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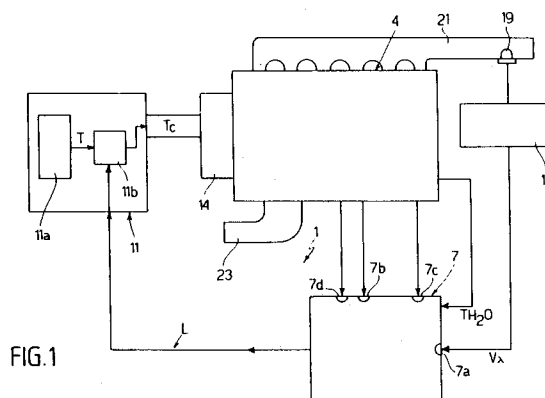
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**I-10121 Torino (IT)**(54) **Electronic system for calculating fuel mixture ratio for an internal combustion engine.**

(57) System for calculating mixture strength in which an electronic panel (7) is capable of comparing the voltage generated by exhaust gas sensors, in particular from a lambda probe (19) located in the exhaust manifold (21) of a petrol engine (4), with a threshold value ( $S_{tr}$ ) such as to distinguish between a first and a second state (rich state/lean state), corresponding to an air/petrol mixture supplied to the engine which contains more or less petrol, respectively, than is required by the stoichiometric ratio. The system enables this threshold to be updated periodically.

**EP 0 657 637 A3**



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## EUROPEAN SEARCH REPORT

Application Number  
EP 94 11 7678

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                              |                                                  |                                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|----------------------------------------------|
| Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Citation of document with indication, where appropriate, of relevant passages                                                                                                                                | Relevant to claim                                | CLASSIFICATION OF THE APPLICATION (Int.Cl.6) |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | US-A-4 459 669 (CHUJO ET AL)                                                                                                                                                                                 | 1,9,10,12,14,16                                  | F02D41/14                                    |
| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | * column 2, line 1 - column 5, line 65 *<br>---                                                                                                                                                              | 4-6,19                                           |                                              |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | US-A-4 491 921 (SUGIXAMA ET AL)                                                                                                                                                                              | 1,9,10,12,14,16                                  |                                              |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | * column 2, line 51 - column 7, line 56 *<br>---                                                                                                                                                             | 2,3,5,6                                          |                                              |
| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | EP-A-0 047 968 (HITACHI LTD)<br>* page 3, line 17 - page 4, line 8 *<br>* page 13, line 21 - page 14, line 17 *<br>* page 21, line 20 - page 24, line 12 *<br>* page 25, line 10 - page 28, line 13 *<br>--- | 4-6                                              |                                              |
| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | FR-A-2 592 685 (REGIE NATIONALE DES USINES RENAULT)<br>* page 2, line 33 - page 3, line 15 *<br>* page 6, line 18 - line 22; claims 1,4 *<br>---                                                             | 19                                               |                                              |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | US-A-4 359 029 (FURUHASHI ET AL)<br>* the whole document *<br>---                                                                                                                                            | 1-6                                              | TECHNICAL FIELDS<br>SEARCHED (Int.Cl.6)      |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | GB-A-2 184 265 (FUJI JUKOGYO KABUSHIKI KAISHA)<br>* the whole document *<br>---                                                                                                                              | 4-7                                              | F02D                                         |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | US-A-4 844 038 (YAMATO ET AL.)<br>* column 5, line 55 - column 8, line 15; figure 4 *<br>---                                                                                                                 | 8                                                |                                              |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | US-A-4 502 443 (HASEGAWA ET AL.)<br>* the whole document *<br>---                                                                                                                                            | 11,15                                            |                                              |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | GB-A-2 103 845 (HONDA GIKEN KOGYO KK.)<br>* the whole document *<br>---                                                                                                                                      | 11,15                                            |                                              |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | EP-A-0 423 792 (JAPAN ELECTRONIC CONTROL SYSTEMS CO.,LTD.)<br>-----                                                                                                                                          |                                                  |                                              |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                              |                                                  |                                              |
| Place of search<br>THE HAGUE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                              | Date of completion of the search<br>19 July 1995 | Examiner<br>Moualed, R                       |
| <b>CATEGORY OF CITED DOCUMENTS</b><br>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<br>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>& : member of the same patent family, corresponding document |                                                                                                                                                                                                              |                                                  |                                              |



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## CLAIMS INCURRING FEES

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

- ☐ All claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for all claims.
- ☐ Only part of the claims fees 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 claims:
- ☐ 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 requirement 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.
- ☐ 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 respects of which search fees have been paid, namely claims:
- ☐ None of the further search fees has 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:



## LACK OF UNITY OF INVENTION

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

The description of the above mentioned application is lacking in unity.

A distinction has to be made between the following subjects:

1. Claims 1-3 : Fuel injection system with closed loop correction and modifiable exhaust gas sensor signal threshold with means for modifying that threshold
2. Claims 1,4-18 : Fuel injection system with closed loop correction and modifiable exhaust gas sensor signal threshold with enabling means for transiting to different states by counting engine strokes including access to means defining a state of malfunction
3. Claims 1,19 : Fuel injection system with closed loop correction and modifiable exhaust gas sensor signal threshold with means for variably increasing the percentage of petrol in the mixture depending on the transition time of the sensor output between two given reference values

The attached search report has been drawn up for the first subject.