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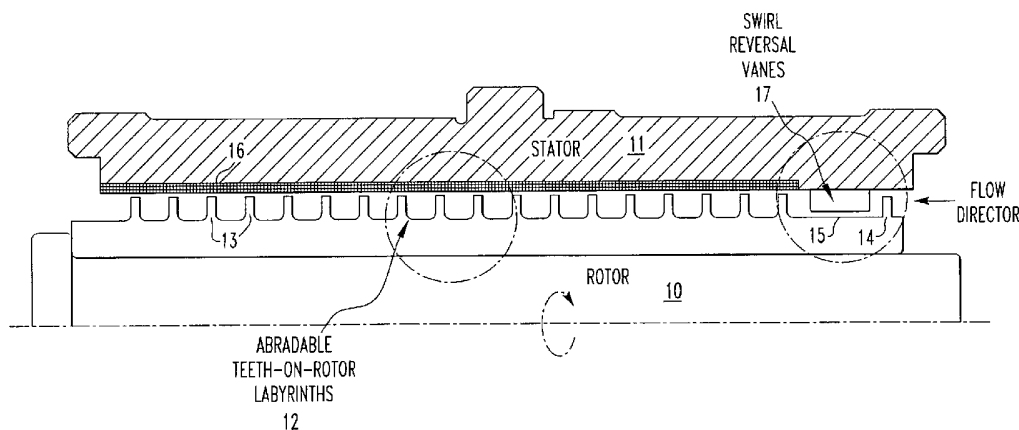
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(54) Title: SWIRL-REVERSAL ABRADABLE LABYRINTH SEAL



(57) Abstract: An apparatus for restricting axial flow through the clearance between a rotating shaft and a seal stator comprises an abrasion labyrinth seal and swirl-reversal vanes upstream of the labyrinth seal. The shaft comprises a first toothed axial section having a plurality of annular teeth, a second upstream toothed axial section having a few annular teeth from one to three, and a section therebetween having a cylindrical surface of diameter less than the outer edge of the teeth of the toothed sections, the swirl-reversing vanes being fastened to the stator seal between the toothed sections.

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/19496

<p>A. CLASSIFICATION OF SUBJECT MATTER IPC(7) : F16J 15/40, 15/447; F01D 11/00, 1/02 US CL : 277/347, 409-416, 418-421; 415/208.2, 171.1, 191 According to International Patent Classification (IPC) or to both national classification and IPC</p>																										
<p>B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) U.S. : 277/347, 409-416, 418-421; 415/208.2, 171.1, 191</p> <p>Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched</p> <p>Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)</p>																										
<p>C. DOCUMENTS CONSIDERED TO BE RELEVANT</p> <table border="1"> <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>X --- Y</td> <td>US 4,273,510 A (AMBROSCH et al) 16 June 1981 (16.06.1981), column 4, line 67 to column 5, line 12. Also see Figures 7-8.</td> <td>1-2 ----- 1-6</td> </tr> <tr> <td>X --- Y</td> <td>US 4,370,094 A (AMBROSCH et al) 25 January 1983 (25.01.1983), entire document</td> <td>1 ----- 1-6</td> </tr> <tr> <td>Y</td> <td>US 5,967,746 A (HAGI et al) 19 October 1999 (19.10.1999), see Figure 1.</td> <td>1-6</td> </tr> <tr> <td>A</td> <td>US 881,474 A (JUDE) 10 March 1908 (10.03.1908), see entire document</td> <td>1-6</td> </tr> <tr> <td>A</td> <td>US 3,575,523 A (GROSS, JR.) 20 April 1971 (20.04.1971), see Figures 1-3.</td> <td>1-6</td> </tr> <tr> <td>A</td> <td>US 2,963,307 A (ROBO) 06 December 1960 (06.12.1960), see Figures 3-4.</td> <td>1-6</td> </tr> <tr> <td>A</td> <td>US 4,420,161 A (MILLER) 13 December 1983 (13.12.1983), see entire document.</td> <td>1-6</td> </tr> </tbody> </table>			Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X --- Y	US 4,273,510 A (AMBROSCH et al) 16 June 1981 (16.06.1981), column 4, line 67 to column 5, line 12. Also see Figures 7-8.	1-2 ----- 1-6	X --- Y	US 4,370,094 A (AMBROSCH et al) 25 January 1983 (25.01.1983), entire document	1 ----- 1-6	Y	US 5,967,746 A (HAGI et al) 19 October 1999 (19.10.1999), see Figure 1.	1-6	A	US 881,474 A (JUDE) 10 March 1908 (10.03.1908), see entire document	1-6	A	US 3,575,523 A (GROSS, JR.) 20 April 1971 (20.04.1971), see Figures 1-3.	1-6	A	US 2,963,307 A (ROBO) 06 December 1960 (06.12.1960), see Figures 3-4.	1-6	A	US 4,420,161 A (MILLER) 13 December 1983 (13.12.1983), see entire document.	1-6
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<p>Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201</p>		<p>Authorized officer <i>[Signature]</i> Vishal Patel Telephone No. 571-272-7060</p>																								