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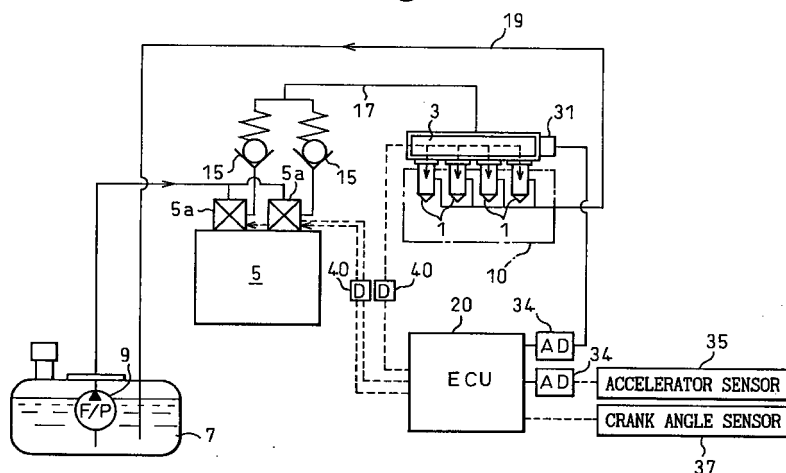
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(54) **A fuel injection system for an internal combustion engine**

(57) Fuel injection valves (1) of the engine (10) are connected to the common rail (3). The high pressure fuel pump (5) supplies pressurized fuel to the common rail (3). The electronic control unit (ECU) (20) determines whether one or more of the fuel injection valves has failed. When one or more of the fuel injection valves is determined as having failed, the ECU stops the high pressure fuel pump and injects fuel from all of the fuel

injection valves including the fuel injection valve determined as being failed. Since the fuel remained in the common rail is expelled from the common rail through, not only the failed fuel injection valve, but also other fuel injection valves, the common rail is depressurized in a short time and, thereby, the abnormal fuel injection from the failed fuel injection valve stops in a short time.

**Fig.1**





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# EUROPEAN SEARCH REPORT

Application Number  
EP 98 10 2890

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                 |                                                     |                                                 |
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| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                 | 1,8                                                 |                                                 |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                 |                                                     |                                                 |
| Place of search<br>THE HAGUE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                 | Date of completion of the search<br>20 January 2000 | Examiner<br>De Vita, D                          |
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# EUROPEAN SEARCH REPORT

Application Number  
EP 98 10 2890

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                  |                                                            |                                              |
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| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                  |                                                            | TECHNICAL FIELDS<br>SEARCHED (Int.Cl.6)      |
| Place of search<br><b>THE HAGUE</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                  | Date of completion of the search<br><b>20 January 2000</b> | Examiner<br><b>De Vita, D</b>                |
| <p><b>CATEGORY OF CITED DOCUMENTS</b></p> <p>X : particularly relevant if taken alone<br/>Y : particularly relevant if combined with another document of the same category<br/>A : technological background<br/>O : non-written disclosure<br/>P : intermediate document</p> <p>T : theory or principle underlying the invention<br/>E : earlier patent document, but published on, or after the filing date<br/>D : document cited in the application<br/>L : document cited for other reasons<br/>-----<br/>&amp; : member of the same patent family, corresponding document</p> |                                                                                                                                                                                                  |                                                            |                                              |

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European Patent  
Office

Application Number

EP 98 10 2890

### 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:



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**LACK OF UNITY OF INVENTION  
SHEET B**

Application Number  
EP 98 10 2890

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: 1-4

Common Rail with depressurating means in case of fuel injection valves failure.

2. Claims: 5-9

Common Rail system with failure determining means using fuel injection pressure changes as criteria for determination of system failure.

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

EP 98 10 2890

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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