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D E C I S I O N
of 18 March 2003

Case Number: T 0430/00 - 3.5.2

Application Number: 93301116.5

Publication Number: 0558225

IPC: H01R 13/00

Language of the proceedings: EN

Title of invention:
High frequency electrical modular jack

Patentee:
AT&T Corp.

Opponent:
KRONE (U.K.) Technique Ltd.,

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56

Keyword:
"Novelty - yes"
"Inventive step - yes (amended claims)"

Decisions cited:
-

Catchword:
-

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Case Number: T 0430/00 - 3.5.2

D E C I S I O N
of the Technical Board of Appeal 3.5.2
of 18 March 2003

Appellant: (Opponent)
KRONE (U.K.) Technique Ltd.,
Runnings Road
Kingsditch Trading Estate
Cheltenham
Glos GL51 9NQ (GB)

Representative:
Sunderland, James Harry
HASELTINE LAKE PARTNERS
Motorama Haus 502
Rosenheimer Strasse 30
D-81669 München (DE)

Respondent: (Proprietor of the patent)
AT&T Corp.
32 Avenue of the Americas
New York, NY 10013-2412 (US)

Representative:
Williams, David John
Page White & Farrer
54 Doughty Street
London WC1N 2LS (GB)

Decision under appeal: **Interlocutory decision of the Opposition Division of the European Patent Office posted 16 February 2000 concerning maintenance of European patent No. 0 558 225 in amended form.**

Composition of the Board:

Chairman: W. J. L. Wheeler
Members: R. G. O'Connell
P. Mühlens

Summary of Facts and Submissions

I. This is an appeal by the opponent as sole appellant against the interlocutory decision of the opposition division that European patent 558 225 as amended met the requirements of the EPC.

II. The sole independent claim has been further amended in the appeal proceedings and now reads as follows (bold italics mark insertions vis-à-vis claim 1 as approved by the opposition division):

"1. An electrical modular jack (10, 20, 30) including a plurality of input terminals (323), a plurality of output terminals (I), and interconnection means for electrically interconnecting the input and output terminals, the interconnection means comprising at least two pairs of non-insulated ***lead frame*** conductors (322) that are spaced apart from each other and mounted on a dielectric block (330), said conductors being generally parallel to each other along a portion of the interconnection path between input and output terminals,

CHARACTERISED IN THAT

the conductors (322) of certain of the pair***s*** of spaced-apart conductors are crossed-over each other once without making electrical contact so as to minimize crosstalk therebetween."

III. The following prior art documents, which were among those considered in the first instance proceedings, featured in the appeal proceedings:

D1: EP-A-525 703 and English translation (Article 54(3) EPC);

D2: The Post Office Electrical Engineers' Journal (October 1956), vol 49, part 3, pages 216, 217, 246;

D3: Communications cables and transmission systems, by Werner Schubert, 3rd revised edition, pages 135 to 146;

D4: Publication of the Postmaster-General's Department, Australia, Engineering Branch, 1951, entitled "Course of technical instruction", pages 1 to 16;

D5: Technical Manual No. 11-486-3, published by Department of the Army, Washington 25, DC, 26 December 1956, ref C1, TM 11-486-3;

D6: Principles of Electricity applied to Telephone and Telegraph Work, published by AT&T, June 1961, Chapter 32, pages 334 to 344;

D10: GB-A-2 242 080;

D13: US-A-4 418 239.

IV. In addition, with a submission following the statement of grounds of appeal, the appellant opponent filed the following prior art document:

D14: JP Utility Model 64-20690 and a certified English translation.

V. Oral proceedings were held before the board on 18 March 2003.

VI. The appellant opponent requested that the decision under appeal be set aside and that the patent be revoked.

VII. The respondent proprietor requested that the patent be maintained in amended form in the following version:

- claims 1 to 8 filed with letter dated 14 March 2003

- description, columns 7 and 8 filed in the oral proceedings; and

- description, columns 1 to 6, and drawings as approved by the opposition division.

VIII. The appellant opponent argued essentially as follows:

Prior art document D14 was clear evidence that crossing conductors in an electrical modular jack to prevent crosstalk was known before the priority date of the opposed patent. The paragraph beginning at page 4, line 3 of the English translation explained that capacitors 30 were provided in pairs and mounted on the bottom surface of the printed circuit board 32. The penultimate sentence of this paragraph said that by conveniently selecting the capacitance of the capacitor 30 the equilibrium of a bridge could be obtained that was formed by the capacitance between the lines and by this means stray signals between the lines due to capacitive coupling could be prevented. The final sentence of the next paragraph went on to state that when the equilibrium of the capacitance present between the lines was not too significantly impaired intersection of the traces 33 on the printed circuit

board 32, as shown in figure 4, could be used as a crosstalk counter-measure without the need for a capacitor 30. Hence this document also disclosed the use of an intersection or crossover as a way of minimising crosstalk in a modular jack. In effect it disclosed the two solutions which were the only two feasible options open to the skilled person, viz lumped capacitors and crossing conductors. It could not be hindsight to argue that it was obvious to do what the prior art clearly teaches.

