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81 305 022.6

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Heated fuel line

Bezeichnung der Erfindung:

Title of invention:

Titre de l'invention :

Klassifikation / Classification / Classement :

**ENTSCHEIDUNG / DECISION**  
8 July 1990  
vom / of / du

Anmelder / Applicant / Demandeur :

Patentinhaber / Proprietor of the patent /  
Titulaire du brevet :

Paccar Inc.

Einsprechender / Opponent / Opposant :

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Article 56

Schlagwort / Keyword / Mot clé :

"Inventive step (no)"  
"Analogous substitution"

Leitsatz / Headnote / Sommaire

Europäisches  
Patentamt  
Beschwerdekammern

European Patent  
Office  
Boards of Appeal

Office européen  
des brevets  
Chambres de recours



Case Number : T 213/87

**D E C I S I O N**  
of the Technical Board of Appeal  
of 8 July 1990

**Appellant :** Paccar Inc.  
777 106th Avenue N.E.  
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**Representative :** Meddle, Alan Leonard et al.  
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**Decision under appeal :** Decision of Examining Division 102  
of the European Patent Office dated  
23 January 1987 refusing European  
patent application No. 81 305 022.6  
pursuant to Article 97(1) EPC

**Composition of the Board :**

**Chairman :** G. Szabo  
**Members :** M. Noel  
M. Schar-Schupisser

## Summary of Facts and Submissions

I. European patent application No. 81 305 022.6 filed on 23 October 1981 (publication No. 0 052 945) was refused by a decision of the Examining Division dated 23 January 1987, on the basis of amended Claims 1 to 4 received on 11 February 1986.

II. Claim 1 reads as follows:

"A heated fuel line for a liquid-fuel engine having a fuel tank, a fuel line leading from the tank to the engine, and an electrical power supply, the fuel line comprising: an elongate electrical resistance heating element comprising a pair of parallel conductive wires spaced apart and covered by a non-metallic resistance sheath in the shape of a flat, thin tape formed of a radiation cross-linked polymer with free carbon, having the property of being less resistant and producing more heat under low temperatures than under high temperatures, said element extending through the length of the fuel line between the fuel tank and a fuel filter adjacent the engine, and being of substantially less cross-sectional area than the fuel line; a fitting in the fuel line with means connecting the heating element to the exterior of the fuel line; and external wiring connecting the connecting means and the heating element in an electrical circuit to the power supply, whereby the fuel line is heated directly and efficiently by the heating element, and solidifying of fuel in the line in extremely low temperature is avoided."

Independent Claim 4, relating to a vehicle, differs therefrom only by the incorporation of additional constructional features with respect to the fitting assembly as well as to the electrical circuit.

III. The reason for the refusal was that the subject-matter of independent Claims 1 and 4 did not involve an inventive step in the light of the disclosure of the documents US-A-2 669 299 (1) and DE-A-2 755 077 (2), essentially.

IV. A Notice of Appeal was filed on 19 March 1987 and the appeal fee was paid on the same date. In the Statement of Grounds received on 26 May 1987, the Appellant made essentially the following points:

- Because of the dangerous nature of the earlier proposals, such as the system of document (1), one would first have to overcome the established prejudice (attested to by Mr Parks' Affidavit of 7 February 1986) against the use of such electrical heaters having bare wires in fuel lines.
- Heating elements of the type according to document (2), available at the filing date of the present invention, were not suitable for direct incorporation in a fuel line. As Mr Parks explained, considerable development effort had been necessary to achieve a satisfactory heated fuel line starting from the originally available PTC (Positive Temperature Coefficient) tapes. Moreover, the document (2) had given no indication that the heating element described therein could be used in connection with a vehicle fuel line.
- Many indications such as updating an old-fashioned system, long-felt want and commercial success were relevant in this case and clearly demonstrated the presence of an inventive step.

V. The Appellant requests that the decision of the Examining Division be set aside and that a European patent be

granted on the basis of Claims 1 to 4 submitted on 11 February 1986.

