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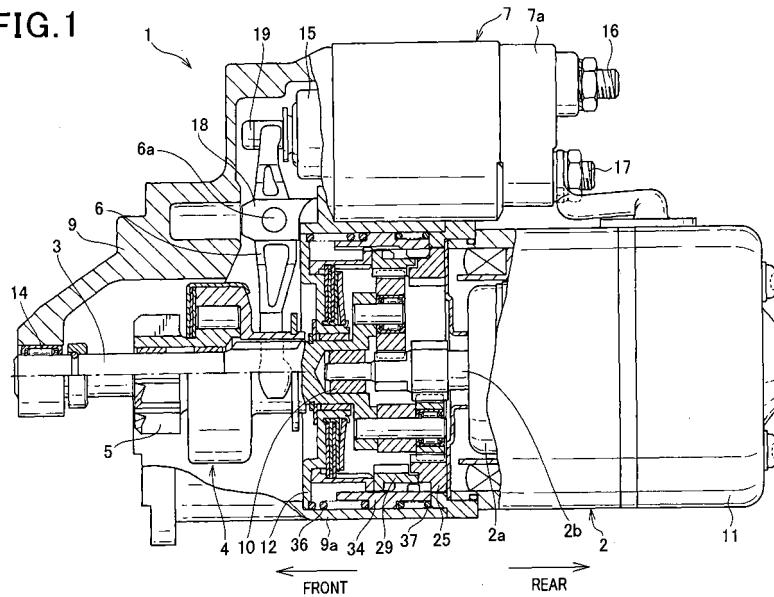
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(54) Starter having two planetary speed reducers with different speed reduction ratios

(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.

FIG. 1





EUROPEAN SEARCH REPORT

Application Number
EP 08 02 0899

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

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