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**Datasheet for the decision  
of 2 September 2009**

**Case Number:** W 0040/08 - 3.2.06

**Application Number:** PCT/EP 2006/003355

**Publication Number:** WO 2007/115579

**IPC:** F01K 23/06

**Language of the proceedings:** EN

**Title of invention:**

A large turbocharged diesel engine with energy recovery arrangement

**Applicant:**

MAN DIESEL A/S

**Opponent:**

-

**Headword:**

-

**Relevant legal provisions:**

PCT R. 13.1, 13.2

**Relevant legal provisions (EPC 1973):**

-

**Keyword:**

"Lack of unity (yes)"

**Decisions cited:**

-

**Catchword:**

-



Case Number: W 0040/08 - 3.2.06

International Application No. PCT/EP 2006/003355

**D E C I S I O N**  
of the Technical Board of Appeal 3.2.06  
of 2 September 2009

**Applicant:** MAN DIESEL A/S  
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**Representative:** Van Walstijn B., Gerard, G.  
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**Decision under appeal:** Protest according to Rule 68.3(c) of the Patent Cooperation Treaty made by the applicants against the invitation of the European Patent Office (International Preliminary Examining Authority) to restrict the claims or pay additional fees dated 29 August 2008.

**Composition of the Board:**

**Chairman:** P. Alting Van Geusau  
**Members:** G. Pricolo  
S. Hoffmann

## Summary of Facts and Submissions

I. The applicant filed International patent application PCT/EP2006/003355 on 12 April 2006. The application contained 46 claims of which the independent claims 1, 9, 23, 30, 31, 44, 45 and 46 are as follows:

"1. A large turbocharged diesel engine comprising: a plurality of cylinders that are each connected to an exhaust gas receiver via respective manifold pipes, an upstream exhaust gas conduit for leading the exhaust gases from the exhaust gas receiver to the inlet of the turbine of the turbocharger, a downstream exhaust gas conduit for leading the exhaust gases from the outlet of the turbine of the turbocharger to the atmosphere, one or more exhaust gas heated boilers or heat exchangers for recovering heat energy from the exhaust gases, characterized in that at least one of said boilers or heat exchangers is disposed within said exhaust gas receiver."

"9. A large turbocharged diesel engine comprising: a turbocharger with an exhaust gas driven turbine that is connected to a charging air compressor, a first exhaust gas heated boiler on the high pressure side of the turbocharger, a power turbine driven by a portion of the exhaust gases that is branched off from the high pressure side of the turbocharger."

"23. A large charged two-stroke diesel engine comprising: an exhaust gas driven turbine driving an electric generator, a charging air compressor driven by an electric drive motor, and a heat exchanger on the

high pressure side of the turbine for extracting heat from the exhaust gas."

"30. A large charged two-stroke diesel engine comprising: an exhaust gas driven turbine driving a hydraulic pump, a charging air compressor driven by an hydraulic drive motor, and a heat exchanger on the high pressure side of the turbine for extracting heat from the exhaust gas."

"31. A charged internal combustion engine for use in a combined heating and power plant, said engine comprising: an intake system for taking in air at ambient pressure and temperature, the intake system including a compressor for delivering charging air with a pressure above ambient to the cylinders of the internal combustion engine, a turbine driven by exhaust gas, and a heat exchanger on the high pressure side of the turbine for extracting heat from the exhaust gas, the heat exchanger and the turbine being configured to obtain an exhaust gas temperature at the low pressure side of the turbine below ambient."

"44. A charged combustion engine comprising an intake system for taking in air at ambient pressure and temperature, the intake system including a compressor for delivering charging air with a pressure above ambient to the cylinders of the internal combustion engine, a first turbine with a given effective turbine area driven by exhaust gas, a second turbine with a given effective turbine area driven by exhaust gas and a heat exchanger on the high pressure side of the turbine for extracting heat from the exhaust gas, and means for selectively using either or both turbines in

order to operate the engine with different exhaust gas temperatures at the low pressure side of the turbine."

