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D E C I S I O N
of 24 September 1996

Case Number: T 0281/95 - 3.5.2

Application Number: 86201172.3

Publication Number: 0209936

IPC: H01R 9/09

Language of the proceedings: EN

Title of invention:
Electrical contact pin for printed circuit board

Patentee:
CONNECTOR SYSTEMS TECHNOLOGY N.V., et al

Opponent:
Siemens AG

Headword:
-

Relevant legal provisions:
EPC Art. 56
EPC R. 64b, 65

Keyword:
"Appeal admissible"
"Inventive step - yes, after amendment"

Decisions cited:
-

Catchword:
-

Case Number: T 0281/95 - 3.5.2

D E C I S I O N
of the Technical Board of Appeal 3.5.2
of 24 September 1996

Appellant: (Opponent)
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Representative:
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Respondent: (Proprietor of the patent)
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Decision under appeal:
Decision of the Opposition Division of the European Patent Office posted 7 February 1995 rejecting the opposition filed against European patent No. 0 209 936 pursuant to Article 102(2) EPC.

Composition of the Board:

Chairman: W. J. L. Wheeler
Members: A. G. Hagenbucher
C. Holtz

Summary of Facts and Submissions

I. The appellant filed an opposition against European patent No. 209 936 and now contests the decision of the opposition division rejecting the opposition.

II. In the notice of opposition the appellant raised the objection that the patent as granted did not meet the requirements of Article 52(1) in connection with Articles 54 and 56 EPC. In the appeal proceedings arguments were presented only with respect to lack of inventive step. The following documents cited in support of the opposition remain relevant to the present appeal:

D5: US-A-3 827 004,
D6: US-A-3 824 554 and
D7: EP-A-132 704.

In the appeal proceedings the parties referred to the following additional documents:

D9: "Lehrbuch der Umformtechnik", editor: Kurt Lange, volume 2: "Massivumformung", Springer Verlag 1974, pages 72, 73, 82, 321 to 325, 344, 366, 367, 401, 402, 404, 424 - 427 (already partly cited during the opposition proceedings) and

D10: EP-A-59 462.

III. Oral proceedings were held on 24 September 1996. The respondent filed new claims 1 to 3.

IV. Claims 1 and 3 filed during the oral proceedings read as follows:

"1. An electrical contact pin for mounting in a hole of an electrical component such as a printed circuit board, said pin comprising a longitudinal contact section (1) which interacts with the hole when inserted therein, said contact section being of generally H-shape in cross section formed by four projecting bendable fins (3, 4) extending generally parallel to the longitudinal axis of the pin and interconnected by a central crossbar along the length of the contact section, each fin having a thickness smaller than the average thickness of the central crossbar and the two side walls of each fin being parallel, and said fins and crossbar defining two longitudinal recesses (2) disposed on both sides of the crossbar,
characterized in that
each longitudinal recess (2) has a symmetrical V-shaped floor (5), the fins (3, 4) on both sides of each longitudinal recess are of the same height and thickness and the transition (6) from the V-shaped floor (5) to the fins (3, 4) on both sides of each recess (2) is rounded, to impart a stiffening of the initial sections of the fins, whereby the fins bend uniformly upon mounting in the hole."

"3. A process for making the electrical contact pin according to claims 1 or 2, wherein the contact section (1) is formed by stamping operation using dies for the forming of the longitudinal recesses (2), and the V-shape floors (5) on both sides of the

crossbar are formed by means of two corresponding knife-shaped dies which produce a tracking effect to center the V-shape and to provide a precentering for a more deeply penetrating stamping action to form the longitudinal recesses (2), thereby resulting in symmetrical fins (3, 4) of the same height and thickness on each side of the recesses (2) over the length of the contact section (1) and bendable uniformly upon mounting in a hole, the height decreasing gradually only near the ends of the contact section into a transition section from the contact section to the remainder of the pin."

