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

Datasheet for the decision of 16 December 2013

Case Number: T 2034/12 - 3.2.04

Application Number: 10005277.8

Publication Number: 2261481

IPC: F02B37/013, B60K13/04

Language of the proceedings: EN

Title of invention:
Turbocharged engine for a vehicle, vehicle equipped therewith, and corresponding method

Applicant:
Mazda Motor Corporation

Headword:

Relevant legal provisions:
EPC Art. 84, 123(2), 54, 56

Keyword:
Claims - clarity after amendment (yes)
Amendments - added subject-matter (no)
Novelty - (yes)
Inventive step - (yes)

Decisions cited:

Catchword:

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern
Boards of Appeal
Chambres de recours

European Patent Office
D-80298 MUNICH
GERMANY
Tel. +49 (0) 89 2399-0
Fax +49 (0) 89 2399-4465

Case Number: T 2034/12 - 3.2.04

D E C I S I O N
of Technical Board of Appeal 3.2.04
of 16 December 2013

Appellant: (Applicant)	Mazda Motor Corporation 3-1, Shinchi Fuchu-cho Aki-gun Hiroshima 730-8670 (JP)
Representative:	Müller-Boré & Partner Patentanwälte PartG mbB Grafinger Straße 2 81671 München (DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 11 June 2012 refusing European patent application No. 10005277.8 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman: E. Frank
Members: J. Wright
T. Bokor

Summary of Facts and Submissions

I. The appeal lies from the decision of the examining division dated 11 June 2012 to refuse European application No. 10 005 277.8 pursuant to Article 97(2) EPC according to the state of the file (as requested by the applicant in its letter of 18 May 2012). The examining division held, *inter alia*, that the subject-matter of engine claim 1 and method claim 12 according to the main and auxiliary requests as filed on 10 June 2011 and 10 January 2012, respectively, did not meet the requirements of inventive step in the light of D1 and common general knowledge.

The appellant (applicant) filed a notice of appeal on 8 August 2012, paying the appeal fee on the same day. The statement of grounds of appeal was filed on 10 August 2012. The grounds of appeal were directed at claims 1 and 12, in a main and an auxiliary requests, for the details of which reference is made to the file.

II. Following two telephone conversations with the rapporteur of the Board the appellant filed new amended claims on 25 October 2013. Subsequently, the previously appointed oral proceedings before the Board were cancelled. The following evidence has been considered for the purpose of the present decision:

D1 = FR 2 922 595 A
D2 = JP 2008 248814 A
D3 = JP 2006 070878 A
D4 = JP 59 211718 A

III. The appellant requested that the decision under appeal be set aside and that a patent be granted solely on the basis of the set of claims filed on 25 October 2013.

IV. The wording of claims 1 (engine) and 11 (method) reads as follows:

"1. A turbocharged engine (1) for a vehicle, comprising:
a small-sized turbocharger (3), a turbine (3a) of which is connected to an outlet of an exhaust manifold (21) provided on a side face of an engine body (2); a large-sized turbocharger (4), a turbine (4a) of which is connected to an outlet of the turbine (3a) of said small-sized turbocharger (3); and

an exhaust-gas purification device (5) connected to an outlet of the turbine (4a) of said large-sized turbocharger (4),

wherein said small-sized turbocharger (3) is arranged near one side of the engine body (2) in the axial direction of a crank-shaft at said side face of the engine body (2), said large-sized turbocharger (4) is arranged substantially above said small-sized turbocharger (3) near said one side at said side face of the engine body (2) so that the outlet of the turbine (4a) thereof faces substantially toward the side which is opposite to said one side in the axial direction of said crank-shaft, said exhaust-gas purification device (5) is arranged substantially vertically on said side, which is opposite to said one side, relative to said small-sized turbocharger (3) and large-sized turbocharger (4) at said side face of the engine body (2) so that an exhaust inlet thereof is located above and an exhaust outlet thereof is located below, and the exhaust inlet of the exhaust-gas purification device (5) is connected to the outlet of the turbine (4a) of the large-sized turbocharger (4) and the exhaust outlet of the exhaust-gas purification device (5) is connected to an exhaust pipe (12)."

"11. A method of arranging a small-sized turbocharger (3), a large-sized turbocharger (4), and an exhaust-gas purification device (5) on a turbocharged engine (1) for a vehicle, comprising the steps of:

providing a small-sized turbocharger (3), a turbine (3a) of which is connected to an outlet of an exhaust manifold (21) provided on a side face of an engine body (2);

providing a large-sized turbocharger (4), a turbine (4a) of which is connected to an outlet of the turbine (3a) of said small-sized turbocharger (3); providing an exhaust-gas purification device (5) connected to an outlet of the turbine (4a) of said large-sized turbocharger (4);

arranging said small-sized turbocharger (3) near one side of the engine body (2) in the axial direction of a crank-shaft at said side face of the engine body (2);

arranging said large-sized turbocharger (4) above said small-sized turbo-charger (3) near said one side at said side face of the engine body (2) so that the outlet of the turbine (4a) thereof faces substantially toward the side which is opposite to said one side in the axial direction of said crank-shaft; and

arranging said exhaust-gas purification device (5) substantially vertically on said side, which is opposite to said one side, relative to said small-sized turbocharger (3) and large-sized turbocharger (4) at said side face of the engine body (2) so that an exhaust inlet thereof is located above and an exhaust outlet thereof is located below, and the exhaust inlet of the exhaust-gas purification device (5) is connected to the outlet of the turbine (4a) of the large-sized turbocharger (4) and the exhaust outlet of the exhaust-

gas purification device (5) is connected to an exhaust pipe (12)."

