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Aktenzeichen / Case Number / N° du recours : T 460/87 - 3.3.1

Anmeldenummer / Filing No / N° de la demande : 81 830 137.6

Veröffentlichungs-Nr. / Publication No / N° de la publication : 0 059 296

Bezeichnung der Erfindung: Application of polyglycols soluble in water as
Title of invention: lubricant in mechanical expanders effecting the cold
Titre de l'invention : straightening and gauging of lengthwise welded steel
tubes

Klassifikation / Classification / Classement : C10M 3/22

ENTSCHEIDUNG / DECISION

vom / of / du 20 June 1989

Anmelder / Applicant / Demandeur :

Patentinhaber / Proprietor of the patent /
Titulaire du brevet :

VISCOSUD of Dott.Ing. Mario Fiorese S.r.l.

Einsprechender / Opponent / Opposant :

BP CHEMICALS LTD
LUBRITALIA S.P.A.

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Article 56

Schlagwort / Keyword / Mot clé :

"Inventive step (denied) - promising teaching
inviting to try"
"Person skilled in the art - team"

Leitsatz / Headnote / Sommaire

Europäisches
Patentamt

Beschwerdekammern

European Patent
Office

Boards of Appeal

Office européen
des brevets

Chambres de recours



Case Number : T 460/87 - 3.3.1

D E C I S I O N
of the Technical Board of Appeal 3.3.1
of 20 June 1989

Appellant : VISCOSUD of Dott.Ing. Mario Fiorese S.r.l.
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Decision under appeal : Decision of the Opposition Division of the European
Patent Office dated 11 December 1986, posted on
20 October 1987, revoking the European patent
No. 0 059 296 pursuant to Article 102(1) EPC.

Composition of the Board :

Chairman : K. Jahn

Members : C. Gérardin
G.D. Paterson

Summary of Facts and Submissions

- I. The mention of the grant of the patent No. 59 296 in respect of European patent application No. 81 830 137.6 filed on 29 July 1981 was published on 2 May 1984 on the basis of one claim.

This claim reads as follows:

"Use of a water soluble lubricant in the process of cold straightening and gauging of lengthwise welded steel tubes in a mechanical expander, to lubricate the surface between the central wedge (1) and the external wedge shaped elements (2) sliding on said wedge and moving radially in a centrifugal direction as the result of the motion of a tension rod (3), characterized by

- (a) a lubricant comprising an ethylene oxide propylene oxide copolymer having a load carrying capacity of $>12 \text{ kg/mm}^2$;
- (b) selectively removing slags and ferrous scales that have settled on the lubricant wetting the wedge of the expander by washing with water at a pressure below 4 kg/cm^2 , and
- (c) subsequently removing the lubricant settled on the inner surface of the tube by washing with water at a pressure above 4 kg/cm^2 ."

- II. On 10 July 1984 Respondent 1 (Opponent 1) filed an opposition against the grant of the patent on the grounds that the subject-matter of the single claim did not involve an inventive step and that the patent in suit did

not disclose the invention in a manner sufficiently clear to be carried out by a person skilled in the art.

Respondent 2 (Opponent 2) gave notice of opposition to the granted patent on 6 September 1984 and requested revocation thereof for non-compliance with the requirements of Articles 56, 83 and 123(2) EPC.

These various objections which were emphasised and elaborated in several later submissions were based essentially on the following documents:

- (1) US-A-3 980 571
- (8) Polyalkylene glycol lubricants accepted for industrial applications by E.R. Mueller, presented at the American Institute of Chemical Engineers, 67th National Meeting and Biennial Material Sciences and Engineering Division Conference, 15 to 18 February 1970, Atlanta, Georgia
- (14) Technical Information Sheet "Gleitbahnoel EP 3" issued by Grote Mineraloel, 1978
- (15) Some industrial experiences with synthetic lubricants by C.H. Sweatt and T.W. Langer, Mechanical Engineering, June 1951, pages 469-476
- (18) FR-A-2 229 472

In support of his arguments the Appellant (Patentee) filed the following documents:

- (12) Mannesmann Report No. 28/82, 29 September 1982
- (12') Mannesmann letter to Viscosud of 23 April 1982.

