BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS

BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE

CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

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File Number: T 0699/89 - 3.2.4

Application No.: 87 105 884.8

Publication No.: 0 242 862

Title of invention: Fuel control apparatus

Classification: F02D 41/18

D E C I S I O N
of 8 June 1993

Applicant: MITSUBISHI DENKI KABUSHIKI KAISHA

Headword:

EPC Article 56

Keyword: "Inventive step (yes) - non-obviousness of one of two groups of features"

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number : T 0699/89 - 3.2.4

D E C I S I O N
of the Technical Board of Appeal 3.2.4
of 8 June 1993

Appellant : MITSUBISHI DENKI KABUSHIKI KAISHA
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Decision under appeal : Decision of the Examining Division of the European Patent Office dispatched on 15 June 1989 refusing European patent application No. 87 105 884.8 pursuant to Article 97(1) EPC.

Composition of the Board :

Chairman : C.A.J. Andries
Members : H.A. Berger
J.C.M. De Preter

Summary of Facts and Submissions

I. European patent application No. 87 105 884.8, filed on 22 April 1987 and published under the publication number 0 242 862, was refused by a decision of the first instance dispatched on 15 June 1989.

The decision was based on Claims 1 to 4 filed with the letter of 9 March 1989.

The reason given in the decision was lack of inventive step of the subject-matter of Claim 1 in comparison with the state of the art disclosed in documents

D1: DE-A-3 207 394

D2: Patent Abstracts of Japan, vol. 7, no. 223 (M-247)[1368], 4th October 1983, abstract of JP-A-58-117 326.

In the European Search Report also document

D6: EP-A-0 162 293

was listed.

In the application document

D5: JP-A-76 182/1979

was cited which is a member of the same patent family as document

D4: FR-A-2 408 820.

III. An appeal was lodged against the decision on 14 August 1989 and the appropriate fee was paid on the same date. The Statement of Grounds of Appeal was submitted on 13 October 1989.

IV. In a communication the Board drew attention to document

D3: Book: "Gemischbildung und Verbrennung im Ottomotor", Dr.Ing. Kurt Löhner and Dr.Ing. Herbert Müller, 1967, Springer Verlag, page 105.

V. Oral proceedings took place on 8 June 1993 during which the Appellant presented a new Claim 1 forming the basis for his request. New Claim 1 reads as follows:

"A fuel control apparatus for calculating the quantity of fuel required for operating an internal combustion engine (8) based on an output of a hot-wire type intake air quantity sensor (2; 41) disposed in an air intake passage (6; 38) for the internal combustion engine (8) and supplying the optimum amount of the fuel to the engine by controlling a fuel control valve (9) in accordance with the calculated value, said fuel control apparatus comprising a burn-off control section (105) for heating the hot wire of said sensor (2) at a temperature higher than a temperature in the normal operation, after said engine (8) has been stopped, so as to burn off a deposit on said hot-wire, and a circuit system for stopping the burn-off operation of said burn-off control section to prevent undesired firing when an output from said sensor (2) falls below a predetermined value, characterized in that an additional circuit system for stopping the burn-off operation of said burn-off control section comprises a voltage detecting circuit (200) to detect a voltage reduction of the power source (51) of said circuit system and a device (200, 105',62) for prohibiting the burn-off operation when the source

voltage of said circuit system is lower than a predetermined level so that the burn-off operation is stopped, and that means for storing the history of stops of operation of said burn-off control section and for generating a fault signal (16) indicative of trouble are provided when the burn-off operation has been stopped at least twice."

During the oral proceedings the Appellant argued that none of the prior art documents disclosed a voltage detection circuit to detect a voltage reduction of the power source. In the circuit system of document D1 only the voltage of the output of the hot-wire type intake air quantity sensor was detected and the burn-off operation only was interrupted by voltage reduction due to self-ignition of the fuel air mixture. The control apparatus of the invention however prevented burn-off operation if the voltage of the power source and therewith the voltage of the circuit system were reduced to a value lower than a predetermined level where erroneous operation of the electronic control unit might occur.

