BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS

BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE

CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

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File Number: T 637/89 - 3.4.1

Application No.: 81 106 768.5

Publication No.: 0 055 323

Title of invention: Apparatus for soldering chip type components

Classification: H05K 3/34

D E C I S I O N
of 18 June 1991

Proprietor of the patent: Matsushita Electric Industrial Co.Ltd.

Opponent: Robert Bosch GmbH

Headword: Solder/MATSUSHITA

EPC Art. 56

Keyword: "Inventive step (no)"

Headnote

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number : T 637/89 - 3.4.1

D E C I S I O N
of the Technical Board of Appeal 3.4.1
of 18 June 1991

Appellant : (Opponent)
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Representative :

Respondent : (Proprietor of the patent)
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Decision under appeal :
Decision of Opposition Division of the European Patent Office dated 28 August 1989 rejecting the opposition filed against European patent No. 0 055 323 pursuant to Article 102(2) EPC.

Composition of the Board :

Chairman : G.D. Paterson
Members : R. Shukla
U. Himmler

Summary of Facts and Submissions

I. The only independent claim 1 of the patent as granted, with a spelling correction in the word "accessive" so as to read "excessive", reads as follows:

"An apparatus (G) for soldering chip type components (3) onto printed circuit boards (4) which apparatus comprises independent first and second nozzles (17, 18) for spouting molten solder (16) upwardly therefrom so as to respectively form first and second solder waves (36, 37), and transport means which hold the printed circuit board (4) for transporting said printed circuit board (4) so as to bring an under surface of the printed circuit board (4) into successive contact with said first and second solder waves (36, 37) spouted from said first and second nozzles (17, 18), said second solder wave (37) from the second nozzle (18) located at a downstream side being arranged to be higher in the height of crest thereof than said first solder wave (36) from said first nozzle (17) located at an upstream side with respect to the direction of transportation of said printed circuit board (4), said first and second nozzles (17, 18) being adapted to form said first and second solder waves (36, 37) flowing in a direction opposite to each other, said transport means being arranged to transport said printed circuit board (4) in a state inclined at an angle corresponding to the heights of said first and second solder waves (36, 37) of said first and second nozzles (17, 18), characterized in that said first nozzle (17) is formed such that the first solder wave (36) is spouted only in the direction of movement of the printed circuit board (4) whereas said second nozzle (18) is provided with a dam member (40) at a front upper edge thereof so as to direct the molten solder (16) forming said second solder wave (37) in a direction counter to the direction of movement of the printed

circuit board (4) and that the spouting ports (17a, 18a) of said first nozzle and second nozzle (17, 18) are so arranged and formed that excessive solder paddings (38, 39) formed on the chip type component (3) by the first solder wave (36) are removed as they are passed through the second solder wave (37)."

II. The Appellant filed an opposition requesting revocation of the patent on the ground of lack of inventive step having regard to the prior art as disclosed in

D1 GB-A-1 099 330 and
D2 US-A-4 101 066.

III. The Opposition Division rejected the opposition pursuant to Article 102(2) EPC, since in its view, to a skilled person starting from the closest prior art as disclosed in D2, there was no incitation in D2 to reverse flow directions of first and second solder waves, as set out in the claimed invention, with a view to forming good solder connections without any excess solder. It was considered that although D1 taught to produce a second solder wave in a direction opposite to that of the movement of a printed circuit board so as to remove excess solder, incorporation of this measure in the apparatus of D2 would not lead the skilled person to the claimed apparatus having a first nozzle providing solder flow in the direction of the movement of the printed circuit board. Further, the modifications necessary in the apparatus of D1 to arrive at the claimed apparatus, that is, the replacement of a symmetrical first nozzle by an asymmetrical nozzle, and the use of a transport means to transport a printed circuit board at an inclination corresponding to the heights of the solder waves and a dam member, were not regarded obvious by the Opposition Division.

IV. In the appeal proceedings, the Appellant requested revocation of the patent and submitted essentially the following arguments in support of his request.

