

Internal distribution code:

- (A) [] Publication in OJ
(B) [] To Chairmen and Members
(C) [X] To Chairmen

D E C I S I O N
of 20 December 1994

Case Number: T 0344/92 - 3.2.4

Application Number: 82109900.9

Publication Number: 0078054

IPC: F02P 5/04

Language of the proceedings: EN

Title of invention:

Knock-free engine control system for turbocharged automotive engine

Patentee:

NISSAN MOTOR CO., LTD.

Opponent:

Robert Bosch GmbH

Headword:

-

Relevant legal provisions:

EPC Art. 56, 123

Keyword:

"Inventive step - (yes) after amendment"

"Amendments - clarity"

Decisions cited:

-

Catchword:

-



Case Number: T 0344/92 - 3.2.4

D E C I S I O N
of the Technical Board of Appeal 3.2.4
of 20 December 1994

Appellant: Robert Bosch GmbH
(Opponent) Zentralabteilung Patente
Postfach 30 02 20
D-70442 Stuttgart (DE)

Representative: -

Respondent: NISSAN MOTOR CO., LTD.
(Proprietor of the patent) 2 Takara-cho, Kanagawa-ku
Yokohama-shi
Kanagawa-ken (JP)

Representative: Patentanwälte
Grünecker, Kinkeldey,
Stockmair & Partner
Maximilianstrasse 58
D-80538 München (DE)

Decision under appeal: Decision of the Opposition Division of the
European Patent Office dispatched on 4 February
1992 rejecting the opposition filed against
European patent No. 0 078 054 pursuant to
Article 102(2) EPC.

Composition of the Board:

Chairman: C. A. J. Andries
Members: H. A. Berger
J. P. B. Seitz

Summary of Facts and Submissions

I. The Appellant (Opponent) lodged an appeal, received on 2 April 1992, against the decision of the Opposition Division, dispatched on 4 February 1992, rejecting the opposition against patent No. EP-B-0 078 054. The fee for appeal was received on 2 April 1992. The statement setting out the grounds of appeal was received on 12 May 1992.

Opposition was filed against the patent as a whole and based on Article 100(a) and (b) EPC. The reasoning was based mainly on the following prior art documents:

(D4) SAE Technical Paper, Series no. 810060, "A Turbocharged Engine with Microprocessor Controlled Boost Pressure", from J.E. Rydqvist, et al, 23rd-27th February 1981, pages 215-223;

(D6) SAE Technical Paper, Series no. 780413, "BUICK'S TURBOCHARGED V-6 POWERTRAIN FOR 1978", from T.F. Wallace, pages 1 to 19.

II. The following additional prior art document was cited during the appeal:

(D7) DE-A-2 951 321

III. Oral proceedings were held on 20 December 1994 during which the Respondent (Proprietor of the patent) filed new Claims 1 to 6 and further amended documents.

Claim 1 reads as follows:

"An engine control system for a turbo charged internal combustion engine for controlling spark ignition timing and charge pressure in an air induction passage, comprising:

- first means (68) for measuring engine speed and producing a first signal (S_n) having a value representative of the engine speed;
- second means (30) for measuring charge pressure (P) in the air induction passage of the engine and producing a second signal (S_p) having a value representative of the charge pressure (P);
- third means (60) for detecting an engine knocking condition and producing a third signal (S_m) indicative of the engine knocking condition;
- fourth means (52,38,36) for controlling charge pressure (P), said fourth means including an electrically controlled valve (52) for controlling said charge pressure (P);
- fifth means (64) for controlling a spark advance angle (θ), defining the spark ignition timing; and
- sixth means (100) for operating said fourth and fifth means (52,38,36; 64) in order to control charge pressure (P) and spark ignition timing in accordance with the engine operation conditions represented by said first to third signals (S_n, S_p, S_m),

characterised in that

- said sixth means (100) is responsive to said third signal (S_m) to selectively operate one of said fourth and fifth means for knock prevention independently from each other,
- said sixth means (100) defining a predetermined variation range defined by predetermined extremes (θ_{min} ,

θ_{max}) of said spark advance angle (θ) and a standard charge pressure value (P_{set})

- and operating said fourth means (52,38,36) upon occurrence of knocking to reduce the actual charge pressure (P) to the standard charge pressure (P_{set}) while the actual spark advance angle (θ) is maintained (steps 1022 - 1026),
- and upon continuation of knocking to operate said fifth means (64) to reduce the spark advance angle (θ) by a given amount (α_1) while said standard charge pressure (P_{set}) is maintained (steps 1028, 1038, 1040 - 1044),
- and upon further continuation of knocking to operate said fourth means to further reduce the charge pressure with respect to said standard pressure (P_{set}) when the minimum extreme value (θ_{min}) of said spark advance angle (θ) is attained by said previous angle reduction, the spark advance angle then being maintained at a value ($\theta_{min} + 1^\circ$) close to said minimum spark advance angle (θ_{min}) (steps 1028 - 1036),
- said sixth means (100) operating said fourth means (52, 38,36) upon absence of knocking to increase the actual charge pressure (P) by a predetermined amount if not at the standard charge pressure (P_{set}) to bring it to said standard pressure (P_{set}) while the actual spark advance angle (θ) is maintained (steps 1046 - 1054),
- and upon further absence of knocking to operate said fifth means to increase the spark advance angle (θ) by a given amount (α_2) while the standard charge pressure (P_{set}) is maintained (steps 1056 - 1064),
- and upon further continuation of the absence of knocking to operate said fourth means to further increase the charge pressure (P) with respect to the standard pressure (P_{set}) when the maximum extreme value (θ_{max}) of the spark advance angle (θ) is attained by said previous angle increase, the spark advance angle then

being maintained at a value ($\theta_{max} - 1^\circ$) close to said maximum spark advance angle (θ_{max}) (steps 1056, 1066 - 1070)."

