BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS

BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE

CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

Internal distribution code:
(A) [ ] Publication in OJ
(B) [X] To Chairmen and Members
(C) [ ] To Chairmen

D E C I S I O N
of 7 October 1998

Case Number: T 0458/96 - 3.4.2

Application Number: 87301851.9

Publication Number: 0236125

IPC: H05K 3/34, H01R 9/00

Language of the proceedings: EN

Title of invention:
Electrical connector with pin retention feature

Patentee:
E.I. Du Pont de Nemours and Company

Opponent:
01: The Whitaker Corporation
02: Minnesota Mining & Manufacturing Company of 3M Centre
03: Siemens AG
04: Stocko Metallwarenfabriken Henkels und Sohn GmbH & Co.

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56, 123(2), 114(2)

Keyword:
"Inventive step - (yes) after amendment"

Decisions cited:
T 0015/91, T 1002/92

Heatnote:
When both the technical content of a claim and the whole description of the patent clearly establish that the specific manner in which terminal pins of an electrical connector cooperate with respective holes in a printed circuit board constitutes an essential feature of the invention for which protection is sought, a claim directed to an electrical connector which is defined *inter alia* by way of features reciting such specific cooperation cannot be construed as if these features merely defined an intended use of the connector, which should be disregarded for the purpose of assessing patentability of the claimed subject-matter (see point 3 of the Reasons).

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0458/96 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 7 October 1998

Appellant: (Proprietor of the patent)
E.I. Du Pont de Nemours and Company
1007 Market Street
Wilmington
Delaware 19898 (US)

Representative:
Geissler, Bernhard, Dr.jur., Dipl.-Phys.
Patent- u. Rechtsanwälte Bardehle
-Pagenberg-Dost-Altenburg-
Geissler-Isenbruck
Galileiplatz 1
81679 München (DE)

Respondent: (Opponent 01)
The Whitaker Corporation
Suite 450, 4550 New Linden Hill Road
Wilmington, Delaware 19808 (US)

Representative:
Warren, Keith Stanley
Baron & Warren
18 South End
Kensington
London W8 5BU (GB)

(Opponent 02):
Minnesota Mining and Manufacturing Company
of 3M Center
P.O. Box 33427
St. Paul, Minnesota (US)

Representative:
Patentanwälte
Hauck, Graalfs, Wehnert,
Döring, Siemons
Neuer Wall 41
20354 Hamburg (DE)

(Opponent 03):
Siemens AG
Postfach 22 16 34
80536 München (DE)

(Opponent 04): Stocko Metallwarenfabriken
Henkel und Sohn GmbH & Co.
Kirschhofstrasse 52
42327 Wuppertal (DE)

Representative: Stenger, Watzke & Ring
Patentanwälte
Kaiser-Friedrich-Ring 70
40547 Düsseldorf (DE)

Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted 5 March 1996 revoking European patent No. 0 236 125 pursuant to Article 102(1) EPC.**

Composition of the Board:

Chairman: E. Turrini
Members: A. G. Klein
V. Di Cerbo

Summary of Facts and Submissions

I. Four oppositions were filed against the grant of European patent No. 0 236 125 (application No. 87 301 851.9), on the grounds that its subject-matter was not patentable within the terms of Articles 52 to 57 EPC and that it extended beyond the content of the application as filed.

The objections of lack of novelty and inventive step were substantiated in the opposition procedure *inter alia* with the following citations and pieces of evidence:

(D8) Amp catalogue 85-773 issued November 1985 entitled AMPMODU MTE Interconnection System

(D14) Drawings C1139-SP Symbex dated 25 October 1983

(D20) Prospecus EH Connector; JST Trading Company Limited; September 1983

(D22) Prospectus PH Connector; JST Trading Company Limited; June 1984

(D23) Catalogue Steckverbinder-Systeme RFK Stocko; March 1986

(D27) Prospectus Scotchflex; 3M; October 1983

(D30) Japanese Utility Model No 56-72485 and a certified English translation thereof.

II. The patent was revoked by the Opposition Division.

The reason for the revocation was that the subject-matter of claim 1 was not novel in view of the connector disclosed in document D30, and that it constituted anyway a trivial variation thereof.

