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Anmeldenummer / Filing No / N^o de la demande : 80 105 198.8

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Bezeichnung der Erfindung: Application of ambient temperature cured polymers or
Title of invention: polymers to a cured elastomer and cured elastomeric
Titre de l'invention : articles obtained

Klassifikation / Classification / Classement : B29H 17/36, B60C 21/00, B29H 7/14, B29H 7/22

ENTSCHEIDUNG / DECISION

vom / of / du 15 November 1990

Anmelder / Applicant / Demandeur : THE FIRESTONE TIRE & RUBBER COMPANY

Patentinhaber / Proprietor of the patent /
Titulaire du brevet :

Einsprechender / Opponent / Opposant :

Stichwort / Headword / Référence :

EPO / EPC / CBE Article 56

Schlagwort / Keyword / Mot clé : "Inventive step - denied (analogous substitution)"

Leitsatz / Headnote / Sommaire

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Case Number : T 93/87 - 3.2.2

D E C I S I O N
of the Technical Board of Appeal 3.2.2
of 15 November 1990

Appellant : THE FIRESTONE TIRE & RUBBER COMPANY
1200 Firestone Parkway
Akron, Ohio 44317 (U.S.A.)

Representative : Mr. Kraus, Kraus, Weisert & Partner
Thomas-Wimmer-Ring 15
D - 8000 München 22

Decision under appeal : Decision of Examining Division 2.3.09.094 of the
European Patent Office dated 29 October 1986
refusing European patent application
No. 80 105 198.8 pursuant to Article 97(1) EPC

Composition of the Board :

Chairman : G. Szabo

Members : J. du Pouget de Nadaillac
J. van Moer

Summary of Facts and Submissions

- I. European patent application No. 80 105 198.8 (publication No. 25 904) filed on 1 September 1980 was refused by decision of the Examining Division dated 30 October 1986.
- II. The grounds for the refusal was that the subject-matter of the application as a whole lacks inventive step as required by Article 56 EPC in view of the prior art shown by:
- (1) US-A-3 190 338
 - (2) FR-A-1 183 983
 - (3) US-A-3 991 255
- III. The Appellant lodged an appeal against this decision on 16 December 1986 with simultaneous payment of the fees, and filed a Statement of Grounds on 23 February 1987.
- IV. With letter of 12 November 1990, the Applicant filed new Claims 1 and 2 and a complete new description as main request and a single claim and a new description as auxiliary request. The main object of this filing was to limit the subject-matter of the application to a process of repairing a cured tire instead of the resulting repaired product, as originally claimed.
- V. The independant Claim 1 of the main request reads as follows:
- "A process of repairing a cured tire substrate having an opening in its external surface, comprising the steps of: cleaning the surface of said opening, applying, from a liquid system, at least one layer of a treating agent, which layer is effectively bonded to the surface of said opening,

and filling said opening with a liquid system containing a polymer or a prepolymer in a polar solvent and a curing agent, said polymer or prepolymer effectively bonding to said treating agent layer at ambient temperature, characterised in that the treating agent is selected from the group consisting of N-halosulfonamides, N-halohydantoins, N-haloamides and N-haloimides."

VI. The independant Claim 1 of the auxiliary request reads as follows:

"A process of repairing a cured tire substrate having an opening in its external surface comprising the steps of: cleaning the surface of said opening with acetone, applying, from a liquid system, at least one layer of a treating agent, which layer is effectively bonded to the surface of said opening, and filling said opening with a liquid system containing a polymer or a prepolymer in a polar solvent and a curing agent, said polymer or prepolymer effectively bonding to said treating agent layer at ambient temperature, characterized in that the treating layer is applied as a solution of trichloroisocyanuric acid, said polymer or prepolymer liquid system is polytetramethylene ether glycol, containing 2.4 to 6.4 percent isocyanate end groups by weight in acetone or methyl ethyl ketone as polar solvent, said curing agent is a complex of 4,4'-methylene dianilina with sodium chloride salt in a 50 percent by weight solution of dioctylphthalate or tetraethylene glycol bis-2-ethyl hexoate and that the curing is carried out at an ambient temperature of 10 °C to 50 °C."

VII. Oral Proceedings were held on 15 November 1990. The Appellant's arguments can be summarised as follows:

In the whole teaching of document (1), with regard to the surface treatment of an opening, only the idea of coating with an adhesive is disclosed (cf. col. 5, lines 26-30). No oxydative surface treatment is disclosed or suggested and all the bonding agents listed in this document function in a way totally different from the invention. Document (1) is based on the idea of using a separate layer as an adhesive, which gives a three-parts combination as a repair, namely the substrate, the adhesive layer and the bonded polyurethane mixture. This composition differs from that of the invention, which involves a two-parts layer, namely the substrate with its surface modified by the treating agent and the curable polymer bonded directly on the treated surface of the substrate. Thus a simple process, having fewer components, is employed, which is very useful when repairing on the spot.

