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**D E C I S I O N**  
**of 16 February 2004**

**Case Number:** T 1199/02 - 3.2.4

**Application Number:** 97925247.5

**Publication Number:** 0906503

**IPC:** F02M 7/22

**Language of the proceedings:** EN

**Title of invention:**  
Fuel-air mixture apparatus

**Applicant:**  
Omarsson, Kristjan Björn

**Opponent:**  
-

**Headword:**  
-

**Relevant legal provisions:**  
EPC Art. 56

**Keyword:**  
"Inventive step - yes"

**Decisions cited:**  
-

**Catchword:**  
-



Case Number: T 1199/02 - 3.2.4

**D E C I S I O N**  
of the Technical Board of Appeal 3.2.4  
of 16 February 2004

**Appellant:** Omarsson, Kristjan Björn  
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**Representative:** Brooks, Nigel Samuel  
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**Decision under appeal:** Decision of the Examining Division of the  
European Patent Office posted 19 June 2002  
refusing European application No. 97925247.5  
pursuant to Article 97(1) EPC.

**Composition of the Board:**

**Chairman:** C. A. J. Andries  
**Members:** T. Kriner  
M.-B. Tardo-Dino

## Summary of Facts and Submissions

I. The appellant (applicant) lodged an appeal against the decision of the examining division, posted on 19 June 2002, refusing the European patent application No. 97 925 247.5. The notice of appeal was filed and the appeal fee paid on 14 August 2002. The statement setting out the grounds of appeal was received on 16 October 2002.

II. The Examining Division had held in the decision under appeal that the application did not meet the requirements of Article 52(1) EPC in conjunction with Article 56 EPC in view of the disclosure of documents:

D1: DE-A-2 819 474 (corresponding to US-A-4 235 210 cited in the application) and

D2: FR-A-850 652.

In addition to these documents the following documents have been cited in the international search report:

D3: JP-A-56-072244 (Patent Abstracts of Japan)

D4: JP-A-60-001362 (Patent Abstracts of Japan)

D5: US-A-4 216 753.

III. The appellant requests (see the letter of 16 October 2002, page 5, section 9; and the letter of 7 January 2004, page 2, last paragraph) that the decision under appeal be set aside and a patent be granted on the basis of the following documents:

- Claims:** 1 to 22 filed with the letter of  
7 January 2004;
- Description:** Pages 1 to 7 filed with the letter of  
7 January 2004;
- Drawings:** Figures 1 to 3, 6, 7 filed with the  
letter of 9 December 1998; wherein the  
reference number 40 for the constriction  
in Figure 1 is replaced by the reference  
number 50.

IV. Claim 1 reads as follows:

"A fuel-air mixture apparatus comprising:

- a primary air passage (5) having an inlet (6), an adjustable throttle (7) for controlling the air flow in the primary air passage and an outlet (9),
  - a secondary air passage (13) having an inlet (14) and an outlet (15) to the primary air passage between its adjustable throttle and its outlet,
  - a nozzle (21) having an orifice opening into the secondary air passage for introducing fuel therein, and
  - a valve element (32) arranged coaxially of the nozzle with its small diameter end (36) at least normally extending from the orifice into the secondary air passage, the valve element being axially movable to provide variability of the orifice of the nozzle and control of fuel flow through the nozzle;
- the arrangement being such that in use the fuel flow from the orifice of the nozzle towards the small diameter end of the valve element mixes with the air

flowing through the secondary passage prior to mixing with the air flowing in the primary air passage; characterised in that:

- the valve element is a needle (32); and
- the apparatus further comprises a mechanical linkage (10) directly linking the position of the needle (32) to the position of the adjustable throttle (7) in the primary air passage for adjustment of the orifice of the nozzle, the arrangement being such that in use the fuel flow from the orifice of the nozzle is matched to the position of the adjustable throttle."

V. In support of his requests, the appellant relied essentially on the following submissions:

The subject-matter of the present claim 1 differed from the fuel-air mixture apparatus disclosed in D1 in that there was no direct mechanical linkage between the valve element and the throttle valve, and in that the valve element was not a needle.

The fuel-air mixture devices according to D1 and D2 fell into different categories. Therefore, the skilled person would not combine the teachings of these documents, in particular, since such a combination would not provide a satisfactory control system.

Therefore, the subject-matter of claim 1 was not only novel, but also involved an inventive step.

