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D E C I S I O N
of 30 November 1999

Case Number: T 0126/97 - 3.4.2

Application Number: 88305705.1

Publication Number: 0296836

IPC: G02B 6/44

Language of the proceedings: EN

Title of invention:
Optical fibre cables

Patentee:
BICC Public Limited Company, et al.

Opponent:
Alcatel Kabel Beteiligungs - AG

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step - (yes) exclusion of hindsight"

Decisions cited:
-

Catchword:
-

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Case Number: T 0126/97 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 30 November 1999

Appellant: (Opponent)
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Decision under appeal:
Decision of the Opposition Division of the European Patent Office posted 17 December 1996 rejecting the opposition filed against European patent No. 0 296 836 pursuant to Article 102(2) EPC.

Composition of the Board:

Chairman: E. Turrini
Members: S. V. Steinbrener
B. J. Schachenmann

Summary of Facts and Submissions

I. The appellant (= opponent) lodged an appeal against the decision of the Opposition Division rejecting the opposition against European patent No. 0 296 836.

II. The opposition filed by the appellant against the patent as a whole was based on Article 100(a) EPC, in particular on Article 56 EPC, since the subject-matter of the patent in suit allegedly lacked an inventive step. Moreover, an objection was raised under Rule 35 EPC.

III. In its decision, the Opposition Division held that the subject-matter of claim 1 as granted, which was maintained in unamended form, was inventive with respect to the available prior art comprising (in the numbering of the Opposition Division), *inter alia*, the following documents:

D1: EP-A-0 157 610, and

D6: DE-A-32 19 455.

The opponent's arguments relating to Rule 35 EPC were not considered relevant because this was not a ground for opposition under Article 100 EPC.

IV. The above documents were again referred to by the appellant in the statement of grounds of appeal.

During the appeal proceedings, the respondent (= patent proprietor) cited

D7: Bayer brochure "Guide data Desmopan", Edition 1996, and

D9: American Society for Testing and Materials, Designation D 2240-86: "Standard Test Method for Rubber Property - Durometer Hardness", May 1986.

The appellant additionally referred to

D8: International Wire & Cable Symposium Proceedings 1984, pages 98 to 100.

V. In the communication of 12 August 1999 pursuant to Article 11(2) of the Rules of Procedure of the Boards of Appeal, the Board shared the parties' view that document D1 anticipating the pre-characterising portion of claim 1 as granted, came closest to the subject matter of the patent in suit which differed from this prior art by the features of the characterising portion of claim 1, i.e by the material of the inner sheath having a Shore hardness of not more than 60A and a modulus of elasticity of less than 100 MPa.

The technical effect achieved by these differences seemed to relate to a reduction of microbending phenomena occurring either during processing or in service and being in particular due to forces exerted by temperature variations.

Whether or not the claimed solution to said microbending problem was obvious from the remaining prior art, in particular from document D6, should be discussed at the scheduled oral proceedings. At present, the Board had some difficulties in accepting

that a skilled person would derive the claimed material properties from document D6 (which apparently refers to materials of higher hardness) and combine those properties with the teaching of document D1 (which relates to blowable cables) in order to arrive at the claimed solution in an obvious way.

VI. Oral proceedings which had been arranged at the parties' respective subsidiary requests took place on 30 November 1999. At the end of the oral proceedings, the decision of the Board was given.

VII. The appellant requested that the decision under appeal be set aside and that the European patent be revoked.

VIII. The respondent requested that the appeal be dismissed and that the patent be maintained as granted.

IX. The wording of claim 1 reads as follows:

"1. An optical fibre cable comprising an inner sheath (3) containing at least one coated optical fibre member (1, 2), and an outer sheath containing the inner sheath, the outer sheath (5) being of a material having bulk and surface properties such that the cable is blowable along a previously installed duct by fluid drag of a gaseous medium as determined by a test in which:
(a) a 50 m length of duct having a circular internal cross-section 4.0 mm in diameter is wound in a single layer around the outside of a cylindrical drum 0.75 m in diameter, the static coefficient of friction between the cable and the duct being 0.15;
(b) a 50 m length of the cable is inserted completely

into the duct by any suitable method;
(c) an air flow of 20 standard litres/minute is established down the duct; and
(d) the time taken for the cable to emerge completely from the downstream end of the duct is recorded, the cable being regarded as blowable if the said time is not greater than 1 hour, the internal cross-section of the duct and the air flow being appropriately modified from the values of 4.0 mm and 20 standard litres/minute respectively if the diameter of the cable differs from 1.7 mm;
characterized in that the inner sheath (3) is of a material which has a Shore hardness of not more than 60A and has a modulus of elasticity of less than 100 MPa."

