BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS

BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE

CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

Internal distribution code:
(A) [ ] Publication in OJ
(B) [ ] To Chairmen and Members
(C) [X] To Chairmen
(D) [ ] No distribution

Datasheet for the decision of 8 September 2006

Case Number: T 0758/03 - 3.2.04

Application Number: 00121497.2

Publication Number: 1063398

IPC: F02B 23/10

Language of the proceedings: EN

Title of invention:
Piston for a direct injection gasoline engine

Applicant:
NISSAN MOTOR CO., LTD.

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56, 92(1), 111(1), 158(3)
RPBA Art. 10b(3), 11(1)

Keyword:
"Inventive step (no) - further technical problem"
"Auxiliary requests filed at the oral proceedings (not admitted) - subject-matter not previously claimed - additional search"

Decisions cited:
G 0010/93, T 0936/96

Catchword:
-

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0758/03 - 3.2.04

D E C I S I O N
of the Technical Board of Appeal 3.2.04
of 8 September 2006

Appellant: NISSAN MOTOR CO., LTD.
2 Takara-cho, Kanagawa-ku
Yokohama-shi
Kanagawa 221-0023 (JP)

Representative: G. Klitsch c/o
Grünecker, Kinkeldey,
Stockmair & Schwanhäusser
Anwaltssozietät
Maximilianstrasse 58
D-80538 München (DE)

Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 18 February 2003 refusing European application No. 00121497.2 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: M. Ceyte
Members: M. Poock
C. Heath

Summary of Facts and Submissions

I. European patent application No. 00 121 497.2 was refused with the decision of the examining division posted 18 February 2003.

The examining division held that the subject-matter of claim 1 of a main, first and second auxiliary request lacks an inventive step. It was obvious for the skilled person starting from the teaching of JP-A-09 079 038 (D1) in view of its general common knowledge as evidenced by EP-A-0 575 184 (D2). With respect to D1, the applicant did not object that the examining division cited from EP-A-0 778 403 (D1') which was not pre-published but provides an English translation thereof.

II. On 7 April 2003, the applicant (appellant) lodged an appeal against this decision and paid the prescribed appeal fee. The statement of grounds of appeal was received on 27 June 2003.

III. In the communication of 4 May 2006 pursuant to Article 11(1) of the Rules of Procedure of the Boards of Appeal (RPBA), the board expressed its provisional view that the subject-matter of claim 1 appears to be known from the obvious combination of the teaching of D2 with the combustion gasoline engines known from D1, particularly those shown in figures 63 and 64. Moreover, the applicant was informed that further amendments of the application should reach the board at least one month before the date of the oral proceedings.

IV. Oral proceedings took place on 8 September 2006 as requested with a first auxiliary request.

The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the main request, or alternatively on the basis of the second or third auxiliary request, all filed with letter of 9 January 2003, or the fourth or fifth auxiliary request, filed in the oral proceedings.

The second and third auxiliary request correspond to the first and second auxiliary request underlying the decision of the examining division.

Regarding the main, second and third auxiliary request, the discussion in the oral proceedings focused on whether the subject-matter of claim 1 involves an inventive step. In this respect, the appellant accepted that, although D1' was published after the priority dates of this application, the embodiments of D1' represent state of the art as defined in Article 54(2) EPC because they were published with WO-A-9 630 633 (D1''), D1' being the English translation thereof in accordance with Article 158(3) EPC.

Regarding the fourth and fifth auxiliary request, the discussion focused on their admissibility because they were submitted only at the end of the oral proceedings.

V. The independent claims read as follows:

Main request: "1. A piston for an internal combustion gasoline engine having an ignition plug and an injector for injecting fuel directly into a cylinder, comprising

a projection section (21) provided at a top surface of the piston, said projection section (21) is provided with a first inclined surface (22), a second inclined surface (23) and side surfaces (24, 25) connected to the first and the second inclined surfaces (22, 23), a cavity combustion chamber (12) is recessed in the projection section (21), characterized in that a pair of valve recesses (31, 32) are recessed in the projection section (21) superposed on the cavity combustion chamber (12), and an arcuate dam section (21a) is formed along the periphery of the valve recesses (31, 32)".

