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D E C I S I O N
of 11 March 2003

Case Number: T 0298/99 - 3.3.7

Application Number: 92401967.2

Publication Number: 0524058

IPC: C09J 109/00

Language of the proceedings: EN

Title of invention:
Rubber-based adhesive/Sealant

Patentee:
LE JOINT FRANCAIS SNC

Opponent:
Henkel Teroson GmbH

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (yes) - problem and solution - non-obvious solution"

Decisions cited:
-

Catchword:
-



Case Number: T 0298/99 - 3.3.7

D E C I S I O N
of the Technical Board of Appeal 3.3.7
of 11 March 2003

Appellant: Henkel Teroson GmbH
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Representative: Mathes, Nikolaus, Dr.
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Respondent: LE JOINT FRANCAIS SNC
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Decision under appeal: Interlocutory decision of the Opposition Division
of the European Patent Office posted 28 January
1999 concerning maintenance of European patent
No. 0 524 058 in amended form.

Composition of the Board:

Chairman: R. E. Teschemacher
Members: B. J. M. Struif
G. Santavicca

Summary of Facts and Submissions

I. The mention of the grant of European patent No. 0 524 058 with respect to European patent application No. 92 401 967.2, filed on 8 July 1992, was published on 20 December 1995, on the basis of ten claims. Claim 1 thereof read as follows:

"A hot-vulcanisable, pumpable rubber-based adhesive/sealant where the rubber component is a mixture of butadiene solid rubber and butadiene or isoprene liquid rubber, characterised in that the liquid rubber contains carboxylic acid groups."

Claims 2 to 9 were dependent on claim 1.

Claim 10 read as follows:

"Use of the adhesives/sealants according to one of Claims 1 to 9 for bonding metal sheeting in the construction of automobile shells."

II. On 19 September 1996 a notice of opposition was filed against the granted patent, in which the revocation of the patent in its entirety was requested on the grounds of Article 100(a) EPC that the claimed subject-matter lacked novelty and an inventive step having regard to the following documents:

E1: R. E. Drake and J. M. Labriola, "Adhesion Promotion Using Maleated Liquid Polybutadiene Resins in Rubber Compounds", paper presented at the Toronto Meeting, May 1991, American Chemical Society Rubber Division

E2: EP-B-0 097 394 (in this decision reference is made to the A-publication as in the previous proceedings)

E3: I. Skeist, "Handbook of Adhesives", third edition, Chapter 14, "Carboxylic Polymers in Adhesives", van Nostrand Reinhold, N.Y., 1990, pages 270 to 277

E4: R. E. Drake, J. M. Labriola and H. Sessions Jr., "Using Polybutadiene Derived Resins for Improved Elastomer Bonding", paper presented at the 138th Meeting of the Rubber Division, American Chemical Society, Washington D.C., 9 to 12 October 1990

During the proceedings before the opposition division *inter alia* the following further document was cited:

E7: DE-A-38 34 818

III. In a decision posted on 28 January 1999, the opposition division decided that the patent could be maintained in amended form based on a set of claims 1 to 8 submitted by letter dated 23 April 1997 as the sole request. Claim 1 as amended read as follows:

"A hot-vulcanisable, pumpable rubber-based adhesive/sealant where the rubber component is a mixture of butadiene solid rubber and butadiene or isoprene liquid rubber, characterised in that

- the **butadiene or isoprene** liquid rubber contains carboxylic acid groups **and has more than 70 mole % of cis-1,4 double bonds and no more than 2 mole % of vinyl double bonds, and in that**
- **the butadiene or isoprene liquid rubber represents**

from 10 to 20% by weight of the total weight of the adhesive/sealant whereas the butadiene solid rubber represents from 1 to 15% by weight of the total weight of said adhesive/sealant." (emphasis added on the differences from claim 1 as granted)

Granted claims 2 and 3, 5 to 7, 9 and 10 remained as claims 2 to 8 after a corresponding renumeration.