"45. A charged combustion engine comprising an intake system for taking in air at ambient pressure and temperature, the intake system including a compressor for delivering charging air with a pressure above ambient to the cylinders of the internal combustion engine, a turbine with a variable effective turbine area driven by exhaust gas and a heat exchanger on the high pressure side of the turbine for extracting heat from the exhaust gas."

"46. A method of operating a charged combustion engine, said charged combustion engine comprising an intake system for taking in air at ambient pressure and temperature, the intake system including a compressor for delivering charging air with a pressure above ambient to the cylinders of the internal combustion engine, a first turbine with a given effective turbine area driven by exhaust gas, a second turbine with a given effective turbine area driven by exhaust gas and a heat exchanger on the high pressure side of the turbine for extracting heat from the exhaust gas, comprising the steps of selectively using turbines to obtain different exhaust gas temperatures at the low pressure side of the turbine or turbines."

II. On 29 August 2008 the EPO, acting in its capacity as International Preliminary Examining Authority (IPEA), issued an invitation (on Form PCT/IPEA/405) to restrict or to pay additional fees pursuant to Article 34(3)(a) and Rules 68.2 and 68.3(e) PCT. The IPEA indicated that

it considered that there were four inventions claimed in the international application, namely:

indicated as follows:

1. Claims 1 to 8, directed to a multi stage heat exchanger system for heat recovery from the exhaust of a turbocharged Diesel engine;
2. Claims 9-22, 44, 46 directed to a power turbine in parallel to the turbocharger for recovery of energy from the exhaust of a turbocharged Diesel engine;
3. Claims 23-30, directed to a turbocharger system with hydraulic or electric power transmission between turbine and compressor;
4. Claims 31-46: directed to the operation of a turbocharger as a heat pump.

The IPEA identified the special technical features of the claimed inventions having regard to the closest prior art disclosed by document

D2 : EP-A-0 434 419,

cited in the search report, and explained that the special technical features of the claimed inventions solved different problems that were not in any way linked to each other.

- III. With letter dated 11 September 2008 the applicant paid under protest three additional fees for preliminary examination of all claims and submitted arguments as to why the inventions were unitary. These arguments can be summarized as follows:

The invitation was based on the erroneous assumption that "an exhaust gas receiver" was not a well defined constructional element of a large two-stroke diesel engine. The exhaust gas receiver in a large two-stroke diesel engine was different from the manifold used in normal sized engines because of the pressure fluctuations and standing waves of pressure in the exhaust gas receiver that required that the exhaust gas receiver of a large two-stroke diesel engine had particular size and dimensions which were much larger, also relatively seen, when compared with the manifolds used in normal sized engines. Thus, the exhaust gas receiver in accordance with the application was not a simple pipe, but had special characteristics determined by the size and the way in which the exhaust gas receiver was connected to the cylinders. Therefore, it was incorrect to assume that any exhaust gas receiving device directly or indirectly connected to the cylinders via manifold pipes could be considered to fall within the scope of the "exhaust gas receiver" of independent claim 1.

- IV. With a communication dated 31 October 2008 on Form PCT/IPEA/437, a review panel confirmed the IPEA's opinion regarding lack of unity and invited the applicant to pay a protest fee for the examination of the protest. The review panel essentially argued that the feature "exhaust gas receiver" as used in independent claim 1 included not only an exhaust gas receiver directly mounted on the exhaust manifold pipes of the engine but also any other exhaust gas receiver positioned at any other location within the system claimed.

V. The applicant paid the protest fee on 20 November 2008.

### **Reasons for the Decision**

1. The protest is admissible.
  
2. The applicant's protest hinges only on the interpretation of the expression "exhaust gas receiver" recited in claim 1. According to the appellant's submissions, an exhaust gas receiver was a well defined constructional element of a large two-stroke diesel engine, which was different from the manifolds used in normal sized engines, and therefore the analysis of features of claim 1 vis-à-vis D2 carried out by the IPEA was incorrect.