IV. No arguments were brought forward by the Appellant (Opponent) against the amended version of the patent with the new Claim 1 filed during the oral proceedings.

V. Requests

The Appellant requested that the decision under appeal be set aside and that the patent be revoked.

The Respondent requests that the decision under appeal be set aside and that the patent be maintained on the basis of

- 1) Claims 1 to 6 as filed during the oral proceedings.
- 2) Description as amended during the oral proceedings.
- 3) Figures 1, 4, 5, 6, 7 as originally filed.
Figures 2, 3, 8 as filed during the oral proceedings.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments*

2.1 Only minor corrections were made in the pre-characterising portion of the new Claim 1 with regard to the granted Claim 1.

2.2 The features of the characterising portion of the new Claim 1, which are in principle a combination of those of the granted Claims 1 and 6, not only define the characterising portion more precisely with regard to the granted version, overcoming thereby clarity problems in the granted Claim 1, but also limit the protection conferred. The amended features of Claim 1 are based on the embodiment of Figure 3 and the corresponding part of the description.

2.3 The amendments of the description and drawings concern corrections of obvious errors which were made to facilitate the understanding of the patent.

2.4 The Board has no objections with regard to Article 123(2) and (3) EPC against the amendments made. The Appellant did not bring forward any arguments against these amendments.

3. *Novelty*

The Board ascertained during the study of the cited prior art documents that none of them discloses an engine control system with all the features of Claim 1. The novelty of the subject-matter of Claim 1 was not disputed by the Appellant.

4. *Inventive step*

4.1 The preamble of granted Claim 1 is based on document D4 which can be considered as the closest state of the art document.

4.2 In view of the state of the art disclosed in document D4 the objective problem to be solved is to provide an engine control system which is suitable to optimally comply with the working condition of the engine and at

the same time to avoid harmful knocking of the engine (see column 1, lines 38 to 42 of the opposed patent).

- 4.3 This problem is solved by the features of the new Claim 1. By independently controlling the ignition timing and the boost pressure a significant drop in engine performance is prevented, not only when it is necessary to overcome engine knocking but also when no engine knocking is detected. By checking the charge pressure and setting it to the optimum pressure in accordance with the engine running condition the engine power output is kept at its optimum. The limited retard angle of spark ignition prevents detrimental high exhaust gas temperature and also loss of engine power.
- 4.4 None of the discussed prior art documents can lead to the control system of new Claim 1.

According to document D4 ignition timing and the boost pressure are simultaneously reduced when engine knocking occurs. Two other strategies are mentioned in document D4 to prevent knocking, these are the control of ignition timing only or the control of the charge pressure only. Therefore, document D4 gives no hint, in order to overcome engine knocking, to selectively operate, independently from each other, first the means for controlling charge pressure (fourth means), then the means for controlling a spark advance angle (fifth means) and then again the means for controlling charge pressure (fourth means).

Neither can document D6 lead to the control system of the impugned Claim 1 since it deals with a technique to prevent engine knocking by spark control only.

Document D7 describes a method for controlling an internal combustion engine wherein the spark ignition is adjusted to late upon occurrence of knocking and is adjusted only up to a predetermined maximum value and if further knocking occurs then the throttle valve angle is reduced (throttle valve closing direction). A turbo charger is not mentioned in this document D7. If the teaching of document D7 were used in a turbo charged engine, then at a first step the ignition timing would be retarded to a predetermined limit when knocking occurs, and then if knocking still exists, the boost pressure would be reduced. Therefore, neither can document D7 lead to the control system of the new Claim 1.

- 4.5 Furthermore, the Appellant brought forward no reasons with regard to inventive step of the subject-matter of new Claim 1.
- 4.6 The subject-matter of Claim 1 involves an inventive step within the meaning of Article 56 EPC.
5. In view of the above, the patent in suit can be maintained on the basis of the amended documents.

Order

For these reasons it is decided that:

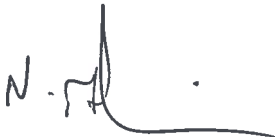
1. The decision under appeal is set aside.
2. The case is remitted to the first instance with the order to maintain the patent in the following version:

Claims: 1 to 6 as filed during the oral proceedings on 20 December 1994;

Description: Columns 1 to 12 as filed during the oral proceedings on 20 December 1994;

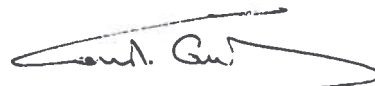
Drawings: Sheets 1/8, 4/8 to 7/8 according to the granted patent EP-B-0 078 054; sheets 2/8, 3/8 and 8/8 as filed during the oral proceedings on 20 December 1994.

The Registrar:



N. Maslin

The Chairman:



~~E. Andries~~

