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(54) INTERNALLY CURVED LOW-SPEED HIGH-TORQUE HYDRAULIC MOTOR WITH TORQUE BEING OUTPUT BY MEANS OF ROTATION OF HOUSING

(57) Disclosed is an internally curved low-speed high-torque hydraulic motor with torque being output by means of the rotation of a housing. The hydraulic motor is composed of a left bearing block (1), a right end cover (7), a spacer ring (3), a cylinder body (4), an internally curved cam ring (2), an axial oil distribution pan (6) and a plurality of radially arranged plunger assemblies (5). The axial oil distribution pan (6) is axially arranged on one side of the cylinder body (4). The internally curved cam ring (2), the left bearing block (1), the spacer ring (3) and the right end cover (7) are connected in series via high-strength bolts so as to form a motor housing. The motor is composed of the fixed cylinder body (4) and the rotatable housing. The structure broadens the application fields of the internally curved low-speed high-torque hydraulic motor, optimizes the mechanical structure of a driving portion of the motor, reduces costs, and reduces transmission links so as to become a direct drive, eliminates low-speed crawling and increases stability and reliability during operation. Under acting forces of a spring and a balancing plunger provided in the axial oil distribution pan, contact surfaces between the axial oil distribution pan and the cylinder body can always be tightly fitted, thereby reducing internal leakage of the motor and prolonging the service life of the motor.

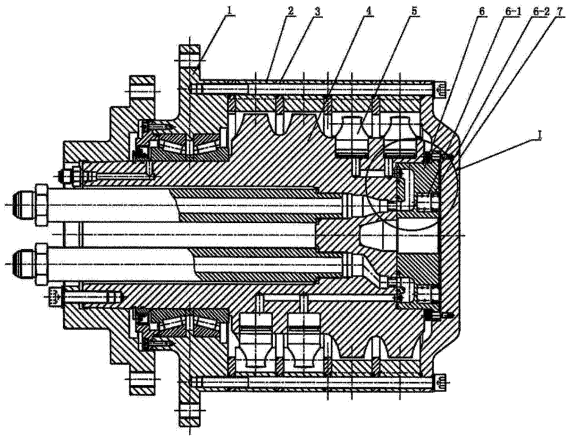

Fig. 1

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Description

Technical Field

[0001] The present invention relates to a low-speed high-torque hydraulic motor in the field of hydraulic motors, in particular to an internally curved low-speed high-torque hydraulic motor with torque being output by means of the rotation of a housing.

Background Art

[0002] With the fierce competition in the engineering vehicle market, how to reduce costs, improve vehicle performance and occupy the market is crucial. At present, the wheel drive hydraulic motor used in the engineering vehicle has two structures: one structure is a planetary reduction gearbox with a plunger hydraulic motor for driving the rotation of a housing; and the other is an internally curved hydraulic motor with a rotatable cylinder body (spindle) and a fixed motor housing. The first structure is not conducive to market competition due to its complicated structure, low efficiency, low speed crawling, and high failure rate; the second structure is an internally curved hydraulic motor with a rotatable cylinder body (spindle) and a fixed motor housing, thereby occupying a large space and having limited application in engineering vehicles. Therefore, how to increase the efficiency, decrease the failure rate, reduce the occupancy space and make the layout of the main machine more reasonable by improving the structure on the basis of ensuring the driving performance of the vehicle is a very meaningful subject in the art.

[0003] In the industries of ships, lifting equipment, and the like, a Viking motor is commonly used. The Viking motor also has the structure of a rotatable housing, but it has a different oil distribution mode in comparison with the internally curved motor with a rotatable housing. The Viking motor uses a radial oil distribution mode. During use, the oil distribution shaft seal ring or clearance seal may be worn out, thus causing failure of compensation after the clearance is large, and causing internal leakage and failure of normal operation. In the case of the same displacement and torque, the rated speed is low, and the internally curved hydraulic motor with a rotatable housing can be widely used in industries such as travelling construction machinery, ships, lifting equipment, etc.

