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D E C I S I O N
of 10 September 1998

Case Number: T 0123/97 - 3.2.1

Application Number: 89300531.4

Publication Number: 0325470

IPC: F16L 11/08, B29D 23/22

Language of the proceedings: EN

Title of invention:
Tubes for peristaltic pumps and methods of making them

Patentee:
AVON POLYMER PRODUCTS LIMITED

Opponent:
PHOENIX AG

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step - technical problem"
"Obvious to try (yes)"
"Long period of time merely a secondary indication for
inventive step"

Decisions cited:
T 0142/84, T 0195/84, T 0774/96

Catchword:
-



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Boards of Appeal

Chambres de recours

Case Number: T 0123/97 - 3.2.1

D E C I S I O N
of the Technical Board of Appeal 3.2.1
of 10 September 1998

Appellant:
(Opponent)

PHOENIX AG
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21048 Hamburg (DE)

Respondent:
(Proprietor of the patent)

AVON POLYMER PRODUCTS LIMITED
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Representative:

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Decision under appeal:

Decision of the Opposition Division of the
European Patent Office posted 9 January 1997
rejecting the opposition filed against European
patent No. 0 325 470 pursuant to Article 102(2)
EPC.

Composition of the Board:

Chairman: F. Gumbel
Members: M. Ceyte
V. Di Cerbo

Summary of Facts and Submissions

- I. The respondent is proprietor of European patent No. 0 325 470 (application No. 89 300 531.4).

Claim 1 as granted reads as follows:

"1. The use of a tube having an inner rubber layer (2), an outer layer (8) and a reinforcement (3,6) between them, the reinforcement (3,6) being provided by at least two layers of tyre-cord wound in opposite helices, as the tube of a peristaltic pump acted on by the peristaltic impeller(s) of such a pump."

- II. The patent was opposed by the appellant on the ground of lack of patentability.

The following state of the art was inter alia cited:

D4: GB-A-1 007 229
D5: DE-A-3 327 669
D6: DE-C-2 703 754

- III. By a decision posted on 9 January 1997 the Opposition Division rejected the opposition.

- IV. On 29 February 1997 the appellant (opponent) lodged an appeal against this decision, with the appeal fee being paid in due time.

In the statement of grounds of appeal filed on 7 May 1997 reference was inter alia made to the further documents:

D13: GB-A-1 033 547
D14: Hose technology by Colin W. Evans, Palmerton Publishing Co. Inc 1974 pages 1 to 9, 86 and 87.

In the annex to the summons for oral proceedings, the Board expressed its provisional opinion that the belatedly filed document D13 should be admitted to the procedure because of its relevance.

In the course of the oral proceedings held on 10 September 1998, the respondent (patentee) requested that the other belatedly filed document D14 should also be taken into consideration.

- V. The respondent requested that the appeal be dismissed and the patent be maintained as follows:

As the main request:

The patent as granted

As first auxiliary request:

On the basis of claims 1 to 10 filed on 11 August 1997

As second auxiliary request:

On the basis of claims 1 to 3 filed during the oral proceedings before the Board of Appeal.

Claim 1 of the auxiliary request No. 1 corresponds to claim 1 of the main request with the exception that the following wording "having cords embedded side by side in a matrix of rubber, the layers being" has been inserted after the expression "tyre cords" in claim 1 of the main request.

Claim 1 of the auxiliary request No. 2 corresponds to claim 8 of the main request. It reads as follows:

"1. A peristaltic pump incorporating as a tube acted on by its impeller(s), a tube having an inner rubber layer (2), an outer layer (8) and a reinforcement (36) between them, the reinforcement (3,6) being provided by at least two layers of tyre-cord wound in opposite helices."

VI. In support of its requests, the respondent (patent proprietor) made the following submissions:

(i) It is not disputed that peristaltic pumps were known and that tubes had been made for use with them which included crossing-helical reinforcements of individual cords. This is acknowledged in the patent in suit at column 1 lines 15 to 28 and disclosed in document D6.

The invention lies in using tyre-cord as reinforcement layers for making the tube. The use of this defined material results in two advantages which are especially important to peristaltic tubes: the maintenance of a spacing between the cords in each layer and between the layers in order to avoid any direct frictional action between cords which would have disastrous effects on the performance of a peristaltic tube; and, on the other hand, the possibility of laying the parallel cords very closely side by side, thus allowing a high density of cord for resisting the very high and specific forces experienced by the peristaltic tube without needing many superimposed layers, thus achieving in a thinner and more flexible hose.

The question regarding inventive step is not whether the skilled person could have chosen a tube having layers of tyre-cord for use in a peristaltic pump, of course he could, but whether he would have done so, in the expectation of solving the specific problems arising with this use.

