tungsten material and all of the silicon material are removed. *See, e.g.*, Spec. ¶ 69 (disclosing that “all or substantially all of the tungsten material is removed or vented, prior to the all of silicon material being removed”).

Claim 1, the sole independent claim on appeal, is reproduced below from the Claims Appendix to the Appeal Brief.

1. A structure, comprising a cavity and a cantilevered beam formed within the cavity including an upper cavity portion formed over the cantilevered beam, the cantilevered beam including a recess, wherein *the cavity and the recess are formed by removal of tungsten material and silicon material*, which are located in different regions of the upper cavity portion from one another, *through a venting process*, further comprising a lid formed over the upper cavity portion, the lid including at least two vent holes, wherein a first of the at least two vent holes is located to be directly over the *silicon material* formed in the upper cavity portion above the cantilevered beam structure *which*

² US 2011/0315527 A1, published December 29, 2011 (“Dang”).

³ The final rejection of claim 18 under 35 U.S.C. § 112(b) was withdrawn in the Advisory Action dated November 24, 2017.

is removed through the venting process and a second of the at least two vent holes is located to be directly over *the tungsten material* formed in the upper cavity portion above the cantilevered beam structure *which is removed through the venting process*, wherein the tungsten material and the silicon material are located relative to one another and to the respective at least two vent holes so that substantially all of the tungsten material is removed prior to removal of the silicon material.

App. Br. 15 (emphasis added).

B. DISCUSSION

1. Claims 1–4, 7–9, 12, 13, 15–17, 19, and 20

“In order to be patentable, a product must be novel, useful and unobvious. In our law, this is true whether the product is claimed by describing it, or by listing the process steps used to obtain it.” *In re Brown*, 459 F.2d 531, 535 (CCPA 1972). Thus, “it is the patentability of the *product* claimed and *not* of the recited process steps which must be established.” *Id*; *see also In re Thorpe*, 777 F.2d 695, 697 (Fed. Cir. 1985) (“If the product in a product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process.”).

“Where a product-by-process claim is rejected over a prior art product that appears to be identical, although produced by a different process, the burden is upon the applicants to come forward with evidence establishing an unobvious difference between the claimed product and the prior art product.” *In re Marosi*, 710 F.2d 799, 803 (Fed. Cir. 1983).

In this case, independent claim 1 is written in product-by-process format. *See* Final Act. 3.⁴ The Examiner concludes that “the claimed product is a MEMS cantilever beam with cavities above and below the cantilever beam and a lid

⁴ Final Office Action dated September 8, 2017.

covering the MEMS beam structure wherein the lid comprises at least two vent holes.” Final Act. 3. The Examiner finds Dang describes the claimed product. Final Act. 4 (referring to Dang Figs. 21A and 21B); Ans. 4⁵ (comparing Appellant’s Figure 5 with Dang Figure 22).

There is no dispute on appeal that Dang’s product is produced by a different process from the claimed product. *See* Ans. 3 (finding that “Dang does not form both tungsten and silicon in the upper cavity prior to sequentially removing these sacrificial materials”). Nonetheless, the Examiner finds that the Appellant’s process for forming a cavity free of tungsten and silicon does not structurally distinguish the claimed product from the product described in Dang which also has a cavity free of tungsten and silicon. *See* Final Act. 4–5; *see also* Final Act. 8 (finding that “[a] product free of tungsten may be anticipated by a product never having any tungsten in the first place, or a product that once had tungsten which was then removed since each still result in a product free of tungsten”).

In an attempt to distinguish the claimed product from the product described in Dang, the Appellant argues that “claim 1 recites where two different vent holes are located in the structure, based upon the respective locations of the silicon material and the tungsten material filled in the upper cavity *before venting*.” App. Br. 4 (emphasis added). Claim 1, however, is directed to the product formed *after* the tungsten and the silicon are removed through a venting process. Thus, basing the vent hole locations on the locations of materials that are absent from the claimed product does not structurally distinguish the claimed product from the product described in Dang which also describes vent holes over a cavity. *See* Ans.