Summary of the Invention

[0004] The main object of the present invention is to overcome the defects of the existing planetary reduction gearbox with a plunger hydraulic motor for driving the rotation of a housing, such as low efficiency, low-speed crawling, heavy weight, large size, and the like, and to overcome the defects of the internally curved hydraulic motor with a rotatable cylinder body spindle for outputting and a fixed housing, such as occupying a large space and having limited application. The present invention provides a novel structure of an internally curved low-speed high-torque hydraulic motor with torque being output by means of the rotation of a housing. The technical problem to be solved is to improve the structure so as to easily implement the technical performance required for the wheel driving of the engineering vehicle, thereby reducing defects and deficiencies caused by the structure of the wheel-driving traveling hydraulic motor in the existing engineering vehicle, which is quite suitable for practical use.

[0005] The following technical solutions are used for achieving the object of the present invention and solving the technical problem thereof. An internally curved low-speed high-torque hydraulic motor with torque being output by means of the rotation of a housing is provided according to the present invention, composed of a left bearing block, a right end cover, a spacer ring, a cylinder body, an internally curved cam ring, an axial oil distribution pan and a plurality of radially arranged plunger assemblies, wherein the internally curved cam ring, the left bearing block, the spacer ring and the right end cover form a motor housing; the motor housing with a split structure is formed by connecting the internally curved cam ring, the left bearing block, the spacer ring and the right end cover in series via high-strength bolts; the motor as a whole is combined by the fixed cylinder body and the rotatable motor housing; the motor housing rotates around the cylinder body, while the cylinder body is fixed; the axial oil distribution pan is axially arranged on one side of the cylinder body, and connected to an oil passage of the cylinder body through an oil passage. Plunger holes of the cylinder body are arranged in a single row or a plurality of rows depending on the magnitude of output torque, and the plurality of plunger assemblies are uniformly arranged in the plunger holes in a radial direction around the cylinder body.

[0006] The plurality of plunger assemblies are uniformly arranged in a radial direction around the cylinder body.

[0007] An internally curved low-speed high-torque hydraulic motor with output by means of the rotation of a housing is described above, wherein the axial oil distribution pan is provided therein with a spring and a balancing plunger, the balancing plunger is cup-shaped, the spring is against a cup bottom of the balancing plunger, and an outer surface of the cup bottom of the balancing plunger is in tight fit with the right end cover; under the action of acting forces and reacting forces, acting forces of the spring and the balancing plunger cause contact surfaces between the axial oil distribution pan and the cylinder body to be in close contact; when pressurized oil enters, the axial oil distribution pan relies on the acting forces of the spring and the balancing plunger together with the action of the pressurized oil to cause the contact surfaces between the axial oil distribution pan and the cylinder body to be always in tight fit; in the case of wear, the acting forces of the spring and the balancing plunger can be used to cause the contact surfaces between the

axial oil distribution pan and the cylinder body to maintain close contact, thereby compensating for the wear, compensating for the wear of the axial oil distribution pan, reducing internal leakage of the motor and prolonging the service life of the motor.

[0008] Compared with the prior art, the present invention has obvious advantages and beneficial effects. The present invention has at least the following advantages:

1. An internally curved low-speed high-torque hydraulic motor with torque being output by means of the rotation of a housing according to the present invention, due to the use of the structure of a rotatable housing, provides an effective approach to the application of the internally curved hydraulic motor to the engineering vehicle. Furthermore, the present invention also provides a new solution for the wheel driving mode of the engineering vehicle.

2. An internally curved low-speed high-torque hydraulic motor with torque being output by means of the rotation of a housing according to the present invention, due to the use of the structure of a rotatable housing, has the advantages of simpler structure, higher efficiency, higher stability at low speed, lighter weight, smaller size, easier manufacturing process, and lower failure rate than the planetary reduction gearbox of plunger hydraulic motor driving; and it has the advantages of smaller occupancy space, more beneficial layout of the main machine, and the like compared with the internally curved travelling hydraulic motor with a rotatable cylinder body and a fixed housing.

