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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte JAE-WOONG NAH

Appeal 2020-000972
Application 15/591,611
Technology Center 2800

Before TERRY J. OWENS, KAREN M. HASTINGS, and
JEFFREY B. ROBERTSON, *Administrative Patent Judges*.

Opinion for the Board filed by *Administrative Patent Judge* HASTINGS.

Opinion Dissenting-in-part filed by *Administrative Patent Judge* OWENS.

HASTINGS, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellant¹ requests our review under 35 U.S.C. § 134 of the Examiner's final decision rejecting claims 1 and 3–12. We have jurisdiction over the appeal under 35 U.S.C. § 6(b).

We AFFIRM.

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 Br. 2).

CLAIMED SUBJECT MATTER

Claims 1 and 8 are illustrative of the subject matter on appeal
(emphasis added to highlight key limitations in dispute):

1. A system to form solder bumps on a substrate, the system comprising:

a solder ball fixture; and
a substrate;

wherein the solder ball fixture comprises a first array of cavities and a second array of cavities formed in a surface of the solder ball fixture;

a first set of preformed solder balls disposed in the first array of cavities, and a second set of preformed solder balls disposed in the second array of cavities;

wherein the substrate is disposed on the solder ball fixture, wherein the substrate comprises a first array of contact pads aligned to, and in contact with, the first set of preformed solder balls disposed in the first array of cavities of the solder ball fixture, and wherein the substrate comprises a second array of contact pads aligned to, and in contact with, the second set of preformed solder balls disposed in the second array of cavities of the solder ball fixture:

wherein the first and second sets of preformed solder balls differ in size, wherein the preformed solder balls of the first set of preformed solder balls have a diameter D_1 , wherein the preformed solder balls of the second set of preformed solder balls have a diameter D_2 , wherein D_2 is greater than D_1 ;

wherein the first array of cavities and the second array of cavities formed in the surface of the solder ball fixture are sized and shaped such that top portions of each of the first and second sets of preformed solder balls, which protrude from the first and second arrays of cavities past the surface of the solder ball fixture, are coplanar; and

a solder reflow tool configured to perform a solder reflow process with the substrate disposed on the solder ball fixture during the solder reflow process to heat the preformed solder balls and bond the first set of preformed solder balls to the first array of contact pads of the substrate and bond the second set of

performed solder balls to the second array of contact pads of the substrate.

8. A substrate, comprising:
a first array of contact pads comprising a first array of performed solder balls bonded thereto;
a second array of contact pads comprising a second array of performed solder balls bonded thereto;
wherein the first array of performed solder balls comprises performed solder balls having a first composition;
and
wherein the second array of performed solder balls comprises performed solder balls having a second composition, *wherein the first and second compositions are different*;
wherein the first array and the second array of performed solder balls form an array of solder balls having both the first and second compositions of performed solder balls interspersed within the array of solder balls.

REJECTIONS²

Claims 8, 10, and 12 are rejected under 35 U.S.C. § 102(a)(1) as being anticipated by Pang (US 2008/0003805 A1; published Jan. 3, 2008)(Final Act. 3), or in the alternative, under 35 U.S.C. § 103 as being unpatentable over Pang (Final Act. 6).

Claim 9 is rejected under 35 U.S.C. § 103 over the combined prior art of Pang and Kurata (US 2003/0141342 A1; published July 31, 2003) (Final Act. 7).

² We will not address the objection to the Specification made by the Examiner (Final Act. 2) as this objection should be decided by the Director on petition, and is not appealable. *See, e.g.*, MPEP §§ 706.01, 1201(9th ed. Rev.08.2017 Jan. 2018).

Claim 11 is rejected under 35 U.S.C. § 103 over the combined prior art of Pang and Budd (US 7,780,063 B2; issued Aug. 24, 2010) (Final Act. 8).

Claims 1, 3, 4, 6, and 7 are rejected under 35 U.S.C. § 103 over the combined prior art of Pang, Jomaa (US 2008/0054047 A1; published Mar. 6, 2008), and Budd (Final Act. 8–13).

Claim 5 is rejected under 35 U.S.C. § 103 over the combined prior art of Pang, Jomaa, Budd, and Kurata (Final Act. 14).

ANALYSIS

After considering the evidence presented in this Appeal and each of Appellant’s arguments, we are not persuaded that Appellant identifies reversible error in the § 103 rejections made by the Examiner. On the other hand, we do not sustain the Examiner’s § 102 rejection of claims 8, 10 and 12.

