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D E C I S I O N
of 24 January 1995

Case Number: T 0811/92 - 3.2.4

Application Number: 86114519.1

Publication Number: 0219843

IPC: F02D 41/08

Language of the proceedings: EN

Title of invention:
Method and system for idle speed control

Patentee:
HITACHI, LTD.

Opponent:
Robert Bosch GmbH

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (yes)"

Decisions cited:
-

Catchword:

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0811/92 - 3.2.4

D E C I S I O N
of the Technical Board of Appeal 3.2.4
of 24 January 1995

Appellant: (Proprietor of the patent)
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Respondent: (Opponent)
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Representative:
-

Decision under appeal:
Decision of the Opposition Division of the European Patent Office dispatched on 1 July 1992 revoking European patent No. 0 219 843 pursuant to Article 102(1) EPC.

Composition of the Board:

Chairman: C. A. J. Andries
Members: C. G. F. Biggio
J. P. B. Seitz

Summary of Facts and Submissions

I. The Appellant (Proprietor of the patent) lodged an appeal, received on 31 August 1992, against the decision of the Opposition Division, dispatched on 1 July 1992, to revoke the European patent No. 219 843.

The appeal fee was paid on 31 August 1992.

The Statement setting out the Grounds of Appeal was received on 11 November 1992.

The Opposition Division found that the grounds for opposition mentioned in Article 100(a) EPC prejudiced the maintenance of the patent based on independent Claims 1 and 4 having regard to the documents DE-A-2 149 823 (D7) and DE-A-3 129 078 (D8).

II. The Appellant requests that the decision under appeal be set aside and that the patent be maintained on the basis of the description of the patent as granted, the drawings as granted, Claims 2, 3, 5, 6 as granted and Claims 1 and 4 as filed with letter of 30 November 1994.

III. During the appeal proceedings the Respondent (Opponent) filed neither requests nor comments nor arguments.

IV. Independent Claims 1 and 4 now read as follows:

"1. A method for controlling the idle speed of an internal combustion engine having a plurality of cylinders, said method comprising the steps of:

(a) detecting the rotations of the engine using a signal from a crank angle sensor (10),

(b) measuring the flow rate of air supplied to the engine using a signal from an air flow sensor (9),

(c) controlling the amount of fuel supplied to the engine using fuel supply means (4),

(d) detecting that the engine is in idle state using a signal from an idle switch (3), and

(e) detecting an abnormal condition in which the engine speed exceeds a predetermined value in idle state using electrical signals supplied from said sensors to an electronic control unit (13),

characterised in that it further comprises the steps of

- in the case of detecting that the engine is in idle state in step (d) setting a target idle speed and adjusting the area of a bypass for flowing air to said cylinders so as to keep the actual idle speed of the engine in consistency with said target idle speed and
- in the case of detecting an abnormal engine condition in step (e) generating a cylinder signal for determining the cylinder to be supplied with fuel at every predetermined rotational speed on the basis of an output signal from said crank angle sensor (10), counting said cylinder signal and stopping the fuel supply when said count value reaches a predetermined number greater than one and having no common divisor with the number of cylinders other than one."

"4. A system for controlling the idle speed of an internal combustion engine having a plurality of cylinders, comprising

- a crank angle sensor (10) for detecting the rotations of said engine,

- an air flow sensor (9) for detecting the flow rate of air supplied to said engine,
- fuel supply means (4) for controlling the amount of fuel supplied to said engine,
- an idle switch (3) for detecting that said engine is in idle state,
  and
- an electronic control unit (13) capable to detect an abnormal condition in which said engine speed exceeds a predetermined value in idle state using electrical signals supplied from said sensors,

characterised by

- means (301) which in the case that said idle switch (3) detects that said engine is in idle state set a target idle speed and adjust the area of a bypass for flowing air to said cylinders so as to keep the actual idle speed of the engine in consistency with said target idle speed
  and
- means (302 to 305) which in the case that said electronic control unit (13) detects said abnormal engine condition generate a cylinder signal to determine the cylinder (7) to be supplied with fuel at every predetermined rotational speed on the basis of an output signal from said crank angle sensor (10), counting said cylinder signal and stopping the fuel supply when said count value reaches a predetermined number greater than one and having no common divisor with the number of said cylinders (7) other than one."