3. An internally curved low-speed high-torque hydraulic motor with torque being output by means of the rotation of a housing according to the present invention mainly differs from the Viking motor in the oil distribution mode. The Viking motor uses a radial oil distribution mode, but the disadvantage is that the oil distribution shaft seal ring or clearance seal may be worn out after a long time, and internal leakage may occur, thereby affecting the output torque of the motor and causing failure of normal use. The oil distribution mode of the present invention is an axial oil distribution mode, and has the spring, the balancing plunger and oil pressure in the axial oil distribution pan to compensate wear so that the service life of the motor is long.

[0009] The above description is only an overview of the technical solutions of the present invention. In order to have a clearer understanding of the technical means of the present invention, the present invention can be implemented in accordance with the contents of the description. In order to make the above and other objects, features and advantages of the present invention more obvious and understandable, preferred embodiments will be described in detail below with reference to the drawings.

Brief Description of the Drawings

[0010] In the present invention:

Fig. 1 is a structural schematic diagram of an internally curved low-speed high-torque hydraulic motor with torque being output by means of the rotation of a housing according to the present invention.

Fig. 2 is a left view of Fig. 1.

In which:

1: left bearing block 2: internally curved cam ring
3: spacer ring 4: cylinder body
5: plunger assembly

6: axial oil distribution pan
6-1: spring 6-2: balancing plunger
7: right end cover

Fig. 3 is a partial enlarged diagram of Fig. 1.

Detailed Description of Preferred Embodiments

[0011] In order to further illustrate the technical means and effects of the present invention for achieving the predetermined inventive object, the specific embodiments, structures, features and effects of an internally curved low-speed high-torque hydraulic motor with torque being output by means of the rotation of a housing provided according to the present invention will be described in detail below with reference to the drawings and preferred embodiments.

[0012] Referring to Figs. 1-3, an internally curved low-speed high-torque hydraulic motor with torque being output by means of the rotation of a housing according to preferred embodiments of the present invention is mainly composed of a cylinder body 4, a left bearing block 1, an internally curved cam ring 2, a spacer ring 3, an axial oil distribution pan 6, a right end cover 7, and a plurality of radially arranged plunger assemblies 5, wherein the internally curved cam ring 2, the left bearing block 1, the spacer ring 3 and the right end cover 7 form a motor housing; the motor housing with a split structure is formed by connecting the internally curved cam ring 2, the left bearing block 1, the spacer ring 3 and the right end cover 7 in series via high-strength bolts. The motor as a whole is combined by the fixed cylinder body 4 and the rotatable motor housing; the motor housing rotates around the cylinder body 4, while the cylinder body 4 is fixed. Plunger holes of the cylinder body 4 may be designed in a single row or a plurality of rows depending on the magnitude of output torque, and the plurality of plunger assemblies 5 are uniformly arranged in the plunger holes in a radial

direction around the cylinder body 4. Referring to Fig. 3, the axial oil distribution pan 6 is axially arranged on one side of the cylinder body 4, and connected to an oil passage of the cylinder body 4 through an oil passage. The axial oil distribution pan 6 is provided therein with a spring 6-1 and a balancing plunger 6-2, wherein the balancing plunger 6-2 is cup-shaped, the spring 6-1 is against a cup bottom of the balancing plunger 6-2, and an outer surface of the cup bottom of the balancing plunger 6-2 is in tight fit with the right end cover 7, thus under the action of acting forces and reacting forces, the spring force of the spring 6-1 can be used to cause the contact surfaces between the axial oil distribution pan 6 and the cylinder body 4 to be always in tight fit.

