

Publication in the Official Journal Yes / No

File Number: T 498/90 - 3.3.1
Application No.: 85 308 816.9
Publication No.: 0 184 434
Title of invention: Method for desalting crude oil

Classification: C10G 31/08

D E C I S I O N
of 31 March 1992

Applicant: The British Petroleum Company p.l.c., et al

Headword: Desalting of crudes/BP
EPC Articles 54(3) and 56
Keyword: Novelty (affirmed) - Inventive step (yes)

Headnote



Case Number : T 498/90 - 3.3.1

D E C I S I O N
of the Technical Board of Appeal 3.3.1
of 31 March 1992

Appellants : The British Petroleum Company p.l.c.
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and

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Decision under appeal : Decision of Examining Division of the European
Patent Office dated 26 January 1990 refusing
European patent application No. 85 308 816.9
pursuant to Article 97(1) EPC.

Composition of the Board :

Chairman : K. Jahn
Members : J. Jonk
R. Spangenberg
J.-C. Saisset
J. Stephens-Ofner

Summary of Facts and Submissions

- I. European patent application No. 85 308 816.9, filed on 4 December 1985 (publication No. 0 184 434) and claiming priority of 7 December 1984 based on GB-8 431 013, was refused by a decision of the Examining Division posted on 26 January 1990. The decision was based on Claims 1 to 6 as originally filed, the only independent one reading as follows:

"A method for reducing the salt content of a heavy crude oil characterised by the fact that the method comprises the steps of

- (a) mixing 70 to 98% by volume of a heavy crude oil having a viscosity in the range 200 to 250,000 mPa.s at the mixing temperature with 30 to 2% by volume of an aqueous solution of an emulsifying surfactant or an alkali, percentages being expressed as percentages by volume of the total mixture; mixing being effected under low shear conditions in the range 10 to 1,000 reciprocal seconds, in such manner that an HIPR emulsion is formed comprising distorted oil droplets having mean droplet diameters in the range 2 to 50 microns separated by aqueous films,
- (b) breaking the resulting emulsion, and
- (c) separating the resulting mixture into a layer of relatively salt-free oil and a layer of relatively salt-enhanced water."

- II. The essential ground for the refusal was that the subject-matter of Claim 1 lacked novelty in the sense of Article 54(3) EPC in the light of the earlier European patent application:

(1) EP-A-0 156 486,

claiming a priority date of 18 February 1984 based on GB-8 404 347 and having a filing date of 14 February 1985 and a publication date of 2 October 1985 (Bulletin 85/40).

The Examining Division held that the resolution of the transported emulsions prepared according to document (1) must be regarded as a desalting step, because the transported HIPR (high internal phase ratio) emulsions were the same as the emulsions prepared and used for reducing the salt content of the oil according to the present patent application. The view of the Examining Division that the emulsions were the same was based on the fact that in both cases the starting oil was a Lake Marguerite crude oil having an API Gravity of 10.3° and a viscosity of 19.800 mPa.s at 25°C. Moreover, the preparation of the emulsions according to document (1) also involved the use of salt water, so that the oil phase inevitably would contain small droplets of brine.

Referring to T 161/82, it was considered by the Examining Division that a process previously described was not rendered novel by the fact that attention was drawn to an advantage associated with the process (desalting) but not hitherto acknowledged by the art, and which occurred when the process was carried out without any change.

As regards dependent Claims 2 to 6 the Examining Division held that the subject-matter of these claims was neither novel with respect to document (1) nor inventive in the light of the disclosure in document:

(2) GB-A-1 283 462.

III. A Notice of Appeal was submitted against this decision on 17 March 1990 and the appeal fee was paid on the same date.

A Statement of Grounds of Appeal was submitted on 19 May 1990.

By a further letter received 18 February 1992 three sets of claims were submitted (Appendices I to III) replacing the original claims.

IV. In the course of oral proceedings held on 31 March 1992 the earlier filed claims were replaced by new Claims 1 to 6. Claim 1 corresponded to the original Claim 1, except that the introductional part was replaced by:

"A method for reducing the salt content of a heavy crude oil containing salt in the form of small droplets of brine dispersed in the oil without using a hydrocarbon diluent."