III. The appellant (proprietor of the patent) appealed against the decision revoking the patent, and requested that it be set aside and that the patent be maintained as amended on the basis of a set of claims 1 to 11, of which claim 1 presented at the oral proceedings, the only independent claim, reads as follows:

"1. An electrical connector or header (10, 20, 30, 40, 50) comprising:
a retainer (14, 34, 44, 54) of plastics material having a plurality of terminal pins (12, 32, 42, 52) mounted therein,
the pins (12, 32, 42, 52) being relatively thick and stiff and extending from the retainer (14) and having a longitudinal axis and end portions for insertion through respective holes of a printed circuit board (18); wherein
the pins include at least one pair of pins (12A, 12B; 32A-32D; 42A-42D; 52A, 52B) having at the insertion portion of each pin an offset in the form of a crimp which causes the longitudinal axis to deviate in one direction and in an opposite direction relative to the uncrimped portion of the pin and the remainder of the pin adjacent the retainer with the insertion portions of the rest of the pins being straight;

the crimp of one pin of said one pair of pins extends in a direction opposite to the crimp of the other pin of the pair of pins, the crimp being arranged at said end portions and being so shaped that on insertion into the holes of the printed circuit board, each pin with a crimp only contacts the printed circuit board with its crimp within its respective hole and only on one side of said hole and at a region inwardly spaced from the end of the hole remote from the retainer and thereby exerts a relatively high normal force against said printed circuit board only at said one side of the hole which is opposite to the corresponding normal force exerted by the other pin of the pair of pins in an opposing insertion hole to thereby act as a retention means for retaining the connector in a position for soldering, whereby when the pins are all inserted in the holes in the printed circuit board and positioned for soldering, the connector is retained in position for soldering solely by the normal forces exerted by the crimped pins."

IV. The respondents 01 to 04 (opponents 01 to 04) requested that the appeal be dismissed.

V. Oral proceedings were held on 7 October 1998, at which respondent 03 was not represented. The decision was announced at the end of the oral proceedings.

VI. In support of his request, the appellant essentially submitted the following arguments.

The claimed connector had become a mass product, which was sold and used by millions of units. Its main

advantages were its capacity to work perfectly with printed circuit boards of standard dimensions and tolerances, and the uniform, low insertion force required for its mounting on such boards, by which it was specially well adapted for automatized mounting by robotic loaders.

As a result of their specific configuration, which was defined both structurally and functionally in claim 1, the crimped pins designed for retaining the connector in position for soldering after insertion of the whole set of pins into corresponding holes in the printed circuit board, only contacted the printed circuit board on one side of the holes during the insertion process. This only contact allowed for smooth insertion, and the position of the region of contact in the fully inserted state, which was spaced from the end of the hole remote from the retainer, was such as to preclude any damage at the edge of the hole itself and weakening of the metallised conductive pads around it.

None of the prior art products achieved the same effects, and there was no combination of them which could in an obvious way lead to the claimed connector.

Document D8 in particular disclosed a crimped pin which was so shaped that on insertion it necessarily contacted opposite sides of the hole, against which it was maintained by an interference fit.

In the prior art embodiments in which the deformed portion of the pin contacted only one side of the hole in which it was inserted, like in the embodiment of

document D30, the shape and lateral extension of the deformed pin, and its position with respect to the hole were such that the opposite side of the hole could not but be contacted also during the insertion process. In addition, document D30 recommended the use of straight pins, which were not crimped in the claimed manner but provided with ill-defined projections, facing the edge of the hole in the inserted state.

The available prior art did not in any way suggest to provide the region of contact between the deformed pin portion and the sidewall of the hole at a location which was inwardly spaced from the end of the hole remote from the retainer.

Although such configuration might theoretically have resulted from the use of a known connector assembly like the one disclosed in document D30, with a thicker printed circuit board, the skilled person had no obvious reason to proceed to such modification. Electrical connectors were indeed designed for use with printed circuit boards of narrowly defined specifications. Board thickness was an essential element of such specifications since it determined the length of the end portion of the pins which would emerge from the other side of the circuit board after insertion, which itself was of paramount importance both for the quality and reproductivity of the soldering operation and for the overall dimensions of the mounted assembly.

VII. The respondents for their part submitted that the subject-matter of the patent extended beyond the

content of the application as filed in the sense of Article 100(c) EPC, and they also questioned the patentability of the subject-matter of claim 1.