VI. The Appellant requested that the impugned decision be set aside and a patent be granted on the basis of the following documents:

Claims 1 and 2: filed during the oral proceedings on 8 June 1993;

Description: pages 1 to 18 filed during the oral proceedings on 8 June 1993;

Drawings: Figures 1, 2, 3(a), 3(b), 4 and 5 filed during the oral proceedings on 8 June 1993.

Reasons for the Decision

1. The appeal complies with the requirements of Articles 106 to 108 and Rule 64 EPC. It is admissible.

2. Admissibility with regard to Article 123(2) EPC

2.1 The wording of the originally filed Claim 1 "means (100,62;200,62) for stopping the operation of said burn-off control section when an output from said sensor (2) exceeds a predetermined value and for outputting a signal (16) indicative of a trouble in said sensor" was changed in the present Claim 1 to "a circuit system for stopping the burn-off operation of said burn-off control section to prevent undesired firing when an output from said sensor (2) falls below a predetermined value". The circuit system for stopping the burn-off operation to prevent undesired firing is disclosed in the originally filed description, page 10, line 4 to page 11, line 15. The replacement of the word "exceeds" by the term "falls below" is a clarification indicating more precisely the direction of the voltage change and is disclosed on page 8, lines 21 to 24; page 11, lines 9 to 15, and page 13, lines 3 to 11 of the originally filed description.

An "additional circuit system for stopping the burn-off operation of said burn-off control section ... for prohibiting the burn-off operation when the source voltage of said circuit system is lower than a predetermined level so that the burn-off operation is stopped" according to the first group of features of the characterising portion of Claim 1 is disclosed in the originally filed Claim 3 in connection with the originally filed Figure 7. According to the originally filed European patent application which is based on three

priority documents, Claim 3 is dependent on Claim 1 and the apparatus defined therein comprises the means of Claim 1.

Means for storing the history of stops according to the second group of features of the characterising portion of Claim 1 are described in the originally filed Claim 2 and in the originally filed description page 12, line 24 to page 13, line 2.

2.2 The subject-matter of Claim 2 is disclosed in the originally filed Figure 7 and the corresponding part of the originally filed description page 19, line 19 to page 20, line 16.

2.3 The amendments in the description relate to an adaptation of the description to the newly filed Claim 1, to the acknowledgement of document D1 and to corrections of obvious mistakes. The amendments in the drawings concern the cancellation of embodiments and again corrections of obvious mistakes e.g. concerning reference signs and connection points in the circuit of newly filed Figure 5. These amendments do not give rise to any objection.

2.4 The application therefore does not contravene Article 123(2) EPC.

3. Novelty

After the examination of the cited documents, the Board is satisfied that none of them discloses an apparatus having all the features defined in Claim 1. Novelty was not disputed in the decision of the first instance.

The subject-matter as set forth in Claim 1 is to be considered novel within the meaning of Article 54 EPC.

4. Closest State of the Art

The Board shares the opinion of the first instance and of the Appellant that document D1 describes the closest prior art. This document discloses a fuel control apparatus with all the features defined in the precharacterising portion of Claim 1 of the application.

The subject-matter of Claim 1 differs therefrom by an additional circuit system and by means for storing the history of stops of operation as defined in the characterising portion of Claim 1.

5. Problem and Solution

5.1 By the additional circuit of Claim 1 the burn-off operation is already stopped when the source voltage of the circuit system is lower than a predetermined level, i.e. when malfunctioning of the control system of the injection device must be expected which may result in burn-off operation during fuel supply to the air intake passage (see page 3, lines 2 to 7 of the originally filed description), for instance in an engine with fuel injection into the air intake passage.

By the means for storing the history of stops it is prevented that a fault signal is already displayed if burn-off operation is stopped only once which may occur if fuel is occasionally present in the vicinity of the air quantity sensor even though the burning-off condition is satisfied and all of the parts are normally operated.

5.2 With regard to the most relevant prior art document D1 and to the disclosure of the application (page 3, lines 2 to 7; page 17, lines 9 to 13 and page 10, line 24 to page 11, line 2) the technical problem to be solved consists on the one hand in preventing burn-off operation

when malfunctioning of the fuel control system and therewith undesired firing must be expected and on the other hand in the provision of information about malfunctioning of the burn-off control section.