- (ii) In documents D4 and D13 the use of tyre-cord is mentioned only in context with making an ordinary pressure or suction hose which do not have to undergo any of the special strains and distortions of a peristaltic tube.

These two citations do not teach or suggest any way to deal with the problems with which the patent in suit is concerned in order to arrive at a robust long-lasting effective tube to be acted on by the impellers of a peristaltic pump, this tube having a high density of cords while avoiding friction between adjacent cords.

For forming the tube reinforcement, the skilled person did not merely have the choice between two alternatives, namely either winding yarn or wire onto the inner rubber layers or wrapping tyre-cord. As stated in document D14, instead of using as the reinforcement a fabric known as tyre-cord he could have chosen various other woven fabrics.

Document D6 shows a peristaltic pump with individually wound wires in crossed layers. This is the structure acknowledged in the introductory part of the patent in suit. This citation emphasises the very specific qualities required by a peristaltic tube and discusses failures of ordinary hoses or tubes.

(iii) Documents D4 and D13 which disclose hoses with a tyre-cord reinforcement were published in 1965 and 1966. Thus a significant time (more than 20 years) has elapsed between the publication of these documents and the priority date of the patent in suit (1988). Having regard to the aforementioned advantages gained by using a peristaltic tube having a tyre-cord reinforcement, it is surprising that if it was obvious, it was not adopted at a date earlier than that of the priority date. Such a long period of time should be considered as a clear indication in support of inventive step.

VII. The above submissions were contested by the appellant (opponent) who requested that the appeal be dismissed and the European patent be revoked in its entirety.

Reasons for the Decision

1. The appeal is admissible.
2. *Main request*
 - 2.1 The invention according to the patent in suit is said to relate to tubes for peristaltic pumps and methods of making these tubes (column 1 first paragraph).

As the patent specification stresses, the design and structural considerations for a peristaltic tube are peculiar and specific. In contrast to many ordinary tubes, they have to withstand repeated and extreme cyclic rolling compression and extension. As explained in column 1 second paragraph, the three portions or linings of the tube have different functions: the inner portion must not only fulfil the ordinary function of fluid tightness but be capable of absorbing any

irregularities due to lumps and solids in the material being pumped. The reinforcement gives strength in general and must resist the stretching effect of the impellers. The outer portion must resist the rolling wear of the impellers and tend to restore the tubes to circularity after flattening.

On column 1 third paragraph the patent specification refers to a known method for making such peristaltic tubes:

They have been made, usually in a continuous process, by extrusion of a first sleeve of uncured rubber to form the inner portion, the winding-on to it of a single reinforcement cord at an angle, application of a thin layer of rubber, the winding-on of a second single reinforcement cord at an opposite equal angle, application of a further third layer of rubber and then third and fourth layers of single cord with an intermediate rubber layer between them and finally application of a second sleeve to form the outer portion of the tube, followed by curing of these all together.

According to column 1 fourth paragraph of the patent specification, this prior art method suffers from the drawback that none of the cord layers can be wound on at a sufficient density to provide the desired strength, without a serious risk of contact within the layer. Furthermore, due to the interposition of a rubber layer between two adjacent cord layers, the radial thickness of the reinforcement is relatively high, resulting in high stresses at the boundaries of the reinforcement. These in turn tend to cause separation of the cords from the adjacent rubber. This effect is increased by the conventional semi-circle disposition of the tube in the peristaltic pump.

The above disadvantages are similar to those acknowledged in document D6 which relates to such a peristaltic tube with individually wound wires in crossed layers. As stated in this citation, the peristaltic tube despite the reinforcement of wire layers may have severe difficulties. It may be necessary to provide the peristaltic tube with further wire layers as reinforcement. These in turn tend to render the peristaltic tube not enough flexible and the tube would after some service period delaminate or otherwise fail (column 1, penultimate paragraph).

- 2.2 Therefore the technical problem to be solved by the present invention is to provide a peristaltic pump tube which overcomes the above drawbacks, i.e. a robust long-lasting tube having the required reinforcement to provide the desired strength, said reinforcement being also of reduced thickness while avoiding friction between adjacent cords.

This problem is in essence solved according to one aspect of the invention by the use of a tube as defined in claim 1, said tube being provided by at least two reinforcing layers of tyre-cord wound in opposite helices, as the tube of a peristaltic pump acted on by the peristaltic impellers(s) of such a pump.

This problem is also solved according to another aspect by a peristaltic pump as defined in claim 8 (corresponding to claim 1 according to auxiliary request No. 2) incorporating as a tube acted on by its impeller(s) a tube provided with at least two reinforcing layers of tyre-cord wound in opposite helices.