With respect of the alleged extension of the subject-matter of the patent beyond the content of the application as filed, respondent 04 in particular objected to the admissibility of the features of the pin having a "longitudinal axis" and of said longitudinal axis being caused to "deviate" in opposite directions as defined in claim 1. The application as filed did not disclose these features, and it was clear that the retaining effect exerted by the pin was due only to the overall lateral offset of the deformed portion of the pin, which was fully independent of the configuration of the remainder of the pin, and of the presence of a longitudinal axis.

The original application documents did not disclose a region of contact which was "inwardly spaced from the end of the hole remote from the retainer" either, as was now set out in claim 1. The only teaching to be derived, if any, from the figures was that such region of contact was spaced from the end of the hole by a distance to about 50% of the length of the pin extending from the retainer. Anyway, the precise position of the region of contact depended on the thickness of the printed circuit board, which the patent description itself acknowledged as not being critical.

Concerning the allowability of dependent claim 11, which had no counterpart in the set of claims as

originally filed and was introduced in the course of the examining procedure, respondent 01 submitted that the addition of a dependent claim 11, which specified that no contact was required between the rest of the pins (i.e. the straight pins) and the printed circuit board, necessarily implied that the preceeding claims disclosed subject-matter not restricted to the details of that claim, and hence straight pins which were actually in contact with the printed circuit board before soldering. Such pins had however not been originally disclosed.

With respect to the issue of the patentability of the subject-matter of claim 1, the respondents submitted that the aspects emphasized by the appellant in connection with the way the deformed pin was inserted into a respective hole and the way it cooperated with its side walls actually defined an insertion process rather than an electrical connector as such. Since the claim was directed to an electrical connector, those features which were not directed to the configuration of the connector per se, but only to the way its connecting pins were intended to be inserted into respective holes of a printed circuit board should be disregarded.

The respondents in this respect also expressed their fears that prior art devices like those of documents D8 or D23 might possibly be considered to infringe present claim 1, due to the unclear status of the features of the claim directed to the intended use of the claimed connector. The claim therefore did not combine "a fair protection for the patentee with a reasonable degree of

certainty for third parties" in the sense of the Protocol on the Interpretation of Article 69 of the Convention.

The respondents submitted that the connector of document D8 clearly exhibited all the structural limitations set out in claim 1, and that its crimped portion was also intended to contact only one side of the hole, as was evidenced by an affidavit by Mr Dennis George Dupler dated 5 January 1996 and filed by respondent 01 with his letter dated 7 November 1996.

In the arrangement of document D8, like in that of document D30, the position of the region of contact between the deformed portion of the pin and the inner wall of the hole would depend only on the thickness of the printed circuit in which the pin was inserted. Upon insertion into a hole in a thick printed circuit board, the region of contact would necessarily be inwardly spaced from the end of the hole remote from the retainer, in the sense of claim 1. With respect to the thickness of the printed circuit boards to be used with the prior art connector arrangements, the respondents submitted that such connectors were generally sold without any board thickness recommendations. Respondent 02 with his letter dated 18 August 1998 filed drawings showing the pin of document D27 as inserted into a printed circuit board hole. As a result of the specific shape of the pin, the latter was so deflected that it only contacted the wall of the hole at a region substantially spaced from the end remote from the retainer. The connector arrangement of document D27 therefore also completely anticipated the

features of claim 1.

Reasons for the Decision

1. The appeal is admissible.

2. *Compliance of the amended claims with the requirements of Article 123(2) and (3) EPC*

2.1 In addition to a number of minor, clearly admissible clarifications brought to claim 1 in the course of the examining procedure, which were not contested by any of the respondents, present claim 1 has been further supplemented with a definition of the "offset in the form of a crimp" as was set out in claim 1 as granted, and with an indication that, on insertion, each pin with a crimp only contacts the printed circuit board "at a region inwardly spaced from the end of the hole remote from the retainer".

Concerning first the definition of the crimped offset, present claim 1 now specifies that the crimp causes the longitudinal axis to deviate in one direction and in an opposite direction relative to the uncrimped portion of the pin and to the remainder of the pin adjacent the retainer. Such specific pin configuration, in which the pin is so deformed that its longitudinal axis at the insertion portion of the pin is caused to deviate successively in one direction and in an opposite direction was shown consistently throughout the figures of the application as originally filed. The present

definition of the crimp, which emphasizes the successive deviations of the pin axis into opposite directions, in the Board's view is also fully consistent with the usual meaning in the English language of the substantive "crimp" used in the original description, and with its association with waves, curls, folds.