In the above wording, two printer's errors have been removed by correcting "dray" to read "drag" and replacing "." at the end of feature (d) by ";".

Claims 2 to 10 are appended to claim 1.

X. The appellant advanced the following arguments:

Document D1 already discloses a blowable optical fibre cable, the specific construction of which apparently leads to relatively high microbending losses caused by forces resulting from temperature variations. Since microbending is a fundamental phenomenon to which all kinds of optical cables are susceptible, a skilled person would consider a broad field of available prior art in order to solve the microbending problem existing in blowable cables.

When proceeding in this way, a skilled person would take account of document D8 clearly relating to the minimisation of microbending. In accordance with D8, this problem is solved by coating the fibre with a soft inner layer having a very low modulus of elasticity of the order of $< 10^{-2}$ MPa. As possible materials for this layer, document D8 mentions two alternatives: a low viscosity compound or a softly cross-linked compound, the latter in the appellant's view being solid plastic material. Otherwise, no modulus of elasticity could be measured. Although the Shore hardness of the material is not specified, the overall disclosure of D8 imparts enough information for a skilled person to select appropriate hardness values.

On the other hand, attention is drawn to the fact that claim 1 of the patent in suit only defines an upper limit for the hardness and modulus values so that even a viscous liquid would fall within the claimed range. This still remains true in the light of the fact that liquids normally are not subjected to Shore hardness measurements since it is undeniable that the Shore hardness of a liquid can be measured, the result being Shore hardness zero in accordance with document D9.

Document D6 also points to microbending phenomena, albeit not explicitly mentioned, and proposes an analogous solution by providing a soft elastic intermediate layer, *inter alia* consisting of soft polyester or polyamide elastomers. The layer material has a modulus of elasticity in the range of 30 to 50 MPa. As can be seen from the drawings, the cable structures of the prior art and the patent in suit are in substance identical. Judging from the cable

dimensions, it must be assumed that the cable of D6 would also be suitable for installation by the blown fibre method. Although the Shore hardness value of the soft intermediate layer is not mentioned in D6, its selection would be straightforward in view of the cushioning effect to be achieved.

Hence, the combination of the teachings of either documents D1 and D8 or documents D1 and D6 would lead to the claimed invention without the exercise of inventive skill.

XI. The respondent's argument in support of its request may be summarised as follows:

The basic document relating to the so-called blown fibre method is EP-A-0 108 590 cited in the patent in suit, which document however does not disclose any detailed cable construction. Such a construction was for the first time described in document D1 originating from one of the inventors of the blown fibre method. Therefore, document D1 would be considered by a skilled person to have more authority than an average prior art document.

The particular construction of D1 aims at preventing buckling of the optical fibres. In the embodiment of Figure 3, this is achieved by using a tightly fitting sheath of high modulus material for coupling the fibres to an integral unit which has enough rigidity to stop the buckling effect. Figure 5 of D1 shows a different approach, the fibres being loosely enclosed in a very high modulus tube which as such does not buckle.

Before the priority date of the patent in suit, a combination of foamed outer sheath and high modulus inner sheath was the only cable design proposed for blown fibre installation. Although D1 also mentions conventional cables as suited for the blown fibre method, this cannot be understood to mean an invitation to go back and look generally at conventional optical fibres.

Starting from D1, there are potentially two ways of modifying the prior art in order to arrive at the claimed invention irrespective of whether the cable contains one or more fibres: either by substituting a sheath of soft material for the inner high modulus sheath or by applying an additional soft sheath within the inner high modulus sheath. The first approach cannot be obvious since it clearly goes against the invention of D1. The alternative approach would also directly contradict the teaching of document D1 based on rigid structures for buckling prevention. Moreover, document D1 already provides some remedy for temperature strain in that the moduli of the inner and outer sheaths may be chosen such that the overall expansion coefficient of the composite sheath structure is practically negligible or matched to the fibre expansion coefficient. Document D1 thus already provides a complete solution to all problems caused by temperature variations.

For these reasons, a very large incentive would have been required for a skilled person not to comply with the teaching of D1. However, in the respondent's view such an incentive is neither given by document D6 nor by document D8. Neither of these documents relates to a

blowable fibre cable so that a skilled person would not have taken them into account.