III. By a decision orally announced on 11 December 1986 and posted on 20 October 1987, the Opposition Division revoked the patent on the ground of lack of inventive step. More

specifically, it was stated in this decision that since the good lubricating properties of polyglycols were generally known in the art, these compounds were regarded as obvious alternatives to the polluting lubricant combinations recommended by the manufacturers of the Mannesmann mechanical double-head expanders.

- IV. The Appellant thereafter filed a notice of appeal together with the Statement of Grounds on 7 December 1987 and paid the prescribed fee on 17 December 1987. The arguments presented in the Statement of Grounds filed on 17 February 1988 and duly translated as well as during oral proceedings held on 20 June 1989 can be summarised essentially as follows:

Owing to the specificity of the Mannesmann mechanical expanders, especially the size of the opposed surfaces of the wedge and wedge-shaped elements, there was a prejudice not only against deleting the extreme pressure additives, but even against substituting the mineral oil lubricants by polyglycols. Firstly, the use of polyglycols would not follow the recommendations made in document (12) by the manufacturers of the mechanical expanders themselves, who must be regarded as the persons skilled in the art. Secondly, the instability of polyglycols at high temperature would deter the skilled man from using these compounds as lubricating agents in an application involving both high pressure and high temperature conditions. Finally, in the prior art documents which concern metal working operations, especially document (1), the polyglycol lubricant was always used as a water solution, for water is necessary to carry off the heat generated during operation.

- V. In their counter-statements the Respondents put forward essentially the following arguments:

By the filing date of the patent in suit it was well known, especially from document (15), that polyglycols were at least as stable as mineral oils at high temperatures; in fact, in the present case, this specific property was not even a decisive criterion for the selection of an alternative lubricant, since the temperature increase remained low and the lubricant was used only once for a few seconds and then dispatched to waste.

The alleged prejudice against deleting extreme pressure additives did not exist at all, since they are neither described as mandatory in the prior art, nor excluded from the scope of the patent in suit.

It is questionable whether document (12) should be considered at all, since it relates to tests carried out almost one year after the filing date of the application; in any case, such an internal unpublished report cannot demonstrate the existence of a prejudice amongst the expert lubrication engineers.

- VI. Although duly summoned to the oral proceedings which they had requested, the Respondents did not attend these proceedings.
- VII. The Appellant requested that the decision under appeal be set aside and that the patent be granted without amendments.

The Respondents requested that the appeal be dismissed. At the end of the oral proceedings the decision was announced that the appeal was dismissed.

Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is, therefore, admissible.
2. The patent in suit concerns the application of polyglycols soluble in water as lubricants in mechanical expanders effecting the cold straightening and gauging of lengthwise welded steel tubes. First of all, the scope of the protection sought by the Appellant should be made clear. The Appellant has constantly based his argumentation regarding inventive step as if the lubricant actually consisted of polyglycol only and consequently did not contain water or extreme pressure additives. The Board cannot share this interpretation of the scope of the claim, since the wording "comprising" is not limitative, but on the contrary leaves open the possibility of having other ingredients. However, for the purpose of the decision the Board will follow the interpretation of the claim adopted by the Appellant, according to which the polyglycol lubricant should not contain extreme pressure additives.

Following the recommendations of manufacturers of mechanical expanders, the established industrial practice consists in lubricating these expanders with an emulsifiable mineral oil to waste after each working cycle. As the oil falls into the tube to be straightened and gauged, it becomes necessary to clean the inner surface thereof repeatedly, which is achieved by means of chemical solvents. This operation has the major drawback that it gives rise to environmental problems due to the subsequent discharge into water of large amounts of products which are both polluting and not biodegradable

and which moreover contain slags and ferrous scales due to the cold-working of the expander. These problems can only be overcome by carrying out expensive recuperation treatments of exhausted lubricant, which in turn considerably increases the cost of the finished tubes.

The problem underlying the patent in suit may thus be seen in providing a non-polluting lubricant, easily washable with water as well as biogradable, without impairing the lubrication required for the sliding metal surfaces to unacceptable levels, even in the absence of extreme pressure additives.

According to the patent in suit this problem is solved essentially by substituting the conventional mineral oil lubricants by polyglycols which are copolymers of ethylene oxide and propylene oxide. More specifically, the solution claimed by the Appellant involves using such polyglycol as single lubricant, removing slags and ferrous scales by merely washing the wedge of the expander with water at a pressure lower than 4 kg/mm^2 and subsequently removing the lubricant settled on the inner surface of the tube by washing with water at a pressure higher than 4 kg/mm^2 .

