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opinion in support of the decision being entered today (1) was not written for publication in a law journal and (2) is not binding precedent of the Board.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. 27

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte HORST PLANKENHORN and THOMAS LINDNER

Appeal No. 1997-2016
Application No. 08/196,126

ON BRIEF[1]

Before ABRAMS, McQUADE and BAHR, Administrative Patent Judges.

BAHR, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal from the examiner's final rejection of claims 9-16, which are all of the claims pending in this application.

[1] An oral hearing, requested in Paper No. 21 and scheduled for May 17, 2000, was waived (Paper No. 26). Accordingly, this appeal is decided on brief.

BACKGROUND

The appellants' invention relates to a method and apparatus for aligning, stacking and bonding structured substrates (2, 3, 4) which have approximately the same surface area and at least one of which (3) is not transparent. Each substrate is received in a first working area (10) in a receiving means (14) which is supported on an xy-coordinate table (13) rotatable through 360 degrees and precisely positioned by means of precision drives (16). A pair of microscopes (31, 32) are used to image alignment markings on the substrate onto image carriers (monitors 35, 36). The position and orientation of the xy-coordinate table are adjusted until the images of the alignment marks of the substrate are aligned with cross-hairs (28, 29) on the monitor denoting nominal positions so that the substrate may be precisely aligned relative to the nominal positions. Each such aligned substrate is then transported by a conveying sled (23) and deposited on a depository table (17) in a second working area (11). The positional accuracy of the substrate during transporting is ensured by use of a fixed stop (22), which fixes the position of the sled in relation to the alignment field when it picks up the substrate. The substrates (2, 3, 4) are deposited one upon another on the depository table, with each substrate retaining its precise alignment achieved in the first working area, to form a substrate package (1). The substrate package is then directed to a heating device (38) provided with means (42) for uniform heating of the substrate package on all sides.

Claim 9, the only method claim on appeal, is reproduced in the appendix to appellants' brief. The copy of independent apparatus claim 10 contained in the appendix to appellants' brief is incomplete. Therefore, a correct copy of claim 10 on appeal is appended to this decision.

The prior art references of record relied upon by the examiner in rejecting the appealed claims are:

Hentz et al. (Hentz)	4,070,229	Jan. 24, 1978
Phillips	4,669,866	Jun. 2, 1987
Hulderman et al. (Hulderman)	5,062,149	Oct. 29, 1991

The following rejections are before us for review.

Claims 9 and 10 stand rejected under 35 U.S.C. § 103 as being unpatentable over Hentz in view of Hulderman.

Claims 11-16 stand rejected under 35 U.S.C. § 103 as being unpatentable over Hentz in view of Hulderman, as applied above, and further in view of Phillips.

Reference is made to the brief and reply brief (Paper Nos. 19 and 22) and the answer (Paper No. 20) for the respective positions of the appellants and the examiner with regard to the merits of these rejections.

OPINION

In reaching our decision in this appeal, we have given careful consideration to the appellants' specification and claims, to the applied prior art references, and to the respective positions articulated by the appellants and the examiner. As a consequence of our review, we make the determinations which follow.

Hentz discloses an apparatus for positioning and adhering a plurality of extremely small semiconductor devices (10) to sites (16) on a translucent alumina substrate (18), which has a thin-film printed circuit (20) and fiducial marks (22, 24) formed thereon (column 3, lines 21-23 and 31-33). The apparatus comprises a base (30) having a plurality of inverted pyramid-shaped cavities (28) with square cross sections formed therein which are wide enough at their upper ends to accommodate the largest device and narrower at their lower ends than the smallest device and a tube (26) coaxially mounted for vertical movement within each cavity. A bore (40) in each tube communicates with a vacuum chamber to provide a suction gripping force at the tip of each tube. The devices (10) are placed in their approximate proper location and orientation on the ends of tubes 26 when the tubes are in their raised positions. The tubes are then lowered into the cavities, thereby causing any off-center or skewed devices (10) to contact the walls of the cavities such that they are guided into the proper location and alignment on the tubes (see column 4, lines 34-57). The substrate (18) is disposed on the base (30), where it is forced against rotatable guide collars (60). As best seen in Figures 3 and 5, indicator marks

(52, 54) are provided on prisms (56) disposed in the base (30). The marks (22, 24) of the substrate (18) are viewed through microscopes (68) and the substrate (18) is moved by rotating guide collars (60) until the marks (22, 24) register with the marks (52, 54). To adhere the devices (10) to the substrate, a platen (70) which is mounted on the base (30) so that it pivots on a pin (72) and is held against the substrate (18) by a latch (74) heats the substrate to liquefy an eicosane layer coated on the sites (16) of the printed circuit (20) formed on the substrate. The platen is subsequently cooled to thus cool the substrate and solidify the eicosane and adhere the devices (10) to the substrate. The platen is heated and cooled by alternately flowing hot and cold water through its hollow interior.