In particular, document D6 is earlier art with respect to document D1. Therefore, a skilled person would not combine the respective teachings of D1 and D6 since he must assume that the inventor of D1 would have had access to document D6. Moreover, document D6 does not disclose anything about microbending.

However, even if such a combination were considered, the claimed invention would not have been obtained by the skilled person. Although according to D6 the modulus of elasticity of the intermediate layer is below the upper limit defined in claim 1, no hardness values are given in this prior art. From the materials disclosed in D6, i.e polyurethanes, polyesters and polyamides, it must be concluded that the respective Shore hardness values of the known intermediate layer are higher than 60A. This is in particular true for polyurethanes as can be seen from the data sheet of D7 where all the compounds having the required moduli of elasticity are much harder than permissible. Finally, no evidence has been produced that the cable of D6 is indeed blowable.

The material used in D8 for fibre buffering is a low viscosity, softly cross-linked non-dripping compound, i.e. some kind of thick liquid which is not solid at all. This fact is confirmed by the very low modulus of elasticity which is consistent with the behaviour of a thick viscous paste. As a consequence, the Shore hardness requirement of claim 1 of the contested patent is not met since the method of determining Shore

hardness inherently imposes a lower limit on the hardness values and is not intended to test liquids (see document D9). Moreover, an application of the viscous liquid of D8 inside the high modulus inner sheath or tube according to D1 does not seem to make sense since it would either provoke slippage and thus prevent locking the fibres together or would be superfluous in the case of a rigid tube.

Reasons for the Decision

1. *Admissibility of appeal*

The appeal meets the requirements of Rule 65 EPC and is therefore admissible.

2. *Article 54 EPC*

The subject-matter of claim 1 is not disclosed in any one of the documents identified, as can also be seen from the discussion of inventive step below. In particular, none of these documents discloses a blowable optical fibre cable which comprises a soft inner sheath of a material conforming to the requirements set out in claim 1. Novelty has, in fact, not been contested in the present proceedings.

3. *Article 56 EPC*

3.1 Having regard to the issue of inventive step, the Board agrees with the parties' and the Opposition Division (see page 5, points 2 to 4 of the impugned decision)

that document D1 comes closest to the subject matter of claim 1 which in substance differs from the closest prior art (see in particular Figures 3 and 5 and associated text of D1) by the features of the characterising portion: according to the patent in suit the inner sheath is of a material which has a Shore hardness of not more than 60A and a modulus of elasticity of less than 100 MPa, whereas the known inner sheath has a modulus of the order of $10^9 Nm^{-2}$ (see D1, claim 15), i.e 1000 MPa, and its Shore hardness is not specified. However, the Shore hardness of the material preferred in D1, i.e. polypropylene (see D1, claim 16), must be assumed to be considerably higher than 60A. This fact was not contested by the appellant.

3.2 In accordance with the patent in suit (see page 2, line 52 to page 3, line 7), the risk of microbending due to forces resulting from temperature variations is reduced by the soft inner sheath providing a cushioning effect.

Although document D1 does not explicitly refer to microbending, there is disclosed the possibility of avoiding appreciable strain on the fibres by matching the moduli of the inner sheath and the outer sheath such that the overall thermal expansion coefficient is practically negligible or matched to the fibre expansion coefficient (see D1, page 7, lines 3 to 13). Apparently, this measure also leads to reduced microbending (see page 3, lines 3 to 7 of the patent in

suit) so that the objective problem solved by the above differences with respect to the closest prior art may be seen in realising an alternative approach to microbending prevention or in achieving a further improvement in this respect.

3.3 Document D1 describes the first and only cable design particularly adapted for use with the blown fibre method before the priority date of the patent in suit. The document originates from one of the inventors of the blown fibre method, and thus must be assumed to have considerable weight in the eyes of a skilled person. The Board therefore shares the Opposition Division's doubts (see page 6, first paragraph of the impugned decision) as to whether in the light of the above problem a skilled person would seriously consider a major deviation from the teaching of D1 without having compelling reasons.

In the Board's opinion, replacing the high modulus inner sheath of D1 by a soft, low modulus layer would be a measure directly against the teaching of document D1 for which a stiff inner structure is essential, the structure being achieved either by locking the fibres together into a fixed matrix with the aid of the high modulus inner sheath (see Figure 3 of D1) or by making the inner sheath itself resistant to shrinkage of the outer sheath (see Figure 5 of D1). Nor would the additional provision of a soft inner sheath between the fibres and the known high modulus element be compatible with the teaching of D1 since it either interferes with the tight locking concept or, at least in a first approximation, seems to be superfluous for fibres loosely enclosed in a stiff tube.

