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PATENTS ACT 1977

IN THE MATTER OF Patent Application
No 9027412.7 by Usui Kokusai Sangyo Kaisha
Limited

DECISION

The application was filed on 18 December 1990 with a priority date of 18 December 1989 so the unextended Section 20 period expires on 20 June 1994. At the substantive examination stage, objection was raised, inter alia, against amended claims filed with the agents' letter dated 7 March 1994 on the ground of lack of inventive step under Section 1(1)(b) of the Act (official letter dated 30 March 1994).

Further amendment stages having failed to resolve the inventive step issue and expiry of the Section 20 period being imminent, a hearing was appointed for 17 June 1994. Subsequently the agents notified the Office that they would not attend the hearing. I shall therefore determine the inventive step issue on the basis of the documents at present on file.

The invention relates to an Otto-cycle engine with a rotary valve mounted in the induction passage to control the effective compression ratio of the engine so as to improve its thermal efficiency while avoiding knock. Valve control is effected to maintain maximum effective compression ratio without knock using a knock sensor or a system for forecasting the onset of knock.

In their last letter (dated 9 June 1994) dealing with the inventive step objection, the agents filed a revised set of claims of which claim 1 is the broadest and reads as follows:-

An Otto-cycle engine having an induction passage;
a rotary valve mounted in the induction passage and having a valve actuating timing-adjusting device, the valve being moveable to closed condition prior to the bottom

dead centre of an induction stroke to set an expansion ratio of the engine at from 11:1 to 16:1, said expansion ratio being higher than the effective compression ratio set under full load conditions; and a combustion knock sensing means acting to sense combustion knock at the commencement thereof and for generating an output signal at the commencement of combustion knock, the valve actuating timing adjusting device acting in use to advance the timing at which the rotary valve is closed, in response to an output signal from the sensing means, to adjust the compression ratio of the engine to a value close to the critical value at which combustion knock occurs.

Claims 2 and 3 are appendant to claim 1 and specify alternative knock sensing means, claim 2 specifying a knock sensor, and claim 3, one or more sensors from a group comprising an engine water temperature sensor, an engine speed sensor, an accelerator sensor and an oxygen sensor, which in use monitors the operating conditions of the engine, to facilitate knock forecasting. Claim 4 is an independent claim and comprises the features of claim 1 with the of the knock forecasting means of claim 3, the valve being controlled in response to signals from at least one of the knock sensing means and knock forecasting means. Finally, claim 5 is an omnibus claim.

During the amendment stages, in official letters dated 22 November 1993 and 30 March 1994, the examiner raised and pursued inventive step objections on the grounds that citations showed that the rotary valve arrangement itself was known, controlling the rotary valve arrangement in dependence on knock or engine operating conditions related to knock were also known and there was nothing inventive in applying the construction and control procedure to known higher expansion ratio engines.

Referring to the citations:-

US 4426985 (having the same inventor as the present application) discloses a similar construction to that described in the present application using a knock sensor to control the rotary valve but only referring to an expansion ratio of 10:1.

GB 2122251 describes the control of a similar valve arrangement in accordance with engine conditions related to knock.

With regard to the expansion ratios specified in the claim, the examiner, in the official letter dated 30 March 1994, commented that "compression ratios and thus expansion ratios of at least 12:1 in Otto-cycle engines are well known" and cited as examples GB 1548709 and WO 89/00643, the former referring to a ratio of 17:1 and the latter to a ratio range from 12 to 20.

In their responses to the inventive step objection (letters dated 7 March 1994, 10 May 1994 and 9 June 1994), as I understand them, the agents have presented the following arguments against the above citations:-

US 4426985 discloses an engine with a fixed expansion ratio but teaches nothing regarding such a high expansion ratio as from 11:1 to 16:1.

GB 2122251 is entirely different from the present invention in both object and structure.

GB 1548709 and WO 89/00643 are concerned with different constructions and modes of control from the present invention.

Turning to the relevant sections of the Act, Section 1(1)(b) requires the invention to involve an inventive step and Section 3 states that an invention shall be taken to involve an inventive step if it is not obvious to a person skilled in the art.

With the inventive step requirements of the Act in mind and considering claim 1, US 4426985, in my view, discloses all of the features of the claim except the specified range of expansion ratios. The agents have argued that the US document does not teach its application to higher expansion ratio engines but I am satisfied that the examiner has demonstrated, with the GB 1548789 and WO documents, that such engines are known in the art and, in my

view, it would be obvious to the man skilled in the art to apply the teaching of the US document to such engines. I therefore find that claim 1 lacks an inventive step.

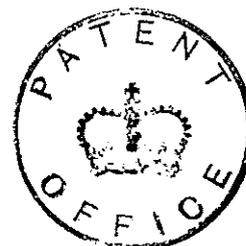
Turning to claim 2, the US citation describes knock sensing means in the form of a knock sensor so I also find that this claim lacks an inventive step on the same grounds as claim 1.

Moving on to claim 3, I am satisfied that the examiner has demonstrated that the use of knock forecasting sensors as specified in the claim is known, for example as disclosed in GB 2122251, and therefore I find that this claim also lacks an inventive step.

Finally, turning to claim 4, as this claim appears to be effectively a combination of claims 1 and 3, I find that it also lacks an inventive step.

In the result, I find that the application fails to comply with Section 1(1)(b) of the Act. Accordingly, I hereby refuse the application under Section 18(3).

Dated this 29 day of JUNE 1994



K C THOMAS
Principal Examiner, acting for the Comptroller

THE PATENT OFFICE