Reasons for the Decision

1. The appeal is admissible.

2. *Allowability of the amendments under Article 123(2) EPC*

The granted Claims 1 and 4 have been modified by specifying in the pre-characterising portions how the signals are obtained and by adding to the characterising portions the method step of controlling the normal idling speed. The Board does not see any objection under Article 123(2) EPC to these amendments.

3. *Allowability of the amendments under Article 123(3) EPC*

Compared with the granted claims the normal idling speed control method step has been defined more precisely so that there is no objection under Article 123(3) EPC.

4. *Novelty*

None of the cited prior art documents discloses either a method for controlling the idle speed as claimed in Claim 1 or an apparatus for controlling the idle speed as claimed in Claim 4.

Therefore the subject-matter of each independent claim is novel.

5. *Inventive step*

Since the Respondent did not bring forward any argument during the appeal proceedings, the Board has concentrated on the prior art documents used by the Opposition Division in its decision to revoke the

patent, namely the documents D7 and D8, and on the method claim, the apparatus claim having corresponding features.

5.1 Document D7 describes an electronic safety system preventing the overrunning of an internal combustion engine i.e. preventing the number of revolutions per minute from exceeding a fixed numerical limit. This system is said to be adapted for engine rotational speeds which are very high, e.g. above 6000 rpm (see page 7, handwritten numbering, 3rd and 4th paragraphs) and when the engine is in a condition where the car drives the engine instead of the reverse, a so called engine braking condition (e.g. downhill with closed throttle valve). In case of too high an engine speed, this document teaches that the injection valves of a cylinder be switched off in order to reduce the power output and thereby to avoid damage to the engine itself.

In document D7 there is no teaching as to the way in which idling speed should be controlled or as to how too high an idling speed should be dealt with.

It should be emphasised that the problem of overrunning in the meaning of document D7, i.e. high speed range linked to engine damage, cannot be compared with the occurrence of an abnormally high idle speed, not only with respect to the totally different speed ranges involved, but also with respect to the consequences (possible damage) for the engine itself.

5.2 Document DE-A-3 129 078 (D8) describes a method for controlling the number of working cylinders independently from engine rotational speed. It is mainly meant to be applied in case of multicylinder engines with a high number of cylinders, in order to increase

the efficiency. In other words the aim of the teaching disclosed in document D8 is not to diminish the engine speed by cutting off one or a plurality of cylinders, but to determine the number of active cylinders in relation to the desired power output.

This document does not disclose a specific method for controlling the idle speed, let alone a method to avoid an excessive idling speed. It is only mentioned on page 4 that the number of active cylinders in the idling mode can be reduced to one.

5.3 The present invention, on the contrary, is directed toward a method for controlling the idle speed of an internal combustion engine having a plurality of cylinders in such a manner that not only an undue increase of the engine speed can be suppressed, but also a stable rotational condition of the engine during the abnormal idling operation can be maintained. In this method the idling speed is controlled in a usual way by adjusting the area of a bypass for air flowing to the cylinders unless an **abnormal** high idling speed is detected. In such a case the invention teaches that the number of active cylinders be diminished or in other words that one fuel injection from a series of injections be cancelled. Furthermore the invention teaches the way of choosing the particular cylinder which will not be supplied with fuel.

By selecting the cylinder which is not supplied with fuel in the claimed way, it is guaranteed that the idling speed will be reduced while the engine nevertheless will have a regular rotational speed.

5.4 This teaching is not present in either of the prior art documents D7 or D8 nor is there any hint toward such a solution.

It is even questionable whether the skilled man having the specific problem of idling-control in mind would have considered these documents (D7 and D8) since they are not concerned at all with the occurrence of abnormally high idle speed or even with controlling of the idle speed in the normal case. The combination of these documents seems to be the result of an ex-post-facto analysis.

5.5 Therefore the claimed invention is not obvious for a person skilled in the art, with respect to documents D7 and D8.

The method specified in independent Claim 1 thus fulfils the requirement of Article 56 EPC.

The same reasoning is applicable to independent Claim 4 since it defines an apparatus having corresponding features to the ones of Claim 1.

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 maintain the patent in the form indicated in section II above.

The Registrar: The Chairman:

N. Maslin C. Andries