In case of realising microbending problems with a blowable cable according to Figure 3 of D1, the Board holds the view that a skilled person in a first step would either try the construction of Figure 5 expecting - at least in a certain temperature range - the loose fibres to be less prone to microbending phenomena. Alternatively, a skilled person would follow the suggestion of expansion coefficient matching clearly expressed in D1. Both alternatives would be in line with the teaching of D1 and - at least in part - solve the microbending problem.

Since the blown fibre method constitutes a radical change in cable installation technology, the Board is convinced that a skilled person would *a priori* not consider the prior art existing in the field of conventional cables, which have not been specifically designed for blown fibre installation, to be promising in the present context.

In consequence, given the specific state of the art at the priority date of the patent in suit, the claimed modification of the known blowable fibre cable does not appear to be obvious to a skilled person.

3.4 Nor would the subject matter of claim 1 be reached in an obvious way if the available prior art on conventional fibre cables were taken into account, be it for the reason of alleged structural similarity or for the reason of alleged blowability as put forward by the appellant.

Although document D6 (see page 6, lines 16 to 20) discloses a rubber like, "soft-elastic" intermediate

layer having a relatively low modulus of elasticity of between 30 and 50 N/mm^2 (30 to 50 MPa), the Shore hardness values of the layer material consisting in particular of polyurethanes and "soft" polyester or polyamide elastomers are not specified. On the basis of the respondent's submissions, there are considerable doubts as to whether the said materials meet the claimed Shore hardness requirements, i.e. have a Shore hardness value of not more than 60A. As can be seen from document D7 (see the table at pages 6 and 7), all of the polyurethanes listed there and having moduli in the claimed range share a hardness value of at least 80A. Thus, in the absence of any evidence to the contrary it must be assumed that the materials qualified as "soft" in D6 are not suitable for the inner sheath in accordance with the teaching of the patent in suit.

Therefore, even if the microbending aspect were already referred to in D6 (see page 5, lines 23 to 29) as the appellant holds, a skilled person considering a combination of documents D1 and D6 would not arrive at the claimed solution.

Document D8 cited for the first time during the present appeal proceedings does clearly relate to the microbending problem and for its solution proposes a three-layer buffer comprising a coated fibre surrounded by a layer of "low viscosity or softly cross-linked compound" enclosed within a hard, double-layered plastic shell (see D8, page 98, left-hand column, first paragraph). At page 98, right-hand column, second paragraph of D8, said layer is described to consist of a "low viscosity or softly cross-linked, non-dripping

compound" having a very low modulus of the order of $< 10^{-2}$ N/mm^2 (10^{-2} MPa). Contrary to the appellant's assertions, the Board does not consider "softly cross-linked compound" to mean solid material but rather a substance consisting of two or more monomers which are weakly polymerised. From the context (see also D8, page 98, right-hand column, third paragraph), it must be concluded that the compound is viscous, i.e. of semifluid type. In the Board's view, this conclusion is also supported by the existence of a very low modulus of elasticity reported in D8.

Therefore, even if the hardness and modulus requirements of the patent in suit were considered to be formally met in that a Shore hardness of zero could be attributed to a viscous liquid, such viscous liquid is clearly excluded by the wording of claim 1 of the contested patent referring to an inner "sheath", i.e. a close-fitting solid cover. This interpretation of claim 1 is in line with the fact that Shore hardness is only specified for homogeneous materials ranging from soft vulcanised rubber to rigid plastics and having hardness values of at least 10A (see document D9).

Hence, a combination of documents D1 and D8 would also not lead to the subject matter of claim 1 as granted.

Since neither document D6 nor document D8 give any incentive for further modifications of their respective teachings, a skilled person cannot be assumed to consider such further modifications without hindsight, in particular if such modifications required a complete exchange of the respective inner layer materials.

3.5 Therefore, the subject-matter of claim 1 as granted involves the inventive step required by Articles 52(1) and 56 EPC, and claim 1 is accordingly allowable.

Dependent claims 2 to 10 concerning specific embodiments of claim 1 and the remaining parts of the patent specification also meet the requirements of the EPC.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

P. Martorana E. Turrini