The suitability of polyglycols for this purpose has not been disputed by the Respondents; the Board is thus satisfied that the above defined technical problem is plausibly solved.

3. After examination of the cited documents the Board has reached the conclusion that this technical teaching is not disclosed in any of them and that the subject-matter of the patent in suit is, therefore, novel. Since the issue of novelty has not been raised by the Respondents, it is not necessary to consider this matter in detail.

4. It still remains to be examined whether the subject-matter of the patent in suit involves an inventive step with regard to the teaching of the cited documents.

4.1 The first question which arises is whether document (12) issued on 29 September 1982, i.e. eleven months after the filing date of the patent in suit, should be considered and whether the conclusions thereof should be regarded as a prejudice against the use of polyglycols as lubricants in mechanical expanders.

This internal report is an investigation of the suitability of the polyglycol slideway oil Viscosul "Viscosinth EP/ESS" as an expander lubricant which is considered to represent a lubricant according to the patent in suit; in the test, which itself was carried out after 29 June 1982, the pressure absorption capacity of these polyglycols was compared with that of Grote oil EP3 and Grote oil EP22 which both contain extreme pressure additives. At loads of 30 and 50 lbs the friction caused less abrasion with the polyglycol lubricant than with the two Grote oils; however, already at 60 lbs gear scuffing set in with the polyglycol lubricant. Therefrom the authors conclude that polyglycols, because of their low pressure resistance at high surface pressures, are not suitable for lubricating expander heads, especially in the production of thick-walled pipes.

As both Respondents objected in their counter-statement of appeal, the conclusion reached by the Appellant is based on the results of Timken tests which are mainly used for testing gear oils and are not suitable for assessing the performance of lubricants in mechanical expanders. This is even implicitly admitted in document (12) where it

is stated that in assessing the results of the Timken test, it should be noted that the movement flows are not directly comparable with the sliding movements of the expander wedge. As to the actual results, the report further specifies that products that withstand the Timken tests at high loads also give promise of good lubricating properties with mechanical expanders. However, in the Board's view, the mere fact that "Viscosinth EP/ESS" gives inferior results at 60 lbs cannot afford a negative conclusion regarding the suitability of polyglycols as lubricants of mechanical expanders; such an interpretation of document (12) would in any case not reflect the industrial practice reported in document (12'), according to which mechanical expanders were lubricated with polyglycols before 23 April 1982, i.e. five months before the report document (12) was issued.

In view of these ambiguous conclusions, document (12) will be disregarded hereinafter.

- 4.2 Polyglycols, which are described in the prior art, especially in documents (1), (8) and (15), as attractive alternatives to conventional mineral oil lubricants in many industrial applications, meet in particular the specific requirements mentioned above in the definition of the technical problem to be solved.
- 4.2.1 The first property underlined in document (8) is the superior heat stability of polyglycols; even under severe conditions their rate of degradation is slower, the products of degradation remain soluble and viscosity build-up virtually does not occur (page 559, column 1, paragraph 2 and column 2, paragraph 2). A second advantage of polyglycols is their complete water solubility which permits simple clean-up of product and/or equipment when this is required (page 560, column 1, end of paragraph 3).

While they are not biodegradable by the standards applied to surfactants, they have a low biochemical oxygen demand, which means that they will not deplete the oxygen of the water into which they are discharged and have no detrimental effect on the bio-mass in the sewage disposal plant (page 565, column 1, paragraphs 2 and 3). Further, because of their chemical structure, polyglycols inherently exhibit better boundary-lubricating properties than petroleum oils (page 559, column 2, paragraph 1), even in specific applications when these oils are fortified with additives (page 558, column 1, paragraph 2), as well as better heat transfer characteristics than petroleum lubricants of comparable viscosity (page 564, column 2, paragraph 3). Last, it is mentioned in general terms that water soluble polyglycol lubricants are suitable for metal working operations (page 563, column 1, paragraph 2 and column 2, paragraph 2).

