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File Number: T 426/88 - 3.2.2
Application No.: 81 300 304.3
Publication No.: 0 033 616
Title of invention: Closed loop of internal combustion engine
idling speed

Classification: F02P 5/145, F02D 37/02

D E C I S I O N
of 9 November 1990

Proprietor of the patent: LUCAS INDUSTRIES public limited company

Opponent: Robert Bosch GmbH

Headword:

EPC Articles 56, 54(2)

Keyword: "Inventive step (no)" -
"Technical books representing common general
knowledge"

Headnote

I. When books, representing common general knowledge, describe a basic general technical theory or methodology and exemplify the same with specific applications in certain technical fields only, these do not limit the general scope and relevance of such disclosures so as to exclude possible applications in other fields.

II. Furthermore, it is also the view of the Board that the language of publication alone cannot be decisive for the admissibility of a technical book representing the common general knowledge of the skilled person. Otherwise, there would be a differentiation between skilled persons according to their nationality as regards their knowledge, which would be against the objective assessment of the inventive step and be prejudicial to equal treatment.



Case Number : T 426/88 - 3.2.2

D E C I S I O N
of the Technical Board of Appeal
of 9 November 1990

Appellant : Lucas Industries public limited company
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Representative : Marks & Clerk
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Respondent : Robert Bosch GmbH
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Representative : Müller
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Decision under appeal : Decision of the Opposition Division of the European
Patent Office dated 1 August 1988 revoking
European patent No. 0 033 616 pursuant to
Article 102(1) EPC.

Composition of the Board :

Chairman : G. Szabo
Members : M. Noël
M. Aúz Castro

Summary of Facts and Submissions

- I. European patent No. 0 033 616 comprising five claims was granted on 3 July 1985 on the basis of European patent application No. 81 300 304.3 filed on 23 January 1981.

Claims 1 and 4 (method and system) as granted, in which the letters (a) to (c) have been added by the Board for convenience to mark the three main features, read as follows:

- "1. A method of controlling the idling speed of an internal combustion engine which comprises
- (a) generating a signal representing the error between the actual engine speed and a desired idling speed,
 - (b) controlling the ignition timing of the engine directly in accordance with the error signal in a manner to cause the engine speed to approach the desired idling speed and
 - (c) controlling the admission of air or air/fuel mixture to the engine in accordance with the time integral of the error signal in a manner to cause the engine speed to approach the desired idling speed."
- "4. An internal combustion engine closed loop idling speed control system for carrying out the method of Claim 1 comprising

- (a) circuit means for generating an electrical signal representing the error between the engine speed and a desired idling speed,
- (b) ignition timing control means connected to be controlled by said error signal so as to vary the engine ignition timing in accordance with said error signal
- (c) and air admission control means connected to be controlled in accordance with the time integral of the error signal for controlling air flow into the engine air intake manifold."

II. The Respondent (Opponent) having filed a Notice of Opposition against the European patent, the Opposition Division revoked the European patent by a decision dated 1 August 1988 on the ground that the subject-matter of the claims did not involve an inventive step with respect to the combination of documents

- (1) Periodical "Automobil Industrie" 1/79, pages 49 to 56
- (2) DE-A-2 749 369 (GB-2 007 878)

in the light of the general knowledge of a skilled person as illustrated by the Handbook

- (3) Winfried Oppelt, "Kleines Handbuch technischer Regelvorgänge", 1972, Verlag Chemie GmbH, pages 521 to 524.

III. The Appellant (Proprietor of the patent) lodged an appeal against this decision on 28 August 1988, paying the fee for appeal and submitting a Statement of Grounds in good time.