⁵ Examiner’s Answer dated April 9, 2018.

4 (“basing [the locations of the vent holes] on sacrificial elements that are not present in the final structure relates to process limitations”).

The Appellant also argues that “the use of tungsten actually results in improvements in the product itself relative to structures such as Dang’s which do not use tungsten in the manufacturing process.” App. Br. 7 (emphasis omitted). For support, the Appellant relies on paragraphs 20, 21, and 28–34 of the Specification.

The Appellant discloses that “the present invention relates to a MEMS structure fabricated using a hybrid tungsten and silicon cavity layers where the tungsten and silicon layers are formed in separate steps.” Spec. ¶ 19.

The Appellant discloses:

Advantageously, using tungsten provides for a more planar MEMS lid topology, e.g., planar MEMS cavity formation. The planar MEMS cavities will reduce fabrication issues including, for example, lithographic depth of focus variability and packaging reliability due to dielectric cracking. The combination of tungsten and silicon material can reduce or eliminate lid pinning or rubbing, as well as the need for increased contact forces.

Spec. ¶ 20.

The Appellant discloses that “[i]t has been found that *the use of tungsten material, alone*, for the formation of cavity structures has several disadvantages [such as] tungsten adhesion, high wafer bow due to very high tensile stress of CVD tungsten, and venting problems using XeF₂.” Spec. ¶ 21 (emphasis added).

Significantly, the portions of the Specification relied on by the Appellant do not make any comparison between the Appellant’s MEMS structure and a MEMS structure that uses silicon, alone, for the formation of cavity structures, as in Dang. See Ans. 5 (finding that “Appellant’s specification makes no references or comparisons to Dang”). Notably, the Appellant argues that the statements made in

paragraphs 20, 21, and 28–34 “are based on studies by the inventors of products, such as Dang’s, which are produced without using both tungsten and silicon.” App. Br. 9. The Specification, however, does not identify any studies by the inventors, and the Appellant, in the briefs on appeal, does not provide evidence of any studies. *See In re Schulze*, 346 F.2d 600, 602 (CCPA 1965) (“Argument in the brief does not take the place of evidence in the record.”).

In sum, a preponderance of the evidence of record supports the Examiner’s finding of anticipation as to claim 1. The Appellant does not present arguments in support of the separate patentability of any of dependent claims 2–4, 7–9, 12, 13, 15–17, 19, and 20. Therefore, the anticipation rejection of claims 1–4, 7–9, 12, 13, 15–17, 19, and 20 based on Dang is sustained.

“[A] disclosure that anticipates under § 102 also renders the claim invalid under § 103, for ‘anticipation is the epitome of obviousness.’” *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 1548 (Fed. Cir. 1983) (quoting *In re Fracalossi*, 681 F.2d 792 (CCPA 1982)). For that reason, the obviousness rejection of claims 1–4, 7–9, 12, 13, 15–17, 19, and 20 based on Dang also is sustained.

2. Claim 10

Claim 10 recites that “the lid has a thickness of about 3 μ m.” App. Br. 16. The Examiner finds Dang discloses a lid having a thickness of about 3 μ m. Final Act. 5 (citing Dang ¶ 78). The Appellant does not direct us to any error in the Examiner’s finding. *See* App. Br. 12. Therefore, the anticipation and the obviousness rejections of claim 10 are sustained.

3. Claim 11

Claim 11 recites that “the second one of the at least two vent holes is separated from the first one of the at least two vent holes by at least 6 μ m.” App. Br. 16.

The Examiner finds “Dang lacks explicit details of the spacing between at least two vent holes (58) being at least 6 μm .” Final Act. 5. Therefore, the anticipation rejection of claim 11 is not sustained.