Document (2) is directed to an another situation, the fabrication of tires, and requires high temperatures, about 100 °C, for the bonding procedure, which can consequently only be applied in a factory and not on spot. Moreover several kinds of treating agents are disclosed and a few, like for example nitric acid, are quite inappropriate for the process of the present invention.

Document (3) also shows the use of high temperatures in all its examples. The teaching of this prior art is that effective bonding can occur only if the treating agent is incorporated in the incured rubber by mixing and then heat-cured with it, whilst, in contrast, the present invention applies the treating agent to the surface of the already cured substrate surface, which is then brought into contact

with the polymer curable mixture at ambient temperature. This use of ambient temperature is not suggested in Document (3).

Thus the finding at the basis of the present invention, that ordinary temperatures are sufficient when carrying out the claimed process with specific treating agents, is not suggested by these both last documents and an inventive step is therefore to be recognised.

With regard to the auxiliary request a particular combination is claimed, including a specific treating agent, which is a N-haloimid, and a specific polymer, curing agent and solvent, which are moreover brought together under specific conditions. No idea of this selection can be found in the cited prior art.

VIII. The Appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of his main and auxiliary requests based on claims, description and figures as submitted on 12 November 1990.

Reasons for the Decision

1. The appeal is admissible.
2. Main request
 - 2.1 Among the cited prior art documents, Document (1) is the only one, which describes a process of repairing a tire. With respect thereto, the subject-matter of Claim 1 in the present case is clearly novel, since this prior art does not disclose the use of the treating agents specified in the characterising part of said claim. Thus the only issue left to be decided is wheter this subject-matter involves an inventive step.

- 2.2 Document (1) already discloses a solution for repairing tires on the spot, in particular at ambient temperatures. For this reason and other identities indicated in the preamble of the claim, it represents the closest prior art. According to this art, the surface of the opening to be repaired should be cleaned and filled with a liquid compound containing a polyurethan in a polar solvent and a curing agent, said compound curing at ambient temperature. Preferentially, the surface of the opening is, before being filled, coated with an adhesive treating agent in order to improve the bonding between the already cured substrate and the pourable compound. These bonding agents include active compounds such as aromatic polyisocyanates (col. 5, line 41).
- 2.3 In document (1) it is clearly stated that the purpose of coating the substrate with such a treating agent is to improve the adhesion, that is to say the bonding, between the cured substrate and the curable polymer: see column 5, lines 30-44, and Claim 1 of this prior art, which specifies a "bonding" agent. Document (1) cites certain agents for the purpose, as examples; it is clear that their adhesive properties rely on their reactivity. Therefore the basic idea according to document (1) consists of using treating agents for improving the bonding, which teaching is not limited to the examples but opens the door for other compounds providing the same effect.
- 2.4 According to the Appellant, the primary object of the present invention vis-à-vis this above art is to provide a simplest method using one layer less. As shown by the correctly delimited two-part form of Claim 1, this problem is solved by a choice of specific treating agents,

which are halogen-containing oxidants and provide halogens groups to a thin surface layer of the cured substrate which is thereby locally activated and reacts with the curable polymer system, e.g. polyurethan, to form a strong bond (original description, page 14, lines 10-14, and page 19, lines 16-20). By modifying the surface of the substrate to make it more receptive to a direct bonding to the polymer, these treating agents avoid the use of a separate bonding "layer", apparently resulting thereby in a two-part repair system.

- 2.5 The Board takes notice of this, but cannot agree with its technical interpretation. Firstly it is difficult to see why the method of the invention should be easier or simpler than the one disclosed by document (1). As the coating of the substrate surface by a treating agent is also mandatory in the present invention, the same steps as in (1) are in fact followed, including the same number of components, i.e. reactants, and no fewer as asserted by the Appellant. The unreactive parts of the aromatic polyisocyanate binding agent remaining between the two layers in the state of the art is as irrelevant as the remnants of the aromatic isocyaauric acids in the same location. The role of the pre-treated areas is not in substance different in the application from the surface area pre-treated according to document (1). Thus, in essence, both systems incorporate bonding locations or modified areas in the middle, which chemically link, or "adhere", to the rubber, on one side, and to the polyurethan, on the other side. The claims in the present case refer to a "layer" of the treating agent which is then bonded to both of the basic layers.

- 2.6 In view of the above, the technical problem with respect to document (1) can only be seen in providing means for adherence or linkage which is better than what has been provided by the art. Looking for other suitable bonding

agents, the attention of the man skilled in the art would have been drawn towards document (2), which deals with the same problem in very similar circumstances. This prior art also relates to a process for improving the bond between a rubber substrate and a pourable polyurethane compound. Furthermore, the utilisation of a treating agent on the surface of the substrate, before applying the polyurethane or polymer compound to this substrate, is here also recommended. Applications for manufacturing tires, belts, flexible pipes, are mentioned, and the moulding of tires in a centrifugal mould is more particularly described. Since the man skilled in the art for repairing tyres is the same as that for manufacturing tires, the same technical field is concerned and, consequently, the teaching of this document is clearly available to the specialist in question.