2.3 The examination as to whether the claimed subject-matter is disclosed in any of the cited documents leads to the conclusion that the subject-matter of claims 1 and 8 is novel having regard to the fact that they all fail to disclose the claimed peristaltic tube having layers of tyre-cord wound in opposite helices.

2.4 Regarding the issue whether the subject-matter of claim 1 involves an inventive step the question arises whether there is any suggestion in the cited prior art which could lead a skilled person to the idea of incorporating layers of tyre-cord into a peristaltic tube.

2.4.1 It is not in dispute that the skilled person in the present case was a person skilled in the art of manufacturing rubber tubes provided with a reinforcement, this rubber tube manufacturer being expected to consult the expert in the specific field of application, i.e. in the present case that of peristaltic pumps. It is considered that the rubber tube manufacturer is qualified to solve the technical problems addressed in point 2.2 herein above to develop a robust, long-lasting peristaltic tube, the reinforcement thereof being of reduced thickness while providing the required strength and avoiding friction between adjacent cords.

2.4.2 This technical problem results from the drawbacks observed in the prior art acknowledged in the introductory part of the European patent. As stated in decision T 195/84 OJ EPO 1986, 121, point 8.1 of the reasons, since the overcoming of recognised drawbacks and the achievement of improvements resulting therefrom must be considered as the normal task of the skilled person, no contribution to the inventive step can normally be seen in the perception of the problem.

Reference is also made to decision T 142/84 OJ 1987, 112 (point 6 of the reasons) in which the Board held that:

"Since the elimination of deficiencies in an object which come to light during use is a constant preoccupation in technical circles, the aims set by the present application cannot be regarded as contributing to the inventive merits of the solution."

It should be noted in this respect that the main aspect of this problem is disclosed in document D6 (cf. point 2.1 herein above), since this citation stresses the necessity of incorporating additional wire layers in peristaltic tubes with the resulting drawback of a greater stiffness and an increased risk of delamination.

2.4.3 The fabric called "tyre-cord" is a well-known means of reinforcement and is used in a very large scale by tyre manufacturers throughout the world. This is conceded in the patent in suit at column 1 lines 45 to 51, especially lines 50 to 51 "This is **standard material** in the manufacture of tyres" (emphasis added).

Before the priority date it had also been known for a long time to incorporate layers of tyre-cord as reinforcement in rubber tubes, see documents D4 and D13.

While it is true that tyres are structures intended to maintain their form and which are not designed for running while flat, it cannot be denied that tyres have also, like peristaltic pump tubes, to withstand repeated, deliberate cyclic rolling compression.

This is in the Board's view a sufficient incentive for an expert concerned with the manufacture of hoses to be used with peristaltic pumps at least to try to incorporate these well known layers of tyre-cord in peristaltic tubes, in order to ascertain whether such use would solve the technical problem addressed to. The skilled person by carrying out this simple experiment would readily recognise that due to the high density of the parallel cords embedded in the tyre-cord layers the necessary strength of the peristaltic tube can be achieved, without the risk of any contact between the cords and without incorporating additional tyre-cord layers. Thus it would be immediately apparent for him that the thickness of the reinforcement and thus the risk of delamination stated in document D6 can be diminished and the risk of mutual contact between the cords can be avoided.

Nothing in the prior art can be seen which could withhold the skilled person from making use of this type of reinforcement with peristaltic tubes. In this context it is observed that the incorporation of layers of tyre-cord during manufacture of peristaltic tubes, that is pre-prepared laminar products in which parallel cords are laid side by side, each surrounded by a curable layer, appears to be easier than the individual winding of pre-prepared cords as used in document D6 or in the prior art acknowledged in the patent in suit. Furthermore such an experiment involves no risks since it has long been known to reinforce rubber tubes with layers of tyre-cord (cf. documents D4 and D13).

- 2.4.4 On the contrary, document D13 relating to a rubber tube with a reinforcement especially to "a suction or delivery hose" (page 1, line 12) states on page 1, lines 49 to 63:

"It is also known to employ as the reinforcement a fabric, known as "tyre-cord, which fabric consists of a **warp of parallel textile cabled strands**, woven with a very thin and widely-spaced **weft yarns which serves to hold the warp yarns in substantially parallel relationship** during processing but contributes insignificant strength to the reinforcement. Such "tyre-cord" must be treated in the same way as a fabric, and gum-dipped, frictioned with rubber, or otherwise impregnated with polymeric paste or solution so that it subsequently adheres to and becomes bonded to the other components of the hose." (emphasis added)

This citation goes on to say (page 1, lines 64 to 68) "Woven fabrics and tyre cords", after appropriate adhesive treatment, are usually applied to the hose to form a reinforcement by cutting into strips of suitable width and wrapping in helical formation ...".