The location of the region of contact between the deformed portion of the pin and the wall of a respective hole in an associated printed circuit board - the region being inwardly spaced from the end of the hole remote from the retainer - is shown also on each of the figures which in the original drawings represented the claimed connector as mounted onto a printed circuit board. Although these figures all show a region of contact located substantially half way of the thickness of the printed circuit board, the Board cannot agree to the respondents' argumentation to the effect that the figures therefore only disclose this specific median contact position. Such narrow interpretation of the figures would not indeed be consistent with the statement in the original description that "location of the crimp is not dependent upon the thickness of the printed circuit board because retention depends upon the complementary normal forces of a pair of pins against two opposing printed circuit board holes" (see page 4, lines 8 to 12). This passage clearly allows for some deviation from the configuration shown in the figures.

The above amendments to claim 1 also clearly limit the scope of the claim as compared to the scope of claim 1

as granted, and they therefore meet the requirements of both Article 123(2) and Article 123(3) EPC.

2.2 Respondent 01 objected to the allowability under Article 123(2) EPC of dependent claim 11, which specifies that the rest of the plurality of pins (i.e. those which do not comprise the crimped or bent portions) "are not required to be in contact with the printed circuit board until soldered thereto".

In the Board's view, when interpreted in the context of the whole application, said expression appears to merely imply that no special provisions are taken to ensure that the rest of the pins be in contact with the printed circuit board before soldering. This interpretation appears to be adequately supported by Figure 2B as originally filed, which shows that pin 12 is freely engaged into a hole in the printed circuit board, without any contact.

Respondent 01 in this respect submitted that the addition of a **dependent** claim 11 which specified that no contact was required between the rest of the pins and the printed circuit board, necessarily implied that the preceding claims disclosed subject-matter not restricted to the details of claim 11, and hence straight pins which were actually in contact with the printed circuit board before soldering.

This line as argument construction is not however considered convincing. It is true that the scope of protection afforded by claims 1 to 10 which precede claim 11 is not restricted to the subject-matter set out only in dependent claim 11, but it was not so

restricted either before claim 11 was introduced. The mere addition of dependent claim 11 does not therefore in the Board's view result in modifying the preceding claims in such a way that their "subject-matter extends beyond the subject-matter of the application as filed" in the sense of Article 123(2) EPC.

3. *Proper construction of claim 1*

3.1 Claim 1 is directed to an electrical connector or header which comprises a retainer having terminal pins mounted therein. The configuration of the pins is defined in the claim by way of a series of features which can be divided into two categories.

The features of the first category are directed to physical and geometrical characteristics by which the pins are defined independently of any printed circuit board: the pins are relatively thick and stiff, they extent from the retainer and have a longitudinal axis and end portions, they include at least one pair of pins having an offset in the form of a crimp, the general shape of which is also further specified in the claim, and the crimps of the respective pins of said pair of pins extend in opposite directions. The construction of these features does not give rise to any difficulty.

A second category of features then further define the shape of the crimp of the pins by reference to the way it contacts a printed circuit board, on insertion into a respective hole: the crimp is so shaped that on insertion into the hole in the printed circuit board,

each pin with a crimp only contacts the printed circuit board with its crimp within its respective hole and only on one side of said hole and at a region inwardly spaced from the end of the hole remote from the retainer; the pin thereby exerts a relatively high normal force against said printed circuit only at said one side of the hole which is opposite to the corresponding normal force exerted by the other pin of the pair to thereby act as a retention means for retaining the connector in a position for soldering; thereby when the pins are all inserted in the holes in the printed circuit board and positioned for soldering the connector is retained in position for soldering solely by the normal forces exerted by the crimped pins. The question of the interpretation of this second category of features, and of their relevance for the purpose of assessing the patentability of the claimed subject-matter, has given rise to considerable discussion in the procedure.

3.2 The respondents in this respect submitted that the features of the second category only defined an intended use of the claimed electrical connector, rather than its physical structure, and that they should be disregarded, accordingly. So did the Opposition Division in the appealed decision (see paragraph 6.1, last sentence and paragraph 6.2, last sentence of the reasons).

In support of his view respondent 01 in particular referred to Part C, Chapter IV, paragraph 7.6 of the Guidelines for Examination according to which in a claim directed to a physical entity, non-distinctive

characteristics of a particular intended use should be disregarded, and to the case law of the Boards of Appeal, as exemplified by decision T 15/91 (not published in the Official Journal of the EPO).