The decision was based on the following reasons:

- (a) The amended claims were in compliance with the requirements of Articles 123(2) and (3) EPC.
- (b) The claimed subject-matter was novel.
- (c) As to inventive step, the problem of increasing adhesion to metals was known from E2 and E1. Since E3 suggested that the modification of elastomers by carboxylic functional moieties increased the adhesion to substrates, the claimed subject-matter appeared *prima facie* to be obvious over the combined teaching of E2 and E3. As however the maleinated rubbers of E1 or E4 were not an adequate basis for comparison and since E2 referred to unmodified liquid rubber adhesives, the failure mechanism thereof being unknown, the nearest prior art document was considered to be E7, cited in the patent in suit. The claimed adhesive/sealant differed from E7 in that it contained, instead of hydroxyl modified polybutadiene, a liquid rubber modified with carboxylic acid groups and showed in comparison thereto a surprisingly improved shear strength and cohesive failure mechanism which effects supported

an inventive step.

IV. On 20 March 1999 the opponent (appellant) filed a notice of appeal against the above decision with payment of the prescribed fee on the same day. With the statement setting out the grounds of appeal filed on 31 May 1999 a test report, carried out by the appellant and identified as HE 5841 EP, was submitted. During the appeal proceedings the following further documents were cited:

E5: W. Hofmann, "Vulcanization and Vulcanizing Agents", Maclaren and Sons Ltd., London, 1967, p. 6 and 7

E6: B. D. Ludbrook, "Liquid Polybutadiene Adhesives", Int. J. Adhesion and Adhesives, Vol. 4, No. 4, October 1984, p. 148 to 150.

V. In a communication dated 31 October 2002, the board addressed the points to be discussed at the oral proceedings. In particular, attention was drawn to the question, which problem was solved by the claimed subject matter.

VI. Oral proceedings were held from 7 to 11 March 2003. After closure of the discussion on 7 March 2003, the oral proceedings were interrupted for deliberation until 11 March 2003, 11.00 hrs. On that date, the oral proceedings were reopened and the final decision was announced.

VII. The arguments of the appellant, given in writing and at the oral proceedings can be summarized as follows:

Regarding the issue of inventive step, E2 was considered to be the nearest prior art document, since it described a hot-vulcanizable, pumpable rubber based adhesive/sealant composition comprising a mixture of solid and liquid rubbers. The subject-matter of claim 1 differed from E2 only in that the liquid rubber contained carboxylic groups. The liquid rubber contained a high content of cis-1,4 double bonds and provided good adhesion to oiled steel. Furthermore, overlap joints according to the examples of E2 also showed low shear strengths of about 1 MPa. It was general knowledge of the skilled person that the shear strength and the elongation could be influenced by the amount of sulfur so that the desired tensile strength could be achieved by using a suitable amount of sulfur. From E6, which *inter alia* referred to the published UK patent application corresponding to E2, it could be derived that the known adhesives also provided a cohesive failure mechanism. The appellant's comparative tests also showed that the compositions of E2 provided low lap shear strength and a cohesive failure mechanism on different oiled metallic substrates. Thus, in respect of E2 the problem underlying the patent in suit was to provide an alternative adhesive/sealant.

If E7, instead of E2, was considered as an appropriate starting point, the patent in suit did not show any advantage either. In this respect the comparative example according to E7, to which the patent in suit referred in Table II, used an amount of liquid hydroxyl modified polybutadiene below the required minimum amount of E7 and thus did not reflect the teaching of E7.

According to E1, liquid maleinated polybutadiene resins

were commercially available and were used in small amounts together with a solid rubber to provide strong adhesive bonds to metals such as steel. E3 was a handbook which summarized the general knowledge of the skilled person in the adhesive field and disclosed that carboxyl groups in elastomers secured high adhesion to steel and even provided a cohesive failure mechanism. Hence, it was obvious to use such modified polybutadienes in adhesive/sealant compositions of either E2 or E7 to provide an alternative adhesive/sealant. Therefore, the claimed subject-matter did not involve an inventive step.

VIII. The arguments of the respondent, given in writing and at the oral proceedings, can be summarized as follows:

As regards the nearest prior art document, not E2, but E7 was the appropriate starting point, since the adhesive/sealant compositions of E2 referred to in E7 did not show the desired adhesive properties and E7 envisaged to improve the adhesion to metals and its failure mechanism. Thus, E7, and not E2, referred to the cohesive failure mechanism and to a problem similar to that underlying the patent in suit. Such an approach was in line with that of the decision under appeal and with established jurisprudence. Since E7 did not include any example, the appellant's test report did not concern a reproduction of E7 nor was it oriented to the preferred embodiments of E7. It used arbitrarily modified compositions of E7 to provide a low shear strength. The comparative example according to E7 in the patent in suit demonstrated that when using a comparable low amount of hydroxyl terminated polybutadiene no cohesive failure mechanism could be obtained. The appellant's experiment 1 was in

compliance with E7, experiment 2 did not contain any solid rubber and experiments 3 and 4 used a specific Novolac neither specified in E2 nor in E7. The problem to be solved was to overcome the deficiencies of E7 and to provide an alternative composition with the same good properties of E7.

