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D E C I S I O N
of 13 June 2006

Case Number: T 1095/04 - 3.4.03

Application Number: 98931018.0

Publication Number: 1115152

IPC: H01L 23/50

Language of the proceedings: EN

Title of invention:

Punched adhesive tape for semiconductor, method of manufacturing lead frame with the adhesive tape, lead frame with the adhesive tape, and semiconductor device comprising the lead frame

Applicant:

Hitachi Chemical Company, Ltd.

Opponent:

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Headword:

-

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step (no) "

Decisions cited:

-

Catchword:

-



Case Number: T 1095/04 - 3.4.03

D E C I S I O N
of the Technical Board of Appeal 3.4.03
of 13 June 2006

Appellant: Hitachi Chemical Company, Ltd.
1-1, 2-chome, Nishishinjuku
Shinjuku-ku
Tokyo 163-0449 (JP)

Representative: HOFFMANN EITLE
Patent- und Rechtsanwälte
Arabellastrasse 4
D-81925 München (DE)

Decision under appeal: Decision of the Examining Division of the
European Patent Office posted 5 April 2004
refusing European application No. 98931018.0
pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: R. G. O'Connell
Members: V. L. P. Frank
T. Bokor

Summary of Facts and Submissions

I. This is an appeal from the refusal of European patent application 98 931 018.0 *inter alia* for lack of inventive step (Article 56 EPC).

II. Claim 1 of the main request is worded as follows:

"A method of producing an adhesive tape for use in bonding a semiconductor chip, comprising the steps of
providing an adhesive tape comprising a base layer and an adhesive layer on one or both sides of the base layer, for use of bonding a semiconductor chip;
scanning the tape to detect contaminants or defects in the tape; and
piercing the tape to form a hole at or in the vicinity of a region where the adhesive tape contains a contaminant or defect, to remove or identify a tape region which contains a contaminant or defect."

Claim 1 of the 1st auxiliary request is worded as follows:

"A method of producing an adhesive tape for use in bonding a semiconductor chip, comprising the steps of
providing a wound adhesive tape comprising a base layer and an adhesive layer on one or both sides of the base layer, for use of bonding a semiconductor chip;
unwinding the tape and scanning the tape to detect

contaminants or defects in the tape;
piercing the tape to form a hole at or in the vicinity of a region where the adhesive tape contains a contaminant or defect, to remove or identify a tape region which contains a contaminant or defect; and
rewinding the pierced tape to form a wound tape roll."

The main and 1st auxiliary requests also comprise a dependent claim 2 directed to a method of producing an adhesive tape-bearing lead frame in which the adhesive tape roll prepared by the process of claim 1 is used.

The single claim of the 2nd auxiliary request is worded as follows:

"A method of producing an adhesive tape-bearing lead frame, comprising the steps of

- providing an adhesive tape for use in bonding a semiconductor chip prepared by a process comprising the steps of:
 - providing an adhesive tape comprising a base layer and an adhesive layer on one or both sides of the base layer, for use of bonding a semiconductor chip,
 - scanning the tape to detect contaminants or defects in the tape, and
 - piercing the tape to form a hole at or in the vicinity of a region where the adhesive tape contains a contaminant or defect;
 - scanning the pierced tape to detect a hole therein;
 - punching an adhesive tape piece from a part of

the pierced tape with no hole; and
- applying the adhesive tape piece to a lead frame with an adhesive layer of the adhesive tape piece adhering to the lead frame."

III. The following prior art documents were cited in the examination procedure:

D1: Patent Abstracts of Japan, vol. 015, no. 172
(P-1197) & JP 03 037555 A

D1*: English translation of document D1 provided by the applicant

D2: US 5 432 380 A

IV. In the decision under appeal the examining division argued that the conventional method of handling an adhesive tape disclosed in the application was to cut the tape whenever a defect was encountered. This produced, however, a tape with a short and unpredictable length, but without defects. The method of the application provided in contrast a tape with the original length in which the defects were marked, but remained in the tape. The marking of defects was, however, known from document D1 which disclosed storing the position of a defect in a memory and punching a hole in a TAB tape beside the defect for visual inspection by the operator. Moreover, as the apparatus of D1 was extensively applicable for inspecting lengthy articles, the skilled person would combine marking by punching with an adhesive tape inspecting apparatus. This was due to the fact that the approach of no longer providing a "flawless product" resulted in the

necessity to mark any faulty portions, no matter whether the product was a TAB tape or an adhesive tape (point 2 of the reasons for the decision under appeal).