The first part of the problem is solved only by the first group of features of the characterising portion of Claim 1 specifying an additional circuit system, whereas the second part of the problem is solved by the second group of features of the characterising portion of Claim 1 specifying means for storing the history of stops.

Contrary to the opinion of the Appellant the Board cannot see a combined effect in both parts of the problem of which one part deals with the prevention of firing and the other part with the sole indication of malfunction.

6. Inventive step

6.1 With regard to the first part of the problem (prevention of undesired firing) attention is drawn to the most relevant prior art document D1 which discloses a control device in which the burn-off operation is stopped if the temperature dependent resistor of the hot-wire type air quantity sensor is heated by oxidative reaction of fuel in the vicinity of the hot-wire sensor and the voltage at the output of the hot-wire sensor falls below a predetermined value. The voltage level for stopping the burn-off operation therefore is adapted to the temperature dependent resistor of that sensor. An additional circuit system for stopping the burn-off operation of the burn-off control section which comprises a voltage detecting circuit to detect a voltage reduction of the power source of said circuit system and a device for prohibiting the burn-off operation when the source voltage of said circuit system is lower than a

predetermined level is not described or suggested in this document D1. It might be possible that with reduction of the source voltage the voltage at the output of the hot-wire sensor also falls below the predetermined level for stopping the burn-off operation, this however gives no hint for providing an additional circuit system in which the predetermined level of the power source voltage is adapted to the voltage necessary for the correct functioning of the whole control circuit system.

Both document D4 and its family member document D5 also describe a control apparatus with burn-off operation and a control circuit having some features the same as those shown in Figure 5 of the present application. However, they do not disclose a circuit system for interrupting burn-off operation to prevent undesired firing, let alone such a circuit system which is related to the level at the power source voltage.

The system described in document D6 which also discloses a control apparatus with burn-off operation is further away from the apparatus of the application than those of documents D1 and D4, D5. Again no circuit system for interrupting burn-off operation when the temperature of the hot-wire is heated by oxidative reaction of the fuel in the vicinity of the hot-wire sensor and no additional circuit system for interrupting burn-off operation when the power source voltage is lower than a predetermined level is provided in this control apparatus.

Document D2 describes a malfunction prevention device of a micro-computer for an automobile with an interrupter interrupting the power supply to a fuel injector and an igniter when malfunction is transmitted. In this device reset signals are measured by a counter, abnormal signals are generated when four reset signals are counted, and the supply of the power to the fuel injection valve is

stopped while an alarm device is actuated. This document D2 does not describe a burn-off control section for a hot-wire type intake air quantity sensor.

Document D3 deals with reaction of fuel at ignition temperature and does not describe a fuel control apparatus.

Therefore, none of the documents D1 to D6 suggests a fuel control apparatus comprising the features of the precharacterising portion of Claim 1 of the present application with an additional circuit system according to the first group of features of the characterising portion of said Claim 1.

6.2 Since already the first group of features of the characterising portion of Claim 1 for solving the corresponding first part of the problem as above defined in section 5.2, is not obvious, the subject-matter of the whole Claim 1 must be considered to be inventive (Article 56 EPC).

A combination effect of the two groups of features would only have been decisive for the presence of an inventive step if each group of features separately was obvious with regard to the state of the art since then the necessary inventive step could only be supported by a surprising combination effect (see decision T 111/86, section 4.6). It is therefore not decisive if the second group of features, comprising the means for storing the history, is inventive with regard to the general knowledge in the technical field of fuel control devices and to document D2 which already discloses history storing means.

6.3 Thus the subject-matter as set forth in Claim 1 involves an inventive step within the meaning of Article 56 EPC.

7. The subject-matter of Claim 1 is therefore patentable within the meaning of Article 52 EPC, so that a patent may be granted based on this allowable Claim 1, dependent Claim 2 which concerns a preferred embodiment of the apparatus according to Claim 1, and the modified description and drawings filed during the oral proceedings.

Order

For this 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 an European patent on the basis of the documents as defined in above point VI.

The Registrar: The Chairman:

N. Maslin C. Andries