V. In the written submissions and during the oral proceedings the Appellants argued that the process now claimed differed from that in document (1), because according to the known process for the preparation of the HIPR emulsions heavy oils were used which did not contain droplets of brine.

Referring to the documents:

(3) "Our Industry Petroleum", published in 1977 by the British Petroleum Company Limited, pages 139 and 140, and

(4) "Modern Petroleum Technology", 4th Edition (1975), pages 183, 184, 186 and 198,

the Appellants argued that heavy crude oils obtained from the wellheads were normally dehydrated, diluted with a hydrocarbon diluent and desalted at the location of the oil field, so that the person skilled in the art would understand that the starting oil for the preparation of the emulsions according to document (1) was a dehydrated and desalted crude oil. Moreover, it was contended by the Appellants that the parameters defining the Lake Marguerite crude oil used according to the example of the present patent application and the examples of document (1), namely the API Gravity and the viscosity, were measured after dehydration and desalting of the oil, so that they gave no information about the salt content of the oil.

It was also submitted by the Appellants that Claim 1 was allowable in the light of the Decision of the Enlarged Board of Appeal G 2/88.

As regards dependent Claims 2 to 6 the Appellants argued that document (2) disclosed a method for preparing HIPR emulsions of synthetic polymers or thickened animal or vegetable oils and that it was not concerned with the problems of emulsifying crude oils, still less with those of desalting crude oils. Moreover, there was no disclosure or suggestion in this document that the emulsions could be broken by heating.

VI. The Appellants requested that the decision under appeal be set aside and that a patent be granted on the basis of the amended claims submitted in the course of oral proceedings.

VII. At the conclusion of the oral proceedings, the Board's decision to order the grant of the patent in accordance with the request was announced.

Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is, therefore, admissible.
2. The above-mentioned amendments to Claim 1 do not give rise to objections under Article 123(2) EPC. They are based on page 5, lines 30 to 32; page 2, line 33 to page 3, line 2; and page 3, line 34 to page 4, line 1.
3. The issue to be dealt with is whether the subject-matter of Claim 1 is novel.
 - 3.1 Document (1) is state of the art in the sense of Article 54(3) for all the Contracting States designated in respect of the patent application.
 - 3.2 In accordance with the established jurisprudence of the Boards of Appeal it has to be decided whether document (1) as a whole makes available to the skilled person as a technical teaching the subject-matter for which protection is sought, i.e. a method for reducing the salt content of a heavy crude oil containing salt in the form of small droplets of brine dispersed in the oil without using a hydrocarbon diluent, comprising the preparation of an HIPR emulsion, breaking the obtained emulsion and separating the oil from the salt-enhanced water as indicated in Claim 1.
 - 3.3 Document (1) is related to a method for the preparation of an HIPR emulsion of oil in water comprising mixing 70 to

98% by volume of a viscous oil having a viscosity in the range of 200 to 250,000 mPa.s at the mixing temperature with 30 to 2% by volume of an aqueous solution of an emulsifying surfactant, percentages being expressed as percentages by volume of the total mixture, under low shear conditions in the range of 10 to 1,000 reciprocal seconds in such a way that an emulsion is formed comprising highly distorted oil droplets having mean droplet diameters in the range of 2 to 50 micron separated by thin interfacial films (cf. page 3, line 26 to page 4, line 2).

Moreover, this document discloses a method for transportation of a viscous oil comprising the steps of (a) preparing an HIPR emulsion by the method as described, (b) optionally diluting the emulsion with an aqueous phase to a desired viscosity and/or concentration, and (c) pumping the emulsion or the diluted emulsion through a pipeline (cf. page 6, lines 23 to 32).

Suitable oils for preparing the emulsions and for pipelining are the viscous, heavy and/or asphaltenic crude oils to be found in Canada, the USA and Venezuela (cf. page 7, lines 5 to 11). According to the examples, Lake Marguerite crude oil, i.e. a heavy crude oil, having an API Gravity of 10.3° and a viscosity of 19,8000 mPa.s at 25°C, was used (cf. page 7, lines 22 and 23).