We review the appealed rejections for error based upon the issues identified by Appellant and in light of the arguments and evidence produced thereon. *Ex parte Frye*, 94 USPQ2d 1072, 1075 (BPAI 2010) (precedential), *cited with approval in In re Jung*, 637 F.3d 1356, 1365 (Fed. Cir. 2011) (“[I]t has long been the Board’s practice to require an applicant to identify the alleged error in the examiner’s rejections.”). We sustain the Examiner’s § 103 rejections for substantially the reasons expressed in the Final Office Action and the Answer, and we do not sustain the Examiner’s § 102 rejection.

We add the following primarily for emphasis.

With respect to claim 8, Appellant makes one argument for both the §§ 102 and 103 rejections, that is, Pang does not “specifically disclose or fairly suggest” that its first and second array of solder balls are made of two different materials and thus does not teach or suggest doing so as recited in independent claim 8 (Appeal Br. 5, 6; *see also* Reply Br. 5, 6). The Examiner relies upon Pang for its teaching of using solder balls that may comprise “a SnAg or a SnAgCu alloy” for these rejections (Pang ¶ 23; Final Act. 3, 5).

We will not sustain the Examiner’s § 102 rejection based on Pang as Pang does not explicitly disclose that its first array of solder balls of one size/diameter is of a different composition than its second array of solder balls of another size/diameter.

However, it has been well settled that “the [obviousness] analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007); *see also In re Fritch*, 972 F.2d 1260, 1264–65 (Fed. Cir. 1992) (a reference stands for all of the specific teachings thereof as well as the inferences one of ordinary skill in the art would have reasonably been expected to draw therefrom).

Appellant’s *de facto* argument that the Examiner has failed to sufficiently explain how the applied prior art rendered claim 1 obvious is not persuasive of error as Appellant fails to consider the applied prior art as a whole and the inferences that one of ordinary skill would have made. Pang explicitly discloses that the solder balls of different diameters may be applied using “multiple solder delivery heads” (Pang ¶ 19). Additionally, as

the Examiner points out, Pang discloses solder balls may be made of different alloys. Pang ¶ 23. Pang does not expressly require the solder balls to be of the same composition. One of ordinary skill would have readily appreciated that different solder compositions may be used in the different solder heads, and may be optimized for the different sized electrode pads which predictably may be useful for at least slightly different purposes, based at least on their cooperation with electrode pads of different diameters on the microelectronic substrate of Pang.

Thus, Appellant's argument falls short of showing reversible error in the Examiner's § 103 rejection of claim 8 based on Pang. As Appellant does not present any further arguments with respect to dependent claims 9–12, reversible error has not been shown in the rejections of these claims.

With respect to the rejection of claim 1, Appellant does not specifically dispute the Examiner's findings based on Pang and Budd (Appeal Br. 7, 8). Rather, Appellant's main argument is that the microball delivery system of Jomaa is not a "solder ball fixture" that is "within the context" of claim 1 (Appeal Br. 7), such that there is "no motivation to combine the teachings" of the applied references (Appeal Br. 8). The Examiner explains that, to the contrary, one of ordinary skill would have reasonably viewed Jomaa's microball delivery system 300 with its mask 304 as a solder ball fixture (Ans. 10). We agree with the Examiner that a solder ball delivery system as taught in Jomaa is within the scope of a solder ball fixture as recited in claim 1 as each function to deliver solder balls to a substrate.

Consequently, a person of ordinary skill would have looked to Jomaa's teaching that it is useful to have the distal surfaces of different sized

solder balls be coplanar surfaces for better delivery and placement of the solder balls onto the substrate surface (Jomaa, e.g., claim 5, ¶¶ 3, 18; Ans. 11). See *In re Keller*, 642 F.2d 413, 425–26 (CCPA 1981) (“The test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference. . . . Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art.”); see also *In re Merck & Co., Inc.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986) (“Non-obviousness cannot be established by attacking references individually where the rejection is based upon the teachings of a combination of references.”) and *In re Sneed*, 710 F.2d 1544, 1550 (Fed. Cir. 1983) (“[I]t is not necessary that the inventions of the references be physically combinable to render obvious the invention under review.”).

Accordingly, no reversible error has been shown in the Examiner’s obviousness determination of claim 1 that the use of solder balls of two different diameters having coplanar distal surfaces as taught in Jomaa to modify the solder balls of two different diameters of Pang would have been within the skill and creativity of one of ordinary skill in the art.

Accordingly, we sustain the Examiner’s rejections of independent claim 1, as well as all claims dependent thereon, noting that Appellant relies upon the arguments made for claim 1 for all of its dependent claims.

