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) [ ] To Chairmen and Members
(C) [X] To Chairmen

D E C I S I O N
of 4 March 1998

Case Number: T 0152/94 - 3.4.2

Application Number: 88200793.3

Publication Number: 0292037

IPC: G02B 6/44

Language of the proceedings: EN

Title of invention:
Method and device for introducing a cable into a cable guide tube

Patentee:
Koninklijke PTT Nederland N.V.

Opponent:
British Telecommunications public limited company

Headword:
-

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

Keyword:
"Main request: Novelty (no) - known method meets claimed conditions"
"First and second auxiliary requests: Amendments - added subject-matter (yes)"
"Third auxiliary request: Inventive step (no) - obvious "filling the gap""

Decisions cited:
-

Catchword:
-

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0152/94 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 4 March 1998

Appellant: (Opponent)
British Telecommunications public limited company
81 Newgate street
London EC1A 7AJ (GB)

Representative:
Roberts, Simon Christopher
BT Group Legal Services
Intellectual Property Department
8th Floor, Holborn Centre
120 Holborn
London, EC1N 2TE (GB)

Appellant: (Proprietor of the patent)
Koninklijke PTT Nederland N.V.
P.O. Box 95321
2509 CH Den Haag (NL)

Representative:
Dietz, Frans Anton
Vereenigde Octrooibureaux
P.O. Box 87930
2508 DH Den Haag (NL)

Decision under appeal: **Interlocutory decision of the Opposition Division of the European Patent Office posted 21 December 1993 concerning maintenance of European patent No. 0 292 037 in amended form.**

Composition of the Board:

Chairman: E. Turrini
Members: S. V. Steinbrener
L. C. Mancini

Summary of Facts and Submissions

I. Both the patent proprietor and the opponent lodged an appeal against the interlocutory decision of the Opposition Division. In this decision, European patent No. 0 292 037 as amended by the patent proprietor during the opposition proceedings on the basis of an auxiliary request was found to meet the requirements of the EPC, while the main request was not considered allowable. The patent in suit relates to European patent application No. 88 200 793.3 from which application No. 90 203 138.4 is a divisional application.

The opposition was filed against the patent as a whole, referring to Article 100(a) and (b) EPC respectively, since the subject-matter of the patent in suit allegedly lacked novelty and an inventive step, and was not sufficiently disclosed.

In its decision, the Opposition Division held that the subject-matter of claim 1 according to the main request was not novel with respect to document

D1: EP-B-0 108 590.

The subject-matter of claim 1 according to the auxiliary request was, however, found allowable with respect to the available prior art further comprising (in the numbering of the Opposition Division), inter alia, the following documents:

D3: S. A. Cassidy et al.: "A radically new approach to the installation of optical fibre using the viscous flow of air", British Telecom Technology Journal, vol. 2, No. 1, January 1984;, and

D7: IEEE Journal on Selected Areas in Communication, vol. SAC-4, No. 5, August 1986, pages 679 to 685.

II. During the appeal proceedings, both parties additionally cited various further documents, of which the following are relevant to the present decision (the numbering corresponds to that used by the Board during the appeal proceedings):

D9: FR-A-1 557 074

D10: US-A-3 465 941

D11: EP-A-0 185 788

D12: US-A-4 469 267

D13: FR-A-1 083 065

D15: GAST Air Motors and Air-Powered Gearmotors, Gast Manufacturing Corporation, Benton Harbor (03.85)

D17: British Telecom Technology Journal, vol. 5, No. 3, July 1987, pages 19 to 24

D18: TNO-Report 1881/'94E, 26 April 1994

D20: International Conference on Plastics in Telecommunications PIT VI, 16 to 18 September 1992, London, pages 22/1 to 22/8, and

D22: Telephony, 12 November 1984, pages 40 to 54.

Of these documents, documents D17, D18 and D20 do not constitute prior art since the priority date of the contested patent must be considered to be valid as far as D17 is concerned, and the other documents were published after the filing date of the corresponding patent application.

III. Moreover, inter alia, the following further evidence was submitted by the parties in the appeal proceedings:

- Figures 1 to 4 and Exhibits IV and VI as filed with the patent proprietor's statement of grounds and corrected with the proprietor's letter dated 16 February 1995;

- statutory declarations by Mr Cassidy, Professor Tabor and Dr Barden as filed with the opponent's letter dated 2 December 1994, the last declaration comprising Graphs A and B which have been re-submitted as "Exhibit VI" and "Exhibit IV" respectively, in a corrected version with the opponent's letter dated 7 November 1997;

- a copy of an English translation of a decision of the District Court of The Hague dated 3 July 1996 as filed with the proprietor's letter of 6 August 1996; and

- statutory declarations by Professor Jones as filed with the opponent's letter dated 14 November 1997 and by Dr Griffioen as filed with the patent proprietor's letter of the same day.

