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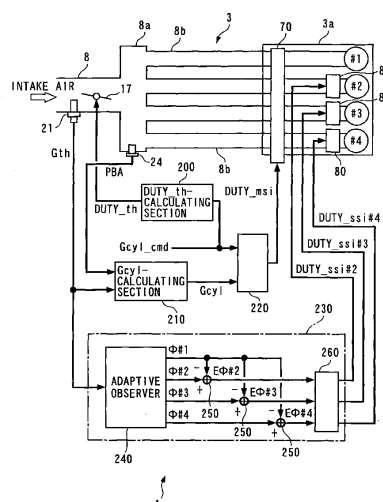
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(54) **Control system for internal combustion engine**

(57) A control system for an internal combustion engine, which is capable of reducing exhaust emissions during and after the start of the engine. A control system is capable of changing the valve-closing timing of intake valves relative to the valve-opening timing thereof as desired using a variable intake valve actuation assembly. The control system includes an ECU. The ECU sets a target auxiliary intake cam phase to a start value that sets the valve-closing timing of the intake valves to retarded-closing timing, during starting of the engine, and to a catalyst warmup value that sets the same to timing closer to timing in the Otto cycle operation, during catalyst warmup control after the start of the engine.

FIG. 22





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EUROPEAN SEARCH REPORT

Application Number
EP 04 01 2784

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X	JP 2001 263050 A (DENSO CORP) 26 September 2001 (2001-09-26) * abstract *	7	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 24 April 2008	Examiner Pileri, Pierluigi
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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European Patent
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 24 April 2008	Examiner Pileri, Pierluigi
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (F04C01)

**CLAIMS INCURRING FEES**

The present European patent application comprised at the time of filing more than ten claims.

- ☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

- ☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.
- ☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:
- ☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:
- ☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).



The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-3,5,11,13,15

A control system for an internal combustion engine that is capable of changing valve-closing timing of an intake valve relative to valve-opening timing of an intake valve as desired by a variable intake valve timing device comprising intake valve timing-setting means for setting the valve-closing timing of the intake valve to retarded timing with respect to predetermined timing in which a compression ratio becomes equal to an expansion ratio in a combustion cycle of the engine, when it is determined by said start operation-determining means that the engine is in starting operation

2. claims: 4,6,16

A control system for an internal combustion engine that is capable of changing valve-opening timing of an exhaust valve relative to valve-closing timing of the exhaust valve as desired by a variable exhaust valve timing device,
the control system comprising
exhaust valve timing-setting means for setting the valve-opening timing of the exhaust valve to retarded timing with respect to predetermined timing in which a compression ratio becomes equal to an expansion ratio in a combustion cycle of the engine, when it is determined by said start operation-determining means that the engine is in starting operation

3. claims: 7-9,10,12,14,17

A control system for an internal combustion engine that has a catalytic converter provided in an exhaust passage, for reducing emissions of exhaust gases, and is capable of changing an amount of intake air as desired by a variable intake air amount device, and capable of changing valve-opening timing of an exhaust valve relative to valve-closing timing of the exhaust valve by a variable exhaust valve timing device comprising
exhaust valve timing-setting means for setting the valve-opening timing of the exhaust valve to advanced timing with respect to predetermined timing in which a compression ratio becomes equal to an expansion ratio in a combustion cycle of the engine, when it is determined that the catalyst warmup control should be carried out

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 04 01 2784

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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24-04-2008

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