However, claim 1 is not limited to two-stroke diesel engines, but generally relates to "large turbocharged diesel engines". Accordingly, the expression "exhaust gas receiver" cannot be understood as referring to an exhaust gas receiver having specific features that are (possibly) implied by its suitability for large two-stroke diesel engines, but encompasses any exhaust gas receiver which is suitable for any large diesel engine.

Thus, in accordance with the IPEA's analysis, D2 discloses (see Fig. 2) a large turbocharged diesel engine (see col. 1, line 3) comprising a plurality of cylinders (1) that are each connected to an exhaust gas receiver (consisting of the exhaust pipe 2 and the casing of the boiler 5; note that the element 5 is an exhaust gas boiler but, since the exhaust gas passes within the casing of the boiler 5, see col. 3, line 17,



the casing acts as an exhaust gas receiver) via respective manifold pipes (provided between the cylinders and the exhaust pipe 2), an upstream exhaust gas conduit (the pipe on the right hand-side of the boiler 5) for leading the exhaust gases from the exhaust gas receiver to the inlet of the turbine of the turbocharger (3), a downstream exhaust gas conduit (the pipes and the second boiler 10 downstream of the turbine) for leading the exhaust gases from the outlet of the turbine of the turbocharger to the atmosphere, one heat exchanger (within boiler 5 casing) for recovering heat energy from the exhaust gases (see col. 3, line 22), wherein the exchanger is disposed within said exhaust gas receiver (i.e. within the boiler 5 casing). Therefore, D2 discloses all the features of claim 1 in combination.

D2 also discloses the features of claims 2 to 4 dependent on claim 1, since it discloses that a preheating boiler (10) is provided at the low-pressure side of the turbocharger (3), that the boiler disposed within the exhaust gas receiver (i.e. within the casing of boiler 5) is used to overheat steam produced by the boiler at the low-pressure side of the turbocharger (see col. 2, lines 45-54), that a steam turbine (col. 3, line 33) driven by the steam produced by the boiler or boilers is provided, and that the turbine drives an electric generator (see col. 3, lines 37, 38).

The IPEA found that D2 does not disclose the features of dependent claims 5 to 8. Claim 5 additionally defines that the exhaust gas receiver houses a plurality of boilers. If the term "boiler" is understood as "heat exchanger", as in the present

application (see page 12, line 6: "the heat exchanger therefore acts as a boiler"; and page 14, lines 19-21, referring to the "boiler" which is inside the exhaust receiver in the embodiment of Figs. 1 and 2: in this embodiment there are heat exchanger elements 57a, 58a, 57b, 58b inside the exhaust receiver), then D2, of which Fig. 2 shows two heat exchangers tubes within the casing of the boiler (5), also discloses the subject-matter of claim 5. These two heat exchangers tubes constitute preheating and superheating boilers (see col. 2, lines 45 to 54) and therefore D2 discloses the subject-matter of claim 6 as well.

However, the Board concurs with the IPEA's view that the additional feature of claim 7 dependent on claim 1 is not known from D2. Thus, this additional feature can be regarded as special technical feature within the meaning of Rule 13.2 PCT, i.e. as a technical feature that defines a contribution over the prior art.

The special technical feature according to claim 7 is that the exhaust gas receiver is transversely divided into an exhaust gas collection channel and a heat exchanging channel. It solves the technical problem of providing efficient heat transfer within the exhaust gas receiver. Since it is dependent on claim 7, claim 8 includes this special technical feature and therefore the Board comes to the same conclusion of the IPEA that claims 1 to 8 relate to one invention.

3. The other independent claims 9, 23, 30, 31, 44, 45 and 46 do not include the feature relating to the exhaust gas receiver. Since the Board is satisfied that the analysis of the features of these claims vis-à-vis D2

as made by the IPEA is correct, and this analysis is not contested by the applicant, there is no need to discuss it in detail here.

