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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte YANGYANG SUN, RANDALL S. PARKER, JASPREET S. GANDHI, and JIN LI

Appeal 2019-003007
Application 13/478,010
Technology Center 2800

Before MONTÉ T. SQUIRE, DEBRA L. DENNETT, and MERRELL C. CASHION, JR., *Administrative Patent Judges*.

CASHION, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

Pursuant to 35 U.S.C. § 134(a), Appellant[1] appeals from the Examiner's decision to reject claims 1, 2, 5–7, 16, 27, and 28. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

The invention relates to semiconductor constructions. Spec. ¶ 1. The invention seeks to develop new methods of forming connections to through-substrate interconnects and to develop new through-substrate interconnect architectures to address problems encountered during formation

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[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 Micron Technology, Inc. Appeal Br. 3.

of connections to through-substrate interconnects. *Id.* ¶ 5. Claim 1 is illustrative of the subject matter claimed and is reproduced below:

1. A semiconductor construction comprising:

an electrically conductive post consisting of one or more electrically conductive compositions, the conductive post extending vertically through a semiconductor die; the conductive post having an electrically conductive upper surface above a backside surface of the die, and having an electrically conductive vertical sidewall surface extending between the backside surface and the electrically conductive upper surface;

a photosensitive material over and in physical contact with the backside surface; the photosensitive material having a first portion having a first thickness with an elevationally uppermost surface and having an opening encircling the conductive post, a second portion of the photosensitive material being directly against and along the electrically conductive sidewall surface and having a second thickness;

a first electrically conductive material directly against the electrically conductive upper surface of the conductive post; the electrically conductive material being configured as a cap over the conductive post; the cap having an edge that extends laterally outwardly beyond the conductive post and encircles the conductive post within the opening; an entirety of the edge being directly over the second portion of photosensitive material; and

a second electrically conductive material over the first conductive material and extending within the opening, at least one of the first and second electrically conductive materials comprising copper; and

a third electrically conductive material over the second conductive material and extending into the opening, the third conductive material comprising one or both of nickel and palladium.

Independent claim 16 recites a semiconductor construction similar to the one recited by the subject matter of claim 1 but including additional features.

Appellant requests review of the Examiner's rejection of claims 1, 2, 5–7, 16, 27, and 28 rejected under pre-AIA 35 U.S.C. § 103(a) as unpatentable over Pratt (US 2009/0032960 A1, published February 9, 2009), Gaul (US 5,618,752, issued April 8, 1997), and Cheng (US 8,466,553 B2, issued June 18, 2013). Appeal Br. 8; Final Act. 3.

Appellant argues independent claims 1 and 16 together and presents separate arguments for dependent claim 6. *See generally* Appeal Br. Accordingly, we select claim 1 as representative of the subject matter claimed and decide the appeal as to the rejection of claims 1, 2, 5, 7, 16, 27, and 28 based on the arguments presented for claim 1. We address claim 6 separately.

OPINION

After review of the respective positions the Appellant presents in the Appeal and Reply Briefs, and the Examiner presents in the Final Action and Answer, we AFFIRM the Examiner's prior art rejection of claims 1, 2, 5–7, 16, 27, and 28 under 35 U.S.C. § 103(a) for the reasons the Examiner presents. We add the following for emphasis.

Claim 1

Claim 1 is directed to a semiconductor construction comprising an electrically conductive post having a cap comprising three layers of electrically conductive materials.

The Examiner finds that Pratt teaches a semiconductor construction comprising an electrically conductive post surrounded by a photosensitive material that differs from the claimed invention in that Pratt does not disclose placing a cap comprising three layers of electrically conductive materials at the exposed end of the electrically conductive post. Final Act. 3–4; Pratt Figures 1, 2F. The Examiner finds Gaul teaches that it is known to cover an electrical post with a cap comprising two layers of electrically conductive material having the structure for claimed first and second electrically conductive materials. Final Act. 4; Gaul Figure 20, col. 5, ll. 25–67, col. 6, ll. 58–67. The Examiner further finds that Cheng teaches that it is known to apply a cap to an electrically conductive post comprising three layers of electrically conductive material. Final Act. 5; Cheng Figure 24, col. 5, ll. 30–47. The Examiner determines that it would have been obvious to one of ordinary skill in the art to use the cap of Gaul, modified to have a third layer of electrically conductive material, in the invention of Pratt because Gaul teaches the cap as a conventional means to extend electrically conductive posts in semiconductor constructions. Final Act. 4–5.