V. The appellant applicant argued essentially as follows:

- Document D1 was not the closest prior art, since it differed in several crucial aspects from the present invention. It provided a unitary solution in which the defects of a TAB tape were identified and marked but afterwards removed and the tape rejoined. This method was, however, not applicable to adhesive tapes, as these tapes could not be rejoined. There was the risk of using the rejoined boundary of the tape when punching out the small tape portions used for bonding the semiconductor chip on the lead frame.
- The respective prior art from which the application and D1 started were completely different as well as the problems addressed in each document. There was no reason therefore to search in document D1 for a solution to the problem addressed by the present application.
- Document D1 related to TAB (tape automated bonding) tapes whereas the application related to adhesive tapes. Both tapes belonged to different fields of technology and different skilled persons were involved. In the representative's view the notional skilled person for the present invention was a process engineer working in the field of semiconductor processing, in particular in the field of mounting integrated circuits on lead frames.

- A further indication of the presence of an inventive step were the five years which had elapsed between the publication of D1 and the priority date of the application. This was an extremely long period in the fast developing field of semiconductor technology.

VI. The appellant applicant requests that the decision under appeal be set aside and that a patent be granted in the following version:

as main request:

claims 1 and 2 filed with the statement of grounds of appeal dated 13 August 2004

as 1st auxiliary request:

claims 1 and 2 also filed with the statement of grounds of appeal dated 13 August 2004

as 2nd auxiliary request:

a single claim 1 filed with the letter dated 15 May 2006.

Reasons for the Decision

1. The appeal is admissible.
2. The sole issue in this appeal is inventive step.
3. The adhesives tapes addressed in the present application are used for bonding semiconductor chips to lead frames before encapsulating the chip in a resin mould (such a process is disclosed eg in document D2,

column 1, lines 37 to 64; Figs 2 to 4). To assure high reliability of the encapsulated chip, the defective or contaminated portions of the adhesive tape should not be used. In the conventional method, according to the present application and the submissions of the appellant, defective portions are removed by simply cutting the tape whenever a defect is found. This results, however, in shorter tapes having an unforeseeable length (page 1, lines 5 to 20 of the published application). It is this inconvenience that is addressed by the present invention.

4. *Main request - Inventive step (Article 56 EPC)*

4.1 The appellant applicant emphasized in his submissions that document D1 should not be regarded as the closest prior art for the assessment of inventive step. In his view, it was the conventional method of cutting the tape mentioned in the present application which should be regarded as the closest prior art.

In the decision under appeal the examining division, however, did not consider document D1 as the closest prior art, but the conventional method referred to in the present application. The board agrees with this view.

4.2 It is therefore common ground that the closest prior art is the conventional method mentioned in the present application in which the adhesive tape is cut whenever a defective portion is found. The objective technical problem addressed by the invention is therefore to avoid cutting the adhesive tapes, so that the production of short tapes, as is the case for the

conventional method, can be prevented (page 1, lines 27 to 33).

However, if the defective portions of the adhesive tape are not removed they have to be identified in some way to prevent these portions being afterwards employed for bonding the chip to the lead frame.

- 4.3 If the conventional but undocumented cutting of adhesive tapes mentioned in the present application is considered not to be part of the state of the art, as the appellant called this an internal state of the art implying that it was not available to the public, then the objective technical problem has to be defined having regard to the semiconductor mounting process disclosed in document D2. In this document small portions of an adhesive tape are punched out and fixed to a lead frame, while the semiconductor chip is bonded to these tape portions. Avoiding using defective portions of the tape is, however, not disclosed in this document (D2, column 1, lines 41 to 64).

The objective technical problem having regard to document D2 is therefore to avoid using the defective portions of the adhesive tape for bonding the semiconductor chip to the lead frame.

- 4.4 The skilled person is therefore faced in both cases with the task of finding a way of identifying the defective portions and it is at this point that the disclosure of document D1 becomes relevant.
- 4.5 Document D1 discloses an automatic inspecting apparatus for a tape of interconnected frames. The particular use

of this apparatus disclosed in D1 is to inspect and identify defective frames of a TAB (Tape Automated Bonding) tape. The conventional method of handling these tapes, as disclosed in D1, involves identifying the defective frames by an image recognition technique, but not removing them from the tape. Instead their positions are stored in an external memory and the defective frames are merely skipped during the semiconductor mounting process on the basis of the stored positions (D1*, page 2, 2nd paragraph). However, as the operators have to playback the external memory to identify a defective frame and cannot recognize it by mere visual inspection, the efficiency of the mounting process is reduced (page 2, 3rd paragraph). A further drawback of the conventional process is that whenever several contiguous frames are defective, all these frames have to be skipped in the chip mounting step reducing further the efficiency of the process (page 2, 4th paragraph).