Additionally and alternatively it should he remembered that transposition of conductors was a tool of the trade which the person skilled in the art would routinely employ to solve a problem of crosstalk between conductors wherever it occurred. As the prior art documents D2 to D6 showed it had been used on transmission lines for a century or so to solve the problem of crosstalk caused by closely-spaced signal-carrying conductor pairs. By the same token UTP, ie unshielded twisted pair, cable had come into general use in data transmission circuits some time before the priority date of the opposed patent. In a typical installation the UTP cables extended up to the RJ 45 modular jack, ie the kind known from prior art document D10, which the opposition division had regarded as closest prior art in the decision under appeal. Thus anyone in the art dealing with RJ 45 connectors would have been familiar with UTP cables and the way in which crosstalk was alleviated in those cables, viz by twisting, which was in principle the same as crossing-over as specified in the claim of the opposed patent.

When, shortly before the priority date of the patent, the relevant international telecommunications standard

for modular jacks and associated cabling was amended to specify a requirement for reduced crosstalk at frequencies up to 140 MHz for the connecting cable and the connector it was clear to the skilled person that at such high frequencies the conductors within the connector needed to be treated as transmission lines and the obvious solution to a problem of high-frequency crosstalk in the connector was a crossover of the conductors within the connector.

Although it was true that the conventional approach was the use of either spacing and screening as in D13 or lumped compensating capacitors as in D14, it would inevitably become clear to the skilled person that these techniques would not solve the problem at the high frequencies stipulated in the new standard for modular jacks and he would equally inevitably then turn to the other well-known approach, viz crossover.

IX. The respondent proprietor argued essentially as follows:

Prior art document D14 did not destroy the novelty of claim 1 since the latter was now restricted to a lead frame type modular jack to the exclusion of printed circuit board types. The same applied to D1.

As regards inventive step, the appellant opponent's interpretation of D14, in particular the critical sentence at page 4, lines 25 to 28, was incorrect. The latter sentence stated as a main clause that when the equilibrium of the capacitance present between the lines was not too significantly impaired crosstalk countermeasures could be easily conducted without using the capacitors. In this clause there was embedded a

concessive circumstantial clause: "even if the trace 33 of one of the lines is intersected by the mounting of the printed circuit board 32, as shown in Fig. 4". Whatever this meant, it was not a clear teaching to cross-over conductor pair**s** so as to minimize crosstalk therebetween. The trace 33 was depicted in the drawing as having a minor part running anti-parallel to a minor part of one conductor of the other pair; this would give rise to a small coupling in a compensatory sense for two conductors, one from each of the two pairs. There was no compensatory coupling for the remaining two conductors, the respective other half of each pair. This could not reasonably be regarded as teaching the application of the principle of transposing the conductors of conductor pairs in a symmetrical fashion to effect as near as possible identical couplings in opposite senses - as known *per se* for long telephone transmission lines - so as to minimize inter-pair crosstalk.

The only thing that was clearly taught in D14 was compensation of crosstalk by the use of capacitors on a printed circuit board. There was no teaching of crossover of conductor pairs, even on a printed circuit board, much less crossover of lead frame conductors.

The assessment of inventive step in the decision under appeal was correct. The closest prior art was the standard RJ 45 modular jack as represented by prior art document D10, the problem being to alleviate the unacceptably high level of crosstalk in this connector at the high frequencies required for new data transmission applications. Such a connector is a lumped circuit, not a transmission line. The standard approach in the art to the problem of crosstalk in such

connectors was (i) to reduce crosstalk by spacing and/or screening the conductors and/or (ii) to compensate parasitic coupling giving rise to crosstalk by means of a balancing coupling, ie of opposite sense, provided by lumped capacitors. The former was the approach taught in D13 and, contrary to the appellant opponent's interpretation, the latter was the approach taught in D14.

Furthermore the appellant's assertion that crossover was the obvious solution to the problem of high frequency crosstalk at the priority date of the patent - 24 February 1992 - was belied by his own actions in filing a patent application (now US-A-5 074 804) in March 1990 for an RJ 45 modular jack which did not solve the problem, followed by US-A-5 496 196 filed in December 1992 which solved the problem by adopting a non-standard circular cross-section. Only after publication of the US patent corresponding to the opposed patent did the appellant adopt the crossover technique in patent applications filed by him, eg US-A-5 580 270 filed in October 1993.

Reasons for the decision:

1. *Admissibility*

The appeal is admissible.

2. *Amendments*

Claim 1 of the patent as granted has been restricted by inclusion of the "lead frame" feature which was disclosed as item 320 in figures 3 and 4 and specified

in claim 4 of the application as originally filed. The restriction to "modular jack" is based on the specific embodiments and terminology of the original disclosure (cf page 4, lines 5 to 10); the description has been amended at column 8 to eliminate reference to printed circuit board embodiments originally contemplated. The term "apparatus" has been replaced by the more appropriate term "means". All these amendments are permissible under Article 123(2) EPC and Article 123(3) EPC.