As acknowledged in the patent specification, an asymmetric first nozzle supplying a first solder wave only in the direction of transport of the printed circuit board produces solder contacts with excessive solder, so that this measure in the apparatus according to claim 1 is no more than a constructional detail without any real advantage over a symmetrical nozzle known from the closest prior art disclosed in D1 which also produces solder contacts with excess solder. The rear termination of the outlet of the second nozzle in D1 carries out the function of the dam member since it also directs the solder flow in a direction opposite to that of the transport direction of a printed circuit board. Also, from the acknowledgement of the prior art described with reference to figure 4 in the patent specification, it is evident that in the art it is known to employ a dam member on a nozzle to generate a quiet zone of solder. As regards the requirement in the claim that the transport means transports the printed circuit board along an inclined plane, this measure is already known from D2. In view of the above, the subject-matter of claim 1 is essentially an aggregation of measures known in the art.

V. In his reply to the grounds of appeal and during the oral proceedings before the Board, the Respondent disputed that the symmetrical first solder wave in D1 has the same function as the solder wave flowing only in the direction of movement of the printed circuit board, and submitted that D1 and D2 are concerned with soldering of wiring leads of components and do not address the problem of providing soldering contacts on the front and the rear sides of chip-type components, in particular, leadless

surface mounted devices, as is the case in the patent in suit. Further, since the printed circuit board is transported along an inclined plane, removal of the excess solder by the second solder wave flowing in a direction opposite to that of the transport direction of the board is ensured. The dam member not only directs the flow of the solder but also forms a quiet pool of solder so that formation of solder spikes is avoided as the chip type component emerges from the pool of solder. The second nozzle in D1 is not provided with such a dam member. A combination of the features as set out in the main claim of the patent in suit was therefore not rendered obvious by the disclosure in the cited documents.

VI. The Respondent requested that the appeal be dismissed.

VII. At the conclusion of the oral proceedings, the Board announced its decision to set aside the Decision of the Opposition Division and revoke the patent.

Reasons for the Decision

The only issue in the appeal is the question of inventive step.

1. In the opinion of the Board, the soldering apparatus described in D1 represents the closest prior art. In this prior art a first symmetrical nozzle (2,4) and a second asymmetrical nozzle (3,5) located respectively at the upstream and downstream ends of the transport direction of a printed circuit board fed in a horizontal position produce respectively a first symmetrical solder wave and a second solder wave directed opposite to the transport direction of the printed circuit board. The non-turbulent symmetrical solder wave having a smooth surface has two

components, one flowing in the transport direction and the other in the opposite direction (page 1, lines 38 to 58, page 2, lines 57 to 93 and Figure 2). The height of the symmetrical solder wave is adjusted such that it contacts the underside of the printed circuit board, whereas the second solder wave, being slightly lower than the symmetrical solder wave, hardly reaches the underside of the board. With this arrangement the solder applied by the symmetrical wave produces good soldered joints between lead terminals and the printed circuit board conductors, and any excess solder associated with the projecting ends is removed by the directional asymmetrical second wave without detriment to the soldered joints (page 2, lines 101 to 125).

2. In contrast to the above, in the apparatus as set out in the main claim of the contested patent

(a) the first nozzle is formed such that the first solder wave is spouted only in the direction of movement of the printed circuit board ,

(b) the height of the second solder wave is higher than that of the first solder wave and the printed circuit board is advanced in a state inclined at an angle corresponding to the heights of the first and second solder waves and

(c) the second nozzle is provided with a dam member so as to direct the second solder wave in a direction opposite to the transport direction of the printed circuit board.

As regards the requirement in the claim that the spouting ports be so arranged and formed that excessive solder paddings are removed, the nozzle outlets (4,5) in D1 indeed enable the removal of excess solder.

Whereas the measure (a) ensures a firm soldering of chip type components with excess solder, the measures (b) and (c) remove any excess solder formed on the component (see, for example, page 4, lines 31 to 53). The symmetrical nozzle in the apparatus of D1 is also intended to form good solder joints, possibly with excess solder (page 2, lines 117 to 121), so that contrary to the submission of the Respondent, the measure (a) and the symmetrical nozzle are intended to produce the same end result. Further, there is no evidence before the Board demonstrating any advantageous effect of the measure (a) over the known symmetrical nozzle, so that in relation to the prior art, the measure (a) can be regarded as merely providing a simplified nozzle construction which enables the formation of firm solder joints, possibly with excess solder. The measure (c) provides an alternative nozzle construction for directing the solder flow in relation to the asymmetric nozzle of D1. Although it is not disclosed in the patent in suit, the Board recognises that since the printed circuit board is transported at an angle (measure (b)), any excess solder is pulled back on account of gravity as the component advances through the second solder wave.

