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**Datasheet for the decision
of 22 February 2018**

Case Number: T 2449/13 - 3.4.03

Application Number: 08007057.6

Publication Number: 1983809

IPC: H05K1/11

Language of the proceedings: EN

Title of invention:
Printed wiring board

Applicant:
YAZAKI CORPORATION

Headword:

Relevant legal provisions:
EPC Art. 52(1), 56, 123(2)

Keyword:
Inventive step - (yes) - after amendment

Decisions cited:

Catchword:



Beschwerdekammern
Boards of Appeal
Chambres de recours

Boards of Appeal of the
European Patent Office
Richard-Reitzner-Allee 8
85540 Haar
GERMANY
Tel. +49 (0)89 2399-0
Fax +49 (0)89 2399-4465

Case Number: T 2449/13 - 3.4.03

D E C I S I O N
of Technical Board of Appeal 3.4.03
of 22 February 2018

Appellant: YAZAKI CORPORATION
(Applicant) 4-28, Mita 1-chome
Minato-ku
Tokyo 108-8333 (JP)

Representative: Grünecker Patent- und Rechtsanwälte
PartG mbB
Leopoldstraße 4
80802 München (DE)

Decision under appeal: **Decision of the Examining Division of the
European Patent Office posted on 17 July 2013
refusing European patent application No.
08007057.6 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman G. Eliasson
Members: S. Ward
W. Van der Eijk

Summary of Facts and Submissions

- I. The appeal is against the decision of the Examining Division refusing European patent application No. 08 007 057 on the grounds that the subject-matter of claim 1 of the main request was not new within the meaning of Article 54(1) and (2) EPC, and that the subject-matter of claim 1 of the second auxiliary request did not involve an inventive step within the meaning of Article 56 EPC. The first auxiliary request was not admitted into the proceedings pursuant to Rule 137(3) EPC.
- II. At the end of the oral proceedings held before the Board the appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the following documents:
- claim 1 as filed during oral proceedings before the Board;
 - pages 2 and 5-16 of the description as originally filed, and pages 1, 3, 4 and 17 as filed during oral proceedings before the Board;
 - drawings sheets 1/5-5/5 as originally filed.
- III. The following document is referred to:
- D8: DE 88 06 029 U1
- IV. Claim 1 reads as follows:
- "An assembly of a printed wiring board (1a) and an electric component (22), said electric component (22) having a terminal (22b), said printed wiring board (1a) comprising:*

*an insulation board (2);
a conductive pattern (6) arranged on the board (2) and
formed into a predetermined circuit;
a through-hole (4) penetrating the board (2); and
a non-conductive area (5),
wherein the terminal (22b) of the electric component
(22) inserted into the through-hole (4) projects from a
surface (2a) of the board (2), and the electric
component (22) is mounted on the printed wiring board
(1a) by bending the terminal (22b) toward the
surface (2a) of the board (2), so that the bent terminal
(22) is positioned in the non conductive area (5)
wherein the non-conductive area (5) is formed adjacent
to the conductive pattern (6) into a shape expanding
toward a tip of the terminal (22b) of the electric
component (22) from a center of the through-hole (4),
and prevents contact between the terminal (22b) and the
conductive pattern (6), and
wherein the non-conductive area (5) is formed by the
shape of the conductive pattern into a fan-shaped
shape."*

Reasons for the Decision

1. The appeal is admissible.
2. *Article 123(2) EPC*
- 2.1 Claim 1 is chiefly based on claims 1 and 2 as originally filed. The first clause has been amended to make it explicitly clear that the electric component and the terminal (both of which were mentioned in claim 1 as originally filed) form part of the claimed subject-matter.

The bent terminal being positioned in the non-conductive area is supported by page 4, lines 20-24; page 15, lines 22-26 and Figs. 3 and 4. The feature that the non-conductive area is formed "adjacent to the conductive pattern", and more specifically that it is formed "by the shape of the conductive pattern" finds explicit support on page 11, lines 5-6, and is clearly shown in the drawings. The description has been adapted to present claim 1.

2.2 The Board is therefore satisfied that the requirements of Article 123(2) EPC are met.

3. *Inventive Step*

3.1 The Board agrees with the appellant that, among the available prior art documents, D8 represents the closest prior art.

3.2 The appellant argued that the assembly of claim 1 differed from the arrangements of D8 in the features defined in the last two paragraphs:

"wherein the non-conductive area (5) is formed adjacent to the conductive pattern (6) into a shape expanding toward a tip of the terminal (22b) of the electric component (22) from a center of the through-hole (4), and prevents contact between the terminal (22b) and the conductive pattern (6), and

"wherein the non-conductive area (5) is formed by the shape of the conductive pattern into a fan-shaped shape."

In D8 the tip of terminal (16a) lies on (or possibly just above) a non-conductive area, and so it might be possible to argue that some of the above features could be identified in D8. However, the non-conductive area being formed "by the shape of the conductive pattern into a fan-shaped shape" is not disclosed in D8, and claim 1 thus differs from the closest prior art at least in this respect.

3.3 According to the application, it would appear that the invention is intended to solve two problems:

- (a) to minimize the size of the non-conductive area;
and
- (b) to prevent electrical shorting and/or damage to conductive patterns.

As more fully explained below, measures designed to have a positive impact in relation to either one of these requirements would be likely to have a negative impact in relation to the other one, and the position of the appellant is essentially that the claimed solution represents an optimal compromise, which would not be obvious from the prior art.

The Board will first consider whether these problems can be considered reasonable and appropriate problems on which to base the analysis of inventive step.

3.4 The prevention of damage to the conductive patterns and the avoidance of electrical shorting can be seen as ever-present considerations in the design of PCBs, and so attempting to solve the second problem is a reasonable aim for the skilled person.