When starting from E2 as the closest prior art document, the claimed subject-matter differed from E2 not only by the carboxylic liquid rubber but also by the content of vinyl double bonds and by the amount of the liquid rubber. In addition, the initial shear strength in E2 was much too high for use in bonding metal sheets in the construction of automobile shells. In the appellant's test report, the compositions of formulation 3 contained a phenol-novolac-hexamethylene tetramine which was not used in E2 and did not represent a real reproduction thereof.

Although E3 disclosed several carboxylic elastomers as metal-to-rubber adhesives, wherein the carboxylic groups secured high adhesion to steel, there was no indication towards any liquid carboxylic containing butadiene rubber to bond metal sheets together. Having regard to carboxylic elastomers as metal-to-metal adhesives, there was no indication to use any liquid polybutadiene rubber containing carboxylic groups for that purpose. The liquid butadiene rubber of E1 had a high content of vinyl double bonds and the exemplified compositions contained in comparison to the claimed subject-matter a too high amount of solid rubber and a too low amount of liquid rubber. There was no hint in E1 that a liquid carboxylic acid modified rubber could be used to provide a cohesive failure mechanism. Thus, the compositions exhibited a high viscosity, were not

pumpable when cold and could not be used for the intended purpose. In E2 the amounts of liquid and solid rubber actually used in the examples did not meet the requirements of the claimed subject-matter. Thus, the cited prior art did not suggest a modification of the compositions of E2 or E7 in a direction as claimed to solve the problem posed. Hence, the claimed subject-matter involved an inventive step.

- IX. The appellant requested that the decision under appeal be set aside and that the patent be revoked.
- X. The respondent requested that the appeal be dismissed and that the patent be maintained in the version underlying the decision under appeal.

Reasons for the Decision

- 1. The appeal is admissible.

Inventive step

Closest prior art document

- 2. The patent in suit concerns a rubber-based adhesive/sealant. Such compositions are known from E2, which the appellant regarded as the closest prior art document and from E7, which was the starting point for the opposition division and the respondent.
 - 2.1 E2 describes an adhesive composition comprising 100 parts by weight of a liquid polybutadiene polymer specimen having an average molecular weight in the range 1000 to 10000 and viscosity in the range 2 to 800

dPas at 25°C, 5 to 60 parts by weight of powdered sulphur, 2.5 to 70 parts by weight of an organic accelerator or accelerators, and up to 80 per cent by weight, calculated on the weight of the adhesive composition, of an inert filler or fillers, characterized in that the liquid polybutadiene polymer specimen has at least 40 per cent of the unsaturation in the 1,4-configuration (claim 1).

The liquid polybutadiene has preferably at least 70% of the unsaturation in the cis 1,4 configuration and less than 5% in the vinyl 1,2 configuration (claims 3 and 4). The compositions can be applied by pressure and can be pumped (page 5, lines 15 to 27, page 6, lines 22 and 23). The composition may contain other optional ingredients, *inter alia* a solid rubber such as polybutadiene (page 6, lines 4 to 8). Examples 1, 2, 4, and 6 disclose a rubber composition containing 100 parts by weight of a liquid polybutadiene and 5.88, 10.0, 11.11 and 7.19 parts by weight, respectively, of a solid polybutadiene together with fillers and vulcanisation agents (page 8, table). Examples 2, 4 and 6 show a shear strength of 1.3, 1.0 and 1.4 MPa, respectively (page 8, lines 24 to 31). The heat curable adhesive compositions are used for adhesive, gap-filling and sealing purposes in the joining of components, for example in the manufacture of a vehicle body (page 1, lines 2 to 5). The high unsaturation in the 1,4 configuration results in products that are very tolerant of cure temperature. They can be made to have good flexibility and adhesion to a variety of surfaces, including oiled steel, when cured at temperatures as low as 140°C or up to at least 250°C (page 5, lines 5 to 10).