- 4.2.2 Similarly, document (15) emphasises the superior properties of polyglycols by first stating that many difficult lubrication problems have been solved by means of their unusual properties, especially good load-carrying capacity, favourable viscosity-temperature relationship and stability at elevated temperatures (page 469, column 1, paragraph 3). It is then confirmed that polyglycols tend to be somewhat more stable at elevated temperatures than conventional lubricants; when they do undergo thermal and oxidative decomposition, the resulting products are fluids similar in character to the original lubricant (page 469, column 1, paragraph 4). Another advantage is that fluid polyglycol lubricants possess basic lubricity characteristics which makes these compounds display unusually high film strength and load-carrying qualities (page 472, column 1, paragraph 4). It is further specified that they act as fluid heat transfer

media at temperatures up to about 260°C (page 471, column 1, paragraph 3) and that they can be easily removed (page 472, column 2, paragraph 5 and page 473, column 1, paragraph 2). Furthermore, the good extreme-pressure properties of polyglycol lubricants have been evident in metal working operations (page 472, column 2, paragraph 3).

4.2.3 Further, in document (1) polyglycols are generally described as synthetic lubricants superior to conventional lubricants and suitable for any process involving the frictional contact of metal surfaces, such as chipless operations wherein a metal is only deformed under pressure without cutting or drilling (column 3, lines 1 to 43 and Example 6). In such deformation and shaping operations, polyglycols are distinguished by an especially high capacity for load carrying (column 5, lines 42 to 44). They are advantageously copolymers of ethylene oxide and higher alkylene oxides having 3 to 8 carbon atoms and can be used as such or applied as homogeneous water solutions (column 3, lines 44 to 52; column 4, lines 1 to 14). Moreover, in connection with cold forming, in contrast to conventional lubricants which cannot simply be dumped into the rivers because of unacceptable water pollution, polyglycols may be fed without any problem into these waters, which makes regenerative processing thereof superfluous, all the more as they are biodegradable (column 5, line 61 to column 6, line 15).

4.2.4 Although the use of polyglycols to lubricate mechanical expanders is not explicitly mentioned in any of these three documents, the fact that these lubricants meet all the requirements mentioned above and are particularly suitable for metal-working operations is regarded as an incentive inviting the substitution of the conventional

lubricant compositions by these polyglycols, at least as a routine experiment.

- 4.3 Even though the Appellant could share this conclusion to a certain extent during oral proceedings, at the same time he saw a twofold prejudice against this substitution in the fact that the manufacturers of the mechanical expanders themselves have recommended the use of lubricants based on mineral oils since these expanders came on the market in 1973 and in the fact that the mere reference to metal working operations could not be interpreted as the lubrication of mechanical expanders because of the specificity of these expanders.

- 4.3.1 The alleged prejudice against the use of other lubricants than those based on mineral oils raises in fact the question whether the builders of mechanical expanders should be regarded as the men skilled in the art whose recommendations would actually deter from looking for any further improvement or just even any alternative.

According to The New Encyclopaedia Britannica, Vol. 18, pages 705 to 709, the interaction of sliding surfaces is a tribological phenomenon whose study includes three different subjects, namely friction, wear and lubrication. Tribology is defined as a complex interdisciplinary subject, since friction is generally regarded as a branch of physics or mechanical engineering, wear is part of material science or metallurgy, while lubrication is a branch of chemistry.

In the present case, thus, the skilled man cannot be regarded as a single person, but as a team approaching the tribological problem from these various angles and associating inter alia the manufacturers of mechanical expanders and the producers of lubricant compositions.

This means that the recommendations alone of the manufacturers of mechanical expanders to use lubricants based on mineral oils cannot build a prejudice against the use of other lubricant compositions in general and of polyglycols in particular.

In fact, the established practice referred to by the Appellant does not prevent the manufacturers of mechanical expanders from looking for alternative lubricants. This is evident from document (12'), already mentioned above, which is a letter from manufacturers of mechanical expanders to the producers of "Viscosynth EP/ESS" lubricants asking for samples to be used routinely for some tests. This interest of manufacturers of mechanical expanders for slideway oils other than the conventional mineral oils corresponds to the need to test the various oils available on the market in order to inform their clients about the most adequate lubricants for the lubrication of expander heads. This can only mean that the manufacturers of mechanical expanders themselves considered polyglycols at least as worth trying.

Moreover, it is highly significant that the authors of document (14), who are lubricant producers, suggest using mineral oil-free lubricants in mechanical expanders. That such oils are intrinsically inferior to the mineral oil lubricants recommended by the manufacturers of mechanical expanders has not been demonstrated by the Appellant.