IV. Oral proceedings were appointed at the respective auxiliary requests of both parties. In the communication of 26 September 1997 pursuant to Article 11(2) of the Rules of Procedure of the Boards of Appeal, the Board expressed its concern under

Articles 123(2) and 84 EPC about amendments to the claims then on file, and summarised the relevance of the available prior art with respect to Articles 54 and 56 EPC for claims which could be considered formally allowable. Moreover, it was pointed out that the above-cited Graphs A and B could not be correct and should hence be clarified before the scheduled oral proceedings.

V. At the opponent's request, oral proceedings were postponed until 4 March 1998 and - at the request of both parties - the present case was consolidated at short notice with the pending appeal proceedings T 0576/97-3.4.2 in the divisional application to the extent that both cases were to be dealt with by the Board in identical composition at oral proceedings on the same day.

VI. Oral proceedings took place on the agreed date. At the end of the oral proceedings, the decision of the Board was pronounced.

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

VIII. The appellant/patent proprietor requested that the appeal be dismissed and that the patent be maintained in amended form on the basis of the main request as submitted with the letter of 14 November 1997 or on the basis of amended first and second auxiliary requests as filed at the oral proceedings, or on the basis of the third auxiliary request corresponding to the patent as "maintained" in the interlocutory decision of the Opposition Division.

IX. Independent claims 1 and 6 according to **the main request** read as follows:

"1. A method for introducing a longitudinal element (26) along a previously installed guide tube (6) of the sort designated as duct with an inlet end and an exit end, whereby the longitudinal element (26) is led into the inlet end and a flow of gas is effected from the inlet end and directed to the exit end of said duct (6) by inserting a compressed gaseous medium into the duct (6) at the inlet end for exerting on the element (26) a drag force distributed throughout the length of the element (26) then existing in the duct (6) so as to further advance the element (26) there into, wherein:

- the longitudinal element (26) is a cable with an intrinsic stiffness which is sufficient to hinder "buckling" of the cable when pushing it into a duct;

- the length of the duct (6) is greater than a given limiting value below which the drag force exerted onto the cable (26) is, once said cable (26) has been led into the duct (6) inlet end, by itself sufficient, at any point along the duct length, for overcoming the friction forces, so that there is a deficiency in friction forces compensating effect of said drag force in a first part of the duct (6) starting from its inlet end; and

- the cable (26) is introduced into the inlet end of the duct (6) by pushing forces, which are exerted near the inlet end, to an extent allowed by the intrinsic stiffness of said cable (26), in a manner such as to be larger than the forces required for overcoming opposing forces on the cable (26) caused by a pressure difference existing at the inlet end of the duct (6) between

.../...

the inside and outside of the duct (6) as a consequence of said inserting of the compressed gaseous medium at the inlet end, and to be effective over said first part of the duct (6) in order to completely counter said deficiency in friction forces compensating effect of said drag force in said first part.

6. System for introducing a cable into a cable duct, which system comprises

- a first duct section (6) with an inlet end and an outlet end, in which a flow of gas can be effected from the inlet end and directed to the exit end and a relevant cable (26) can be led into the inlet end,

- a first cable advancing device (1), coupled to the inlet end of said first duct section (6), comprising:

  + cable advancing means (3, 4, 8 - 15) for advancing a cable (26) downstream into the first duct section (6),

  + gas inserting means (7) for inserting compressed gas in order to cause said flow of gas,

wherein:

- a cable (26) having an intrinsic stiffness which is sufficient to hinder "buckling" of the cable when pushing it into a duct;

- the length of the duct section (6) is greater than a given limiting value below which the drag force exerted onto the cable (26) is, once said cable (26) has been led into the duct section inlet end, by itself sufficient, at any point along the duct

section length, for overcoming the friction forces, so that there is a deficiency in friction forces compensating effect of said drag force in a first part of the duct section (6) starting from its inlet end; and

- the cable advancing means (3, 4, 8 - 15) of said first cable advancing device (1) comprise means adapted for exerting pushing forces on the cable (26) being introduced, to an extent allowed by the intrinsic stiffness of said cable (26), in a manner such as to be larger than the forces required for overcoming opposing forces on the cable (26) caused by a pressure difference existing at the inlet end of the duct section (6) between the inside and outside of the duct section (6) as a consequence of said inserting of the compressed gaseous medium at the inlet end, and to be effective over said first part of the duct section (6) in order to completely counter said deficiency in friction forces compensating effect of said drag force in said first part."

In the above wording, the erroneous repetition of the line "led into the duct section inlet end, by itself" appearing twice in the version of claim 6 as filed, has been deleted.

Claims 2 to 5 and 7 to 19 of the main request are appended to claims 1 and 6 respectively.