3.5 Concerning the first problem, it must be asked what purpose is served by minimizing the size of the non-conductive area (or conversely maximizing the size of the conductive area). The arrangement of D8 represents a design in which minimizing the size of the non-conductive area does not appear to have been an important consideration. According to the appellant, the invention sought to provide an arrangement of a type exemplified by Fig. 5 of the present application, in which most of the available space was devoted to conductive areas. There appears to be no explanation in the application why this is seen as desirable.

The Examining Division saw the purpose of maximizing the size of the conductive area as providing electrical shielding, the large conductive areas forming a ground plane (Reasons, 5.3.2 and 5.3.3.1). This appears plausible *prima facie*, in that the large conductive areas in Fig. 5 give the appearance, at first sight, of forming a ground plane. On closer inspection, however, these areas are clearly carefully insulated from each other, which suggests that they are not all held at a common ground potential.

The appellant suggested that minimizing the size of the non-conductive area would allow a greater density of electrical connections and hence a more compact arrangement. This is not mentioned in the application, and again does not appear to be entirely consistent with Fig. 5, which does not show the available space on the PCB being used to maximize the number of individual connections, but rather to provide connections in the form of large continuous areas of conductive material.

On balance, in deciding this matter, the Board believes that it would be a mistake to attach too much weight to

the figures of the application, since, in some respects at least, these figures are clearly inaccurate (as accepted by the appellant). Fig. 3, for example, depicts both of the lead wires (22b) of an electric component being in contact with respective lands (7), and both lands being in electrical contact with the same conductive pattern (6). This would short-circuit the component, which clearly cannot be the intention. The same arrangement is shown in Fig. 2.

The Board therefore accepts that, despite the silence of the application on this point and the difficulties interpreting the figures, minimizing the size of the non-conductive area would be a reasonable aim for the skilled person either to provide a maximal ground plane or to maximize the density of electrical connections. Thus problem (a) also appears to be a reasonable basis for building an analysis of inventive step.

3.6 Turning firstly to the case where the purpose of minimizing the size of the non-conductive area is to provide a suitable ground plane, the Examining Division rightly concluded that the skilled person would be well aware that this is typically achieved in the prior art by etching away only a sufficient amount of the conductive material (generally copper) to provide non-conductive contours around the traces and lands, and leaving the rest of the copper coating to form the ground plane (Reasons, point 5.3.3.1).

Analogously, in providing a non-conductive area on which to position a bent terminal of an electric component, an obvious measure for the skilled person would be to create contours for the non-conductive area which follow the shape of the bent terminal, and which

provide just enough space to allow the bent terminal to be positioned therein.

- 3.7 Although this might represent an obvious solution to the first problem, it would exacerbate the second problem, as it would require the terminal of a subsequently mounted electric component to be carefully bent in a specific direction in order to be positioned within the non-conductive area. This would increase the likelihood of the bent terminal making unwanted contact with the nearby ground plane as a result of small deviations from the correct bending direction.
- 3.8 The claimed solution involves adapting the solution to the first problem set out under point 3.6, above, by removing a further amount of copper to define a non-conducting fan-shaped area expanding from the centre of the through-hole, as defined in claim 1. This measure provides protection from shorting and/or damage in the face of possible misalignments or errors in the bending angle, as depicted in Fig. 3, without removing more copper than is necessary to achieve this aim.
- 3.9 The problem of avoiding short circuits due to bent component leads is at least implicitly known from D8, in which measures are taken to prevent leads 16a and 16b coming into contact with, for example, the conductive lines 17 and 18 in Figs. 3 and 4. The solution is to bend the leads in a direction parallel to the lines, and in opposite senses. In this way, mechanical support is provided for the component prior to soldering, while leaving space for the conductive lines 17 and 18 (or the lines 9a, 9b and chip element 10 in Figs. 1 and 2). This is clearly a different solution to problem (a), and problem (b) is not addressed at all.

- 3.10 The Examining Division concluded that the skilled person would arrive at the claimed solution "during his routine work" (Reasons, points 5.3.3.2 and 5.3.3.3). The Board does not agree. The capacity for "routine work" might, for example, allow the skilled person to adapt a measure already known in the art to his own particular purposes, but it would not enable him to create new solutions previously unknown in the art.
- 3.11 The notional skilled person is guided by the teachings of the prior art and common general knowledge, and the starting point for the Board's analysis is the presumption that the documents D1-D8 cited in the proceedings before the department of first instance represent the most pertinent state of the art for the present invention. It is therefore telling that none of these documents discloses an arrangement corresponding to, or even closely resembling, the solution of the present invention, i.e. a PCB in which the lead of an electric component is positioned in a non-conductive area having a fan-shaped form. In view of this, the Board cannot see any realistic basis for concluding that the skilled person, having regard to the state of the art, would find the claimed invention obvious.
- 3.12 Although the above analysis was based on the assumption that the skilled person would wish to minimize the size of the non-conductive area to provide a maximal ground plane, the same conclusion would be reached if, as suggested by the appellant, the aim were to maximize the density of electrical connections, by essentially the same reasoning.

3.13 The Board therefore judges that the claimed subject-matter involves an inventive step within the meaning of Article 52(1) and 56 EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the department of first instance with the order to grant a patent with the following documents:

-claims:

claim 1 as filed during oral proceedings before the Board;

-description:

pages 2 and 5-16 as originally filed
pages 1, 3, 4 and 17 as filed during oral proceedings
before the Board;

-drawings:

sheets 1/5-5/5 as originally filed.

The Registrar:

The Chairman:



S. Sánchez Chiquero

G. Eliasson

Decision electronically authenticated