The Examiner’s decision is affirmed.

CONCLUSION

In summary:

Claims Rejected	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
8, 10, 12	102	Pang		8, 10, 12
8, 10, 12	103	Pang	8, 10, 12	
9	103	Pang, Kurata	9	
11	103	Pang, Budd	11	
1, 3, 4, 6, 7	103	Pang, Jomaa, Budd	1, 3, 4, 6, 7	
5	103	Pang, Jomaa, Budd, Kurata	5	
Overall Outcome			1, 3–12	

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

OWENS, *Administrative Patent Judge*, dissenting-in-part.

I concur in the reversal of the rejection under 35 U.S.C. § 102 and the affirmance of the 35 U.S.C. § 103 rejections as to claims 1 and 3–7. I dissent from the affirmance of the 35 U.S.C. § 103 rejections as to independent claim 8 and its dependent claims 9–12.

I need address only independent claim 8. That claim requires first and second arrays of preformed solder balls having, respectively, first and second compositions, “wherein the first array and the second array of preformed solder balls form an array of solder balls having both the first and second compositions of preformed solder balls interspersed within the array of solder balls.”

The Examiner has the initial burden of establishing a prima facie case of obviousness. *See In re Piasecki*, 745 F.2d 1468, 1472 (Fed. Cir. 1984); *In re Rinehart*, 531 F.2d 1048, 1051 (CCPA 1976).

Pang discloses (¶ 23):

[R]eflow may take place at temperatures above about 250 degrees Centigrade. The 250 degrees Centigrade minimum reflow temperature would for example apply to solder balls comprising a SnAg or a SnAgCu alloy. The SnAg may comprise less than about 4% by weight Ag, while the SnAgCu may comprise less than about 1% by weight Cu and less than about 4% by weight Ag.

The Examiner concludes (Final Rej. 6–7):

[I]t would have been obvious to try the first and second compositions are different because this would have been a known option within the technical grasp of a person of ordinary skill in the art that would lead to anticipated success, and:

"[T]he court erred in concluding that a patent claim cannot be proved obvious merely by showing that the combination of

elements was obvious to try The same constricted analysis led the Court of Appeals to conclude, in error, that a patent claim cannot be proved obvious merely by showing that the combination of elements was 'obvious to try.' ... [A] person of ordinary skill in the art has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense [T]he fact that a combination was obvious to try might show that it was obvious under §103." KSR International Co. v. Teleflex Inc., 82 USPQ2d 1385 (U.S. 2007). See also, Pfizer Inc. v. Apotex Inc., 82 USPQ2d 1852 (Fed. Cir. 2007); In re Kubin, 90 USPQ2d 1417 (Fed. Cir. 2009).

In addition, it would have been obvious to try the first and second compositions are different because a person of ordinary skill would be motivated to solve the problem of providing the first and second compositions and there are a finite number (two) of readily identified, predictable solutions; namely, the first and second compositions are the same and the first and second compositions are different; and:

[T]he court erred in concluding that a patent claim cannot be proved obvious merely by showing that the combination of elements was obvious to try The same constricted analysis led the Court of Appeals to conclude, in error, that a patent claim cannot be proved obvious merely by showing that the combination of elements was "obvious to try." ... When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, [a] person of ordinary skill in the art has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense [T]he fact that a combination was obvious to try might show that it was obvious

under §103." (*KSR International Co. v. Teleflex Inc.*, 82 USPQ2d 1385 (U.S. 2007)).

The Examiner relies upon *KSR* but provides no evidence of a design need or market pressure to solve a problem and a finite number of identified, predictable solutions of the problem such that a person of ordinary skill in the art would have had good reason to pursue the known options within his or her technical grasp. Nor does the Examiner provide evidence that Pang would have led one of ordinary skill in the art to success in forming an array of first and second arrays of preformed solder balls having, respectively, first and second compositions, interspersed within the array. Pang merely exemplifies two solder compositions having a minimum reflow temperature of 250 °C (¶ 23). Pang provides no suggestion to form an array of two preformed solder ball arrays having, respectively, first and second compositions, let alone suggest forming an array of interspersed first and second preformed solder ball arrays, having, respectively, first and second compositions.

Establishing a *prima facie* case of obviousness requires an apparent reason to modify the prior art as proposed by the Examiner. *See KSR*, 550 U.S. at 418. The Examiner has not set forth the required apparent reason as to claim 8. Accordingly, I dissent from the affirmance of the rejection under 35 U.S.C. § 103 of that claim and its dependent claims 9–12.