The claims according to the **first auxiliary request** on file at the time of the present decision differ from those of the above main request in that the following paragraph:

"- the longitudinal element (26) is a cable having an intrinsic stiffness that on the one side is greater than about 0.9 Nm^2, which stiffness is sufficient to hinder "buckling" of the cable when pushing it into a duct, and on the other side having an intrinsic stiffness that is lower than a value for which the friction forces in the duct are not compensable;"

has been substituted in independent claims 1 and 6 of the first auxiliary request for the paragraphs of above claims 1 and 6 of the main request commencing with

"- the longitudinal element (26)..." (claim 1) and "- a cable (26) having an intrinsic stiffness..." (claim 6), respectively.

Independent claims 1 and 5 according to the **second auxiliary request** presently on file differ from claims 1 and 6 of the above first auxiliary request in that the additional passage derived from claim 2 of the main request, i.e.

", the length of the duct being given by the equation

$$l > \frac{p(o)^2 - p(l)^2}{2p(o)} \cdot \frac{\pi r_k r_d}{fW}$$ in which

$p(o)$ = the pressure at the beginning of the duct (Pascal)

$p(l)$ = the pressure at the end of the duct (Pascal)

r_k = the radius of the cable (m)

r_d = the radius of the duct (m)

f = coefficient of friction between the cable and the duct

W = cable weight per unit of length (N/m)"

.../...

has been introduced into independent claims 1 and 6 of the first auxiliary request (the latter claim being renumbered 5, accordingly) at the end of the respective paragraphs commencing with "- the length of the duct (6)..." between "...starting from its inlet end" and "; and".

Claims 2 to 4 and 6 to 17 of the second auxiliary request are appended to claims 1 and 5, respectively.

Claim 1 according to the **third auxiliary request** reads as follows:

"1. System for introducing a cable into a cable duct, which system comprises

- a first duct section (6) with an inlet end and an outlet end, in which a flow of gas can be effected from the inlet end and directed to the exit end and a relevant cable (26) can be led into the inlet end,

- a first cable advancing device (1), coupled to the inlet end of said first duct section (6), comprising:

  + cable advancing means (3, 4, 8 - 15) for advancing a cable (26) downstream into the first duct section (6),

  + gas inserting means (7) for inserting compressed gas in order to cause said flow of gas,

wherein:

- the cable (26) to be introduced has an intrinsic stiffness;

.../...

- the length of the duct section (6) is greater than a given limiting value below which the drag force exerted onto the cable (26) is, once said cable (26) has been led into the duct section inlet end, by itself sufficient, at any point along the duct section length, for overcoming the friction forces, so that there is a deficiency in the friction force compensating effect of said drag force in a first part of the duct section (6) starting from its inlet end; and

- the cable advancing means (3, 4, 8,-,15) of said first cable advancing device (1) comprise means adapted for exerting pushing forces on the cable (26) being introduced, to an extent allowed by the intrinsic stiffness of said cable (26), in a manner such as to be larger than the forces required for overcoming opposing forces on the cable (26) caused by a pressure difference existing at the inlet end of the duct section (6) between the inside and outside of the duct section (6) as a consequence of said inserting of the compressed gaseous medium at the inlet end, and to be effective over said first part of the duct section (6) in order to completely counter said deficiency in the friction force compensating effect of said drag force in said first part,

and wherein

A. said cable advancing means comprise

- a hollow, substantially rectilinear cable lead-through channel (3) with an entrance end (4) and an exit end (5) for leading in and leading out a cable (26) which has to be introduced into the relevant duct section (6),

.../...

- at least one pair of wheels (8, 10; 9, 11) mounted opposite to each other for moving on a cable (26) disposed between these wheels into the direction of the exit end (21) of a relevant duct section,

- a motor (15) coupled to at least one of said wheels for providing a driving couple to it,

B. said gas inserting means comprises a gas channel (7), which debouches into the cable lead-through channel (3) and which is adapted for inserting compressed gas into said lead-through channel (3) between said wheels and the exit end (5) of said lead-through channel (3), wherein

+ a piston (13) has been provided, which is on the one hand movably mounted in a pneumatic cylinder (14) and on the other hand coupled to at least one of said wheels (8; 9), in such a way that when compressed gas is supplied to the pneumatic cylinder (14), transverse forces will be exerted on the cable (26) disposed between the wheels (8, 10; 9, 11),

+ the motor (15) is a pneumatic motor capable of providing said driving couple, which is larger than the driving couple, which has to act on the cable (26) to compensate the difference between the pressure inside and the pressure outside the cable lead-through channel (3),

whereby said pushing forces are exerted by the wheels on the cable (26) as a consequence of the cooperative effect of the driving couple and the transverse forces."

Claims 2 to 12 of the third auxiliary request are appended to claim 1.

.../...