V. The appellant submitted essentially the following arguments:

D1 disclosed an internal combustion engine comprising a group of two turbochargers. An exhaust gas purification device was positioned below this turbocharger group in a horizontal manner. The subject-matter of claims 1 and 11 thus differed from this closest prior art in that the large turbocharger was arranged substantially above the small one, and that the exhaust-gas purification device was vertically arranged on the opposite side in the crank-shaft direction, relative to both turbochargers at one side of the engine body. The underlying effect of these differentiating features was to shorten piping between the large turbocharger and the exhaust-gas purification device, which in turn led to a reduction of thermal expansion of the pipes. Even more importantly, high temperature exhaust gas could be supplied to the exhaust-gas purification device so as to improve purification as well as filter regeneration. See application, pages 1 to 4.

Moreover, D3 described an arrangement of two turbo-chargers and a diesel particulate filter provided on the rear side of an engine body. However, D3 did not provide any hint to arrange the exhaust-gas purification device at the outlet of the large turbocharger. Furthermore, D2 only disclosed an exhaust gas passage, and D4 described an exhaust system of an engine with a single turbo-charger. In conclusion, starting from D1, none of these documents would have led the skilled person to the subject-matter of claims

1 and 11. Thus, claims 1 and 11 involved an inventive step.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments*

2.1 Amended claims 1 and 11 are based on engine claim 1 and method claim 11 as originally filed. The term "a one side face" of the engine body, viz. where the exhaust manifold is provided, has been formulated more concisely and now reads "a side face". Moreover, in claims 1 and 11 as filed "one side" of an endless one-dimensional line, viz. of the crank-shaft direction, was used as a frame of reference thereby unclearly defining the position of both turbochargers, rather than clearly defining their position using one side of the engine body as a frame of reference, when seen from the crank-shaft direction. However, in the context of the description, the skilled person would readily recognize that both the small- and large-sized turbocharger are arranged near one side of the engine body in the axial direction of the crank-shaft: cf. page 2, lines 26 and 27; page 8, line 32 to page 9, line 7; and figures 1 and 2. On the other hand, the exhaust-gas purification device is arranged substantially vertically on a side which is, in the axial direction of the crank-shaft, opposite to said one side of the engine body: cf. page 9, lines 8 to 12; and figures 1 and 2. Thus, the original wording "near one side of a crank-shaft direction" and "on the other side of the crank-shaft direction" has been clarified in newly filed claims 1 and 11 accordingly.

The Board is, therefore, satisfied that the claims now clearly define the matter for which protection is sought, Article 84 EPC (cf. the examining division's communications of 29 September 2010 and 22 August 2011, and the result of consultation dated 13 January 2012).

2.2 As stated above, the amendments of claims 1 and 11 are derivable from the original application for the skilled person, Article 123(2) EPC. Furthermore, Document D1 was identified in the description and the relevant background art disclosed therein was briefly discussed, Rule 42(1)(b) EPC.

3. *Novelty and Inventive step*

3.1 Document D1 concerns a turbocharged engine for a vehicle. A two-stage turbocharger system is described (*"groupe de suralimentation à deux étages"*), which comprises a large-sized turbocharger (*"turbocompresseur 5"*) and, in relation to it, a small-sized turbocharger (*"turbocompresseur 9"*). Moreover, an exhaust-gas purification device is also provided (*"volume de dépollution 34"*). See D1, abstract; the two embodiments of figures 2 and 3, or 4 and 5, respectively; page 2, lines 19 to 21; and page 8, line 18 to page 10. However, both the figure 3 and 5 embodiment of D1 disclose that, near one side of the engine body, i.e. near the left end of the engine shown in the figures, the turbochargers are laterally displaced and the exhaust-gas purification device is horizontally arranged below these two turbochargers.

Thus, the subject-matter of claims 1 and 11 differs from D1's disclosure in that, near one side of the engine body, the large-sized turbocharger is arranged substantially above the small sized-turbocharger, and

in that the exhaust-gas purification device is arranged substantially vertically on the side which is opposite to said one side in the axial direction of the crank-shaft. In other words, compared to document D1, the large turbocharger of claims 1 and 11 of the application has been moved basically over the small turbocharger, both near one end of the engine, with the exhaust purification device mounted vertically nearer the other end, that is, beside the turbochargers rather than below them (cf. the examining division's communication to the summons dated 25 January 2012, page 2).

