



(12) **EUROPEAN PATENT APPLICATION**

(88) Date of publication A3:  
**19.05.2010 Bulletin 2010/20**

(51) Int Cl.:  
**F02N 15/06<sup>(2006.01)</sup> F02N 11/00<sup>(2006.01)</sup>**

(43) Date of publication A2:  
**10.06.2009 Bulletin 2009/24**

(21) Application number: **08020899.4**

(22) Date of filing: **02.12.2008**

(84) Designated Contracting States:  
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT RO SE SI SK TR**  
Designated Extension States:  
**AL BA MK RS**

(72) Inventor: **Niimi, Masami**  
**Kariya-city**  
**Aichi-pref. 448-8661 (JP)**

(30) Priority: **05.12.2007 JP 2007314786**

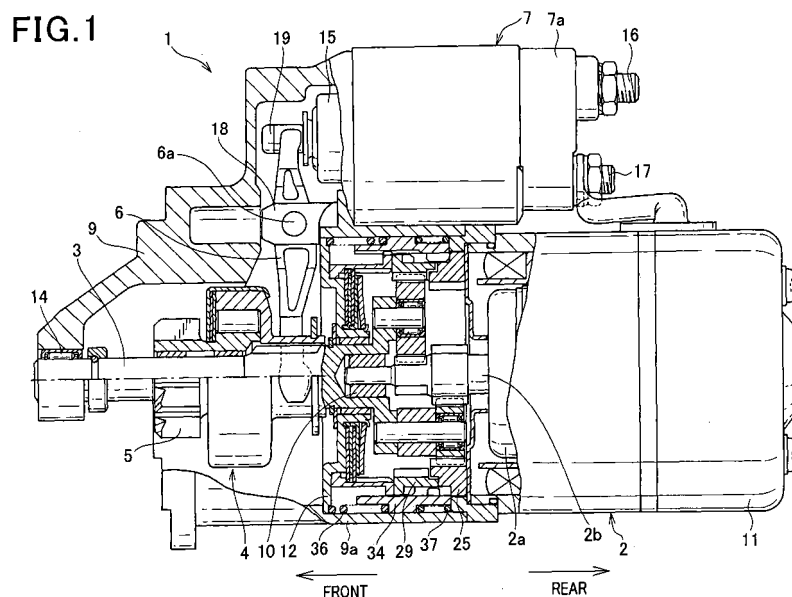
(74) Representative: **Kuhnen, Rainer K.**  
**Kuhnen & Wacker**  
**Patent- und Rechtsanwaltsbüro**  
**Prinz-Ludwig-Strasse 40A**  
**85354 Freising (DE)**

(71) Applicant: **DENSO CORPORATION**  
**Kariya-city,**  
**Aichi-pref. 448-8661 (JP)**

(54) **Starter having two planetary speed reducers with different speed reduction ratios**

(57) A starter (1) is disclosed which includes a speed reducer assembly and a speed reduction ratio shifter (34, 36, 37). The speed reducer assembly includes first and second planetary speed reducers respectively having first and second speed reduction ratios. The speed reduction ratio shifter shifts the speed reduction ratio of the speed reducer assembly between the first and second speed reduction ratios. The speed reduction ratio shifter

includes a gear engaging member (34) and a driver. The driver includes a first spring (36) made of a shape memory alloy and a second spring (37) made of an ordinary spring material, which are respectively disposed on opposite sides of the gear engaging member in the axial direction of an armature shaft (2b). The driver drives the gear engaging member to move in the axial direction by using the difference between restoring forces of the first and second springs.





## EUROPEAN SEARCH REPORT

Application Number  
EP 08 02 0899

| DOCUMENTS CONSIDERED TO BE RELEVANT  |   |  |   |
|--|---|--|---|
| Category   | Citation of document with indication, where appropriate, of relevant passages   | Relevant to claim                                | CLASSIFICATION OF THE APPLICATION (IPC) |
| A  | US 2004/093967 A1 (SHIGA TSUTOMU [JP] ET AL) 20 May 2004 (2004-05-20)<br>* figure 14 *<br>* paragraphs [0011] - [0014] *<br>* paragraph [0054] *<br>----- | 1-8  | INV.<br>F02N15/06<br>F02N11/00          |
| A  | US 6 409 622 B1 (BOLZ MARTIN-PETER [DE] ET AL) 25 June 2002 (2002-06-25)<br>* figure 6 *<br>* column 7, lines 66-67 *<br>* claims 1,7 *<br>-----          | 1-8  |   |
| A  | EP 0 582 429 A1 (FORD MOTOR CO [US]) 9 February 1994 (1994-02-09)<br>* the whole document *<br>-----  | 1-8  |   |
| A,D  | JP 61 282650 A (TAKAHASHI TAKASHI) 12 December 1986 (1986-12-12)<br>* abstract *<br>-----   | 1-8  |   |
|  |   |  | TECHNICAL FIELDS SEARCHED (IPC)         |
|  |   |  | F02N                                    |
| The present search report has been drawn up for all claims   |   |  |   |
| Place of search<br>The Hague   |   | Date of completion of the search<br>7 April 2010 | Examiner<br>Parmentier, Hélène          |
| CATEGORY OF CITED DOCUMENTS<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>& : member of the same patent family, corresponding document |   |  |   |

1  
EPO FORM 1503 03.82 (P04C01)

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

EP 08 02 0899

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  
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

07-04-2010

| Patent document<br>cited in search report |    | Publication<br>date |      | Patent family<br>member(s) |  | Publication<br>date |
|---|----|---------------------|------|----------------------------|--|---------------------|
| US 2004093967                             | A1 | 20-05-2004          | CN   | 1502798 A                  |  | 09-06-2004          |
|   |    |                     | EP   | 1426611 A1                 |  | 09-06-2004          |
|   |    |                     | JP   | 2004218627 A               |  | 05-08-2004          |
|   |    |                     | KR   | 20040044362 A              |  | 28-05-2004          |
| -----                                     |    |                     |      |                            |  |                     |
| US 6409622                                | B1 | 25-06-2002          | BR   | 9906923 A                  |  | 10-10-2000          |
|   |    |                     | WO   | 0029744 A1                 |  | 25-05-2000          |
|   |    |                     | EP   | 1047874 A1                 |  | 02-11-2000          |
|   |    |                     | JP   | 2002530570 T               |  | 17-09-2002          |
| -----                                     |    |                     |      |                            |  |                     |
| EP 0582429                                | A1 | 09-02-1994          | CA   | 2101606 A1                 |  | 07-02-1994          |
|   |    |                     | JP   | 6159205 A                  |  | 07-06-1994          |
| -----                                     |    |                     |      |                            |  |                     |
| JP 61282650                               | A  | 12-12-1986          | NONE |                            |  |                     |
| -----                                     |    |                     |      |                            |  |                     |