X. The patent proprietor argued as follows:

Document D1, which has always been acknowledged to constitute the most relevant prior art, must be read in the context of the other prior art, thereby avoiding any ex post facto analysis. D1 is restricted to "light-weight and flexible" optical fibres and teaches pushing only to the extent of overcoming the hydrostatic pressure at the entrance of the fibre duct, i.e. the prior art actually discloses a method for installing vulnerable optical fibre members by avoiding local stresses on the fibre in that a pulling force is distributed over the fibre length. Therefore, D1 teaches away from using pushing forces.

The patent in suit relates not only to scaling up the prior art method quantitatively to somewhat bigger dimensions but more fundamentally to the problem of improving it qualitatively so that it may be applied to heavy cables and much greater duct lengths. The qualitative change expresses itself in the fact that the dragging forces are to be necessarily supplemented by pushing forces, which is not the case in D1.

This difference is based on the present inventors' insight that the pressure gradient is not constant over the duct length and that therefore stiffer cables can be installed by pushing and blowing.

If a skilled person wants to determine whether a fibre is sufficiently flexible and light-weight in the sense of D1, this document offers two possibilities:

(a) use of trial and error;

(b) use of the theoretical calculation given in Figure 8 showing the dependency of the drag forces on pressure.

.../...

However, an increase in pressure is clearly undesirable as would be an increase in the duct diameter. This has been pointed out in Dr Griffioen's declaration. Experiments are expansive so that the normal skilled person would probably look at related prior art, i.e. documents D3 and D7 which contain more information. The fibres used there have only small diameters (about 2.5 mm) and a weight of about 3 g/m, and the torque of the drive wheels is just enough to overcome the hydrostatic pressure. Moreover, the diagrams in D3 and D7 only show a positive tension measured immediately after the duct inlet, which in the case of pushing should be negative. Therefore, it must be concluded that no pushing forces have been applied in D3 and D7.

When considering the much higher cable diameters and weights used in the patent in suit (9.7 mm and 66.3 g/m, respectively) and taking account of the fact that the drag forces vary linearly with the cable diameter but cable weight and friction forces do so quadratically, then the claimed application cannot be considered obvious.

Even after the priority date the opponent lacked insight into the basic cable transport mechanisms, as can be seen from document D17 stating that there is no explanation why an increase in pressure does not lead to an increase in installation length. Finally, Mr Cassidy, one of the inventors of D1, explicitly declared before the USPTO in 1986 that the method according to D1 was only successful for light-weight cables having large diameters whereas standard cable bundles could not be blown.

In the method according to claim 1 of the **main request** the above differences are clearly expressed by

- a cable stiffness which is sufficient to hinder buckling of the cable when being pushed;

- the duct length being greater than a limiting value reached with blowing alone; and

- pushing forces being larger than the hydrostatic force and overcoming the lack of drag force in the first part of the duct.

The last feature has to be seen in the context of a duct having such a great length that the drag forces are by themselves not sufficient for overcoming the friction forces **at any point** of the duct, whereas in D1 pushing is only used to compensate the difference between total drag force and local drag force at the duct inlet, i.e. over a few centimetres only. D1 nowhere gives any hint for any further pushing as is confirmed by the opponent's own other documents D3, D7, D17 and Mr Cassidy's declaration before the USPTO.

The opponent's Graphs rely heavily on a value of 0.5 for the friction coefficient f (or μ). The friction coefficient crucially depends on material properties and shows much variation. There has been a lot of discussion in these proceedings on the opponent's value which corresponds to the maximum value quoted in the literature (see D22). A value of 0.5 may have been measured in D1 but it is highly doubtful whether such a value was really present. Friction coefficients depend very largely on temperature which could have been reduced by air flow effects. Attention is drawn to the fact that, shortly after the priority dates of D1, the opponent already employed reduced friction coefficients

.../...

of 0.4 in D3 and D7. With such lower values there would be no crossing point in the Graphs, proving that no pushing was necessary. In fact, the fibre elements of D1 cannot be pushed since they will buckle.

Moreover, there is a discrepancy between the pushing lengths derivable from Figure 6 of D3 and those resulting from the formula of the impugned patent when applied to the examples of D3, so that the question arises whether the measured "compression" in Figure 6 is really due to pushing forces or, alternatively, whether the friction coefficient of 0.4 is correct.

In claim 1 of the **first auxiliary request** a lower limit for the cable stiffness has been introduced so that the lower stiffness range has been disclaimed. From the overall disclosure of the patent in suit (see in particular original page 9, lines 11 to 17 and original page 10, lines 23 to 28), a skilled person would understand that higher stiffness values are possible as long as the friction forces remain compensable.

Claim 1 of the **second auxiliary request** additionally includes a formula for the length of the duct, the appearance of square terms in the formula reflecting the fact that there is no linear pressure drop as assumed in D1.

The **third auxiliary request** has already been allowed by the Opposition Division and does not seem to need further extensive argumentation. Even if pneumatic devices were known as such, they involve specific advantages in the impugned patent, and their selection cannot be easily derived from the publications cited since all of these publications do not relate to cable-blowing but to completely different technical fields.