3.2 According to the application, since both turbochargers are arranged near the engine body, the loss of exhaust energy is so small that the supercharging function improves. Further, since the exhaust-gas purification device, e.g., a DPF (diesel particulate filter), is directly connected to the outlet of the turbine of the large-sized turbocharger, the high-temperature exhaust gas is supplied to the exhaust-gas purification device so that filter regeneration improves, see application, page 1, line 25 to page 2, line 4. However, in case the size of the exhaust-gas purification device becomes larger, the whole length of the assembly in crank-shaft direction becomes longer, and may project from both ends of the engine body. This would impose difficulties on the layout of engine devices, such as a cooling-water pump or alternator, layouts of piping of an air cleaner, intercooler, EGR system (i.e. the exhaust gas recirculation) and battery and the like, and in layouts of a master back of a vehicle brake, see application, page 2, lines 5 to 13.

Hence, the arrangement according to the distinguishing features of claims 1 and 11, see point 3.1 above,

enables the flexibility of layout of the engine devices to be improved, whilst the outlet of the (large-sized) turbine and the inlet pipe portion 5a of the exhaust-gas purification device can be connected with the shortest distance. Moreover, since both turbochargers are arranged near one side of the engine body in the crank-shaft direction, intake and exhaust passages which connect the respective turbines or compressors of these turbochargers can be made short as well. That is, the advantages of a laterally arranged side by side large-sized turbocharger and exhaust-gas purification device can be maintained even in case of large exhaust-gas purification devices. Moreover, not only the weight of the pipes forming these passages but the amount of thermal expansion of the pipes may be properly reduced. Finally, the structure of the pipes can be simplified by reducing the number of flexible pipes used, and the support of these turbochargers and the exhaust-gas purification device at the engine body can be facilitated, see application, page 3, lines 16 to 28.

The associated objective problem underlying the distinguishing features vis-à-vis D1, in the Board's view, can thus be formulated as follows: how to provide an alternative compact arrangement of D1's turbochargers and exhaust-gas purification device whilst technically improving D1's two-stage turbocharger system.

3.3 A solution to the above stated problem is nowhere addressed in D1. D1 in particular does not hint at technical advantages of a laterally side by side arrangement of the large-sized turbocharger 5 and exhaust-gas purification device 34, let alone at resulting technical problems as to the layout of other engine components in case the size of, e.g., a DPF

("*filtre à particules*") were too large. Nor is there any suggestion in D1 that might prompt the skilled person to arrange the large turbocharger above the small one, or the exhaust-gas purification device vertically beside the turbochargers instead of horizontally below, if the assembly had to be "packed" into a different shaped space of the engine bay as purported by the examining division (cf. communication to the summons of 25 January 2012).

On the contrary, D1's teaching consistently requires a very specific layout of the turbochargers 5,9 and exhaust-gas purification device 34, respectively, viz. with respect to the planes 26 ("*plan transversal 26*") and 4 ("*plan horizontal 4*"), in order to obtain an optimised, two-stage turbocharged engine system: see D1, page 5, line 26 to page 7, line 13; page 8, line 18 to page 10; and figures 3 and 5. The Board further notes that D1 likewise suggests optimising pipe paths in accordance with this ostensibly advantageous arrangement, rather than suggesting a different configuration of the components to optimise the piping paths, see D1, page 10, last paragraph.

3.4 In summary, starting from D1 and given the numerous technical effects which may be caused by a different layout of the turbochargers' arrangement with respect to the exhaust-gas purification device near the engine body as previously discussed under sections 3.2 and 3.3 of this decision, faced with the above stated problem and applying his common general technical knowledge, the skilled person would not get any suggestion from D1 as to how these engine parts may be differently arranged, much less such that he would arrive at the subject-matter of claims 1 and 11.

3.5 For the sake of completeness, reference is also made to documents D2, D3, and D4. D3 shows a side by side arrangement of two turbochargers "6" and "5" but, however, not above each other, in order to compactly dispose an intake and exhaust system around an engine while considering the performance of intake and exhaust system parts: see D3, abstract, and figure 1. Moreover, D4 (see abstract) concerns a support leg being fixed to an exhaust manifold, in order to prevent a turbine housing from being subjected to the load of the exhaust pipe as well as being subjected to stress due to thermal expansion of the exhaust manifold. However, D4 refers to a single turbocharger only ("turbine housing 5"). Finally, D2 (see abstract) merely describes an exhaust pipe 10 including a catalyst vessel. Hence, with respect to the subject-matter of claims 1 and 11, the Board does not consider these documents to be relevant.

3.6 The Board concludes, therefore, that the subject-matter of claims 1 and 11 fulfils the requirements of novelty and inventive step, Article 52(1) with Articles 54 and 56 EPC.

3.7 The vehicle of claim 8 comprises a turbocharged engine of claim 1 and thus is also allowable.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance with the order to grant a patent based on the following application documents:

   Description: page 1 as originally filed;
   page 2 and 2a as filed on 10 June 2011;
   pages 3 to 15 as originally filed;

   Claims: 1 to 14 as filed as sole request on 25 October 2013;

   Drawings: figures 1 to 8 as originally filed.

The Registrar: The Chairman:

G. Magouliotis E. Frank

Decision electronically authenticated