## Reasons for the decision

1. The appeal is admissible.

2. *Amendments*

The subject-matter of the present claims 1 and 20 is disclosed in figures 1 to 3 and in the corresponding description (page 4, line 20 to page 6, line 9) of the published application (WO-A-97/48897). Claims 2 to 18 correspond to claims 5 to 21 as published, and claims 19, 21, 22 correspond to claims 24 to 26 as published.

The description and the figures have been adapted to the wording of the present claims. Moreover, US-A-4 235 210 (corresponding to D1) which represents the most relevant state of the art has been cited in the description.

Consequently the amendments to the application meet the requirements of Article 123(2) EPC.

3. *State of the art*

3.1 D1 discloses a fuel-air mixture apparatus comprising:

- a primary air passage (10) having an inlet, an adjustable throttle (11) for controlling the air flow in the primary air passage and an outlet,
- a secondary air-passage (25) having an inlet and an outlet to the primary air passage between its adjustable throttle and its outlet,

- a nozzle having an orifice (orifice downstream of valve seat 20) opening into the secondary air passage for introducing fuel therein, and
- a valve element (16) arranged coaxially of the nozzle with its small diameter end (18) at least normally extending from the orifice into the secondary air passage, the valve element being axially movable to provide variability of the orifice of the nozzle and control of fuel flow through the nozzle;

the arrangement being such that in use the fuel flow from the orifice of the nozzle towards the small diameter end of the valve element mixes with the air flowing through the secondary passage prior to mixing with the air flowing in the primary air passage.

However, D1 does not disclose that

- (a) the valve element is a needle;
- (b) the apparatus further comprises a mechanical linkage directly linking the position of the needle to the position of the adjustable throttle in the primary air passage for adjustment of the orifice of the nozzle, and
- (c) the arrangement is such that in use the fuel flow from the orifice of the nozzle is matched to the position of the adjustable throttle.

With respect to feature (a), the board does not share the examining division's opinion according to which the valve element (16) shown in D1 has to be considered as a needle. This valve element has neither the shape of a needle, nor is such a valve element commonly defined as a fuel injection needle. The expression "fuel injection needle" is normally used solely for the valve element of a high pressure fuel injector which typically has the shape of a needle.

The board does also not agree to the examining division's finding that D1 discloses the feature c). D1 exclusively shows that the fuel flow to the first pressure chamber (3) of a fuel differential apparatus (2) is adapted to the position of an air valve (12) which is different from the throttle valve (11). The fuel flow from the orifice of the nozzle is controlled by the pressure in the first (3) and in the second pressure chamber (13) of that fuel differential apparatus (2), wherein the pressure in the latter chamber is controlled by an adjustable valve (14) in dependence on the operating conditions of an associated internal combustion engine. However, there is no disclosure in D1 that any fuel flow is matched to the position of the throttle valve (11), let alone that the fuel flow from the orifice of the nozzle is matched to the position of this valve.

3.2 D2 discloses (see in particular Figure 1) a fuel-air mixture apparatus comprising:

- a primary air passage (a) having an inlet, an adjustable throttle (b) for controlling the air flow in the primary air passage and an outlet,



- a nozzle (free end of m) for introducing fuel into the fuel-air mixture apparatus,
- a valve element (d, k, p, s) which is axially movable to provide control of fuel flow through the nozzle;
- wherein the valve element is a needle;
- the apparatus further comprising a mechanical linkage (f) directly linking the position of the needle to the position of the adjustable throttle (b) in the primary air passage for adjustment of the orifice of the nozzle,

the arrangement being such that in use the fuel flow from the orifice of the nozzle is matched to the position of the adjustable throttle.

However, D2 does not disclose that

- the fuel-air mixture apparatus comprises a secondary air-passage having an inlet and an outlet to the primary air passage between its adjustable throttle and its outlet,
- the orifice is opening into the secondary air passage,
- the needle is arranged coaxially of the nozzle with its small diameter end at least normally extending from the orifice into the secondary air

passage, the needle being axially movable to provide variability of the orifice of the nozzle, and

- the arrangement is such that in use the fuel flow from the orifice of the nozzle towards the small diameter end of the needle mixes with the air flowing through the secondary passage prior to mixing with the air flowing in the primary air passage.

3.3 D3, D4 and D5 are less relevant than D1 and D2.

3.3.1 D3 refers to a fuel-air mixture apparatus comprising:

- a primary air passage having an inlet, an adjustable throttle (15) for controlling the air flow in the primary air passage and an outlet, and
- a secondary air-passage (8, 9) having an inlet and an outlet to the primary air passage between its adjustable throttle and its outlet.