.../...

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

Document D1 does not try to avoid localised pushing forces but rather localised pulling forces because in any case the back pressure has to be overcome. Figure 3 of D1 clearly shows a "cable", and there is an indication in D1 that larger cable diameters may be used. In accordance with D1, pushing continues until the drag forces are sufficient to cause the further advance of the fibre through the duct.

If the examples of D1 are reworked in the light of the theory given in the patent in suit, it turns out that pushing forces have to be provided in the 200 m case over the first 125 m or, if the local force and not the total force has to be considered, as alleged by the patent proprietor, then pushing would still be necessary over about 70 m as can be seen from the point where both curves in the Graph have identical slopes. Although it seems doubtful whether the patentee's allegation is correct, both approaches clearly show that cables of the type considered in the examples of D1 cannot be installed without pushing over a considerable duct length.

This is also confirmed by document D3 showing in Figure 6 negative fibre strain, which means pushing over about 65 m.

The alleged differences between the subject-matter of claim 1 of the **main request** and documents D1 or D3 do not exist. As regards a sufficient cable stiffness, this must necessarily be the case for pushing without buckling. Furthermore, D1 is clearly operating in the claimed duct length regime, and the cable is actually pushed in the prior art as has been shown for the examples given in D1 and D3 (see the Graphs and the

declaration of Professor Jones). In this context, it has to be noted that the overall deficiencies in dragging forces due to blowing alone are very small, i.e. a few Newtons only.

Document D1 is addressed to a practical person who would simply try out the machine of D1 on a specific cable by putting the power on and pushing until the cable starts to move on. Such a person would consider the set-up to be wrong if buckling occurred. Typical for a practical approach is also the linear approximation used in D1 for the pressure gradient. In the impugned patent, a more theoretical approach is carried out for scaling up, which in practice however still makes use of the prior art technique.

The patentee's different attempts to call the lack of novelty into question are not convincing. As regards the value of the friction coefficient of 0.5, document D22 clearly shows that such values were actually measured at the priority date of D1. Of course, there was a tendency to reduce the friction values as much as possible in the course of time as can be seen from documents D3 and D7 ($f = 0.4$) or document D18 from 1994, the latter document referring to cable and duct samples indeed received from the opponent but already based on a lower friction technology. Contrary to the patent proprietor's assumptions, it has to be emphasised that in D1 no air cooling was provided.

Moreover, even with a friction coefficient of 0.4, the maximum duct length for blowing alone which can be derived from the length formula given in the impugned patent would only increase from 140 m to 175 m for the examples given in D1 ($r_k = 1.25$ mm; $r_d = 3.5$ mm; $W = 3.5$ g/m; (over)pressure = 40 psi) and D3 ($r_k = 1.25$ mm; $r_d = 3$ mm; $W = 3$ g/m; (over)pressure = 40 psi), thus still lying below the actually installed

duct lengths of 200 and 325 m respectively. Since there is nothing to suggest discarding friction values of 0.4 or 0.5 disclosed in D1 and D3, these documents already impart the teaching to use duct lengths beyond the limiting value.

Finally, the alleged discrepancies referred to by the patent proprietor do not exist since the only thing to be learnt from Mr Cassidy's declaration before the USPTO is that the dragging forces depend on the material, and Figure 6 of D3 shows real compression, i.e. pushing, measured by a generally recognised method, whereas the device of Figure 4 in D3 lacks the capability of detecting compression so that only positive tensions appear in Figure 5.

Claims 2 and 7 of the main request should not be permitted since the introduction of these claims does not constitute a necessary reaction to the objections raised. An analogous argument holds for claims 2 and 7 of the first auxiliary request.

The independent claims of the **first and second auxiliary requests** respectively are not admissible since they offend against Article 123(2) EPC. There is no clear basis in the original application documents for a stiffness value of "greater than about 0.9 Nm^2", the value of 0.9 being rather a compromise according to the original disclosure. Moreover, such stiffness values would be obvious to a skilled person.

As has been shown above, the examples of D1 and D3 satisfy the length criteria in accordance with the **second auxiliary request**.

.../...

Filling the "gap" in the disclosure of D1 by the addition of pneumatic elements as provided in the **third auxiliary request** is not inventive since a skilled person would ask a mechanical engineer to put the apparatus of D1 into practice, and these elements are known in the technical field concerned. Thus, as can be seen from document D11, no surprising benefits are apparent from the typical use of pneumatic piston/cylinder combinations falling in the same class as nuts and bolts.

Reasons for the Decision

1. *Admissibility of appeals*

The present appeals are admissible.