[0013] Referring to Figs. 1-3, both an oil inlet hole and an oil return hole are arranged on one end of the cylinder body 4; oil enters the axial oil distribution pan 6 from the center of the cylinder body 4 in the direction shown in the figures, and is distributed to the working chambers of the plunger assemblies 5 which are radially uniformly arranged in the cylinder body 4, and pushes the plunger assemblies 5 to move linearly. Under the action of pressure, the plunger assemblies 5 push the motor housing, which is composed of the internally curved cam ring 2, the left bearing block 1, the spacer ring 3 and the right end cover 7, to rotate. Under initial pressure, the axial oil distribution pan 6 relies on the acting forces of the spring 6-1 and the balancing plunger 6-2 to cause the contact surfaces between the axial oil distribution pan 6 and the cylinder body 4 to be always in tight fit; when pressurized oil enters, the axial oil distribution pan 6 relies on the joint action of the spring 6-1, the balancing plunger 6-2 and the pressurized oil to cause the contact surfaces between the axial oil distribution pan 6 and the cylinder body 4 to be in tight fit; in the case where wear occurs on the contact surfaces between the axial oil distribution pan 6 and the cylinder body 4, the acting forces of the spring 6-1 and the balancing plunger 6-2 are used to cause the axial oil distribution pan 6 and the cylinder body 4 to maintain close contact, thereby compensating for the wear, compensating for the wear of the axial oil distribution pan 6, reducing internal leakage of the motor and prolonging the service life of the motor.

[0014] Only preferred embodiments of the present invention are described above, and the present invention is not limited thereto in any way. Although the present invention has been disclosed above in the preferred embodiments, the present invention is not limited thereto. Any person skilled in the art can make some amendments or modifications to the technical contents disclosed above to obtain equivalent embodiments without departing from the technical scope of the present invention. However, any simple amendments, equivalent changes and modifications made to the above embodiments in accordance with the technical essence of the present invention shall still fall within the scope of the technical solutions of the present invention as long as the contents do not depart from the technical solutions of the present invention.

Claims

1. An internally curved low-speed high-torque hydraulic motor with torque being output by means of the rotation of a housing, comprising: a left bearing block (1), a right end cover (7), a cylinder body (4), an internally curved cam ring (2), a spacer ring (3), an axial oil distribution pan (6), and a plurality of radially arranged plunger assemblies (5), wherein the internally curved cam ring (2), the left bearing block (1), the spacer ring (3) and the right end cover (7) form a motor housing; the motor housing with a split structure is formed by connecting the internally curved cam ring (2), the left bearing block (1), the spacer ring (3) and the right end cover (7) in series via high-strength bolts; the motor as a whole is combined by the fixed cylinder body (4) and the rotatable motor housing; the motor housing rotates around the cylinder body (4), while the cylinder body (4) is fixed; the axial oil distribution pan (6) is axially arranged on one side of the cylinder body (4), and connected to an oil passage of the cylinder body (4) through an oil passage; plunger holes of the cylinder body (4) are designed in a single row or a plurality of rows depending on the magnitude of output torque, and the plurality of plunger assemblies (5) are uniformly arranged in the plunger holes in a radial direction around the cylinder body (4).

2. The internally curved low-speed high-torque hydraulic motor with torque being output by means of the rotation of a housing according to claim 1, wherein the axial oil distribution pan (6) is provided therein with a spring (6-1) and a balancing plunger (6-2), the balancing plunger (6-2) is cup-shaped, the spring (6-1) is against a cup bottom of the balancing plunger (6-2), and an outer surface of the cup bottom of the balancing plunger (6-2) tightly fits the right end cover (7); under the action of acting forces and reacting forces, acting forces of the spring (6-1) and the balancing plunger (6-2) cause contact surfaces between the axial oil distribution pan (6) and the cylinder body (4) to be always in tight fit; when pressurized oil enters, the axial oil distribution pan (6) relies on the joint action of the spring (6-1), the balancing plunger (6-2) and the pressurized oil to cause the contact surfaces between the axial oil distribution pan (6) and the cylinder body (4) to be always in tight fit; in the case where wear occurs, the acting forces of the spring (6-1) and the balancing plunger (6-2) are used to cause the contact surfaces between the axial oil distribution pan (6) and the cylinder body (4) to maintain close contact, thereby compensating for the wear, compensating for the wear of the axial oil distribution pan (6), reducing internal leakage of the motor.