3.3.2 D4 discloses a fuel-air mixture apparatus comprising:

- a primary air passage (2) having an inlet, an adjustable throttle (4) for controlling the air flow in the primary air passage and an outlet,
- a secondary air-passage (5) having an inlet and an outlet to the primary air passage between its adjustable throttle and its outlet,

- a nozzle (6) having an orifice opening into the secondary air passage for introducing fuel therein,
- a valve element (9) arranged coaxially of the nozzle , the valve element being axially movable to provide control of fuel flow through the nozzle,

the arrangement being such that in use the fuel flow from the orifice of the nozzle mixes with the air flowing through the secondary passage prior to mixing with the air flowing in the primary air passage.

3.3.3 D5 discloses a fuel-air mixture apparatus comprising:

- a primary air passage (101a) having an inlet, an adjustable throttle (102) for controlling the air flow in the primary air passage and an outlet,
- a secondary air-passage (104, 105) having an inlet and an outlet to the primary air passage between its adjustable throttle and its outlet,
- a nozzle (203) having an orifice opening into the secondary air passage for introducing fuel therein.

3.4 In view of the above assessment, the subject-matter of claim 1 is novel.

#### 4. *Inventive step*

4.1 Starting from the state of the art disclosed in D1, the object to be achieved by the subject-matter of the application is to provide a fuel-air mixture apparatus which causes low quantities of unburned and

incompletely burnt fuel to be present in the exhaust (see page 2, lines 3 to 5 of the present description of the application; WO-A-97/48897: page 1, lines 18 to 20).

The board has no doubt that this object is achieved by the fuel-air mixture apparatus according to claim 1, in particular by features b) and c) described in section 3.1 above, since this apparatus not only enables a good mixture of air and fuel, but additionally enables a direct adaptation of the amount of fuel to the amount of air flowing through the primary air passage.

- 4.2 The replacement of the valve element (16) shown in D1 by a valve element which has the shape of a needle (feature a) is a measure which can be done by the skilled person without the exercise of inventive skill. However, the provision of a mechanical linkage which directly links the position of the needle to the position of the adjustable throttle in the primary air passage for adjustment of the orifice of the nozzle of the fuel-air mixture apparatus according to D1 (feature b) in such a way that in use the fuel flow from the orifice of the nozzle is matched to the position of the adjustable throttle (c), is not suggested by the available documents and cannot be regarded as an obvious measure.

On the contrary, the provision of such a linkage would be in contradiction to the teaching of D1. In accordance with D1, the position of the valve element (16) is essentially controlled indirectly by the valves 1 and 14 which regulate the pressure in the first and second pressure chamber (3, 13) within the fuel

differential pressure apparatus (2) in order to optimize the fuel-air ratio (see page 13, lines 16 to 32). Only the position of the first valve (1) which controls the pressure in the first pressure chamber (3) is linked to the air valve (12), while the position of the second valve (14) which controls the pressure in the second pressure chamber (13) depends on the operating conditions of an associated internal combustion engine. With respect to this kind of control, the skilled person would not tend to control the position of the valve element (16) only in dependence on the position of the air valve (12) when he intends to achieve the object underlying the patent in suit, or in other words when he intends to further improve the fuel-air mixture apparatus according to D1 so that the optimum fuel-air ratio is provided.

Even if the skilled person nevertheless considered the teaching of D2, this would not lead him in an obvious way to the subject-matter of claim 1. D2 suggests the provision of a mechanical linkage which directly links the position of a valve element to the position of an adjustable throttle in the primary air passage. If the skilled person used this suggestion in the fuel-air mixture apparatus according to D1, he would at best provide such a mechanical linkage between the valve (1) and the air valve (12), since there is no reason to abandon the whole control system according to D1 and to provide a mechanical linkage between the valve element (16) and the throttle valve (11).

- 4.3 In the light of the above assessment, the board comes to the conclusion that the subject-matter of claim 1 also involves an inventive step.

## Order

### For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the first instance with the order to grant a patent on the basis of the following documents:

**Claims:** No. 1 to 22 filed with the letter of  
7 January 2004;

**Description:** Pages 1 to 7 filed with the letter of  
7 January 2004;

**Drawings:** Figures 1 to 3, 6, 7 filed with the  
letter of 9 December 1998;

wherein the reference number 40 for the constriction in  
Figure 1 has to be replaced by the reference number 50.

The Registrar:

The Chairman:

G. Magouliotis

C. Andries