2. *Main request*

2.1 Claim 1 of the main request differs from claim 1 as granted in that the intrinsic cable stiffness has been specified as being "sufficient to hinder "buckling" of the cable when pushing it into a duct" as disclosed at page 5, lines 17 and 18, of the impugned patent. In the Board's view, the wording of the amendment is also sufficiently clear to be understood by a skilled person so that the requirements of Articles 123 and 84 EPC can be considered to be met.

2.2 In document D1 (see in particular Figures 3 and 4 and associated text), a method is described for introducing a longitudinal element (Figure 4: fibre member 46) along a previously installed guide tube (Figure 4: conduit 11, ductlet 12) of the sort designated as duct with an inlet end and an exit end, whereby the longitudinal element is led into the inlet end and a

flow of gas is effected from the inlet end and directed to the exit end of the duct by inserting a compressed gaseous medium (Figure 4: arrow at air inlet 45) into the duct at the inlet end for exerting on the element a drag force distributed throughout the length of the element then existing in the duct so as to further advance the element thereinto (see D1, in particular column 8, lines 22 to 34).

Furthermore, in the known method the longitudinal element may be a cable (Figure 3: reinforced fibre member 31) necessarily having an intrinsic stiffness. Although not expressly mentioned in D1, the fact that the intrinsic stiffness of the cable is sufficient to hinder buckling when pushing the cable into a duct is implicit to a skilled person from the above-cited passage since otherwise pushing of the fibre member until the drag force becomes sufficiently great would not be possible in D1.

Having regard to the length of the duct, the limiting value for blowing alone is given in accordance with the patent in suit by the formula of claim 2 of the main request , i.e.

$$l_{limit} = \frac{p(o)^2 - p(l)^2}{2p(o)} \frac{\pi r_k r_d}{fW} .$$

If the parameter values of the test example given in D1 (see column 7, lines 9 to 17) are inserted in this formula in correct units ($r_k = 1.25 \times 10^{-3}$ m; $r_d = 3.5 \times 10^{-3}$ m; $W = 3.5 \times 9.81 \times 10^{-3}$ N/m; $p(o) = 375$ kPa; $p(l) = 100$ kPa; $f = 0.5$) then both parties agreed that the result will be a limiting length of about 140 m. Therefore, since D1 claims to have installed a cable

.../...

under such conditions over a duct length of 200 m (which has not been challenged by the patent proprietor), it must be assumed that in the prior art the length of the duct as well exceeded the limiting length value for blowing.

Finally, it appears from the above-cited passage that in D1 the cable is also introduced into the inlet end of the duct by pushing forces which are exerted near the inlet end to an extent allowed by the intrinsic stiffness of the cable, in a manner sufficient to overcome the opposing forces caused by the pressure difference existing at the inlet end of the duct and to be effective over said first part of the duct in order to counter completely said deficiency in the drag force in said first part. The initial pushing to overcome the hydrostatic force is expressly mentioned in D1 (see also column 10, lines 4 to 15), and pushing is in practice continued "until the surface area of the fibre member which is exposed to the air flow is sufficiently large to produce a drag force to cause the further advance of the fibre member through the tube and the ductlet" (see D1, column 8, lines 26 to 34), i.e. until a deficiency in the drag force over a first part of the duct is compensated.

This interpretation is consistent with the results of calculations submitted in corrected form as "Exhibit VI" (which corresponds to Graph A and should actually read "Exhibit IV" for reasons of consistency with the earlier terminology) with the opponent's letter of 7 November 1997. The calculations are based on formulae (3) and (4) of the impugned patent and presented as a diagram showing the integrated blowing and friction forces as dependent on duct length for the test example given in D1. As can be seen from the diagram, there is a deficiency for the total blowing force in this case over the first 125 m of the duct

.../...

length. Since the cable is said to have been inserted over a duct length of 200 m in D1, this could not have been achieved by blowing alone but had, in fact, to be supplemented by pushing at least over said first 125 m portion. These theoretical findings have been confirmed by experimental tests simulating the conditions of said example of D1 and showing that cables of the type described in D1 can actually be installed over a duct length of 200 m, but with the aid of continuous pushing only (see the declaration of Professor Jones).

In view of the conclusive evidence, it must therefore be assumed that all the features of claim 1 are already anticipated by the prior art disclosed in document D1.

Having regard to documents D3 and D7 disclosing subject-matter similar to D1, at least document D3 also deprives the claimed method of novelty for analogous reasons (see D3, sections "1. Introduction" and "2. Installation details", in particular the example given in section 1).

2.3 The patent proprietor's counter-arguments are not considered convincing.

Although D1 relates to "light-weight and flexible" fibre members, these properties are to be understood as meaning "sufficiently light-weight and flexible for the blowing method" and may be assessed by a trial and error experiment (see D1, column 2, lines 38 to 63). Moreover, as can be seen from Figure 3, the prior art method also relates to the insertion of "cables" (a fact which has been explicitly acknowledged in the impugned patent as well; see page 2, lines 28 and 29) optionally having diameters much larger than the preferred range of 1 to 4 mm (see D1, column 3, lines 44 to 49). Therefore, a skilled person would understand from D1 that in this respect there is hardly

.../...

an a priori restriction to specific cable properties in the known method but suitability of cables must be tried out in practice. Neither are any cable specifications apparent from claim 1 of the main request, the claim only specifying the longitudinal element as a "cable".