- 2.2 The appellant referred to E6 and a test report to show that the adhesives described in E2 also provided a cohesive failure mechanism.
- 2.2.1 E6 discloses liquid polybutadiene adhesives which can be cured by conventional vulcanization processes. A wide range of adhesive strength can be obtained by varying the proportions of sulfur and accelerators (page 148, left column, second paragraph). At several passages in E6 reference is made to GB 21 23 018 which is the published UK application equivalent to E2. In particular, it refers to the high 1,4 configuration needed to obtain good tolerance to stoving temperature (page 149, right column, lines 6 and 7). The compositions provide high shear strength of more than 13 MPa and a cohesive failure mechanism (page 149, Table 1). However, the composition of said tested adhesives is not specified, so that the skilled person cannot reproduce the tested composition of E6 and evaluate whether adhesives of E2 have effectively been used and provide a cohesive failure mechanism or not.
- 2.2.2 In the appellant's test report an adhesive formulation 3, allegedly according to E2, has been tested. This adhesive formulation includes 5% by weight of solid cis-1,4 polybutadiene and 28% by weight of a non-functionalised liquid polybutadiene. Furthermore, 3% by weight of a phenol-novolac-hexamethylene tetramine resin is used. However, none of the ten examples of E2 uses a novolac resin, which is known to improve the rubber to metal bond (D12, page 294, point 4.4.6.2, last sentence of the first paragraph). Therefore, this test is no real reproduction according to the teaching of E2 and cannot be accepted to demonstrate a cohesive failure mechanism.

2.2.3 E2 itself does not address any cohesive failure mechanism. Furthermore in E7, it is specifically mentioned that by using an adhesive on the basis of non hydroxyl terminated liquid rubber, such as adhesives of E2 referred in E7, there is a tendency to adhesive failure mechanism (column 2, lines 38 to 41). From the above it follows that there is no consistent evidence on file that compositions of E2 in fact provide a cohesive failure mechanism.

2.3 E7 discloses an adhesive/sealant rubber composition comprising a) 15 to 50% by weight of a stereospecific, liquid polybutadiene comprising OH terminated polybutadiene, b) 2 to 10% by weight of a solid, stereospecific, cis-1,4- polybutadiene, c) 2 to 10% by weight of sulphur, d) 0.5 to 10% by weight of an organic accelerator or accelerator system, e) 30 to 70% by weight of a filler and optionally 2 to 10% by weight of an adhesion promotor (claim 1).

The preferred adhesives/sealants contain 30 to 40% by weight of component a), 3 to 5% by weight of component b), 3 to 5% by weight of component c) 0.5 to 2% by weight of component d), 50 to 70% by weight of component e) and optionally 3 to 10% by weight of component f) (column 1, lines 58 to 63). The OH terminated polybutadiene has preferably a OH functionality of 2.0 to 3.0, a molecular weight of 1000 to 5000 and a viscosity of 0.5 to 10 Pas, wherein at least 50 % of the unsaturation is in the trans-1,4 configuration and at least 10% in the cis-1,4 configuration (claim 2). A suitable OH terminated polybutadiene *inter alia* has 60% trans 1,4 configuration, 20% cis-1,4 configuration and 20% 1,2 configuration (vinyl double bonds) (column 2, lines 9

to 15). The compositions are used for bonding oiled metal surfaces in the construction of automobile shells (claim 4). E7 acknowledges E2 and aims at adhesive/sealant compositions superior to those known from E2 in providing improved adhesion to metals and an ameliorated failure mechanism (column 1, lines 37 to 41).

2.4 The patent in suit acknowledges both E2 (page 2, lines 15 to 18) and E7 (page 2, lines 23 and 24) as prior art documents. According to the patent in suit the adhesive sealants of E2 do not achieve the good adhesion required in automobile production whilst the compositions of E7 show a predominantly adhesive, partly cohesive failure mechanism (page 6, Table II, comp. Ger. Pat. 38 34 818)). Thus, the patent in suit aims at a hot-vulcanizable, pumpable adhesive/sealant for bonding metal sheeting in the construction of automobile shells which has improved overall properties and provides a cohesive failure mechanism (page 2, lines 31 to 33, Table II).