IV. Oral proceedings took place on 9 November 1990.

(i) In his written submissions and in the oral proceeding Appellant argued substantially as follows:

- It was necessary to combine the teaching of three documents in order to challenge the inventive step present invention. This, therefore, represented an ex-post-facto analysis.
- Documents (1) and (2) each provided a solution which was said to be complete in itself and in no way suggested to the skilled person that further improvement could or should be made by combining their teaching.
- The handbook (10) represented a single prior art reference first published at least twenty years prior to the priority date of the present patent. Therefore, it did not represent the ordinary background knowledge of a control engineer. Moreover, there was no hint or suggestion that the technique might have any application to internal combustion engines.
- The present invention relied principally on the synergistic effect of the combination of a proportional ignition control loop and an integral air flow control loop according to the features (b) and (c) recited in the independent claims.

(ii) These arguments were contested by the Respondent, who essentially stressed that the subject-matter of Claim 1 resulted in the mere aggregation of only two control systems known per se, i.e. from documents (1) and (2), without the exercise of any surprising effect.

- V. The Appellant requested that the decision under appeal be set aside and that the patent be maintained as granted.

The Respondent requested that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible.
2. Formal aspects

There is no formal objection to the current version of the claims, since it is adequately supported by the original disclosure and no amendment has been submitted during the opposition or appeal procedures.

3. Closest prior art

The document (1) appears to be the closest prior art document upon which Claim 1 is based, as was agreed also by the parties at the oral proceedings. It is known from document (1) that the idling speed of an internal combustion engine is influenced by the ignition timing of the engine and by the air or air/fuel ratio. In order to maintain the idling speed constant, i.e. in a manner to cause the engine speed to approach the desired idling speed, both parameters can be used as a means for control. Nevertheless, a compromise has to be found between fuel consumption, noxious exhaust emission and stability (cf. page 51, paragraph "Leerlauf").

More specifically, in the embodiment described on page 54 (Digitale Leerlaufstabilisierung (DLS)), a signal representing the error between the actual engine speed (augenblickliche Drehzahl) and a desired idling speed (Sollwert) is generated and this error signal is applied

directly to vary the ignition timing (Zündzeitpunkt) so as to obtain a rapid reduction of the speed error (see in particular second paragraph). The fact that the rapid response to this adjustment of timing is characteristic of a "proportional" control, was not contested by the parties.

Therefore, the document (1) describes the features (a) and (b) of the claims in suit.

4. Problem and solution

- 4.1 Direct control of ignition timing by the speed error according to document (1) ensures that any speed error is quickly reduced without risking instability. However, where a system relies entirely on ignition timing it is likely to be very problematic from the point of view of exhaust emissions and fuel wastage; moreover, only relatively small speed changes can be obtained if the quantity of air-fuel mixture admitted to the engine is not being appropriately altered. It was also known that in spite of the quick reduction of the error, i.e. deviation, this could not be completely eliminated.

According to document (1), the necessity of adjusting ignition timing to "late ignition", in order to make the influence of ignition timing effective, has also the disadvantage of a lower mean pressure which can, however, be equalised by increasing the air flow, as explained in page 54 under "Digitale Leerlaufstabilisierung" (DLS), fourth paragraph. Consequently, the DLS control of (1) suggests the simultaneous control of the ignition timing (Zündzeitpunkt) and of the quantity of air (Luftdurchsatz) so as to improve the efficiency of the system by taking

account of the general considerations set out under the heading "Leerlauf", page 51. However, there is no indication in the document (1) as to which type of control should be used for appropriately controlling the air admission to the engine. It may be assumed that in the absence of specific guidance in this respect, the same kind of proportional control would be first considered without excluding, however, other possibilities which might offer themselves.

- 4.2 The objective technical problem to be solved in respect of this prior art as a starting point is, therefore, in the Board's view, to further improve the performance of idling speed control of the engine whenever both ignition timing and air admission are simultaneously controlled, and in particular to provide for air admission an appropriate control principle.
- 4.3 This object is achieved according to the remaining feature (c) of Claim 1 or 4 by controlling the admission of air or air/fuel mixture to the engine in accordance with the time integral of the error signal.