3.3 The Board is however not convinced that the above mentioned second category of features of claim 1 merely defines a particular intended use comparable either to the use of a claimed substance as a catalyst as is exemplified in the above passage of the Guidelines, or to the use of a claimed tool for a particular machining operation, as was the issue in the above decision.

As a matter of fact, both the description of the present patent and the technical content of claim 1, in particular the detailed statement in the claim of the technical effect produced by the crimped portion exerting a relatively high normal force against the printed circuit board, clearly establish that the specific way in which the offset portions of the terminal pins cooperate with the walls of the respective holes in a printed circuit board to ensure proper retention of the connector on the printed circuit board constitutes an essential aspect of the invention defined in claim 1 for which protection is sought in the sense of Article 84 EPC.

The claim therefore in the Board's opinion must be construed as including as an essential feature such cooperation between the deformed portion of the pin and the adjacent inner surface of the printed circuit board hole in which it is inserted. Any interpretation to the effect that this cooperation, instead of being an

essential feature of the claimed invention, would only define a facultative element, or an intended use to be disregarded would be consistent neither with the explicit wording of the claim, nor with the whole description and drawings.

For these reasons, the features directed to the cooperation of the deformed portion of the pin with the adjacent walls of a hole in a printed circuit board should be duly taken into account when assessing the novelty of, and the inventive step involved by, the subject-matter of claim 1.

3.4 Incidentally, the Board does not share the respondents' fears that the extent of protection conferred by present claim 1 could not be determined with a "reasonable degree of certainty for third parties", as was required under the Protocol on the interpretation of Article 69 EPC. These fears indeed seem to emerge from an incorrect construction of claim 1, to the effect that its definition could encompass any electrical connector comprising retaining pins having an offset portion in the form of a crimp, simply because it could potentially be used in conjunction with a printed circuit board in such a way as to achieve the cooperation effect set out in the claim.

Since for the above reasons the particular way in which the deformed pins cooperate with the holes in a printed circuit board is to be considered an essential feature of the invention defined in claim 1, the actual occurrence or absence of such cooperation in a device would also be expected to be an essential criteria when

assessing the extent of protection conferred by the claim under Article 69 EPC. In this sense, claim 1 would appear to be directed in effect to a particular combination of an electrical connector with an associated circuit board, such combination being defined by both structural and functional features. Determination of the extent of protection conferred by a claim directed to the combination of two cooperating elements would not appear to give rise to any particular difficulty.

4. *Novelty*

None of the prior art citations on the file in the Board's view anticipates the subject-matter of claim 1. Neither does the evidence produced by the respondent of alleged prior uses prove the availability to the public of the claimed subject-matter at the priority date of the present patent.

4.1 Catalogue D8 in particular discloses two embodiments of an electrical connector having a plurality of terminal pins mounted therein, at least one pair of pins having at the insertion portion an offset in the form of a crimp which causes the longitudinal axis to deviate in one direction and in an opposite direction relative to the uncrimped portion of the pin and the remainder of the pin adjacent to the retainer, the insertion portion of the rest of the pin being straight (see pages 18 and 22, Figures and last sentence of the note, indicating that formed posts are provided in a minimum of two locations per header assembly). In addition, the crimps of each pin of said pair of pins extend in opposite directions, as can be seen on the photography on the first page of the catalogue, for the last pins of the single row of pins shown at the bottom of the page. These "hold down" pins are designed to retain the connector in position for soldering (see page 2, left hand column entitled "Features", 10th paragraph).

Document D8 does not however afford detailed information as to the precise shape of the crimped pins represented schematically in the Figures at the top of pages 18 and 22, nor does it specify the thickness of a printed circuit board for mounting of the connector. In the absence of such information, the document does not disclose the essential features of claim 1 that, on insertion into the holes of a printed circuit board, each crimped pin only contacts the printed circuit board with its crimp within its respective hole and only on one side of said hole and at a region inwardly spaced from the end of the hole remote from the retainer.

The affidavit by Mr Dennis George Dupler filed by respondents 01 in this respect expresses that it was **intent** of the design shown in document D8 to provide for a single contact between the crimped portion of the pin and the wall of the corresponding hole of a printed circuit board. The affidavit only addresses the question of the localisation of the region of contact between the hole and the crimped portion of a pin as fully inserted through the hole. It does not however provide evidence that in a public use of the device in combination with a printed circuit board, before the priority date of the present patent, no other contact occurred during the insertion process, nor that the only region of contact was inwardly spaced from the end of the hole remote from the retainer in the sense of present claim 1.