4.6 The two problems addressed in D1 are solved independently from each other. The solution to the first problem is to mark the defective frame by punching a hole in it so that the frame can be recognized by visual inspection. The solution to the second problem is to excise automatically the marked defective frames and to rejoin the tape whenever a predetermined number of contiguous defective frames are found (page 4, 1st and 2nd paragraphs).

4.7 The board is not persuaded by the argument of the appellant that document D1 discloses a single monolithic solution, namely that all the defective frames are marked and excised from the tape,

irrespective of whether they are contiguous to other defective frames or not. This is clearly contrary to the explicit disclosure of this document, which consistently discloses excising the frames only when their number surpasses a predetermined number of contiguous defective frames (page 3, 3rd and 5th paragraph; page 4, 2nd paragraph; page 7, 2nd paragraph).

- 4.8 It appears further that for the overall process it is more efficient only to mark a single defective frame instead of marking and removing it, since the tape has to be rejoined afterwards. This second option is more efficient only when several frames have to be skipped, since the time lost in the cutting/joining operation is compensated by the time gained by not having to identify and skip these frames. This interpretation is wholly consistent with the explicit disclosure of document D1.
- 4.9 The skilled person learns therefore from document D1 that punching a hole is a way of marking a defective frame in a tape of frames. An adhesive tape is, however, not a succession of frames, but a continuous body. However, he would not be deterred by this difference from applying this marking method to an adhesive tape, as document D1 explicitly mentions that the method is applicable not only to a tape of frames but to elongate articles in general (page 7, last paragraph).
- 4.10 The appellant applicant characterized the skilled person as a process engineer working in the field of semiconductor processing, in particular in the field of mounting semiconductor chips on lead frames. The board finds this characterization reasonable. However, such a

process engineer is confronted with the problems of defective TAB frames and knows about the identification method disclosed in document D1. He is therefore aware that punching a hole is a possible way of marking a defective portion of a tape and would therefore apply this marking manner when the need arises of identifying defects in an adhesive tape.

4.11 The board, moreover, is not persuaded that the field of adhesive tapes and the field of lead frames are separate technical fields, this fact preventing the skilled person from searching for a solution to a problem in one field in the other field. A technical field cannot be defined so narrowly that it only concerns the problem posed in the application, but must be defined in a reasonable manner having regard to the actual field in which the skilled person normally exercises his activity. Under the present circumstances the board considers the technical field of the present invention to be the mounting and encapsulating of semiconductor chips. The person working in this field is therefore confronted *inter alia* with both kinds of tapes, adhesive and TAB tapes, and is therefore aware of the problems and the solutions proposed for both kinds of tapes.

4.12 The use of the marking means disclosed in document D1 (ie punching a hole in the tape) is used moreover for the same purpose (ie marking) in the present application. This cannot be regarded, therefore, as a new use of a known measure. As there is no fundamental difference between the problems addressed in D1 and in the present application, the adoption of the known measure does not involve an inventive step.

- 4.13 The board considers in consequence that the claimed method does not involve an inventive step, since the skilled person would
- a) either replace in the conventional method disclosed in the present application the cutting operation of the adhesive tape by marking the defective portion with a hole in the vicinity of the defect or
 - b) mark in the process disclosed in document D2 the defective portions of the tape by punching a hole so that they may be skipped when bonding the semiconductor chip.

5. *First auxiliary request - Inventive step*

- 5.1 Claim 1 of this request differs from claim 1 of the main request essentially in that the adhesive tape is a wound tape before and after scanning it for defects. This emphasizes that the tape has substantially the same length before and after this process.
- 5.2 However, the finding of lack of inventive step with respect to the main request is not based on the assumption that the tape might have been cut in addition to the defects being marked. In consequence, this clarification of the method has no bearing on the issue of inventiveness.
- 5.3 The board considers therefore that the method of this request does not involve an inventive step for the same reasons as for the main request.

6. *Second auxiliary request - Inventive step*

6.1 Claim 1 of this request is directed to a method of producing an adhesive tape-bearing lead frame and combines essentially the subject-matter of claims 1 and 2 of the previous requests.

6.2 This claim requires the further steps of a) scanning the pierced tape to detect a hole (ie a mark) therein, b) punching an adhesive tape piece from an unmarked part and c) applying the adhesive tape to a lead frame.

6.3 However, as mentioned previously, a method of bonding a semiconductor chip to a lead frame using an adhesive tape is already disclosed in document D2 comprising the steps (b) and (c) (see 4.3). Step (a), namely looking for a mark, is a logical consequence of applying a mark.

6.4 Consequently, the board considers that the method of this request does not involve an inventive step having regard to the combined disclosure of documents D1 and D2.

Order

For these reasons it is decided that:

The appeal is dismissed.

Registrar

Chair

S. Sánchez Chiquero

R. G. O'Connell