Second auxiliary request: "1. An internal combustion gasoline engine, comprising: a cylinder (3), a cylinder head (2) at a head of the cylinder (3), said cylinder head (2) comprises an intake-side inclined surface and an exhaust-side inclined surface, a fuel injector (10) to inject fuel in the form of gasoline directly into the cylinder (3), an ignition plug (7) in the cylinder head (2), to ignite an air-fuel mixture in the cylinder (3), a piston (4) provided within the cylinder (3), said piston (4) comprises a projection section (21) provided at a top surface of the piston, wherein said projection section (21) is provided with a first inclined surface (22), a second inclined surface (23) and side surfaces (24, 25) connected to the first and the second inclined surfaces (22, 23), and a cavity combustion chamber (12) is recessed in the projection section (21), characterized in that a pair of valve recesses (31, 32) are recessed in the projection section (21) superposed on the cavity combustion chamber (12), and an arcuate dam section (21a) is formed along the periphery of the valve recesses (31,

32), wherein said first inclined surface (22) is approximately parallel to the intake-side inclined surface of the cylinder head, and said second inclined surface (23) is approximately parallel to the exhaust-side inclined surface of the cylinder head, said valve recesses (31, 32) are recessed in the said first inclined surface (22) of the projection section (21)".

Third auxiliary request: claim 1 differs from the foregoing request by the following feature: that the valve recesses (31, 32) "are formed in a shallow circular-shape approximately parallel to the intake-side inclined surface of the cylinder head".

Fourth auxiliary request: claim 1 differs from the main request essentially by the addition of the following features: "that each valve recess (31,32) appears in a crescent shape" and that the arcuate dam section (21a) converges "gradually inclined towards said valve recesses (31,32)".

Fifth auxiliary request: claim 1 differs from the main request essentially by the addition of the following features: "said valve recesses (31,32) are gradually lowered in accordance with the inclination of the intake valve-side inclined surface (22) in a direction towards the intake valve side of the piston, whereas the bottom surface of the cavity combustion chamber in a plane perpendicular to the center axis of the piston (4)".

VI. The appellant argued that the subject-matter of claim 1 involves an inventive step for the following reasons:

- the inlet valve shown in figures 63 and 64 of D1' and D1'' are recessed in the cylinder head,
- the prior art does not teach to provide recesses for the inlet valves in the projection section of the piston,
- the technical problem to be solved is not only to improve the combustion efficiency but to also make stratified charge lean combustion and homogeneous charge combustion compatible with each other.

With respect to the admissibility of the fourth and fifth auxiliary request it was argued that, due to a reorganisation of the appellant's patent department, it was impossible to submit them earlier and that their subject-matter does not require an additional search.

Reasons for the Decision

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

2. Inventive step - main, second and third auxiliary request - claim 1

2.1 Closest prior art

2.1.1 Since D1' is, according to Article 158(3) EPC, the English translation of D1'', the following references to text in D1'' relate to D1'.

2.1.2 D1'' relates to a direct injection internal combustion gasoline engine, in which the fuel is injected directly into the combustion chamber.

Figures 63 and 64 show a piston as described in the first portion of claim 1 of the main request and an engine as described in the first portion of claim 1 of the second and third auxiliary request.

The piston 102 has at its top surface a projection section provided with a first inclined surface (right hand side of the piston's projection section), a second inclined surface (left hand side) and side surfaces connected to the first and the second inclined surfaces. A cavity combustion chamber 116 is recessed in the projection section. It can be seen in figure 63 that the first inclined surface is approximately parallel to the intake-side inclined surface of the cylinder head, and the second inclined surface is approximately parallel to the exhaust-side inclined surface of the cylinder head.

A pair of valve recesses for the intake valves 106 (see D1': column 2, line 40) is recessed in the cylinder head superposed on the cavity combustion chamber and (as a result of this) an arcuate dam section is formed along the periphery of these valve recesses (see in particular figure 64: masking wall 108a).