2.5 Both prior art documents relate to a hot-vulcanizable, pumpable rubber based adhesive/sealant which can be used for bonding metal sheeting in the construction of automobile shells and concern rubber compositions containing liquid and optionally solid rubbers. Furthermore, whilst E2 relates to an unmodified liquid polybutadiene having a high content of 1,4-cis configuration and discloses a solid rubber only as optional component, E7 addresses the cohesive failure mechanism of vulcanized bonds between metal sheetings and aims at improving adhesion strength and failure mechanism of the compositions of E2 and is directed to a hydroxyl modified liquid polybutadiene and its

composition contains liquid and solid rubber as essential element within the claimed amounts.

- 2.6 According to established jurisprudence, the closest prior art for the purpose of assessing inventive step is generally that which corresponds to a purpose or technical effect similar to that of the invention and requiring the minimum of structural and functional modifications (Case Law of the Boards of Appeal of the European Patent Office, 4th Edition 2001, I.D.3.1).
- 2.7 From the above analysis it follows that E7 aims at improving the adhesive properties of E2 so that the skilled person has no reason to go back to E2 as starting point. Furthermore, E7 is more closely related than E2 to the technical effect of cohesive failure mechanism and provides a composition comprising a modified liquid rubber and a solid rubber as essential ingredients in specific amounts in line with the claimed subject-matter. Therefore, E7 is regarded as the closest state of the art.

Problem and solution

3. In the examples and the comparative example of the patent in suit, oiled steel sheetings were joined by adhesives to test the adhesion properties. The tested compositions contain two maleic anhydride modified polybutadiene oils 1 (Examples 1, 2 and 4) and 2 (Example 3) both having more than 70 mole % of cis 1,4 double bonds and less than 2 mole % vinyl double bonds but a different number of anhydride groups per molecule (page 3, line 50 to page 4, line 19). In Examples 1, 2 and 4 the liquid polybutadiene 1 is used in an amount of 12 and 15% by weight respectively. In Example 3 a

mixture of 6% by weight of polybutadiene oil 2 and 6% by weight of an unmodified polybutadiene oil is used. All examples contain 5% by weight of a solid butadiene or butadiene-styrene rubber (see Table II). The comparative adhesive of E7 has the same composition as Example 1 except for using, instead of maleic anhydride-modified polybutadiene oil, the same amount of a hydroxyl-terminated polybutadiene oil.

According to Table II, Examples 1, 2 and 4 show that the vulcanized joints of oiled steel sheetings have a shear strength of 1.3 to 1.9 N/mm², a T-peel on oiled steel of 143/48 (commencement of cracking/mean force) to 200/50 and a cohesive failure mechanism. Example 3 provides a shear strength of 1.3 N/mm², a T-peel of 129/52 and a predominantly cohesive-partly adhesive failure mechanism. The comparative example shows a shear strength of 0.9 MPa, a T-peel of 122/48 and a predominantly adhesive, partly cohesive failure mechanism (Table II).

According to the patent in suit, the specific configuration of the liquid rubber provides low viscosity and good adhesion (page 2, lines 49 to 52). Since a low viscosity is necessary to provide the required pumpability and good adhesion is desired, these specific features contribute to the solution of the technical problem as shown by the examples. This also applies to the claimed amounts of liquid and solid rubber.

- 3.1 However, the comparative example of the patent in suit uses 12% by weight of liquid polybutadiene whilst E7 requires at least 15% by weight thereof. Since the comparative example is not a reproduction of the

teaching of E7, it is not demonstrated that an improved effect is generally obtained over the adhesive compositions of E7 under comparable conditions. This lower amount can be the reason why no cohesive failure mechanism was observed contrary to the teaching of E7.

3.2 In this respect E7 explicitly mentions that the compositions provide a cohesive failure mechanism "always" after vulcanization and tearing (column 2, lines 35 to 38). Furthermore, in the appellant's test report an adhesive composition has been produced by using 3.5% by weight of solid cis polybutadiene and 28% by weight of OH terminated polybutadiene (formulation 1). Although no examples are given in E7, the formulation 1 of the appellant's test report comprises the components within the composition range specified in claim 1 of E7 so that it can be regarded as a reproduction of E7. Formulation 1 has been tested by joining steel sheetings together and shows a cohesive failure mechanism and a high shear strength of 15,5 and 13 MPa, respectively.

