(54) Title: LINEAR STEPPER MOTOR, MAGNETIZING FIXTURE, AND METHODS

(57) Abstract: In one preferred embodiment, a linear stepper motor (20), including; a stator structure (32); an axially extending, cylindrical, permanent magnet shaft (30) magnetically interacting with the stator structure (32); and the axially extending, cylindrical, permanent magnet shaft (30) having a smooth surface along a portion thereof with axially alternating radial N and S poles (34, 36) defined in the smooth surface. The present invention also provides a method of magnetizing the shaft of such a motor and a fixture (100) and method of manufacturing the fixture therefor. In another preferred embodiment of the invention, there is provided a shaft (200) for a linear stepper motor that can permit rotational motion. In yet another preferred embodiment of the invention, an "inside-out" motor (300) is provided in which the linearly moving member (314) is external to the stator structure (312).
(88) Date of publication of the international search report:
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.
INTERNATIONAL SEARCH REPORT  
International application No.  
PCT/US02/05028

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) :H02K 41/00  
US CL. : 310/12  
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
U.S. : 310/12, 13, 14; 29/396, 398; 384/625; 148/103, 105, 108

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database consulted during the international search (name of database and, where practicable, search terms used)
USPTO BRS  
search terms: linear, motor, shaft, rod, cylinder, bearing  
search terms: bearing, surface, motor, disk

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>US 5,955,798 A (ISHIYAMA et al) 21 September 19999 (21.09.1999), col 2 lines 57-col 3 line 7, col. 3 lines 50-54, figure 2.</td>
<td>1-8, 10, 11, 13-16, 18 and 20</td>
</tr>
<tr>
<td>Y</td>
<td>US 4,504,750 A (ONODERA et al) 12 March 1985 (12.03.1985), col. 6 lines 20-42.</td>
<td>1-8, 10, 11, 13-16, 18 and 20</td>
</tr>
<tr>
<td>Y</td>
<td>US 4,607,197 A (CONRAD) 19 August 1986 (19.08.1986), see the abstract and figure 2.</td>
<td>1-8, 10, 11 and 13-20</td>
</tr>
<tr>
<td>Y</td>
<td>US 5,179,304 A (KENJO et al) 12 January 1993 (12.01.1993), see col. 4 lines 13-22.</td>
<td>1-8, 10, 11 and 13-20</td>
</tr>
</tbody>
</table>

Further documents are listed in the continuation of Box C.  

See patent family annex.

* A  document defining the general state of the art which is not considered to be of particular relevance
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* &  document member of the same patent family

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