**Reasons for the Decision**

1. The appeal is admissible.
2. The claims in suit are unchanged with respect to the version as rejected. The Board is convinced that there are no formal objections to the current version of the claims.

3. **Novelty**

None of the documents cited in the proceedings discloses a heated fuel line according to the whole combination of Claim 1. Therefore, the subject-matter of Claim 1 must be regarded as novel. Novelty has not, in fact, been in dispute in these proceedings.

4. **Closest prior art**

In the Board's view document (1) can be regarded as the closest prior art since it comprises many features of the claimed subject-matter and already answers the problem tackled in the application, i.e. to improve the efficiency of a fuel line heating system, in particular in a diesel fuel line, and to increase heat transfer from the heating element to the fuel. To this end, as in the application, the solution according to (1) consists of incorporating the electrical heating element directly within and through the entire length of the fuel line, whereby the fuel is heated directly and efficiently by the heating element, and solidifying of fuel in the line at extremely low temperature is avoided (see (1) from column 2, line 51 to column 3, line 11).

In addition to that, document (1) discloses most of the features of the present Claim 1, more particularly an elongated electrical resistance heating element 40 comprising conductive wires extending between the fuel tank 12 and the fuel filter 19 adjacent the engine 15 and being of substantially less cross-sectional area than that of the fuel line (see Figure 3); a fitting 36 with connecting means, an external wiring 56, 52 for connecting the heating element in an electrical circuit 50-56 to the power supply 17.

5. Problem and solution

In the embodiment according to document (1), the heating coil or resistance is preferably formed from any suitable alloy or metal. Although it is specified there that a break in the electrically heated wire coil will cause absolutely no danger from the standpoint of fire, for the reason that the wire coil is heated by means of a low voltage current derived from the battery, risks may indeed be involved particularly in case of damage or high voltage, since no mention is made in (1) of the provision of any protective coating surrounding the wire which latter clearly comes directly into contact with the fuel.

This can be regarded as a disadvantage and thereby the technical problem to be solved by the application resides in the provision of an improved heating element which avoids such undesirable effects. In addition the provision of a more efficient heat transfer can be recognised as desirable in respect of such closest state of the art.

The solution of this problem as set out in the present Claim 1 resides solely in the provision of a special resistance heating element comprising:

- a pair of parallel conductive wires spaced apart and
- covered by a non-metallic resistance sheath
- in the shape of a flat, thin tape
- formed of a radiation cross-linked polymer with free carbon, and
- having the property of being less resistant and producing more heat under low temperatures than under high temperatures.

In addition to such a resistance element being safe because the conductive core material is covered by an insulating and protecting jacket, it is also economical because of the fact that conductive polymer compositions exhibit so-called PTC behaviour, i.e. the electrical resistance decreases at lower temperatures and increases at higher temperatures so that current flow and heat are provided only where needed.

6. Inventive step

- 6.1 The arrangement according to Claim 1 differs from the closest prior art in document (1) by the features stated above (point 5) which define the particular structure and characteristics of the heating element.
- 6.2 According to the application (pages 2 and 4) a preferred heating element for the given purpose is a product marketed under the name Thermo-Limit-Tape by Raychem Corporation, comprising two parallel conductive wires 25 encased within an irradiated self-limiting conductive core material 27, the electrical resistance of which having PTC characteristics, the core material being coated and sealed with a suitable plastics material, as illustrated in Figure 3.

The suitable and even preferred heating element is clearly well known as such in the art, as conceded by the Appellant; such kind of heating element was already disclosed in prior art document (2) in the name of Raychem Corporation (see in particular from page 2, line 32 to page 3, line 5; from page 6, line 22 to page 7, line 2 and from page 9, line 32 to page 10, line 8).