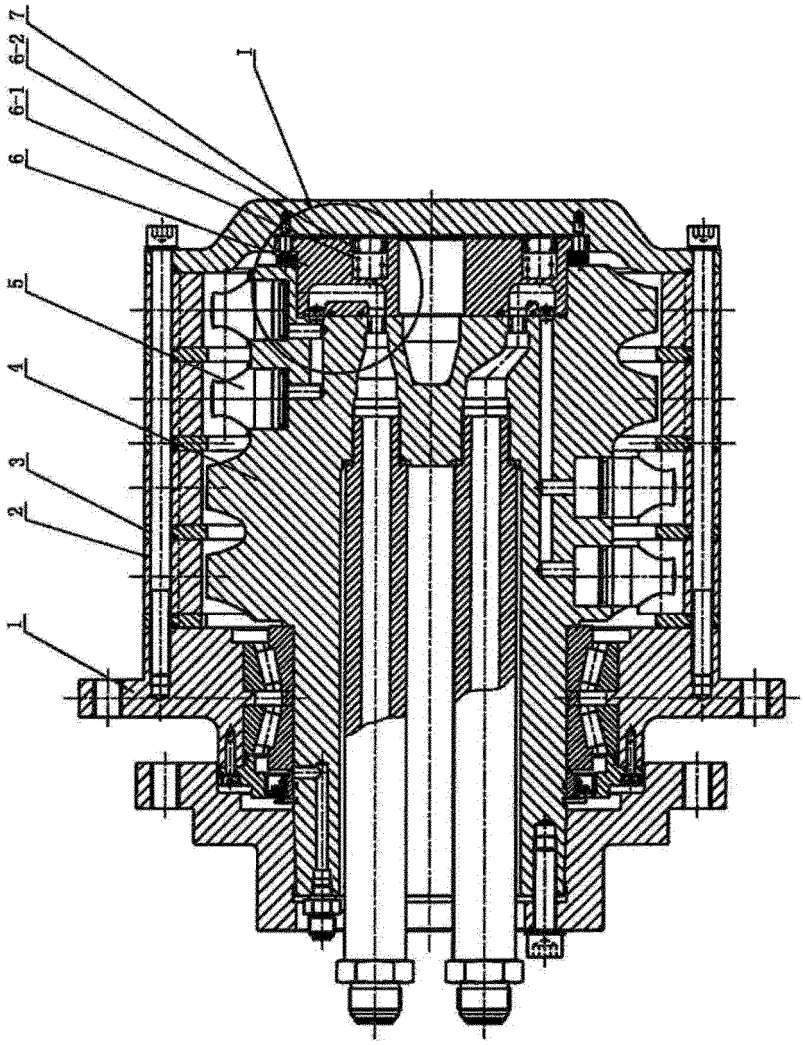

Fig. 1

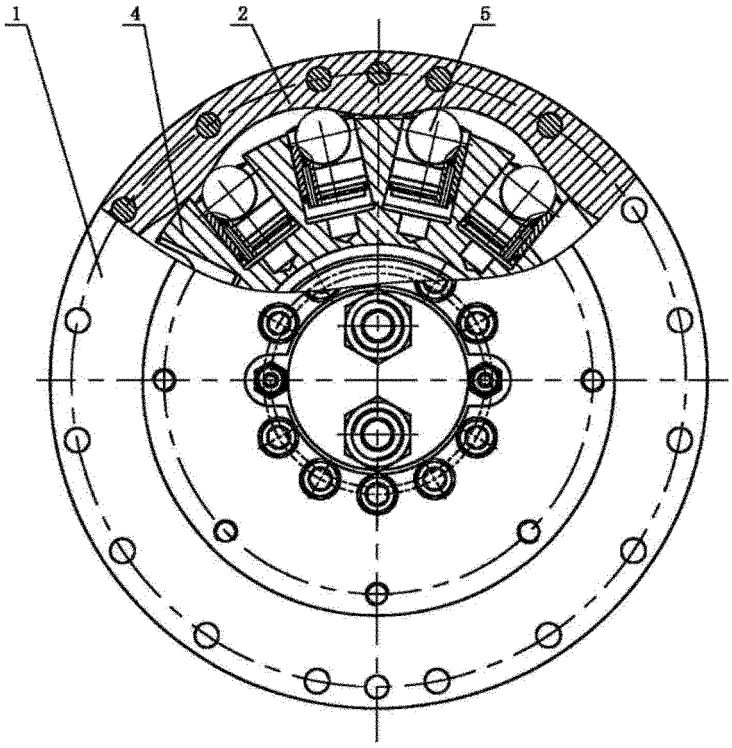

Fig. 2

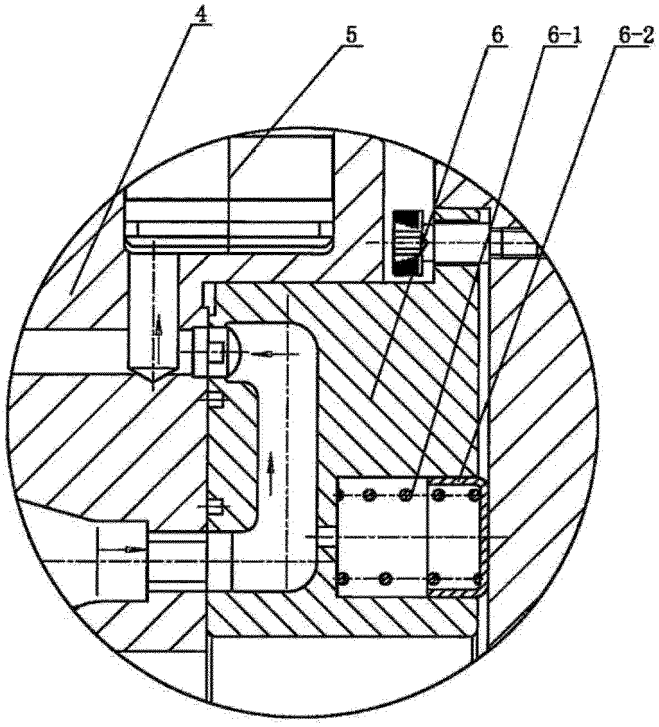

Fig. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2016/000642

A. CLASSIFICATION OF SUBJECT MATTER

F03C 1/00 (2006.01) i; F03C 1/08 (2006.01) i
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)

F03C; F16D

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
VEN, CNKI, CNABS, DWPI: 液压马达, 内曲线, 多作用, 径向, 柱塞, 活塞, 摩擦, 壳转, 转动, 旋转, hydraulic s motor?, radial, plunger?, piston?, friction, rotary, rotat+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 2619064 Y (ZHUZHOU COAL MINE MACHINERY PLANT), 02 June 2004 (02.06.2004), description, particular embodiments, and figures 1-5	1
A	CN 102493913 A (ZHOU, Wei), 13 June 2012 (13.06.2012), entire document	1-2
A	CN 202326004 U (NINGBO DECHEN HYDRAULIC TECHNOLOGY CO., LTD.), 11 July 2012 (11.07.2012), entire document	1-2
A	EP 0046691 A2 (STAFFA PRODS LTD.), 03 March 1982 (03.03.1982), entire document	1-2
A	GB 2400417 A (SAMPO HYDRAULICS OY), 13 October 2004 (13.10.2004), entire document	1-2

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
14 April 2017	09 August 2017
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Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2016/000642

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 2619064 Y	02 June 2004	None	
CN 102493913 A	13 June 2012	None	
CN 202326004 U	11 July 2012	None	
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Form PCT/ISA/210 (patent family annex) (July 2009)