Hulderman discloses a method of making a millimeter wave device, which comprises a circuit board (22) surrounded on both sides by air channel shims (32, 34), cover shims (38, 40) and back plates (42, 44) held together by screws (96) passed through holes (98, 100). As seen in Figures 11A -11F, Hulderman discloses a process for making the air channel shims (32, 34) from shim stock (300). First, as shown in Figure 11B, photoresist layers (306, 308) are laminated onto the shim stock. Next, two photomasks (314, 316) having transparent and opaque portions are aligned over each other using a microscope and then bonded at one edge to a spacer (318) to form the photomask covered assembly illustrated in Figure 11C (column 12, lines 26-31). The photomask covered assembly is then exposed to UV light, with the opaque areas of the photomasks blocking light to the underlying photoresist layers. The photomasks

are then removed from the assembly so that the shim stock and photoresist layers can be subjected to a development process. The areas of the photoresist layer not exposed to UV light are dissolved and removed from the shim stock surface during the development process, while the areas exposed to the UV light remain on the shim stock after development, as shown in Figure 11D. The shim stock is next subjected to an etching step, wherein the portions of the shim stock not protected by the remaining areas of the photoresist layers are etched to form an air channel aperture (352) and hole (354). Finally, the remaining photoresist layer is removed, leaving only the air channel shim.

Phillips discloses a step-and-repeat alignment and exposure system and method for printing an image of a reticle onto a semiconductor wafer using a splitfield microscope (column 2, lines 39-45).

Method claim 9 recites a method of stacking a plurality of structured substrates to be aligned with one another and connected undetachably to one another by bonding, with the substrates having "approximately same surface area" and with at least one of the substrates being non-transparent, comprising, inter alia, the steps of aligning the substrates in a first working area and transporting the substrates to a second working area and depositing the substrates one upon another to form a substrate package. Claim 10, the only other independent claim in this application, recites an apparatus for stacking a plurality of substrates to be aligned with one another and connected undetachably to one another by bonding, with the substrates

having "approximately same surface area" and with at least one substrate being non-transparent, comprising, inter alia, first means for receiving and retaining a substrate in a first working area, alignment means for aligning the substrate, second means located in a second working area for receiving and retaining aligned substrates to be deposited one upon another and means for transporting substrates aligned in the first working area to the second working area and for depositing the aligned substrates one upon another.

It is apparent from the appellants' underlying disclosure that "surface area" as used in the claims refers to the footprint of each of the substrates as viewed in a direction normal to the bonding surfaces of the substrates. While it is true that "approximately" and other similar words are sometimes construed liberally to avoid unduly restricting a patent claim, the imprecision of such a word cannot be allowed to negate the meaning of the words it modifies. The use of the modifier "approximately" in the context of claims 9 and 10, we think, was intended to allow for irregular deviations, resulting from machining tolerances, from perfectly identical footprints of the substrates to be aligned, stacked and bonded together and not to broaden the scope of "same surface area" to encompass substrates which are distinctly not of the same footprint by design. Arvin Industries, Inc. v. Berns Air King Corp., 525 F.2d 182, 185, 188 USPQ 49, 51 (7th Cir. 1975). See also Amhil Enterprises, Ltd. v. Wawa, Inc., 81 F.3d 1554, 1562, 38 USPQ2d 1471, 1476 (Fed. Cir. 1996) (In view of specification, prosecution history, and prior art, "substantially vertical face" in the patent's claim must be

construed as the same as or very close to "vertical face."). We reach this conclusion based upon our review of appellants' specification, which indicates, at page 3, that a semiconductor substrate "is covered on both sides by glass substrates for obtaining a functional sensor" and, at page 4, that "a problem occurs, if one or several of the substrates which have to be aligned with high precision to one another is or are not transparent"[2] and of the accompanying drawings, which illustrate round substrates having the same diameter (Figures 1 and 3).