By the combination of features (b) and (c), that is to say of two control loops operating on the basis of the same error signal the direct proportional control of ignition timing by the speed error first ensures, as before, that any speed error is quickly reduced without, however, being eliminated. The air intake adjustment would then take place more slowly as the magnitude of the time integral of the error increases whilst the error approaches zero, by which time the ignition adjustment will have become insignificant with the air control still being increasingly effective. Thus, the excessive fuel consumption and exhaust emission will only occur as a transient condition, which is perfectly acceptable.

5. Novelty

In view of the above, the subject-matters of Claims 1 and 4 are distinguished over the closest prior art known from document (1) by the characterising feature (c). After examination of other cited documents, the Board is satisfied that none of them discloses a method or a system having all the features as defined in Claims 1 or 4. The subject-matters are, therefore, new within the meaning of Article 54 EPC.

6. Inventive step

- 6.1 In Decision T 195/84 (OJ 5/1986, 121-125) the Board ruled that the state of the art to be considered, when examining for inventive step, includes not merely what is the actual technical field of the application but also what is relevant in the broader area which encompasses it. Principles and solutions of general technical problems with such wide implications must be considered to form part of the general technical knowledge which is to be attributed a priori to skilled persons who are versed in a particular specific technical field.
- 6.2 The person skilled in the art in control techniques who is confronted with the problem set out in point 4.2 to improve the performance of a proportional timing control associated with an air admission control is likely to search for a reliable solution to his control problem and to this end he could be expected to be aware of any suitable reference source relating to control systems generally, as basic means of engineering.

In the Board's view, the handbook (3) represents such a reference source providing to the skilled person the

general common teaching in control systems. Since this book deals generally with closed-loops control with compensation systems (cf. page 521, paragraph 42 "Regelkreise mit Hilfsstellgröße"), such art ought to be considered as knowledge attributable to the control engineer.

- 6.3 As regards the Appellant's assertion that the German handbook (3) is at least twenty years old, not preferred in Great Britain from an expert's point of view (cf. Affidavit by Dr. Williams) and hence not be considered as general knowledge accessible to a skilled person, this submission indeed fails to recognise a basic principle of the Convention that, according to Article 54(2) EPC, the disclosure of any document published anywhere before the priority date of a European application is included in the state of the art and has for that reason to be also considered in assessing inventive step under Article 56 EPC (cf. T 195/84 aforementioned, page 126, point 9(a)), under equal conditions irrespective of the location of the skilled person.

Moreover, it is to be noted that the priority date of the patent starts from the beginning of 1980 whereas the fifth edition of the book (3) is 1972. A gap of only eight years is considered, in the Board's view, as perfectly acceptable, where a regularly republished basic reference is concerned.

- 6.4 If anything, the fact that the book achieved several editions shows its popularity among professional readers and the common general character of its content.

When such books describe a basic general technical theory or methodology and exemplify the same with specific applications in certain technical fields only, these do not limit the general scope and relevance of such disclosures so as to exclude possible applications in other fields.

Furthermore, it is also the view of the Board that the language of publication alone cannot be decisive for the admissibility of a technical book representing the common general knowledge of the skilled person. Otherwise, there would be a differentiation between skilled persons according to their nationality as regards their knowledge, which would be against the objective assessment of the inventive step and be prejudicial to equal treatment.

- 6.5 According to the principle set out in book (3) (page 522, "Grund für die Anwendung von y_H "), the person skilled in control is taught that when a main variable y has to be controlled but cannot be adequately controlled due to unacceptable dynamic output performance (slow response), an auxiliary variable y_H is used such that when the steady state has been reached auxiliary control by y_H is then eliminated. This can be achieved, according to the reference (3), by simultaneously controlling the main variable y in response to the time integral of an error (slow) and controlling the auxiliary variable y_H in proportion with the error (fast).
- 6.6 The skilled person being aware of the above defined problem involving two variables would have, therefore, immediately realised that the same general idea is suitable for solving his particular problem and thus should be applicable for controlling satisfactorily the idling speed of a combustion engine such as described in document (1) by applying an integral control for controlling air admission to the engine in addition to the known proportional timing control as claimed in the present case. He would have arrived directly at the subject-matter of the claims in suit without being inhibited by prejudice against the principle or any difficulties in use or adaptation. Indeed, Claims 1 and 4 are worded in such functional terms that, in the

Board's opinion, they are confined to the mere application of the previously known principle to the control of idling speed.