The skilled person knowing the technical problem to be solved, and thus the necessity of avoiding friction between adjacent cords i.e. that of maintaining the pre-spacing in each layer, something which is critical for this type of peristaltic tubes, gets from this citation the teaching that the cords are maintained in substantially parallel relationship during processing by weft yarns, so that the risk of frictional contact is avoided. Moreover, it was readily available for the skilled reader to recognise that the use of this kind of pre-prepared laminar product as reinforcement can facilitate the manufacture of peristaltic tubes. Also for this reason it would have been obvious for a skilled person to try, with a reasonable expectation of successfully solving the technical problem addressed to, to incorporate layers of tyre-cord in peristaltic tubes. This experiment apparently did not require more than the ordinary skills in this field and in making

such an experiment the skilled person would readily recognise that because of the high density of cords within the layers this results in a reduction of the thickness of the reinforcement and an improvement in flexibility and thus in the longevity of the peristaltic tube.

It is conceded that document D13 does not explicitly deal with the problem with which the patent in suit is concerned. Nevertheless according to the jurisprudence of the Boards of Appeal, it is not necessary that the problem solved should have been stated **expressis verbis** in a prior art document, in order to establish that an inventive step is lacking on the basis of the disclosure in that document (see decision T 142/84, OJ 1987, 112, point 8.1).

- 2.4.5 The respondent has argued that a significant time (more than 20 years) had elapsed between the publication of documents D4 and D13 (1965 and 1966) showing rubber tubes having layers of tyre-cord and the priority date of the patent in suit (1988) teaching a rubber tube having layers of tyre cord to be used in a peristaltic pump.

It is true that the Boards of Appeal have considered in some cases such a long period of time to be a secondary indication for inventive step, see e.g. the recent decision T 774/96 of 20 January 1998 point 4.6 of the reasons. However such a potential indication in support of inventive step has to be considered as being of secondary importance as compared to the direct approach taken above when assessing the issue of inventive step. In the present case, the failure to adopt an obvious solution to the technical problem underlying the patent in suit may result from a variety of causes: for example as stated by the appellant, there may have been a commercial reason for not adopting this new

technique, because the old technique employing the individual windings of pre-prepared cords was found satisfactory by the clients and could also be improved, thus avoiding considerable investment costs involved in the adoption of a new technique on an industrial scale.

2.4.5 Therefore in the Board's judgement, the claimed use according to claim 1 does not involve an inventive step (Article 56 EPC). Consequently the main request must fail.

3. *Auxiliary request No. 1*

Claim 1 of auxiliary request No. 1 is restricted with respect to claim 1 as granted (main request) by indicating that the layers of tyre-cord have cords embedded side by side in a matrix. According to the respondent, the purpose of this amendment was simply to make explicit the structural nature of tyre-cord as claimed in claim 1 of the main request but does not add any substantial feature. Thus the reasoning given above in considering inventive step of claim 1 according to the main request also applies to this claim.

Therefore, the auxiliary request No. 1 must fail for the same reasons stated above in respect of the main request.

4. *Auxiliary request No. 2*

The subject-matter of claim 1 of this auxiliary request is a peristaltic pump incorporating a tube having a reinforcement provided by at least two layers of tyre cord wound in opposite helices.

Since it is not inventive to use a tube having reinforcing layers of tyre-cord wound in opposite helices in a peristaltic pump, it cannot possibly be inventive to provide a peristaltic pump comprising such tube. The Board is unable to see any substantial difference as to the question of inventive step between the use claimed in claim 1 of the main request and the device claimed in claim 1 of the auxiliary request No. 2.

Therefore, for the same reasons given above in respect of the main request, the subject-matter of claim 1 according to the auxiliary request No. 2 does not involve an inventive step either. Consequently, the auxiliary request No. 2 must also fail.

Order

For these reasons it is decided that:

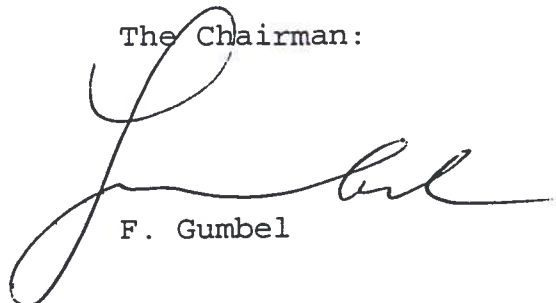
1. The decision under appeal is set aside.
2. The patent is revoked.

The Registrar:



N. Maslin

The Chairman:



F. Gumbel