3.3 The respondent argued that such high shear strength might be unacceptable for certain applications when bonding metal sheetings in the construction of automobile shells. According to the examples of the patent in suit much lower shear strengths could be obtained, which were more suitable for said applications.

However, the claimed subject matter is not restricted in this respect nor was it disputed by the respondent that higher shear strengths can also be achieved by compositions covered by the claims. This is confirmed by E5 according to which the tensile strength or

elongation at break can be adjusted by the amount of bound sulphur content (page 7, Figure 1).

- 3.4 From the above it follows that there is no evidence on file that the claimed subject-matter provides any improvement over the adhesive compositions of E7.
- 3.5 Since the statement in the patent in suit which relates to "improved overall properties" is not supported by experimental results, the technical effects on file only justify the formulation of a technical problem in relation to E7 which is less ambitious. Thus, the problem underlying the patent in suit may therefore be seen in providing a further hot vulcanizable, pumpable adhesive/sealant composition in the form of an alternative composition, for bonding metal sheeting in the construction of automobile shells which provides a cohesive failure mechanism similar to E7.
- 3.6 From the examples discussed above, it can be seen that this problem is effectively solved by the claimed adhesive/sealant.

Inventive step

4. It remains to be decided whether the claimed subject-matter is obvious having regard to the documents on file.
- 4.1 In E7 (see point 2.3) the liquid polybutadiene neither contains carboxylic groups nor provides an indication to use a liquid rubber having the claimed content of cis-1,4 and 1,2-configuration. There is no incentive in E7 to use the claimed amount of 10 to 20% by weight of liquid rubber in combination with the distinguishing

features of the claimed subject-matter. Thus, E7 alone does not suggest any modification towards the solution as claimed.

- 4.2 According to E3, carboxylic elastomer adhesives have already been used, in particular, as metal-to-rubber or metal-to-metal adhesives. In case of metal to rubber adhesives copolymers of butadiene with methacrylic acid can be used. The rubber should possess sufficient diene groups and a sufficient number of carboxyl groups to secure a high adhesion to steel (page 273, left column, last paragraph). Furthermore, a compounded SBR rubber sheet can be surface coated with a copolymer cement derived from butadiene (70), styrene (15) and cinnamic acid (15). The assembly is cured and tested to show a peel strength of 210-263 N/cm at a 90° angle. Natural rubber was bonded to aluminum and brass in a similar manner. The carboxylic copolymer cements generally show greater bond strength as well as a desired cohesive failure mechanism with the rubber, whereas the analogous noncarboxylic copolymers show failure at the steel surface. Thus, carboxylic groups enhance the adhesion of the rubber to the metal surface and improve the cohesive strength of the bonding agent (page 274, left column, second paragraph).

However, the failure mechanism described herein occurs within the rubber and cannot be compared to a situation where metal sheetings are joined together and wherein the cohesive failure mechanism must occur within the adhesive/sealant layer.

In the case of carboxylic elastomers as metal to metal adhesives different elastomers are described including inter alia carboxylic butadiene-acrylonitrile

copolymers, unspecified maleic anhydride elastomer adducts, carboxylic polyethyl acrylates, terpolymers of ethyl acrylate, acrylonitrile and acrylic acid can be used (page 274, right column and page 275, left column). However, E3 does not address a liquid butadiene or isoprene rubber having a specific content of cis-1,4 configuration and 1,2 configuration in mixture with a solid butadiene rubber in specific amount. Although E3 gives a general hint to use carboxylic modified polymers for providing good adhesion, there is no incentive in E3 to replace the hydroxyl terminated polybutadiene rubber of E7, which has a completely different substituent and configuration of double bonds by the specific carboxylic modified liquid rubber as claimed for solving the problem underlying the patent in suit.

4.3 Although E2 discloses in a preferred embodiment liquid polybutadiene containing at least 70% of the unsaturation in the 1,4 configuration and less than 5% in the vinyl 1,2 configuration (page 3, lines 1 to 4) in order to reduce sensitivity to cure temperature (page 4, lines 30 to 34) there is no hint towards any chemical modification, let alone to any addition of carboxylic acid groups so that there is no incentive in E2 to modify the liquid rubber of E7 in a direction as claimed.

4.4 E1 discloses liquid maleinized polybutadiene resins which are commercially available and can be compounded with unvulcanized natural and synthetic rubbers such as EPDM, NBR, BR, SBR, CR and NR to provide strong adhesive bonds to metals, in particular steel (page 1, first two paragraphs, page 10, last two paragraphs, page 6, Experimental, first full paragraph; Figure 4).