V. The appellant argued essentially as follows:

The wording of the preamble of new claim 1 did not contravene Article 123(2) EPC. Its features were known from document D5. Figure 4 of D5 showed an electrical contact pin with a crossbar and fins of the same height and thickness. The transitions from the crossbar to the fins were rounded. Only the ends of the fins were tapered. However, whereas according to figure 4 of D5 the floor of each longitudinal recess was straight, claim 1 of the patent in suit required a V-shaped floor. This difference was not inventive because it was generally known (see D9) that V-shaped stamps enabled a symmetrical flow of material. It was clear that not only conical V-shaped stamps as shown in D9 but also knife or chisel-shaped stamps or dies resulted in a symmetrical flow of material. D6 taught the use of dies with a round cross section for making symmetrical round shaped longitudinal recesses in contact pins, and D7 showed

a contact pin with a flat crossbar in the central section with round transitions similar to Figure 2E of the patent in suit. Moreover, the term V-shaped was ambiguous because various shapes of handwritten V's existed and Figures 2C, 2D and 2E of the patent in suit exemplified various possibilities of deviations from the true V form with only two straight lines. Since centring was only possible with sharp edged stamps, the embodiments according to Figures 2C, 2D and 2E should be cancelled, all the more so because they were obvious in view of D6 and D9.

VI. The respondent's arguments can be summarised as follows:

The appeal should be rejected as inadmissible because it did not comply with Rule 64(b) in that there was no statement regarding the extent to which amendment or cancellation of the decision of the opposition division of the European Patent Office was requested.

Electrical contact pins as claimed were in practice very small with recesses of 0.6 mm width and 8 mm length. D5 disclosed an electrical contact pin as indicated in the preamble of claim 1 and represented the most relevant prior art. Its fins were gradually tapered outwardly in order to seat the pin in boards with different hole diameters. Soldering and not press fitting of these pins was essential for keeping them in the holes. Due to their construction the fins might have small differences in thickness and stiffness so that positioning of the pin in a hole

may damage the metallisation in the hole. In contrast thereto the present invention aimed at providing a press fit pin which could be inserted and removed from the hole many times without damaging the metallisation in the hole. Removal required a force greater than 3 kp. According to the present invention this problem was solved by an absolutely symmetrical cross-section of the pins so that force applied during insertion of the pin into the hole was equally shared by all four fins. The symmetrical construction and material distribution was achieved by means of knife shaped dies stamping the longitudinal recesses with the result that the floor of each recess was V-shaped. The transitions of the V-shaped floor to the fins were rounded to impart a stiffening of the initial sections of the fins with parallel walls. This construction led to a uniform bending of the fins upon mounting in the hole. Nothing in the prior art pointed towards the specific problem underlying the present invention, or modifying the pin known from D5 in the way defined by the present claim 1. The fins of the pin known from D5 were designed to collapse. Collapsed fins had the tendency to crack and could then not be pulled out. According to D5 this was no problem because the pins described there were soldered in place and should not be removed and reinserted in contrast to the present invention. Hence, D5 did not give any hint for solving the problem underlying the present invention. The appellant's arguments with respect to D9 were based on hindsight. Figures 2C, 2D and 2E of the patent in suit only took account of possible tolerances due to wear of the tools which were available for

manufacturing very small contact pins. These figures should be allowed because certain tolerances within claimed subject-matter had always been allowed.

VII. The appellant requested that the decision under appeal be set aside and that the European patent No. 209 936 be revoked.

VIII. The respondent requested that the patent be maintained on the basis of the following documents:

Claims: 1 to 3 as submitted in the oral proceedings of 24 September 1996,
Description and drawings in the form as granted (EP-B-209 936).

Reasons for the Decision

1. *Admissibility of appeal*

In the respondent's opinion the appeal filed by Siemens on 20 March 1995 did not comply with Rule 64(b) in that the appeal did not identify a statement regarding the extent to which amendment or cancellation of the decision of the opposition division was requested. However, it is clear from the opposition file that the opponent sought revocation of the patent in its entirety. It can be derived therefrom that the appeal was lodged against the decision in its entirety. Thereby the extent of the appeal within the meaning of Rule 64(b) is sufficiently identified (see T 925/91; point 1.1, OJ

EPO, 1995, 469). Since the appeal complies also with Articles 106 to 108 EPC and Rule 1(1) EPC, the appeal is admissible; cf. see Rule 65(1).