Document (1) also discloses that, after transportation to a refinery, the emulsions must be resolved into their component parts and that the lack of sub-micron oil droplets may result in a more efficient separation process and a cleaner water phase (cf. page 7, lines 12 to 18).

3.4 The Examining Division based its finding of lack of novelty on two arguments, firstly, that the same crude

oils were used for the preparation of the emulsion because they were defined by identical parameters (cf. (1), page 7, lines 22 and 23; and the present specification, page 6, lines 9 to 11) and, secondly, that the oil phase of emulsions obtained according to document (1) by mixing the crude oil with salt water would inevitably contain salt in the form of droplets of brine (cf. (1) page 4, lines 21 to 24; page 7, lines 22 to 35; and Table 1).

However, the first argument fails because the Board has no reason to doubt Appellants' contention that the identical parameters for the API Gravity and viscosity do not give any information about the original salt content of the crude oils because they were measured after dehydration and desalting of the crude oils. In this connection the Appellants showed during oral proceedings a sample of a typical untreated heavy crude oil consisting of a watery phase containing clods of thick oil. Because of its inhomogeneous consistency, in the Board's view, such a crude oil is unlikely to be suitable for providing useful values for gravity and viscosity.

The second argument rests on the assumption that the oil phase of the oil-in-water emulsion obtained by mixing the crude oil with salt water indicated in Table 1 of document (1) (cf. page 7, lines 26 to 28, and page 9) must contain small droplets of brine. However, it is clearly disclosed in document (1) that the high internal phase ratio (HIPR) emulsions are prepared by mixing the oil with an aqueous solution of an emulsifying surfactant or an alkali under low shear conditions in such a way that an oil-in-water emulsion is formed comprising oil droplets separated by thin aqueous surfactant lamellae, i.e. avoiding the forming of droplets of water in the oil phase (cf. page 3, line 26 to page 4, line 2; and page 8, lines 5 to 15). In addition, the forming of small droplets of water or brine

in the oil phase would also be in contradiction with the teaching and the experimental results in the present patent specification, which show that the HIPR emulsions are prepared and used to remove small droplets of brine originally present in the starting oil (cf. page 3, line 34 to page 4, line 1; and page 5, line 32 to page 6, line 5).

Therefore, in the Board's judgment, the text of document (1) does not provide any evidence that the starting crude oil for the preparation of the HIPR emulsions or the oil phase of the produced HIPR emulsions would contain salt in the form of droplets of brine.

3.5 Moreover, in the absence of any evidence to the contrary, the Board accepts the Appellant's submission that it was common general knowledge that heavy crude oils were normally dehydrated, diluted with hydrocarbon diluents and desalted at the location of the oil fields in order to avoid the occupation of vital space in storage and transport facilities and to prevent corrosion of storage tanks, pipelines and refinery columns. In this connection, they referred to certain general technical literature, namely documents (3) and (4), and in particular to document (3), page 139, left column, last paragraph to page 140, line 8, and to document (4), page 183, first sentence under "separation of oil, gas and water", as well as the paragraph bridging pages 183 and 184. Although these documents, in the Board's finding, teach the importance of the dehydration and desalting of the crude oil at the location of the oil fields, they are silent about the use of diluents. However, because these documents are not concerned with heavy crude oils and because of the thick consistency of heavy oils which would hinder effective washing with fresh water to remove the

undesired salts (cf. document (3), page 139, right column, lines 10 to 8 from the bottom; and document (4), page 184, lines 3 to 6), the Board has no reason to doubt that a diluting step does form part of desalting heavy crudes. Therefore, and also taking into account that document (1) is essentially related to a method of treating heavy crude oils in order to make them more suitable for transport in pipelines (cf. the discussion of the state of the art, particularly on page 1, lines 4 to 23; page 3, lines 14 to 25; and page 6, lines 23 to 32), in the Board's judgment, the skilled person would interpret the disclosed method for the preparation of HIPR emulsion of a heavy crude oil in water in such a way that the method comprises the steps of dehydration and desalting of the crude oil, using hydrocarbon diluents, before the oil is mixed with the aqueous solution of an emulsifying surfactant or an alkali.

- 3.6 Therefore, in the Board's judgment, the claimed process has not been made available to the skilled person as a technical teaching. The subject-matter of Claim 1 is, consequently, novel.

Since the issue of novelty has been decided, there is no need to consider whether the purpose of the claimed process, namely reducing the salt content, would be a differentiating functional technical feature in the sense of the Decision of the Enlarged Board of Appeal G 2/88.

- 4. The remaining issue to be dealt with is whether the subject-matter of Claim 1 involves an inventive step.
- 4.1 Although the decision of the Examining Division was mainly based on lack of novelty, inventiveness was also considered and decided on the basis of document (2).

This document discloses a process for producing HIPR oil-in-water emulsions comprising beating up a mixture of oil and water together with an emulsifying agent, wherein the oil can be a bodied glycerine drying oil, e.g. a vegetable or a fish oil which has been heat-bodied or air-blown; or it can be a synthetic resin (cf. Claims 1 and 2 and page 3, lines 33 to 46).

4.2 Although this document is concerned with the preparation of HIPR oil-in-water emulsions it does not disclose the preparation of such emulsions from heavy crude oils, let alone from crude oils containing small droplets of brine. Therefore, the disclosure of this document is not in any way concerned with the problem underlying the subject-matter of the present patent application, which is to desalt heavy crude oil containing small droplets of brine (cf. page 3, line 34 to page 4, line 1).

4.3 According to Claim 1, this technical problem is essentially solved by forming and subsequently breaking an HIPR emulsion without the use of a hydrocarbon diluent.

In view of the test results indicated in the example, the Board is satisfied that the above-technical problem is credibly solved.

4.4 It remains to be decided whether, in view of the technical problem to be solved, the requirement of inventive step is met by the claimed process.

4.5 As indicated above, document (1) is only state of the art in the sense of Article 54(3) EPC. Consequently, this document has not to be considered in deciding whether there has been an inventive step (Article 56 EPC).

4.6 Document (2) - as indicated above - does not contain any indication that HIPR emulsions could be used in a process for desalting heavy crude oils, let alone that the desalting could be carried out without the use of hydrocarbon diluents. Therefore, in the Board's judgment, the skilled person faced with the existing problem to desalt a heavy crude oil without the use of a hydrocarbon diluent would have disregarded the teaching of this document. Even assuming that the skilled person would have taken this document into consideration, its disclosure that the HIPR emulsions are particularly useful as vehicles for paints and coatings (cf. page 3, lines 116 and 117) and that they are dispersable in water (cf. page 4, lines 10 to 16, and the examples), indicating that the emulsions are very stable even in diluted form, would have led him away from the preparation of such emulsions in a process for desalting crude oils, because a process for desalting crude oil requires that the emulsions obtained after washing with fresh water can be easily broken, so that the salt containing water can be completely separated in a short time.

4.7 After considering the other prior art documents cited in the European search report, the Board finds that none of these documents suggests the preparation and use of HIPR emulsion for desalting heavy crude oil. Since the Examining Division did not base any objection regarding inventive step on any of these documents, there is no need to give detailed reasons for this finding.

4.8 Consequently, in the Board's judgment, the proposed solution to the technical problem underlying the patent application in suit is inventive. Thus, Claim 1 is allowable.

Dependent Claims 2 to 6, which relate to preferred embodiments of the process according to Claim 1, are likewise allowable.

Order

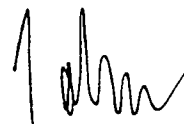
For these reasons, it is decided that:

1. The decision of the Examining Division is set aside.
2. The case is remitted to the Examining Division with the order to grant the patent on the basis of the claims as submitted in the course of oral proceedings with appropriate amendments to the description.

The Registrar:

P. Martorana

The Chairman:



K.J.A. Jahn