2.1.3 This combustion engine and in particular its piston are conceived for the same purpose (see D1', column 4, line 22: to ensure an optimal combustion efficiency) as the claimed combustion engine (see application as filed,

page 3, last paragraph: to perform a high combustion efficiency).

2.1.4 Therefore, the internal combustion gasoline engine of figures 63 and 64 and its piston are considered to represent the closest prior art for the claimed subject-matter.

2.2 Problem to be solved

2.2.1 From the engine disclosed in figures 63 and 64 of D1'', the subject-matter of claim 1 is distinguished in that

- the valve recesses are recessed in the piston's projection section superposed on the cavity combustion chamber (main, second and third auxiliary request),
- the valve recesses are recessed in the said first inclined surface of the projection section (second and third auxiliary request)
- the valve recesses are formed in a shallow circular-shape approximately parallel to the intake-side inclined surface of the cylinder head (third auxiliary request).

2.2.2 Each of these distinguishing features contributes to the effect that the space between the inner wall portion 103b of the cylinder head and the top wall of the piston 102 is minimised when the piston is in its top dead centre position (TDC), so that a higher compression ratio may be obtained (compare with D1', column 3, lines 15-24) resulting in a higher combustion efficiency.

2.2.3 In view of the foregoing, the technical problem to be solved is, on the one hand, to provide a directly injecting internal combustion gasoline engine with improved combustion efficiency (second and third auxiliary request) and, on the other hand, to provide a piston for such engine (main request).

These findings correspond in essence with the problem defined in the application (page 3, last paragraph) and also with the appellant's view expressed in its letter of 27 June 2003 on page 5, paragraph 3.

2.3 Obviousness of the solution

2.3.1 Disclosure of D2

This document relates to a diesel engine of the indirect injection type, in which the fuel is injected into a pre-combustion chamber.

It describes the potential problem (see column 1, lines 14 to 21) that the valves engage the piston crown in its top dead centre position because the relatively high compression ratio of this type of engine requires that the piston crown approaches the cylinder head very closely. For avoiding this, it is proposed that valve recesses 22 are provided in the piston crown at positions corresponding to those of the inlet valves. Thus, when the valves are open and the piston is in its TDC position, the valve discs are received in the recesses 22 (see for example figure 1 in connection with figure 2; column 4, lines 4-24; claim 1).

This permits the combustion efficiency of the engine to be increased (see for example column 2, lines 33 to 37 and column 2, line 55 to column 3, line 10).

Moreover it is disclosed that the recesses are of shallow circular-shape (see column 4, lines 4 to 12) and extend parallel to the bottom surface of the inlet valves (see figure 1).

Thus, document D2 teaches to provide valve recesses in the piston's projection section, which are formed in a shallow circular-shape approximately parallel to the bottom surface of the inlet valves for increasing the combustion efficiency of a diesel engine.

2.3.2 Combination of the teachings of documents D1'' and D2

(a) There is no doubt that the person skilled in the art of gasoline combustion engines knows as well diesel combustion engines. Therefore it can be expected that he would refer to D2 and at least consider its teaching when he tries to find a solution to the problem stated above.

(b) Although D1'' and D2 relate to different types of combustion engines, they address the same technical problem of improving the combustion efficiency.

D2 explains this problem in great detail related to a high compression ratio which requires that the ratio of the volume of the pre-combustion chamber to the volume of the cylinder combustion chamber is high when the piston is in its TDC

position. This is achieved in that the space between the piston crown and the cylinder head, i.e. the volume of the cylinder combustion chamber, is minimized (column 1, lines 36 to 46 and column 3, lines 5 to 10).

D1'' states in this respect for the embodiment of figures 63 and 64 that the space between the piston and the inlet valves limits the compression ratio (see column 3, lines 14 to 24).

(c) Since D1'' already indicates that a high compression ratio is desirable for the embodiment of figures 63 and 64 for increasing the engine's combustion efficiency and D2 gives a very specific teaching as to how such high combustion efficiency can be obtained, the board has no doubts that it is obvious for the person skilled in the art to apply this teaching of D2 relating to a diesel engine to the known gasoline combustion engine of D1''.