In view of the above, the objective problem underlying the present invention can be seen in simplifying the construction of the first nozzle, and providing an alternative transport arrangement of the printed circuit board and an alternative construction of the second nozzle in the apparatus known from D1 so as to produce firm solder contacts without excess solder on the chip type components.

3. In the oral proceedings before the Opposition Division and the Board, the Respondent emphasised the importance of the

dam member in creating a relatively quiet pool of solder which allegedly assists in removing excess solder from the component. In this connection, the Board is of the view that although in Figure 10 of the patent a pool of solder adjacent to the dam member is shown, there is no disclosure in the patent specification that the solder in the pool is stationary and that it assists in removing excess solder. In the Board's view this function of the dam member is also not implicit to a skilled person in what is explicitly disclosed. Though the Board recognises that under appropriate solder flow conditions and depending upon the location of the dam member in relation to the second nozzle, a stagnant pool of solder can be produced by the dam member, the latter, according to the wording of the claim, merely checks the flow of the solder so that the solder flows counter to the transport direction of the board.

In any case, and this has not been disputed by the Respondent, measures (b) and (c) have been employed in combination in the art as acknowledged in the patent specification on page 2, lines 40 to 47 and Figure 4 with a view to avoiding formation of excessive solder paddings. In so far as these measures are concerned, therefore, the invention as claimed merely consists in the application of a known combination of measures for its corresponding effect, and is to be regarded as obvious to a skilled person faced with the task of providing an alternative construction for the second nozzle and an alternative supply arrangement for the printed circuit board. In incorporating these measures in the apparatus of D1, the skilled person would be guided by the teaching of D1 as regards the heights of the two solder waves and adjust these accordingly (page 2, lines 111 to 117).

With regard to the measure (a), although in the art either a bi-directional solder wave or a single directional solder wave flowing in a direction counter to the movement of the board, as in D1 and D2 respectively, for example,is employed to form firm solder connections, the Board is of the view that it is within the competence of the skilled person to realise that besides the direction of the wave in relation to the transport direction of the circuit board, other parameters, such as the width of the crest of the solder wave in relation to the terminal contacts to be soldered and degree of turbulence in the wave, would also influence the formation of solder contacts, so that in looking for ways to simplify the nozzle construction, he would consider an asymmetric nozzle as in measure (a) and adjust the other parameters, if necessary, so that firm solder contacts are produced. The Board also considers that of the two alternatives available to the skilled person, that is, an asymmetric nozzle as in the measure (a) and an asymmetric nozzle directing the solder wave opposite to the transport direction, he would choose the first alternative, since he would realise from the discussion of the prior art wave soldering apparatus in D2 (column 1, lines 45 to 63) that in the second alternative the ability of the solder to wet properly the terminals and conductor paths is likely to be inhibited.

4. During the oral proceedings before the Opposition Division and the Board, the Respondent argued with the help of Sketch 2 submitted at the oral proceedings that whereas the soldering apparatuses in D1 and D2 provide solder connections for lead terminals extending through the printed circuit board, the invention is concerned with soldering chip type components, in particular, leadless surface mounted devices as shown in Figures 2 and 5 of the patent specification and Figure A2 of the Sketch, where solder contacts on the front and rear sides of the component are to be formed, so that the cited prior art

would not be of help in solving the problem encountered in the claimed invention. The Board however cannot accept the above argument mainly because the claim is not limited to leadless surface mounted devices, so that the claimed apparatus also finds application in soldering chip type components having terminal leads projecting through the circuit board.

5. Having regard to the above, the Board comes to the conclusion that the subject-matter of claim 1 of the granted patent lacks an inventive step with respect to the state of the art and therefoe does not meet the requirements of Articles 52(1) and 56 EPC.

Order

For these reasons it is decided that:

The Decision of the Opposition Division is set aside. The patent is revoked.

The Registrar The Chairman

M. Beer G.D. Paterson