- 6.3 The Board considers that the replacement of the heating element used in document (1) by the known thermo-limit-tape disclosed in document (2) in order to make use of the known characteristics and advantageous effects of the PTC composition involving covered wires and providing a more efficient temperature dependent heat transfer, must be regarded as obvious for the person skilled in the art in view of the technical problem arising on the basis of document (1). By such replacement one arrives directly at the subject-matter of Claim 1, without producing any unexpected effects whatsoever.

Unless an in itself patentable feature is incorporated in a combination of features, the use of a known feature in a combination of a known type must itself be non-obvious to render the combination patentable.

There was no prejudice inhibiting the skilled person from considering document (1), as alleged by the Appellant, since the danger and risks were clearly associated with a single feature, the use of bare wires. On the contrary, there was a strong incentive in recognising the technical problem associated with that feature and then focusing on its elimination, i.e. replacement with something better in that respect.



6.4 In the present case, all advantageous results set forth such as "self-limiting" effect according to which heat is provided only where needed, or the "fail-safe" effect according to which any breaks in the conductors will simply shut off the current flow beyond that point, result directly from the known characteristics of the PTC element and were certainly predictable.

Again, in the absence of any unexpected effect, the mere substitution of an element known for its relevant properties to provide that known effect cannot be regarded as patentable. This argument is supported by the reasoning of the Decisions T 130/89 of 7 February 1990 ("analogous use") - to be published) and T 192/82, "Moulding composition/BAYER" ("analogous substitution"), OJ 9/1984, 415-427.

6.5 Having regard to Appellant's further arguments stated above (Point IV), the Board observes as follows:

- When the applicant is aware of a heating element and recommends it in the application as being suitable and available on the market, there is no need to further ask whether the element disclosed in document (2) requires any adaptation or to seek in the description any indication or hint as to using such an element particularly within a fuel line. The cited art introduced generally applicable heating elements with clearly recognisable advantages, and it was up to the skilled person to apply it analogously whenever required. The embodiment disclosed in document (2) indicates an AC supply voltage of 115 volts, by way of example only, leaving the skilled person to choose the voltage according to circumstances. The features according to Claim 1 in the application in suit do not specify any operating voltage, which also means that

again a suitable voltage has to be applied by the user.

- Further, at the time the invention was made, contrary to the assertion of the Appellant, the skilled person could already dispose of a suitable low voltage PTC composition such as disclosed in the document US-A-3 413 442 (1968) communicated by the Appellant himself with his reply of 5 March 1985. In column 2, lines 62 to 68 with reference to Figure 6 of said document it is mentioned that a carbon black filled cross-linked polyethylene PTC obtainable from Cabot Corporation can be applied in a 6-volt circuit. Consequently an appropriate low voltage heating element was already available at that time.
  
- Other indications of the presence of inventive step submitted by the Appellant (cf. Affidavit and Statement of Grounds) such as updating an old-fashioned system, long-felt want, commercial success or development effort are not sufficiently persuasive to reverse the above conclusion of obviousness, where the need was directly satisfied by the use of a means which clearly suggested itself as highly advantageous.

Relating to this, it is pointed out that a mere investigation for so-called "indications" of the presence of inventive step is no substitute for the technically relevant assessment of the invention vis-à-vis the state of the art, involving the recognition and solution of the technical problem in the case.

6.6 For the foregoing reasons, the subject-matter of Claim 1 lacks an inventive step as required by Article 56 EPC.

7. The subject-matter of the independent Claim 4 differs from Claim 1 only by incorporation of further constructional features such as a compression-fitting assembly and an electrical circuit comprising a relay and a switch interposed between the heating element and the battery. In the Board's view these constructional adaptations in circumstances of use in a vehicle come within the scope of the customary practice followed by a person skilled in the art without any additional effect or advantage. In any case these components are all disclosed by document (1) - see in particular column 4, lines 66 to 74 and column 6, lines 19 to 33. Claim 4 therefore also fails to represent an inventive step and the same applies to the dependent claims in the case.

Order

For these reasons, it is decided that:

The appeal against the Decision of the Examining Division is dismissed.

The Registrar:



N. Maslin

The Chairman:



G. Szabo