2.3.3 When this teaching of D2 is applied on the engine of figures 63 and 64 of D1'', the skilled person would not provide the inlet valve recesses in the cylinder head but in the projection section of the piston. The direct result thereof would be that the valve recesses are provided in the first inclined surface of the projection section, superposed on the cavity combustion chamber and formed in a shallow circular-shape approximately parallel to the intake-side inclined surface of the cylinder head. Thus, this would reveal the person skilled in the art subject-matter which is

covered by claim 1 of the main, second or third auxiliary request.

2.3.4 Even if the board accepted the appellant's argument that the technical problem to be solved is not only to improve the combustion efficiency but also to make stratified charge lean combustion and homogeneous charge combustion compatible with each other, the foregoing assessment could not be altered.

Still, it is the first portion of this problem which would have prompted the skilled person to apply the teaching of D2 on the engine of figures 63 and 64 of D1'' and to thus arrive at subject-matter which is covered by claim 1.

In general, once a realistic technical problem is defined and once it is established that a particular solution to such a problem would have been envisaged by a person skilled in the art in the light of the relevant state of the art, then this solution lacks an inventive step. This assessment cannot be altered by the fact that the claimed invention inherently also solves further technical problems (see T 936/96 of 11 June 1999, point 2.6, not published in OJ EPO but mentioned in Case Law of the Boards of Appeal of the European Patent Office, 4th edition, I.D.7.7.1).

2.4 In view of the foregoing, the board concludes that the subject-matter of claim 1 does not involve an inventive step as required by Articles 52(1) and 56 EPC. Consequently, the main, second and third auxiliary request could not be allowed.

3. Admissibility - fourth and fifth auxiliary request

3.1 Article 10b(3) RPBA stipulates that amendments to a party's case after oral proceedings have been arranged shall not be admitted if they raise issues which the board cannot reasonably be expected to deal with without adjournment of the oral proceedings.

3.2 The additional features in claim 1 of the fourth auxiliary request are disclosed respectively on page 19, line 21 and in the drawings, in particular figures 21, 22. The additional features in claim 1 of the fifth auxiliary request are disclosed on page 20, lines 12 to 16 and on page 18, lines 30 to 34 of the application as filed. Thus, these features do only have a basis in the description or the drawings but not in the claims.

Since the search division shall draw up the European search report on the basis of the claims with due regard to the description and the drawings (Article 92(1) EPC), the board has doubts whether the newly claimed subject-matter of these requests has been searched for or not. Moreover, the subject-matter of claim 1 of these requests has not yet been considered by the examining division.

According to Article 111(1) second sentence, the board could consider this new subject-matter or remit the case to the examining division for further prosecution, in particular to decide if an additional search is required. Since proceedings before the boards of appeal in ex - parte cases are primarily concerned with examining the contested decision (see G 010/93, reasons

n. 4; OJ EPO 1995, 172), the second alternative is more appropriate.

However, in any event, the oral proceedings needed to be adjourned.

3.3 After the board’s communication which was drawn up on the same factual situation as the impugned decision, the appellant had to be aware that his chances of success in this appeal mainly depended on new convincing arguments and/or further amendments to the claims. Nevertheless and although the appellant had about three months for filing amendments, the fourth and fifth auxiliary request were only submitted at a very late stage of the proceedings, after the main, second and third auxiliary request had been exhaustively discussed in the oral proceedings. Thus, the board's express invitation to file amended claims at least one month before the date fixed for the oral proceedings was entirely ignored.

In this respect, the reorganisation of the appellant's patent department cannot be regarded as a reason to justify the late filing of these requests. Following such argument would allow parties to deliberately delay granting procedures which is unacceptable for the public.

3.4 In view of the foregoing, it is concluded that with the fourth and fifth auxiliary request issues were raised which the board cannot reasonably be expected to deal with without adjournment of the oral proceedings.

It is further observed that the appellant was allowed to file a main request and two auxiliary requests before the examining division as well as a main request and three auxiliary requests before the present board. Thus, in the board's view, the appellant had sufficient opportunity to defend his patent application.

Consequently, the board decided not to admit the fourth and fifth auxiliary request into the proceedings.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar The Chairman

G. Magouliotis M. Ceyte