The special technical feature of independent claim 9, that a power turbine driven by a portion of the exhaust gases is provided which is branched off from the high pressure side of the turbocharger, has the effect that the overall amount of energy that is recovered from the exhaust gas can be improved under a great variation of operating conditions (see page 4, lines 9 to 20 and page 16, lines 14-21 of the application). Thus, the special technical feature solves the problem of improving the overall amount of energy that is recovered from the exhaust gas.

The next independent claim of the application is claim 23. The IPEA referred to claim 24 which is dependent on claim 23 but defines the negative feature that the large charged two-stroke diesel engine does not comprise a turbo charger. Claim 24 is however a dependent claim as it specifies an alternative falling under the general wording of claim 23, which includes both the alternative with a turbo charger and the alternative without a turbocharger (it covers the embodiments of e.g. Fig. 4, with a turbo charger 6-9, and that of Fig. 7, without a turbo charger). The special technical features of independent claim 23, which are also special technical features of claim 24 (the latter further including the special technical feature that no turbo charger is present), are that the diesel engine is a two-stroke diesel engine and the exhaust gas driven turbine drives an electric generator and the charging air compressor is driven by an

electric generator (according to D2, the turbine and the compressor, both indicated with the reference numeral 3, form a turbo charger and are mechanically connected), have the effect of allowing the operating conditions of the two-stroke diesel engine to be controlled with a greater degree of freedom (see page 5 of the application, lines 23-28). Accordingly, the special technical features solve the problem of improving the flexibility of a large two-stroke diesel engine.

The special technical feature of independent claim 31, that the heat exchanger and the turbine are configured to obtain an exhaust gas temperature at the low pressure side of the turbine below ambient, has the effect that the combustion engine itself is turned into a heat pump, whereby a very high overall fuel efficiency is provided (see page 7 of the application, first full paragraph). Thus, the special technical feature solves the problem of improving the overall fuel efficiency.

4. From the above it follows that the inventions defined in claims 1 to 8, and independent claims 9, 23 and 31, respectively, are each characterized by different special technical features. These special technical features solve different technical problems that are not linked to each other: providing efficient heat transfer within the exhaust gas receiver (claims 1-8), improving the overall amount of energy that is recovered from the exhaust gas (claim 9), improving the flexibility of a large two-stroke diesel engine (claim 23), and improving the overall fuel efficiency (claim 31), represent different technical aspects that

are not necessarily interrelated and would be faced independently of each other. Accordingly, there is no technical relationship among these inventions involving one or more of the same or corresponding special technical features. As a consequence, it is concluded that the requirement of Rule 13.2 PCT is not met for these four inventions.

5. It is noted that the conclusion would be the same even if, in accordance with the applicant's submissions, the expression "exhaust gas receiver" recited in claim 1 were interpreted as defining a particular exhaust gas receiver of a large two-stroke diesel engine, which exhaust gas receiver is not disclosed by D2. Under this assumption, the special technical features of claim 1 would be that the engine is a two-stroke diesel engine having an exhaust gas receiver and that at least one of the boilers or heat exchangers is disposed within said gas exhaust receiver. These special technical features have the effect that the space required, in a large two-stroke diesel engine, for an exhaust boiler and the housing for an exhaust boiler can be saved (see page 14, lines 19-21 of the application). Accordingly, the special technical features solve the problem of providing a large two-stroke diesel engine which is compact (see page 2, line 5 of the application). This is a different technical problem which is not necessarily related with the technical problems solved by the other inventions mentioned above, and therefore the requirement of Rule 13.2 PCT would still not be met for the inventions defined in claims 1, 9, 23 and 31.

6. It follows from the above that claims 1 to 8, and independent claims 9, 23 and 31, respectively, relate

to four inventions that are not so linked as to form a single general inventive concept (Rule 13.1 PCT). Hence, the IPEA's invitation made under Rule 68.2 PCT to pay three additional examination fees was justified.

**Order**

**For these reasons it is decided that:**

The protest is dismissed.

The Registrar:

The Chairman:

C. Eickhoff

P. Alting van Geusau