The maleinized polybutadiene tested have either a combined cis-trans 1,4 content of 80% and a vinyl content of about 20% or a combined cis-trans 1,4 content of about 20% and a vinyl content of about 80% (page 3, Table I and last paragraph). Polybutadienes with high content of 1,2 structure are more viscous than their lower vinyl content analogs (sentence bridging pages 3 and 4). In Tables III and V a peroxide cured EPDM is disclosed which after recalculation comprise 51.0 and 39.5% by weight, respectively, solid EPDM and 5.18 and 3.75, respectively, of maleinized polybutadiene. These compositions lead to high shear strength over 60 kg/cm (6 MPa), as demonstrated in Figure 4. There is no hint in E1 that these adhesives are pumpable.

Consequently, the content of 1,4-cis and 1,2 configuration in the liquid maleinized butadiene rubber and the composition of liquid and solid rubber in E1 is different from what is required by the claimed subject-matter so that there is no incentive in E1 to modify the composition of E7 in a direction of the claimed combination of features.

Since E4 discloses maleinized polybutadiene identical to E1 it provides no further indications to the claimed solution.

The other documents cited during the proceedings are not more relevant than those analysed above. The claimed subject-matter is considered to be non-obvious when taking E7 as the starting point.

4.5 Although E7 is a more appropriate starting point for the problem solution approach than E2 (point 2.7) one

would not reach any other conclusion when starting from E2 as the closest prior art document.

Since there is no consistent evidence on file that the adhesive/sealant of E2 provides a cohesive failure mechanism when joining metal sheetings together and since E2 itself does not address such a property, the problem to be solved over E2 may be seen in providing an adhesive/sealant composition, which can be used for bonding metal sheeting in the construction of automobile shells which *inter alia* provides an improved cohesive failure mechanism.

The Examples 1 to 4 of the patent in suit show that such a problem is effectively solved.

However, E2 only mentions a proportion of solid rubber in addition to other ingredients such as adhesion promoters, dessicants, blowing agents, antioxidants and thixotropic agents as an optional component to modify viscosity and other handling properties (page 6, second paragraph). Solid rubber is only used in Examples 1, 2, 4 and 6 out of ten examples. Furthermore, the amount of liquid polybutadiene in these examples lies between 27,7 to 34.0% by weight based on the total weight of the adhesive composition which is outside the claimed amount of 10 to 20% by weight. Finally, there is no hint in E2 to use a vinyl content lower than 2 mole%, even if a content of vinyl groups lower than 5 mole% is specified in E2.

Since E3 does not address pumpable adhesives and the problem of cohesive failure mechanism in metal-to-metal bonds and does not disclose a mixture of liquid rubber and solid rubber for that purpose, the indication in E3

to use carboxylic polymers in order to improve the adhesion in general provides no incentive to modify a specific liquid butadiene or isoprene rubber in this respect.

Since E2 discloses different adhesives comprising on the one hand only liquid rubber and on the other hand adhesives comprising liquid and solid rubber in amounts different from the claimed ones, the incentive provided in E3 does not suggest which of the compositions of E2 and which components thereof should be modified. Since there is furthermore no pointer in E3 to the claimed amounts of liquid and solid rubber there is no incentive in E3 to modify the compositions in the direction of the claimed combination of features necessary for solving the problem posed.

E1 does not address a pumpable composition nor a cohesive failure mechanism so that there is no incentive to use maleinized rubbers of E1 in adhesives of E2. In addition, E1 concerns a maleinized rubber having a configuration of the double bonds quite different from those required in E2. Furthermore, the solid rubber in E1 is used in amounts much higher than claimed (see point 4.4). Consequently there is no hint in E1 to modify the teaching of E2 in a direction as claimed.

E7 discloses the use of a liquid hydroxyl modified polybutadiene rubber to provide cohesive failure mechanism, which approach is different to that of the claimed subject-matter which uses a carboxylic modified liquid rubber.

Consequently, the claimed subject matter is not

rendered obvious by the cited prior art also when starting from E2 even when considered in combination.

4.6 In summary, the appellant has not established that the claimed subject-matter lacks an inventive step.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

N. Maslin

R. Teschemacher