4.2 Document D14 is a detailed drawing of an electrical connector for mounting onto a printed circuit board designed by the company Symbex, which respondent 02 submitted was shown to individual customers prior to the priority date of the patent. The configuration of the crimped pin in the undeflected state as shown in section A-A in relation to the diameter of the hole and the thickness of the printed circuit board represented also in the figures are such that, on insertion, the pin would necessarily contact opposite sides of the hole. Moreover, in the inserted state shown in section B-B the crimped portion of the pin contacts the printed circuit board almost exactly at the edge of the hole remote from the retainer, not at a region inwardly spaced from it.

4.3 Catalogues D20, D22 and D23 as filed by respondent 04 also disclose electrical connectors comprising crimped pins for retention into respective holes of a printed circuit board. These catalogues do not disclose whether the crimped portions of the pins, on insertion into respective holes, would contact their inner wall on one side only. Concerning the question of the precise position of the region of contact in the inserted state of the pins, it is noticed that the figures consistently show that the maximum offset of the crimped portion lies substantially midway of the pin length, whereas the recommended thickness of the printed circuit board for mounting of the connector is also half the pin length, or less (see documents D20 and D22, penultimate point of the "General specifications" on page 2 and the figures marked "Post-base assembly, Top entry type"; document D23, pages 2, 4, 5 and 6, the figures in the left hand column).

With respect to the products shown in catalogue D23, which are manufactured by respondent 04, the latter at the oral proceedings of 7 October 1998 also produced samples and photographs showing electrical connectors with crimped pins so inserted into holes of a printed circuit board that the only region of contact was substantially at the edge of the hole remote from the retainer.

4.4 Document D30 discloses an electrical connector 7 with pairs of pins 9, 10 comprising respective crimped portions 9a, 10a extending in opposite directions (see Figure 3). In contrast with the claimed subject-matter,

the crimped portions are not formed by successive deviations of the longitudinal axis of the pins in opposite directions, but by deformed side portions obtained by applying a compressive force to form projections at the side walls of the pins (see translation, page 1, paragraph 2). When the pins are inserted into respective holes of a printed circuit board 11, these deformed sections or projections are located at the edge of the hole remote from the retainer 8. Whilst furthermore document D30 explicitly discloses that in the inserted state only the side projections contact the adjacent portion of the wall of the hole (see translation, page 3, fourth paragraph) it does not specify that no other contact occurs during insertion procedure.

4.5 The other documents and evidence on the file do not come closer to the claimed subject-matter.

In particular, the electrical connector numbered 66XX-6002 of catalogue D27 - filed late with accompanying drawings by respondent 02 in the opposition procedure and disregarded by the Opposition Division, accordingly - comprises a long offset section extending parallel to the longitudinal axis of the pin. Respondent 02 in this respect with his letter dated 18 August 1998, which is a few weeks before the oral proceedings in the appeal case, filed still further drawings to show that these pins, when inserted into a corresponding printed circuit board hole, would not contact its inner wall along most of the hole length, but only at a single region remote from the edge of the hole opposite the retainer.

The correctness of this submission was contested at the oral proceedings by the appellant. The submission is also in contradiction with the earlier representation, filed by respondent 02 together with document D27 in the opposition procedure, of such crimped pins as inserted into a printed circuit board hole.

In the Board's view, the exact position of the point or points of contact between the deformed pins of document D27 and the walls of the holes not only depends on the dimensions of the cooperating pin portions and holes, but also on the relative position of the longitudinal axes of the respective pins and holes. In the absence of any detailed information and evidence with respect of the configuration actually made available to the public before the priority date of the patent, the late arguments based on document 27 cannot jeopardize the maintenance of the patent and they are not to be admitted into the appeal procedure, by virtue of the provisions of Article 114(2) EPC (see decision T 1002/92, OJ EPO 1995, 605, point 3 of the reason).

5. *Inventive step*

5.1 The electrical connector shown on pages 18 and 22 of catalogue D8 comprises a retainer having a plurality of terminal pins mounted therein, which exhibits all the structural features of the retainer and pins defined in present claim 1 independently of the printed circuit board, and the document also discloses that at least two symmetrically deformed pins are adapted to exert a retention action on the retainer after its mounting

onto a printed circuit board and before flow soldering (see point 4.1 above).