2. *Articles 123(2) & (3) EPC*

Claims 1 to 3 submitted in the oral proceedings of 24 September 1996 comply with the requirements of Articles 123(2) and (3) EPC. The new claims are narrower in scope than the granted claims. Pages 1 and 2 of the application as originally filed disclose that the fins are constructed absolutely symmetrically and are uniformly bendable. Figures 2a and 2C to 2F show that the thickness of each fin is smaller than the average thickness of the central crossbar and that the two side walls of each fin are esentially parallel. Page 5, last complete paragraph, of the originally filed description indicates that the purpose of the rounded transitions from the V-shaped floor to the fins is to impart stiffening of the initial sections of the fins.

3. *Late filed document D9 and late cited document D10*

Since document D9 represents general knowledge and was referred to by both parties in the appeal proceedings it is considered in the present decision. D10 is acknowledged in the patent in suit and is also considered.

4. *Novelty*

In the notice of opposition the appellant attacked

the subject-matter of the patent as granted for lack of novelty and lack of an inventive step. During the appeal proceedings only the objection of lack of an inventive step was maintained. Indeed none of the available prior art documents discloses all the features in present claims 1 or 3. Hence, their subject-matter is novel.

5. *Inventive step*

5.1 Claim 1

5.1.1 Closest prior art and problem underlying the present invention.

D5, which is the undisputed closest prior art, discloses an electrical contact pin for mounting in a hole of an electrical component such as a printed circuit board. This pin comprises a longitudinal contact section (14) which interacts with the hole when inserted therein. According to Figure 4 of D5 the contact section is of generally H-shape in cross-section formed by four projecting bendable fins (16) which extend generally parallel to the longitudinal axis of the pin and are interconnected by a central crossbar along the length of the contact section. Each fin has a thickness smaller than the average thickness of the central crossbar. Similar to Figures 2a and 2C to 2F of the patent in suit the side walls of each fin are essentially parallel with a slight tapering at the outer edge (see Figure 4 of D5). The fins and the crossbar define two longitudinal recesses disposed on both sides of the

crossbar. Due to a flat floor and a small radius at the transitions from the floor to the internal walls of the fins, the pin known from D5 collapses when it is mounted in a hole. After the pin is situated in the hole, the connection is normally soldered. The collapsable fins which are of gradually increasing height towards their centres, permit mounting the pins in holes of different diameters but not a repeated mounting of the same pin without a danger of injuring the metallisation in the hole or cracking of the fins. Thus, starting from D5, the problem to be solved by the present invention is to provide an electrical contact pin which can be repeatedly introduced into a hole of a printed circuit board without overstressing individual fins (see column 3, lines 63 to 65 of the patent in suit). Soldering the contact section should only be optional (see column 4, lines 31 to 34 of the patent in suit), but not absolutely necessary as required for the pins known from D5. The construction should permit the use of tape material which is per se softer and better to work; see column 4, lines 1 to 7 of the patent in suit.

5.1.2 Solution

According to claim 1 this problem is solved by designing the pin such that the fins bend uniformly upon mounting in a hole due to the following features:

(a) Each longitudinal recess has a symmetrical V-shaped floor,

(b) the fins on both sides of each longitudinal recess are of the same height and thickness and

(c) the transition from the V-shaped floor to the fins on both sides of each recess is rounded to impart a stiffening of the initial section of the fins.

Features (a) to (c) are the result of a stamping action with knife (chisel or wedge) shaped symmetrical dies which produce a tracking effect to center the V-shape and generate a symmetrical material flow during the stamping operation, which in turn is essential for generating fins of absolutely the same thickness and height along the longitudinal extension of the contact portion of the pin. This is necessary for providing an equal distribution of force so that when a pin is inserted into a respective circuit board hole, all fins will bend equally to prevent a pin from rotating while being inserted. Feature (c) requires that the transition is rounded in such a way that the initial section of the fins is stiffened in order to prevent collapsing.