Hentz is specifically directed to an apparatus and method for aligning and adhering a plurality of extremely small semiconductor devices (10) to a significantly larger substrate (18) and thus lacks the limitation in claim 9 that the substrates aligned and deposited one upon another have "approximately same surface area." With respect to claim 10, even if the base (30) and collars (60) are considered an alignment means as claimed for aligning substrates (18), Hentz still lacks a means for transporting the aligned substrates (18) to a second working area and for depositing the aligned substrates one upon another, as also required in claim 10. In fact, Hentz discloses no structure for transporting an aligned substrate (18) from its position on the base (30). While Hentz does disclose means for moving the tubes (26) vertically to thereby transport the small devices (10) toward or away from the substrate (18), these devices

[2] One of ordinary skill in the art would understand from these two statements that the transparent substrates (2, 4) cover the non-transparent substrate but do not extend to any significant degree beyond the periphery thereof; otherwise, alignment marks disposed on the outer transparent substrates beyond the periphery of the non-transparent substrate could be used in conjunction with alignment marks within the periphery of the non-transparent substrate to align all three substrates.

are and must be of significantly smaller surface area than the substrate (18)[3] in order to be accommodated within cavities (28) and, thus, cannot be considered as "having same surface area" as the aligned substrate (18).

In an attempt to overcome the above-noted deficiencies of Hentz, the examiner, pointing specifically to the disclosure of Hulderman in column 12, lines 15-37, directed to aligning and bonding the photomasks (314, 316) in position about the photoresist laminated shim stock (300), takes that position that

> [i]t would have been obvious to one having ordinary skill in the art to have employed the method and apparatus taught by Hentz *et al*. to bond substrates having substantially the same surface area, since Hulderman *et al*. suggest observing indicia through transparent portions of substrates to facilitate bonding of laminae having substantially the same surface areas [answer, page 4].

From our perspective, one of ordinary skill in the art would have recognized that the Hentz apparatus is not capable of use for aligning and adhering substrates, at least one of which is non-transparent, having approximately the same surface area and, thus, would not have been motivated to use it in such a manner for manufacturing a photomask covered assembly as taught by Hulderman. Further, given the very disparate teachings of Hentz and Hulderman, it is not apparent to us why one of ordinary skill in the art would have been led by

[3] The substrate (18) must be sufficiently large to extend over the indicator marks (52, 54) on the prisms (56), which fall well outside the cavities (28).

the combined teachings thereof to use Hentz as a starting point in designing a device for aligning and adhering substrates, such as the shim stock assembly and photomasks taught by Hulderman, having approximately the same surface area.

For the foregoing reasons, we shall not sustain the examiner's rejection of claims 9 and 10 under 35 U.S.C. § 103 as being unpatentable over Hentz in view of Hulderman.

Turning next to the examiner's rejection of claims 11-16 under 35 U.S.C. § 103 as being unpatentable over Hentz in view of Hulderman and Phillips, we have reviewed the additional teachings of Phillips but find nothing therein which overcomes the above-noted deficiencies of the combination of Hentz and Hulderman. It follows then that we shall also not sustain the examiner's rejection of claims 11-16, which depend from claim 10.

CONCLUSION

To summarize, the decision of the examiner to reject claims 9-16 under 35 U.S.C. § 103 is reversed.

REVERSED

NEAL E. ABRAMS Administrative Patent Judge	)
	) BOARD OF PATENT
JOHN P. McQUADE Administrative Patent Judge	) APPEALS) AND) INTERFERENCES
JENNIFER D. BAHR Administrative Patent Judge	)

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APPENDIX

10. An apparatus for stacking a plurality of structured substrates to be aligned with one another corresponding to structuring thereof and connected undetachably to one another by bonding, with the substrates having approximately same surface area and with at least one substrate being non-transparent, said apparatus comprising:

a substrate handling device having spaced first and second working areas;

first means for receiving and retaining a substrate in said first working area of the handling means;

alignment means located in said first working area for supporting said first receiving and retaining means, said alignment means comprising a coordinate table having precision drive means for effecting displacement of said first receiving and retaining means along three mutually perpendicular coordinates for changing an actual position of the substrate supported in said first receiving and retaining means for aligning the substrate;

microscope means provided in said first working area for imaging two spatially separated alignment marks on the substrate supported in said first receiving and retaining means;

second means located in said second working area for receiving and retaining aligned substrates to be deposited one upon another;

means for transporting the substrates aligned in said first working area to said second working area and for depositing the aligned substrates onto said second receiving and retaining means one upon another in accordance with alignment effected in said first working area; and

means for uniformly heating on all sides a substrate package formed in said second working area for effecting simultaneous bonding of the substrates of the package in a single working step.