3. *Novelty*

It is common ground that electrical modular jacks are either of printed circuit board or of lead frame construction. The opposition ground of lack of novelty was based on prior art documents D1 (prior art under Article 54(3) EPC) and D14 (submitted by the appellant opponent during the course of appeal proceedings), neither of which discloses lead frame type modular jacks. Claim 1 as amended in oral proceedings before the board now specifies a modular jack having crossed-over lead frame conductors. The subject matter of the claim is accordingly new.

4. *Inventive step*

4.1 The appellant opponent argues in effect that prior art document D14, if not novelty-destroying, should be regarded as closest prior art. Essentially for the reasons adduced by the respondent proprietor (cf IX above), the board is not persuaded that D14 teaches crossover to minimize crosstalk in the sense of claim 1. The appellant's argument is based entirely on a single clause in (the English translation of) that

document which is at best ambiguous, viz "even if the trace 33 of one of the lines is intersected by the mounting of the printed circuit board 32, as shown in Fig. 4". In his written submission of 21 November 2002 the appellant paraphrased this clause to refer to "intersection of the traces (33)", a paraphrase which, in the boards' view, reflects a reading of D14 which is coloured by hindsight. The fact that the layout shown in figure 4 would probably result in a certain small degree of compensatory coupling does not mean that the skilled person would derive from this document a teaching of the systematic application of symmetrical transposition of the parallel runs of respective members of conductor pairs so as to minimize crosstalk. In the judgement of the board, it would be unconscionable to revoke a patent on the evidence of the strained syntax of this sentence together with the obscure technical implications of the drawing referred to.

4.2 Prior art document D10, which formed the starting point for assessment of inventive step in the decision under appeal, remains the closest prior art. It is common ground that it is an example of the well-known RJ 45 modular jack which is the type of standard modular jack referred to in the introductory part of the description of the opposed patent. The objective technical problem solved by the modular jack of current claim 1 is to minimize the crosstalk which occurs between conductor pairs within a connector of this type as explained in detail at columns 1 to 4 of the patent. As explained there, this problem becomes particularly acute when such modular jacks are used as interfaces for signals having frequencies well in excess of 1 MHz. This problem is solved in accordance with the teaching of

the opposed patent by modifying the known modular jack in the manner specified in the characterising portion of claim 1, viz by a crossover of certain of the conductor pairs.

4.3 It is also common ground that the technique of crossing-over or transposing the conductors of signal transmitting conductor pairs to minimize crosstalk *per se* has been well-known and used since the beginning of the twentieth century in the field of long distance multipair telephone cables as evidenced by prior art documents D2 to D6. Neither does the respondent proprietor contest that a twisted pair is notoriously used to reduce pickup of interfering inductive and radio frequency signals by exploiting the cancellation produced by the opposite senses of the interfering signals in the sections between crossover points of the twisted pair.

4.4 The appellant opponent argues that transposition of conductors was a tool of the trade which the person skilled in the art would routinely employ to solve a problem of crosstalk between conductors wherever it occurred. The board is not persuaded by this argument since it is premised on the assimilation of the "trades" of transmission lines and connectors. In the extensive prior art on file there is neither a disclosure nor a suggestion that crossover should be used within a connector to reduce crosstalk. The person skilled in the art of modular jack design would of course be aware of the technique of transposition for reducing crosstalk, but he would consider it as rooted in the field of transmission lines. Even his theoretical knowledge of the fact that a short conductive path behaves as a transmission line at a

sufficiently high frequency would not lead him as a matter of routine to obliterate the natural conceptual interface between transmission line and connector. The appellant opponent's observation that the jack designer would be familiar with a twisted pair cable being terminated at an RJ 45 modular jack serves only to underline the point that he is accustomed to seeing that transition from cable to connector as marking a boundary with different considerations applying on each side, in particular a distributed circuit approach for transmission line design, a lumped circuit design approach within the connector. It would therefore not be obvious for him to break with the traditional approach represented by D13 and D14 and import a solution from the conceptually distant field of transmission line design.

4.5 Neither is the board persuaded by the argument that the inevitable failure of the lumped capacitor approach would in turn lead inevitably to the crossover solution. Other solutions were clearly possible, such as screening, increasing conductor spacing and/or changing to a circular cross-section for the jack, as evidenced by the appellant opponent's own subsequently filed patent applications. The fact that these other solutions involved disadvantages does not imply that there was a one-way street leading to the solution of the opposed patent.

5. The board concludes that the subject matter of claim 1 is to be considered as being new and as involving an inventive step within the meanings of Article 54 EPC and Article 56 EPC respectively. The patent and the invention to which it relates also meet the other requirements of the 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 maintain the patent in amended form in the following version:

   - claims 1 to 8 filed with letter dated 14 March 2003;

   - description, columns 7 and 8 filed in the oral proceedings; and

   - description, columns 1 to 6 and drawings as approved by the opposition division.

The Registrar: The Chairman:

D. Sauter W. J. L. Wheeler