- 6.7 The Appellant's argument referring to the characteristic "synergistic", i.e. interacting effect between the two kinds of controls, could not be accepted by the Board as relevant either, since in the reference book (3), the transient proportionally controlled variable is also progressively eliminated - with associated drawbacks - to the benefit of the steady-state remaining integrally controlled variable. The same kind of gradually changing interaction between the two control loops is, therefore, not surprising in any way. Moreover, it is to be pointed out that no other interrelationship between the loops is apparent from the claims as drafted and, consequently, such argument could be dismissed for that reason.
- 6.8 In addition to find a solution to his problem on the above basis, the skilled person could alternatively also find in document (2) other suitable and relevant means for the purpose of solving his problem in the same technical field as that of the present patent.

Document (2) describes an idling speed control system which generates a signal representing the error, i.e. difference between the actual engine speed and a desired idling speed for controlling the admission of air or air/fuel mixture to the engine in accordance with the time integral of the error signal (cf. Claim 1, Abstract and page 3, first paragraph).

In particular, in the embodiment according to Figures 2 to 4, a regulator 41 comprises an integrator 60 to which each of error signal y_1 or y_2 is input according to the polarity of the deviation between the actual speed signal x_1 and

the intended speed signal x_2 (see Figure 3 and page 5, first paragraph). As is apparent from Figure 3e), the integrated signal at the output of the regulator varies step-by-step in a manner to cause the engine speed to approach the desired idling speed so that when the speed deviation has been reduced to zero the idling speed remains constant (page 3, first paragraph). Therefore, the document (2) discloses an air admission integral control system having the features (a) and (c) of the contested claims.

- 6.9 The Board is satisfied that there was no reason to prevent the combination of the teachings of documents (1) and (2) and thus to replace in document (1) the simple proportional control for air/fuel input which could, in the absence of any express information, be assumed to be readily applicable with the more promising integral control in the manner of document (2) and thereby solve the problem, particularly, but not necessarily, if the skilled person was also aware of his general knowledge, as illustrated in the handbook (3). After all, when particular means within a combination are not specifically described, the skilled person may first assume the use of simple means, but would nevertheless consider the replacement of this with better means as and when such alternatives become available (cf. T 192/82, OJ 1984, 415 about the obviousness of such "analogous substitutions").

The reproach of ex-post-facto analysis brought forward by the Appellant is, therefore, not justified, as the correct consideration of the prior art leads to the result that the subject-matter of Claim 1 or 4 can be directly derived by combining the teaching of two documents, in particular where the combination of two kinds of controlling means has already been established by the basic reference.

- 6.10 It is irrelevant in this respect that the handbook (3) also gives an example relating to the temperature control of a heat exchanger ("als Beispiel", page 522), since the general principle stated therein is valid for any particular application. This is confirmed when the documents (1) and (2) are to be considered together, both already expressly referring to the same specific field as in the present patent.
- 6.11 For the reasons set out above, the Board has come to the conclusion that the method and system specified in Claims 1 and 4 could be derived in an obvious manner from the available prior art. It follows that their subject-matter is lacking an inventive step within the meaning of Article 56 EPC. The Board sees no features in other appendant claims which would have imparted patentability.

Order

For these reasons, it is decided at oral proceedings that:

The appeal is dismissed.

The Registrar:

The Chairman:

S. Fabiani

S. Fabiani

G. Szabo
G. Szabo

R. Wolf
18.12.90

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Dr. Fritz G. Wolf