This document, which in the Board's view constitutes the nearest prior art, does not however specify the precise shape of the crimp provided at the insertion portion of the pair of retention pins, which is simply shown in a schematical view at the top of pages 18 and 22. It does not describe the position and extent of the maximal lateral offset of the crimp in relation to the walls of a corresponding printed circuit board hole either.

5.2 Accordingly, the technical problem posed to the skilled person who strives at implementing the teaching of document D8 in a practical connector can primarily be seen in properly shaping the deformed pins in relation to the respective printed circuit board holes so as to achieve an adequate retention effect, thus filling an evident information gap in document D8.

5.3 By document D30, which also relates to an electrical connector comprising a retainer mounted onto a printed circuit board via deformed terminal pins which cooperate with corresponding holes of the printed circuit board, the skilled person would then be taught that providing projections only on the lateral surfaces of the terminal pins so as to strongly abut against adjacent inner walls of the insertion holes not only prevents the connector from floating or vibrating in the subsequent soldering step, but also allows for very smooth insertion into the holes (see page 1 of the translation, point 3, first paragraph and page 3,

fourth paragraph). When applied to the connector arrangement incompletely disclosed in document D8, this teaching in the Board's opinion immediately leads the skilled person to design the known crimp in such a way that it "only contacts the printed circuit board with its crimp within its respective hole and only on one side of said hole" in the sense of present claim 1.

The appellant in this respect submitted that document D30 explicitly recommended the use of straight pins, the deformation of which was obtained by laterally compressing or pinching the outer surface of the pins to form projections, and that it could not therefore in an obvious way be transferred to the pin configuration of document D8, in which the crimp was formed instead by successive deviations of the longitudinal axis of the pins into opposite directions.

Document D30, however, explicitly points at the risk of breaking or unduly deforming the terminal pins when the dimension of the portion to be laterally compressed or pinched to form the projection is too large (see page 2 of the translation, seventh to third lines from the bottom). Since in the structure of document D8 the holes for receiving the deformed pins have an increased diameter (see pages 18 and 22, "Recommended PC Board Hole Layout"), a large amount of lateral deformation will clearly be required to warrant sufficient contact with the inner walls of the holes. The explicit warning in document D30 against lateral compression or pinching when larger deformations are required would therefore in the Board's view incite the skilled person, who strives at applying the teaching of document D30

concerning the contacting of the inner walls of the holes to the prior art construction of document D8, to retain the bent pin configuration already present in that construction, rather than to adopt the lateral compression scheme of document D30.

The appellant also stressed that, in the claimed arrangement, it was **during the whole insertion process** that the deformed pin only contacted the inner wall of the corresponding hole with its crimp, whilst the teaching of document D30 did not exclude the occurence of further points of contact before the pin was fully inserted.

Smooth insertion is however a well known prerequisite in the mounting of connectors onto printed circuit boards, which is already emphasized in document D30, and its importance for the performance of automatised mounting assemblies is self evident. Accordingly, once the skilled person has been taught by document D30 that proper retention can be achieved with an only contact between the deformed portion of the pin and the adjacent wall of the hole in the inserted state of the pin, he would as a matter of course avoid any further, unnecessary, contact during the insertion process. Prevention of such further contact can obviously be achieved by providing insertion holes for the deformed pins with an increased diameter, as is already disclosed in document D8.

The appellant in this connection also submitted that it was an essential aspect of the claimed arrangement that it worked correctly with standard printed circuit boards and holes. Neither present claim 1, nor the description, however specify the dimensions of the holes for insertion of the connecting pins, and the claim therefore clearly also covers configurations in which deformed pins would be received into larger holes, as compared to the holes for the remaining straight pins, like in the embodiments of document D8.

For the above reasons, the claimed shaping of the crimp of the deformed pins, so that on insertion into the holes of the printed circuit board the deformed pin only contacts the printed circuit board with its crimp within its respective hole and only on one side of said hole, cannot in the Board's view justify recognition of the required inventive step.

5.4 The electrical connector of claim 1 is further distinguished from the embodiments disclosed in document D8 in that said only contact between the crimp and the side of the corresponding hole occurs "at a region inwardly spaced from the end of the hole remote from the retainer".

The technical effect of this particular localisation of the point of contact is not stated in the description of the present patent, but the Board has no grounds to question the appellant's submission - which was not contested by any of the respondents - that it prevented damage at the edge of the hole and weakening of the conductive pads around it.