Appellant argues that materials of Gaul's cap do not extend into any opening. Appeal Br. 12. Appellant further "contends that even if the capping materials of Gaul were utilized in conjunction with the configuration disclosed by Pratt, it would not necessarily result in both

capping materials being within the depression around the conductive post" because "Pratt teaches that the openings . . . are very small." *Id.* Appellant additionally argues that Pratt does not disclose the thickness ranges for the thickness T or opening depth of the dielectric material while Gaul discloses the thickness of barrier/adhesion material is 1000 angstroms. *Id.* However, Appellant asserts that the cited art does not suggest that even the barrier/adhesion material of Gaul alone would fit within opening 132 of Pratt. *Id.* That is, Appellant argues that the teachings of the cited art cannot be physically combined.

Appellant's arguments do not point to error in the Examiner's determination of obviousness. It is well established that the obviousness inquiry does not ask "whether the references could be physically combined but whether the claimed inventions are rendered obvious by the teachings of the prior art as a whole." *In re Etter*, 756 F.2d 852, 859 (Fed. Cir. 1985) (en banc); *see also In re Keller*, 642 F.2d 413, 425 (CCPA 1981) (stating "[t]he test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference"). "[T]he test [for obviousness] is what the combined teachings of the references would have suggested to those of ordinary skill in the art." *Keller*, 642 F.2d at 425–26.

As the Examiner notes (Final Act., 4; Ans. 3), Gaul recognizes the use of a metallic cap (solder bump interconnection) on electrically conductive pads as a known technique for surface mounting dies on printed circuit boards. Gaul col. 1, ll. 35–45; *see also id.* at col. 8, ll. 6–28. Given this disclosure, Appellant has not explained adequately why one skilled in the art, using no more than ordinary creativity, would not have been capable of

adapting Gaul's cap to fit within Pratt's opening for application to Pratt's post. *See KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007) ("A person of ordinary skill is also a person of ordinary creativity, not an automaton."); *see also In re Sovish*, 769 F.2d 738, 743 (Fed. Cir. 1985) (presuming skill on the part of one of ordinary skill in the art). Therefore, we agree with the Examiner that one skilled in the art would have been able to scale the sizing of the cap to fit the specific application. Ans. 3.

With respect to Cheng, Appellant argues that, while Cheng teaches a cap comprising three metallic layers, Cheng removes the photosensitive material after forming under ball metals (UMBs) such that that the final construction of Cheng does not contain openings in photosensitive material and, thus, the cap is not within any opening. Appeal Br. 13; Cheng Figure 24, col. 4, ll. 45–48.

The argument is unpersuasive of reversible error in the Examiner's determination of obviousness.

As the Examiner explains, Cheng is relied upon to teach the use of a third conductive material in making a three layered cap while Pratt is relied upon for the teaching of an opening in a photosensitive material around a post. Ans. 14. Therefore, Appellant's argument does not address the Examiner's reasons for combining the cited art.

Claim 6

Claim 6 recites that the semiconductor construction has a photosensitive material comprising one or more materials selected from the group consisting of siloxane-containing materials, epoxy acrylate-containing

materials, polyimide-containing materials, and poly(benzoxazole)-containing materials.

The Examiner determines that, while Pratt does not teach the claimed photosensitive material, the claimed materials are conventionally known and used photosensitive materials and it would have been obvious to one of ordinary skill in the art at the time of the invention to use them in the invention of Pratt. Final Act. 5–6. In the Answer, the Examiner cites a number of evidentiary references to support the assertion that the recited photosensitive materials are known and conventional. For example, the Examiner relies on Sir (US 7,365,007 B2, issued Apr. 29, 2008) as disclosing the use of a photosensitive epoxy acrylate to form an interconnect opening. Ans. 5; Sir col. 4, ll. 5–12.

In the Reply Brief, Appellant argues that Sir's material does not contact sidewalls of a conductive post or the backside surface of a die as required by the present claims. Reply Br. 4.

Appellant's arguments do not identify reversible error in the Examiner's determination of obviousness.

The Examiner relies on Sir for the teaching that an epoxy acrylate as a conventional dielectric material for semiconductor constructions. Ans. 5–6; Sir col. 3, l. 65–col. 4, l. 12. As the Examiner notes, Pratt provides the teaching of how the photosensitive material is used in a particular semiconductor construction. Ans. 5.

Given that the Specification discloses that the photosensitive material may comprise any suitable composition (Spec. ¶ 25), Appellant has not explained adequately why one skilled in the art would not have found Sir's

photosensitive material suitable as a photosensitive material for Pratt's semiconductor construction in view of Sir's disclosure.

Accordingly, we affirm the Examiner's prior art rejection of claims 1, 2, 5–7, 16, 27, and 28 under 35 U.S.C. § 103(a) for the reasons the Examiner presents and we provide above.

CONCLUSION

In summary:

Claims Rejected	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
1, 2, 5–7, 16, 27, 28	103(a)	Pratt, Gaul, Cheng	1, 2, 5–7, 16, 27, 28	

TIME PERIOD

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) (2017).

AFFIRMED