As for obviousness, the Examiner finds Dang Figure 21B shows a plurality of vent holes (58) formed inside and outside cavity vias (48). Final Act. 5. The Examiner finds Dang discloses that the vent holes should be placed at a distance of at least 5 μm or greater from the vias (48). Final Act. 5 (citing Dang ¶ 86). Therefore, the Examiner concludes that “it is obvious when forming a plurality of vent holes according to Dang, that at least two [vent holes] will be separated by at least 6 μm ” as recited in claim 11. Final Act. 5; *see also* Ans. 8. That is, the range disclosed in Dang (i.e., “greater than 5 microns”⁶) encompasses the claimed range (i.e., “at least 6 μm ”) and renders the claimed range obvious. *See In re Peterson*, 315 F.2d 1325, 1329 (Fed. Cir. 2003) (a prima facie case of obviousness exists where the claimed ranges overlap the ranges disclosed in the prior art).

The Appellant does not direct us to any evidence to the contrary. *See* App. Br. 13. Therefore, the obviousness rejection of claim 11 is sustained.

4. Claim 14

Claim 14 recites that “the lid has a thickness of 5 μm or more.” App. Br. 16. The Examiner finds “Dang lacks explicit details of the lid (54) having a thickness of 5 μm or more.” Final Act. 5. Therefore, the anticipation rejection of claim 14 is not sustained.

As for obviousness, the Examiner finds that the lid disclosed in Dang has a thickness of about 3 μm .⁷ Final Act. 5 (citing Dang ¶ 78). The Examiner finds

⁶ Dang ¶ 86.

⁷ In the Reply Brief, the Appellant argues for the first time on appeal that Dang paragraph 78 discloses the thickness of the lid before venting and “the venting

Dang discloses that the thickness of the lid may also include a thickness of oxide (52). Final Act. 5 (citing Dang ¶ 74); *see also* Dang ¶ 78 (disclosing that if oxide layer 52 is not removed, then the total oxide thickness of layers 52 and 54 would determine the lid thickness). Dang discloses that layer 52 can be deposited to a thickness of about 5 μm . Dang ¶ 74. Therefore, the Examiner concludes that the lid thickness recited in claim 14 would have been obvious. Final Act. 5.

The Appellant does not direct us to any evidence to the contrary. *See* App. Br. 13. Therefore, the obviousness rejection of claim 14 is sustained.

5. Claim 18

Claim 18 recites “[t]he structure of claim 17,^[8] which is an intermediate structure, wherein the upper cavity portion is formed over an entire upper surface of the cantilevered beam and over the recess.” App. Br. 16.

The Appellant argues:

[I]ndependent claim 1 specifically recites a locational relationship between the first and second vent holes and the silicon material and the tungsten material, respectively. Therefore, it is respectfully submitted that dependent claim 18, reciting the structure as an intermediate structure, is reasonably interpreted as being directed to the structure in this intermediate form with the silicon material on [sic, and] the tungsten material still present, prior to the venting of these materials.

App. Br. 10.

operation would reduce the thickness in Dang.” Reply Brief dated June 11, 2018 (“Reply Br.”), at 13. The Appellant does not direct us to any evidence to support the argument. Nonetheless, the argument is not timely and will not be considered on appeal. 37 C.F.R. § 41.41(b)(2) (2019).

⁸ Claim 17 depends from claim 16, and claim 16 depends from claim 1. App. Br. 16.

The Appellant’s argument is not persuasive of reversible error. To the extent that claim 18 further limits claim 1 by characterizing the claimed “structure” as “an intermediate structure,” that intermediate structure includes an upper cavity portion and a recess formed by removal of tungsten material and silicon material as recited in claim 1. *See* Ans. 7 (“Referring to the claimed structure as an *intermediate* structure in claim 18 does not change the fact that these materials are not present in the final product according to independent claim 1.”). As correctly found by the Examiner, Dang also describes a cavity and a recess that do not contain tungsten and silicon as recited in claim 1.

The anticipation and obviousness rejections of claim 18 based on Dang are sustained.

C. CONCLUSION

The Examiner’s decision is affirmed.

Claims Rejected	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
1–4, 7–20	102(a)(1)	Dang	1–4, 7–10, 12, 13, 15–20	11, 14
1–4, 7–20	103	Dang	1–4, 7–20	
Overall Outcome			1–4, 7–20	

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED