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**Datasheet for the decision  
of 18 April 2008**

**Case Number:** T 1386/06 - 3.3.06

**Application Number:** 03026993.0

**Publication Number:** 1449908

**IPC:** C10L 1/32

**Language of the proceedings:** EN

**Title of invention:**

Method for converting heavy oil residuum to a useful fuel

**Applicant:**

Colt Engineering Corporation

**Opponent:**

-

**Headword:**

Conversion of residuum/COLT

**Relevant legal provisions:**

EPC Art. 56

**Relevant legal provisions (EPC 1973):**

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**Keyword:**

"Inventive step (no): main and auxiliary requests"

**Decisions cited:**

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**Catchword:**

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Case Number: T 1386/06 - 3.3.06

**D E C I S I O N**  
of the Technical Board of Appeal 3.3.06  
of 18 April 2008

**Appellant:** Colt Engineering Corporation  
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AB T2W 4X9 (CA)

**Representative:** Schmitz, Hans-Werner  
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**Decision under appeal:** Decision of the Examining Division of the  
European Patent Office posted 2 May 2006  
refusing European Patent application  
No. 03026993.0 pursuant to Article 97(1)  
EPC 1973.

**Composition of the Board:**

**Chairman:** P.-P. Bracke  
**Members:** G. Dischinger-Höppler  
U. Tronser

## Summary of Facts and Submissions

- I. This appeal is from the decision of the Examining Division to refuse the European patent application No. 03 026 993.0 entitled "method for converting heavy oil residuum to a useful fuel".
- II. The decision was based on the ground that the subject-matter claimed in the then pending main request lacked an inventive step in view of the disclosure of documents
- D1 US 2002/0157304 A1 and
- D4 US-A-5 511 969.
- Concerning the auxiliary request, it was held that the amendments made to the independent claims were not allowable under Article 123(2) EPC.
- III. This decision was appealed by the Applicant (hereinafter Appellant).
- IV. In a communication annexed to the summons for oral proceedings, the Board drew attention, inter alia, to problems under Article 56 EPC.
- V. At the oral proceedings held on 18 April 2008, the Appellant filed amended sets claims in a new main and two auxiliary requests.

Claim 1 of the main request reads:

"1. A method for converting heavy oil residuum to a combustible fuel, comprising the steps of:

providing a source of heavy oil liquid residuum having a viscosity such that said residuum is substantially non flowable;

reducing said viscosity of said residuum by preheating to a temperature of 100°C or more that is sufficient to facilitate flow without thermally degrading said residuum;

providing a mixing means;

providing a source of water;

mixing said water and reduced viscosity residuum in said mixing means to form in said mixing means, an emulsion of predispersed residuum in an aqueous matrix in a size distribution suitable for use as a combustible fuel; and

maintaining said emulsion under pressure greater than the vapour pressure of said emulsion to prevent dehydration of said emulsion."

Claim 1 of the first auxiliary request reads:

"1. A method for converting heavy oil liquid residuum to a combustible fuel, comprising the steps of:

a) providing a source of heavy oil liquid residuum having a viscosity such that said residuum is substantially non flowable;

- b) reducing said viscosity of said residuum by preheating in a temperature range sufficient to facilitate flow without thermally degrading said residuum;
- c) providing a mixing means;
- d) providing a source of water;
- e) mixing said water and reduced viscosity residuum in said mixing means to form in said mixing means, an emulsion of predispersed residuum in an aqueous matrix in a size distribution suitable for use as a combustible fuel; and
- f) storing or passing the emulsion to a combustion device;
- g) maintaining a pressure greater than the vapour pressure of said emulsion from step b to step f."

Claim 1 of the second auxiliary request differs from that of the first auxiliary request by replacing in step b) the term "preheating in a temperature range" by "preheating it to a temperature of 100°C or more that is".

VI. The Appellant, orally and in writing, submitted in essence the following arguments:

The subject-matter claimed in the main request differed from that disclosed in document D1 in that the viscosity of the residuum was reduced by applying

pressure and a temperature of at least 100°C instead of adding a diluent. This offered the option of using residua of higher viscosities.

A skilled person seeking to use such high viscosity residua in the process of document D1 would not consider document D4 since it related to water-in-oil emulsions (w/o emulsions) which were prepared at a minimum temperature of 20°C and under aeration. In contrast, document D1 and the invention were concerned with oil-in-water emulsions (o/w emulsions) wherein water was the transport medium to the burner.

Further, document

D2      US-A-6 001 886

showed that emulsification of residua at temperatures above 100°C did not belong to the common general knowledge of someone skilled in the art.

According to the subject-matter claimed in the auxiliary requests, the emulsion was maintained under pressure greater than its vapour pressure during the whole process. With respect to the method disclosed in document D1, this difference solved the technical problem of avoiding costs of means for adapting temperatures and pressures within the process unit. However, such a once through the mill system having a pressurized process unit from the mixing step to the combustion and the advantages thereof were not suggested in document D4. Therefore, a combination of the disclosure of documents D1 and D4 would not lead to the claimed subject-matter.

The subject-matter claimed in the main request and especially in the auxiliary request was, thus, not obvious in the light of the prior art.

- VII. The Appellant requested that the decision under appeal be set aside and that a patent be granted on the version of the main request or the first or second auxiliary request as submitted during oral proceedings.

### **Reasons for the Decision**

1. The Board is satisfied that the claims as amended in accordance with the new main and two auxiliary requests comply with the requirements of Articles 123(2) EPC and 54 EPC. Since the appeal fails for lack of inventive step, there is no need to give further details.
  
2. *Inventive step (main request)*
  - 2.1 The application in suit relates to a method for converting heavy oil residuum to a fuel which can be used for power generation and steam production, and as a direct process heating source, specifically to a method of formulating a combustible fuel in the form of emulsified particles of a desirable size range for being used in any type of boiler as an energy source (page 1, paragraphs [0001] and [0009]).

It is indicated that a particular advantage of the process consists in the fact that it is reversible so that the emulsion can be de-emulsified readily to

convert the material back into its original form (page 5, paragraph [0027]).

Document D1 relates to a method for exactly the same purpose displaying the same advantage (page 1, paragraphs [0001] and [0007], page 2, paragraph [0033]). It qualifies therefore as a suitable starting point for the assessment of inventive step.

- 2.2 Document D1 discloses a method for converting heavy oil residuum to a combustible fuel, comprising the steps of
- providing a source of heavy oil residuum having a viscosity such that said residuum is substantially non flowable;
  - reducing said viscosity of said residuum to facilitate flow thereof;
  - providing a mixing means;
  - providing a source of water;
  - mixing said water and reduced viscosity residuum in said mixing means and
  - forming, in said mixing means, an emulsion of predispersed residuum in an aqueous matrix in a size distribution suitable for use as a combustible fuel (Claim 1).

Further, it is indicated in document D1 as well as in the application in suit that the raw residuum fed to the mixer is an essentially non-flowable mass if allowed to cool to ambient conditions (D1, page 2, paragraph [0031]; application, page 5, paragraph [0025]).

The Board concludes therefrom that according to document D1 the residuum, when fed to the mixer, is



also in a preheated state, namely at a temperature where it is still flowable but not degraded. It is, therefore, irrelevant that in a preferred embodiment of the process of document D1 diluent is also added for reducing the viscosity (Claim 10), the more so as this option is not excluded in the claimed process (Claims 10 and 23 and Example 2).

- 2.3 The claimed method is, thus, distinguished from the prior art disclosed in document D1 in that
- the residuum is preheated to a temperature of at least 100°C and
  - the emulsion is maintained under pressure greater than its vapour pressure to prevent dehydration.

- 2.4 The Board agrees with the Appellant insofar as a high preheating temperature provides the possibility of using residua of higher softening points.

Concerning the second distinguishing feature, the Board observes that it is a prerequisite in any aqueous system that the pressure must be held above the vapour pressure of the system if dehydration is to be prevented.

Hence, the technical problem actually solved by the claimed subject-matter in view of document D1 may be seen in that such residua of higher softening point are converted to combustible fuel.

- 2.5 It remains to be decided whether it was obvious for someone skilled in the art to solve the above stated technical problem by the means claimed, namely by preheating the heavy oil residuum to a temperature of

at least 100°C and maintaining the emulsion at a pressure above its vapour pressure.

- 2.6 It is known in the art of processing petroleum derivatives to produce aqueous emulsions of residuum or fuel oils at elevated temperatures, that preheating may soften the residuum or oils by reducing their viscosity and that residuum or oils of higher viscosity require for that purpose heating to higher temperatures (see document D2, column 3, lines 6 to 13 and column 4, lines 26 to 29; document D4, column 3, lines 61 to 66 and column 4, lines 12 to 21 and 53 to 57). Further, it is apparent to those skilled in the art that such preheating must be limited to temperatures where no thermal degradation occurs.

The Board is, therefore, of the opinion that a skilled person seeking to provide an aqueous emulsion of residuum of high viscosity would consider heating to a suitable temperature. However, the Board is also convinced that those skilled in the art would know that above 100°C pressure must be applied in order to prevent rapid dehydration of the resulting emulsion. This is corroborated by the teaching of document D4 where it is indicated that emulsification of high viscosity oils must be performed under pressure in order to avoid losses of emulsion water through evaporation at the high temperature required to liquefy the fuel oil (column 4, lines 13 to 21).

Therefore, the Board is convinced that the skilled person would treat according to the process of document D1 even residuum of viscosities requiring temperatures

of at least 100°C and corresponding pressures for producing aqueous emulsions for power generation.

- 2.7 The Appellant argued that prior to the present application, emulsification at temperatures above 100°C would not have deemed to be feasible by those skilled in the art. This was apparent from document D2 which related to a very similar process, namely to a process of converting asphalt residues into aqueous emulsions suitable for use as boiler fuel to produce steam (column 2, lines 14 to 17) but taught that it was important not to exceed 100°C during formation of the emulsion in order to prevent dehydration (column 4, lines 33 to 38).

Further, a skilled person would not look at document D4 in order to solve the above stated technical problem since this document was concerned with w/o emulsions which were aerated and prepared at temperatures around 20°C and wherein the droplets of water were uniformly dispersed in and, hence, surrounded by the fuel oil.

- 2.8 The Board notes that document D2, whilst being concerned with the production of aqueous emulsions of asphalt residues, does not envisage emulsifying asphalt residues having a softening point above 93°C (200°F; see column 3, lines 6 to 20). However, this fact is not sufficient to create a prejudice in the art against emulsifying residues of higher softening points at temperatures above 100°C, especially as doing so is already taught in document D4 (see below), but merely an indication that a skilled person seeking to solve the above stated technical problem (point 2.4 above) would not get any further incentive from document D2.

Apart from that, document D2 is not concerned with a process which is readily reversible. On the contrary, particular emphasis is laid on a stability of the resulting emulsion sufficient to be transportable through a pipeline by pumping. For this purpose, a specific triblock copolymer is used as emulsifier and it is theorized that the chemical composition of this emulsifier is critical for the stability of the emulsion as it should provide a coating on the asphalt particles formed during shearing and, on the other hand, an ionic attachment to surrounding water molecules (column 1, line 58 to column 2, line 13 and column 3, lines 32 to 67). Thus, a skilled person would realize that performing the process of document D2 would require abandoning the advantage of the process of document D1 with respect to reversibility since it is unlikely that conversion of the material back into its original form simply by de-emulsification is possible.

Concerning document D4, the Board agrees with the Appellant insofar as this document does not relate to the same type of emulsions as document D1 but to w/o emulsions which are aerated during formation. However, contrary to the Appellant's opinion, a temperature of 20°C is not generally recommended as the working temperature but merely as the absolute minimum temperature of the water during emulsification. Preferably, however, and depending on its viscosity, the fuel oil is preheated to a temperature between 50°C and 200°C and emulsified under pressure to avoid evaporation (column 2, lines 17 to 20, column 3, line 61 to column 4, line 21). Hence, document D4 teaches the common principle that the formation of

aqueous emulsions of oils preheated to temperatures of 100°C and above requires pressurisation and there is no reason to assume that such conditions would not be suitable to produce o/w emulsions from high viscosity residuum, the more so as agreed by the Appellant, evaporation of w/o emulsions as in document D4 requires higher pressures when compared with o/w emulsions as in document D1.

No evidence to the contrary was provided by the Appellant.

- 2.9 The Board is, therefore, not convinced by the Appellant's arguments and concludes that it was obvious for someone skilled in the art to apply the process of document D1 to residuum of higher viscosity at temperatures of 100°C and more and a corresponding pressure to prevent evaporation in the expectation of producing therefrom aqueous emulsions suitable for power generation.

Hence, the subject-matter of Claim 1 is not based on an inventive step as required by Articles 52(1) and 56 EPC.

### 3. *Auxiliary requests*

- 3.1 Claim 1 of the second auxiliary request differs in essence from that of the main request in that
- subsequent to its formation, the emulsion is stored or passed to a combustion device and
  - the pressure is maintained above the vapour pressure of the emulsion from the point of reducing the viscosity up to the devices for storage or combustion.

- 3.2 It is noted that the first feature, storing of the emulsion or passing it to a combustion device, is known from document D1 (pages 2 and 3, paragraph [0035]). This was not contested by the Appellant.
- 3.3 However, the Appellant argued in writing that the claimed process wherein the pressure is maintained during all process steps in which the emulsion is involved avoided the need of a second pump and costs for means for adapting temperatures and pressures when compared with the process of document D1.
- 3.4 As already indicated in the Board's communication, there is no evidence showing that the process of document D1 required more adaptations than the claimed process. Further, it is apparent that the claimed process also requires a second pump, namely for providing pressurised water to the pressurized mixer.

Hence, the effect actually achieved by the claimed pressurisation still consists in that evaporation of the emulsion is prevented.

The Appellant did not contest these arguments but merely indicated at the oral proceedings that the claimed subject-matter would not result from a combination of the disclosures of documents D1 and D4.

This may be true. However, in the Board's opinion it belongs to the ordinary skill of the artisan aiming at avoiding evaporation how to effect pressurisation for this purpose.

3.5 The same reasons apply mutatis mutandis to Claim 1 of the first auxiliary request since it differs from Claim 1 of the second auxiliary request only in that preheating to the specific temperature of 100°C or more is not required.

3.6 The Board, therefore, concludes that the subject-matter of Claim 1 of none of the auxiliary requests complies with the requirements of Articles 52(1) and 56 EPC.

## **Order**

### **For these reasons it is decided that:**

The appeal is dismissed.

The Registrar:

The Chairman:

P. Cremona

P.-P. Bracke