- 2.7 As treating agents, halogen isocyanuric acids (particularly, trichloro isocyanuric acid) and nitric acid are cited in this prior art. They are applied by brushing, spraying or the like, consistently at ambient temperatures, and are described as powerful oxidants, which modify the surface of the treated substrate so as to provide a strong bond subsequently, even after curing at elevated temperatures. In the given example 2, it is specified that, among other kinds of methods of treatments, like using electrical discharge or sulfuric acid, the treatment by trichloro isocyanuric acid is the most efficient for improving the bondage. During the particular manufacturing process described by this document, the cured rubber material, once its surface treated, is brought into the centrifugal rotor, which rotates at a temperature of about 100°C, and the liquid polyurethane is poured thereon, inside the rotor. It is clearly taught that the said temperature is chosen between 60 °C and 120 °C in order to cure the polyurethane.

- 2.8 Halogen isocyanuric acids are N-haloamids and therefore fall within the treating agents defined in Claim 1 of the application in suit. Thus, with this document (2), the person skilled in the art has a clear teaching, that N-halomids are advantageous treating agents, which also provide an improved bonding between a cured substrate and a polymer compound and can be applied at ambient temperatures. Moreover the oxidative surface treatment realised by these agents is disclosed there, which cannot therefore be considered as a surprise in those and similar circumstances. In view of the teaching, and more particularly of the advice that a strong bond is provided by these treating agents, it is to be expected that the man skilled in the art would try to apply the same in the process according to document (1).
- 2.9 The Board cannot follow the argument of the Applicant that document (2), as it taught the use of high temperatures between 60 °C and 120 °C, gave no suggestion in the direction of the present invention, which describes a process carried out entirely at ambient temperature. As shown above, higher temperatures are indeed used in document (2), but for the curing step for the polyurethane, once applied onto the substrate. The previous step of the treatment of the surface of the substrate by the treating agent is made at ambient temperature.

Moreover it is not out of the skilled man's capacity to make a distinction between manufacture processes, one requirement of which is to be less time consuming, and others processes, in which this requirement is not so important. The skilled person would be aware that high temperatures must be used in the process according to document (2) to reduce reaction and thereby processing

time, especially as a centrifugal rotor is used, and that this has nothing to do with the bonding effect. To accelerate reactions with a somewhat increased temperature is common knowledge in many branches of organic chemistry.

Moreover the specialist in question would also know that polyurethane can be cured at ambient temperature as well as at high temperatures, depending on the formulation of the polyurethane. Such a knowledge of the man skilled in the art is confirmed by document (3), see column 6, lines 5-9, lines 24-34 and lines 57-61, with column 7, lines 6-9. In view of such possibilities, the skilled man would not be prevented from considering the application of treating agents known from document (2) in processes with low temperatures in otherwise very similar circumstances.

It should also be noticed that the lowest value for treatment temperatures according to document (2) (60 °C) is not far from the higher recommended temperature of the present invention (50 °C), so that the effects of any difference could be negligible.

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- 2.10 The argument of the Appellant, according to which an inventive step is to be recognised, since document (2) discloses several treating agents, some of them, such as nitric acid, being quite inappropriate for the repair process of the present invention, is unconvincing in the present case, because of the character of the limited alternative choice given, in fact, by document (2). Apart from the isocyanuric acid variants which are all halogen donating and relevant for the present case, only nitric acid is mentioned, which functions differently.
- 2.11 Thus, the fact that the particular treating agents used in Claim 1 were part of the state of the art together with their bonding properties, at ambient or at high temperatures, renders obvious their incorporation in the

process according to (1). No difficulty is encountered and, in the absence of any evidence, no surprising effect results therefrom ("analogous substitution", T 192/82, OJ EPO, 1984, 415). In view of this, the subject-matter of the independent Claim 1 of the main request is not considered to involve an inventive step within the meaning of Article 56 EPC.

3. Auxiliary request

As recognised by the Appellant, Claim 1 of the auxiliary request gives a particular combination of components and conditions for the process of Claim 1 of the main request. These added features represent no unusual or unknown details: Trichloroisocyanuric acid is specified in documents (2) and (3). The particular curing agent and solvent have already been used for such kinds of mixture, see documents (2), page 3, and (3), columns 4-6, or other documents cited in the examination procedure, like FR-A-2 236 894. There can be no invention based on selecting specific components or percentages among those disclosed in the cited documents, when no disclosure of any surprising effect in respect of the process itself was shown. Thus Claim 1 of the auxiliary request also lacks an inventive step.

Order

For these reasons, it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

S. Fabiani

S. Fabiani

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M. van der Meer

J. W. de Nadailles

G. Szabo

G. Szabo