The claimed inward spacing of the region of contact from the end of the hole remote from the retainer is not known from any of the citations on the file nor from any of the prior uses invoked by the respondents (see point 4 above). The Opposition Division did not explain for which reasons it considered it to be "merely a trivial variation" (see point 6.2, last paragraph of the decision).

None of the nearest prior art citations on the file addresses the question of the proper location of the contact zones between terminal pins and the walls of corresponding holes in relation to the end of the holes, nor of the prevention of damages at the edges of the holes or at the adjacent conductive pads.

Neither did any of the four respondents propose a conclusive line of arguments showing how the skilled person, starting from a given prior art arrangement and following an uninterrupted sequence of obvious steps would have arrived at the claimed localisation without the exercise of inventive ingenuity.

The respondents only submitted that the claimed localisation would result from the use, with a connector arrangement as disclosed for instance in document D8, of a printed circuit board of an appropriate thickness. They did not, however, explain for which obvious reason the skilled person would have actually combined a connector exhibiting the known crimped pin configuration with a printed circuit board of such a thickness as to meet, after insertion, the

claimed requirement.

The appellant for his part convincingly submitted that for the mounting of electrical connectors onto printed circuit boards and their subsequent soldering, the length of the terminal pins as emerging beyond the end of the holes opposite the retainer was a most important parameter. This parameter was carefully selected, taking into account in particular the desired overall dimensions of the assembled parts, and the specific requirements of the soldering process and equipment. The skilled designer of electric equipment would not therefore depart from a selected or recommended board thickness for use with a given connector arrangement, if not for good reasons.

Scrutinizing of the numerous citations on the file shows that the only disclosures of connector arrangements explicitly said to be adapted for use with printed circuit boards of different thicknesses can be found in documents D20 and D22 (see point 4.3 above). In these arrangements, the upper limit of the stated range of circuit board thicknesses between 0.8 mm and 1.6 mm does not exceed the half length of the deformed pin (3.2 mm in D20, 3.4 mm in D22), of which the maximal lateral offset is also located substantially at the middle of the pin, as is apparent from the otherwise precisely dimensioned sketches represented under the heading "Post-base assembly Top entry type" in both documents. Accordingly, within the specified range for the thickness of the printed circuit board, the crimp of the deformed pins of these embodiments could not contact the side of a corresponding hole at a

region inwardly spaced from the end of the hole remote from the retainer in the sense of claim 1.

Therefore, in the face of the evidence on file, the latter feature cannot in the Board's view be considered obvious. The subject-matter of claim 1, by virtue of this feature, shall thus be considered as involving an inventive step in the sense of Article 56 EPC.

The same conclusion applies to the subject-matter of dependent claims 2 to 11 which define the same subject-matter, with additional limitations.

6. To meet the formal requirements of the Convention, the description should still be supplemented with a short acknowledgement of the relevant content of documents D8 and D20 which best reflect the background art, and be adapted to the amended wording of claim 1 (see Rule 27(1)(b) and (c) EPC).

Concerning the necessary adaptation of the description, attention is drawn in particular to the passages of the patent specification as granted which state that the deformation of the terminal pins is not dependent upon the thickness of the printed circuit board, or that the invention operates equally well in very thin and very thick circuit boards (see column 3, lines 27 to 35 and column 4, lines 43 to 54). These passages indeed explicitly refer only to the effect of the thickness of the printed circuit board on the retention effect which results from the complementary action of symmetrical pins against corresponding hole surfaces.

The additional feature introduced into claim 1 as directed to the region of contact of the crimp with the side of the corresponding hole being inwardly spaced from the end of the hole remote from the retainer clearly imposes further constraints in respect of the thickness of the printed circuit board in relation to the shape of the insertion pins: if a given insertion pin embodies the additional feature when used in conjunction with a thin printed circuit board it would certainly do so with a thicker printed circuit board, but the reverse might not necessarily be true. The above mentioned statements in the description should therefore be supplemented with the proviso that the region of contact remains inwardly spaced from the end of the hole.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the Opposition Division with the order to maintain the patent in amended form as follows:

Claims: 1 as presented at the oral proceedings of 7 October 1998;
2 to 11 of the patent specification;

Description: to be adapted;

Drawings: sheets 1/4 to 4/4 as in the patent specification.

The Registrar: The Chairman:

P. Martorana E. Turrini