Therefore, the argument that a prejudice had to be overcome by not following the recommendations of the manufacturers of mechanical expanders to use mineral oil based lubricants, cannot be accepted.

4.3.2 Nor can the Board see in the alleged specificity of the mechanical expanders a prejudice against the application claimed by the Respondent.

Firstly, it should be noted that the teaching of document (18) which mentions a long list of potential applications wherein a metal is in movable contact with a second metal and a polyglycol lubricant, is not restricted to the working of non-ferrous metals as the Appellant put forward, but can be extended to advantage in the working of ferrous metals as well. According to a specific embodiment, this disclosure concerns the tube reduction of zirconium alloy in movable contact with a mandrel and a polyglycol lubricant (page 1, lines 10 to 31).

The analogy, or even equivalence, between the movements of a mandrel and expander heads has been underlined by Respondent 2 in opposition procedure (statement filed on 17 September 1985, page 1, paragraph 4 to page 2, paragraph 2) and in the appeal stage (counter-statement of 21 July 1988, page 4, paragraphs 3 to 9). From a strictly mechanical point of view, the expander heads are nothing else than mandrels, i.e. nothing more than a tribological coupling of sliding pig-iron surfaces of a given area which slide reciprocally with a certain contact area. In this type of tribological model the lubricant film acts as a separating element making the intermetallic contact impossible as long as the fluid is sufficiently compressed, the relative movement is slow and the film is not subjected to acceleration or deceleration.

In the Board's view, there is no fundamental difference between this schematic representation of mechanical expanders given by Respondent 2 and the running conditions of these expanders described by the Appellant in the statement filed on 14 March 1988. In the paragraph dealing

with the preliminary explanations on the running of the mechanical expander, the Appellant has not expressed in terms of properties required for the lubricant the specific working of the expander; in particular, no argument has been provided explaining why a polyglycol having the combination of properties described in documents (1), (8) and (15), as stated above in point 4.2, would not be suitable for that purpose. There is thus no reason why a general teaching concerning the lubrication of mandrels with polyglycols could not be transposed to the specific lubrication of mechanical expanders.

- 4.3.3 In the absence of any prejudice regarding the use of polyglycols as lubricants in mechanical expanders, the application claimed by the Appellant is thus regarded as a mere case of analogous use, i.e. as an obvious solution to the above defined problem.
- 4.4 The values of the load-carrying capacity of the polyglycol and the pressures used to first wash the edge of the expander and then remove the lubricant settled on the inner surface of the tube, as specified in the claim, cannot be regarded as inventive features.

First, as Respondent 1 argued in the statement filed on 16 November 1985 (page 11, paragraph 2), the need to have such a load-carrying capacity arises as a consequence of the load put on the lubricant by the machine during use; hence the determination of the lower limit of this parameter is a mere question of matching the characteristics of the machine and the properties of the lubricant. As specified in document (1), the load-bearing capacity is a standard parameter in the field whose measurement only requires well known methods (column 7, lines 3 to 7).

As to the pressures necessary to carry out the steps (b) and (c) according to the claim, they can easily be determined by routine experiments based on a trial and error approach since polyglycols are water soluble.

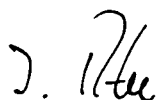
- 4.5 A comparison between the levels of lubrication in mechanical expanders achieved with conventional lubricants based on mineral oils and polyglycols has not been provided. In fact, the superiority of polyglycols has not even been claimed by the Appellant and, in practice, the conventional oils containing extreme pressure additives have not been supplanted by polyglycols, as conceded by the Appellant during oral proceedings; thus, neither technical effect, nor commercial breakthrough can be put forward as arguments in favour of an inventive step.
- 4.6 It is self-evident that all the above arguments apply equally against a narrower interpretation of the claim, i.e. against the application of any lubricant composition based on polyglycols and containing further ingredients, such as extreme pressure additives.
5. In conclusion, for the reasons given above, especially obviousness and absence of technical effect of the solution claimed by the Appellant, the subject-matter of the patent in suit does not involve an inventive step.

Order

For these reasons, it is decided that:

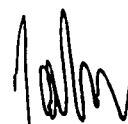
The appeal is dismissed.

The Registrar:



J. Rückerl

The Chairman:



K. Jahn