It is true that in D1 (and similarly in documents D3 and D7) the rubber wheels are said to be driven by a torque **just sufficient to overcome the hydrostatic force** (see D1, column 10, lines 4 to 32). However, in the Board's view, a skilled person would consider this condition to be a minimum requirement and in practice continue pushing until the blowing force becomes sufficiently strong or - if this does not occur - until the cable is inserted over the whole duct length as advocated in D1, column 8, lines 26 to 34. In this context, it has to be noted that in accordance with the above-mentioned Graph the additional pushing forces necessary to compensate the deficiency in blowing force are rather small (at most about 0.1 N, i.e. about 10% of the friction force) so that no additional requirements should be expected for the driving mechanism.

Hence, although the Board in no way wishes to belittle the present inventors' contribution in correctly describing the pressure conditions fundamental to blowing theory, this theoretical insight does not appear to cause any really different approach when putting the claimed method into practice.

Neither can the objections raised in the context of the opponent's calculations challenge the finding of lack of novelty. In view of the available prior art (see, in particular, documents D1, D3, D7 and D22; see also document D20 published after the priority date of the present patent) and Mr Cassidy's declaration filed with

the opponent's letter of 2 December 1994, the Board sees no reason to call into question the value of 0.5 for the friction coefficient. Moreover, even if this value were reduced to 0.4 in accordance with documents D3 and D7, then the example of D1 will still fall within the claimed regime according to the above calculations. This argument also holds if the total blowing and friction forces are replaced by the local ones, in accordance with the patent proprietor's allegation.

Moreover, the Board does not feel capable of finally deciding the issue of whether the alleged experimental discrepancies in Figures 4 to 6 of document D3 have been substantially removed by the opponent's comments. In the Board's view, this issue is not however prejudicial to deciding on the question of novelty since the latter can in substance be based on an evaluation of the test examples of the prior art in the light of its general teaching and the theory disclosed in the patent in suit.

2.4 In consequence, the Board comes to the conclusion that the subject-matter of claim 1 of the main request lacks the novelty required by Articles 52(1) and 54 EPC, the claim being not allowable for this reason.

An analogous argument holds for independent claim 6 of the main request, which, thus, is also not allowable.

3. *First and second auxiliary requests*

In the independent claims of the first and second auxiliary requests, the feature of the main request relating to cable stiffness has been replaced by "- the longitudinal element (26) is a cable having an intrinsic stiffness that on the one side is greater

than about 0.9 Nm^2, which stiffness is sufficient to hinder "buckling" of the cable when pushing it into a duct, and on the other side having an intrinsic stiffness that is lower than a value for which the friction forces in the duct are not compensable".

In the Board's view, this amendment introduces subject-matter which extends beyond the content of the application as filed.

Having regard to original disclosure, the patent proprietor referred to pages 9, lines 11 to 17, and 10, lines 23 to 28, of the application documents as filed. However, the first passage referred to explicitly states that a stiffness of about 0.9 Nm^2 is **illustrative of a cable used in practice**, and continues "Such a stiffness will be sufficient to hinder "buckling" of the cable..., and on the other hand the friction forces...still prove to be compensable". Therefore, a skilled person would understand from this passage that a cable stiffness of 0.9 Nm^2 constitutes a suitable compromise for the claimed method, whereas lower **and** higher stiffness values may cause problems of a different nature.

Without referring to any cable properties, the second of the above passages only underlines the fact that the installation length will increase if the number of windings and curves in the duct is reduced, i.e. the teaching of this passage can only be seen in that one may go further with less friction forces while still employing a stiffness value suitable in practice.

.../...

The Board cannot see - neither from these passages nor from the remaining application documents - how a skilled person would directly and unambiguously derive the information from the application as filed that the stiffness value should be "greater than about 0.9 Nm^2" (emphasis added by the Board).

On the contrary, the first passage gives a clear indication that values **above** 0.9 Nm^2 may provoke excessive friction forces, which value has consequently been selected as an "illustrative" value also in the example given at page 9, line 28, to page 10, line 5, of the original application documents. This view is further confirmed by lines 25 to 28 of original page 12, stating: "In order to ensure that the pushing force working will be effective it is essential that the relevant cable has a certain stiffness. The cables used in practice meet this requirement." (emphasis added by the Board). Such cables typically have a stiffness of about 0.9 Nm^2 as the skilled person learns from the former passages cited above.