Figures 2C to 2F show usual tolerances. Such tolerances cannot be avoided if very small electrical contact pins are manufactured by a stamping operation, due to wear and blunting of the dies.

5.1.3 Document D5 does not aim at avoiding overstress of individual fins by an absolutely symmetrical fin construction and features (a) to (c) in paragraph 5.1.2 above cannot be derived from D5.

According to this prior art the floors of the recesses are flat so that the stamping tools usually used for manufacturing the known pins cannot impart a precentering function which is essential for generating a symmetrical material flow during the stamping operation. The fins known from D5 collapse towards each other when a pin is introduced into a hole. In accordance with these functions the radius at the transition from the floor to an internal wall of each fin is as small as possible in order to allow bending or collapsing of the initial or root sections of the fins, but not stiffening as required in feature (c) (cf. paragraph 5.1.2 above) at this transition.

5.1.4 Although D9 describes the use of cone-shaped die plungers for permitting a better flow of material, the die plungers comprise sharp edges at the transition from the cone to the collar. It does not mention knife (chisel or wedge) shaped plungers. Neither D9 nor D5 gives any hint to use knife shaped plungers which could be used for modifying the flat floor known from D5 into a V-shaped floor and rounding the transition to the fins as indicated in claim 1.

5.1.5 The pins known from D6 have semi-circularly shaped recesses. There is no actual transition between a floor and sides of fins because no floor and no sides of fins can be identified. The shape of the contact portion according to D6 is designed to resist bending, in each cross-section thereof, because there are no functionally distinct areas in the recess.

There is no disclosure of fins having a thickness smaller than the average thickness of the crossbar. In fact, there is not really a crossbar. There are no fins with parallel walls. The construction does not allow an easy bending or flexing and the sharp outside edges of the external areas will dig into the metallisation surface of the hole into which the pin is inserted. The problem underlying the present invention is neither addressed in D6 nor solved by the pin known from D6.

5.1.6 D7 discloses a contact pin without a V-shaped floor. The outer portions 5 are not meant to deform. When the pin is inserted into a circuit board hole, the flat contact portion S, which is called swaging zone, between the outer portions 5 will deform. Since according to D7 the swaging zone buckles when the pin is inserted into the hole, the longitudinal axis of the pin will not remain centred. This causes stress in the board around the hole. Hence, D7 teaches away from the claimed subject-matter.

5.1.7 D10 describes a contact pin having a M-shaped contact portion. It does not have a crossbar where the apexes of the Vs are directed against each other. When such a form is stamped, the material is not forced to flow symmetrically in both recesses into the area of the fins in order to produce fins of the same thickness and height. The general function of a pin having a M-shaped contact portion is entirely different from that of a pin having a H-shaped cross-section. When a pin with a M-shape is inserted into a hole, the fins will bend differently at the top of the M and the

bottom of the M. Hence, no equal stress distribution is possible. A person skilled in the art cannot get any hint from this document for solving the problem underlying the present invention.

5.1.8 It follows from the above considerations that in view of the fact that the prior art does not show or hint at pins which have recesses with symmetrical V-shaped floors the skilled person would not even derive from a combined consideration of the cited documents the suggestion for solving the specific problem underlying the opposed patent by means of the combination of features specified in claim 1. Hence, the subject-matter of claim 1 involves an inventive step.

5.2 Claims 2 and 3

Claim 2 is properly dependent on claim 1 and also allowable.

Claim 3 concerns a process for making an electrical contact pin according to claim 1 or 2. It can be derived from paragraphs 5.1.3 to 5.1.7 above that the prior art does not hint at recesses with symmetrical V-shaped floors or at manufacturing contact pins by means of two corresponding knife shaped dies which produce a tracking effect to center a V-shape and to provide a precentering for a more deeply penetrating stamping action to form the longitudinal recesses with symmetrical fins for the pins defined in claims 1 or 2. Hence, the subject-matter of claim 3 also involves an inventive step.

Order

for these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to maintain the patent on the basis of claims 1 to 3 as submitted in the oral proceedings with the description and drawings as granted.

The Registrar: The Chairman:

M. Kiehl W. J. L. Wheeler