Hence, there is no original disclosure of the method being provided for a higher range of stiffness values having a value of 0.9 Nm^2 as a **lower limit** only and the upper limit being determined by the friction forces as claimed in the first and second auxiliary requests, and these requests are therefore not allowable pursuant to Article 123(2) EPC.

4. *Third auxiliary request*

4.1 Claim 1 of the third auxiliary request relates to a "system for introducing a cable in a cable duct" and corresponds to the claim on which the interlocutory decision of the Opposition Division was based. The claimed subject-matter meets the requirements of

.../...

Articles 123 and 84 EPC and is not anticipated by the available prior art, as can be seen from the discussion of inventive step below. Moreover, no objections have been raised in this respect in the present proceedings.

4.2 Taking account of the findings in item 2 above, the claimed system differs from the closest prior art described in D1 (see in particular Figure 4 and associated text: first duct section 11, 12; cable 46; cable advancing device 41; cable lead-through channel 42, 43, 44 and 49; pair of wheels 47, 48; motor implicit from "constant torque driving mechanism"; gas channel 45) basically by

(i) a piston movably mounted in a pneumatic cylinder and coupled at least to one of said wheels for exerting the transverse forces on the cable whereas in D1 the means for exerting said transverse forces (which must exist in D1 for the purpose of pushing) is not specified; and

(ii) a pneumatic motor for providing the necessary driving couple whereas the type of driving mechanism employed in D1 is not disclosed.

4.3 The advantageous effects associated with these differences relate to the provision of a constant pressure force on the cable allowing variations in the cable thickness (difference (i), see the impugned patent, page 6, lines 42 to 45) and to the exertion of a driving couple proportional to air pressure and tolerating a slow-down - or even standstill - of the motor without harmful consequences, in particular during the so-called "tandem" operation (difference (ii), see the patent specification, page 6, lines 14 to 18).

.../...

The objective technical problem may therefore be seen in putting the prior art system into practice while achieving the above effects. Since filling the "gap" in the disclosure of D1 is an obvious necessity for the realisation of a working system, and both the existence of cable thickness variations and the requirement of tandem coupling are familiar to an average practitioner (see also D1, column 10, lines 39 to 43, in this context), the above problem cannot contribute to patentability.

4.4 In the Board's view, the differences (i) and (ii) are not linked in a synergetic way and therefore may be assessed separately.

As the opponent has demonstrated by submission of further evidence in the appeal proceedings, pneumatic piston/cylinder combinations acting on drive wheels and track belts and their above-mentioned advantages appear to be well-known in the field of cable tension and transport systems (see e.g. documents D11 (in particular page 3, lines 3 to 12; page 5, lines 1 to 11; page 6, lines 9 to 15; and page 8, lines 25 to 30) or D12 (in particular column 1, lines 50 to 58; column 3, lines 38 to 52; and column 4, lines 5 to 46) or D13 (in particular page 1, first paragraph of left-hand column and second paragraph of right-hand column)).

An analogous argument holds good for the use of pneumatic motors as the drive mechanism for said wheels and track belts (see e.g. documents D9 (in particular page 1, right-hand column, second paragraph - page 2, left-hand column, second paragraph; and page 3, right-hand column second and third paragraphs) or document D10 (in particular the abstract and column 3, lines 18 to 22) or D15 relating to pneumatic motors as such (in particular page 4)).

.../...

Therefore, the Board is convinced that a skilled person in the specific field of cable blowing would be aware of these known design possibilities and their respective advantages in the general field of cable transport. In view of the desired effects, a skilled person would consequently envisage pneumatic solutions without exercising inventive skill. A further strong incentive to select pneumatic drive elements must be seen in the fact that for cable blowing the presence of compressed air is imperative so that further use of this energy source by implementing existing pneumatic solutions for drive elements, thus forming some type of integrated "pneumatic tool kit", would readily occur to a skilled person.

4.5 The patent proprietor's argument that the claimed pneumatic devices are not known in the field of cable blowing is correct, however, it relates to the requirement of novelty rather than to the requirement of inventive step. Moreover, it may also be true that the examples given in D11 and D12 do not concern cables of the type considered in D1 for blowing. These documents are, however, not restricted to specific cable types. Furthermore, as can be seen from the prior art, pneumatic piston/cylinder combinations lend themselves to an extremely broad range of cable transport applications (from manufacturing cable trees in the automobile industry (see D11) to paying out or hauling in submarine communication cables (see D12)). Therefore, the Board is of the opinion that a skilled person in the field of cable blowing would not a priori disregard such broadly applicable pneumatic solutions in view of his own specific needs.

4.6 In consequence, the subject-matter of claim 1 of the third auxiliary request lacks the inventive step required by Articles 54 and 56 EPC, and claim 1 is accordingly not allowable.

.../...

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The patent is revoked.

The Registrar: The Chairman:

P. Martorana E. Turrini