April 18, 1961 M. P. H. COUTURIER 2,980,030

ROTARY VANE-TYPE HYDRAULIC MACHINE

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Fig. 1

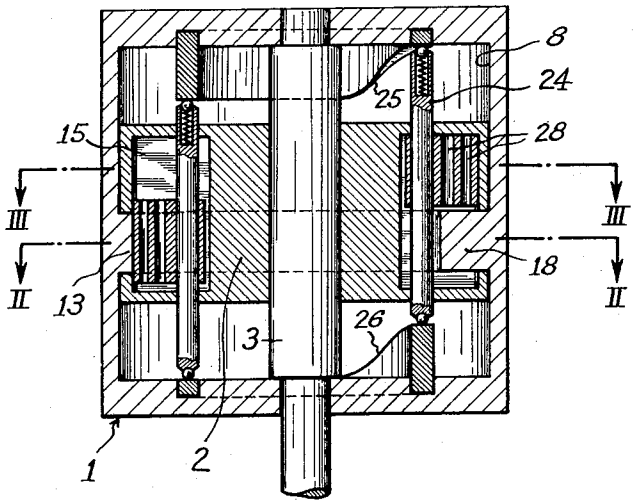
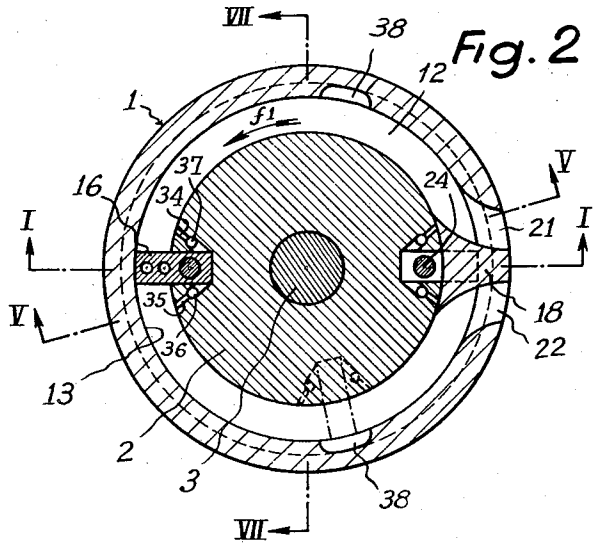


Fig. 2



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Fig. 3

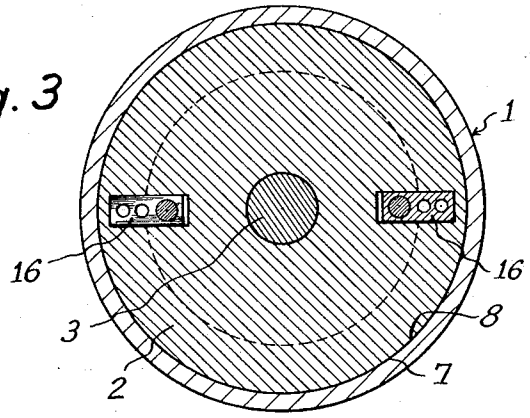


Fig. 4

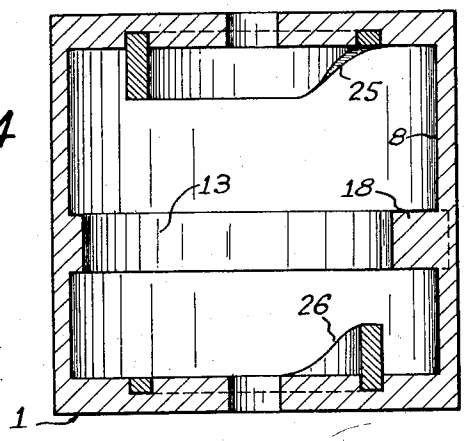
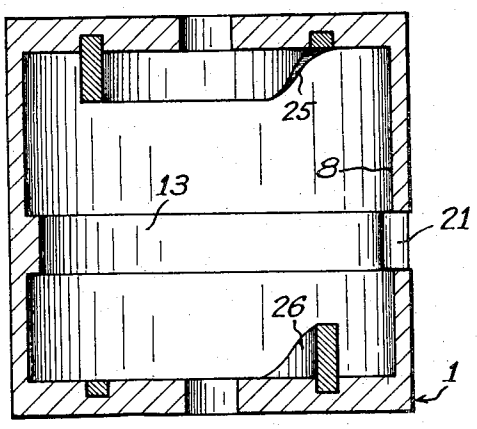


Fig. 5



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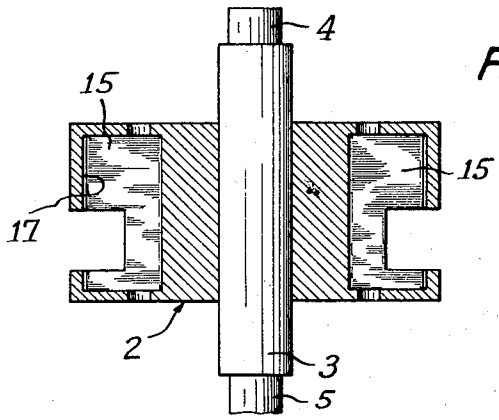


Fig. 6

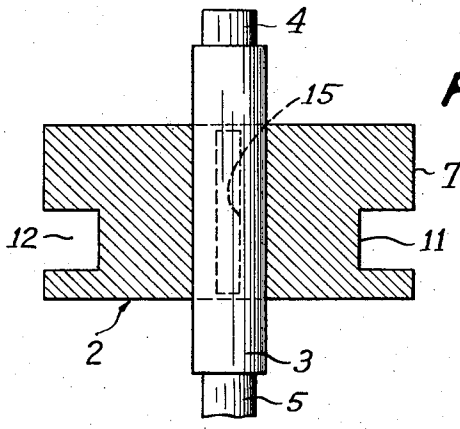


Fig. 7

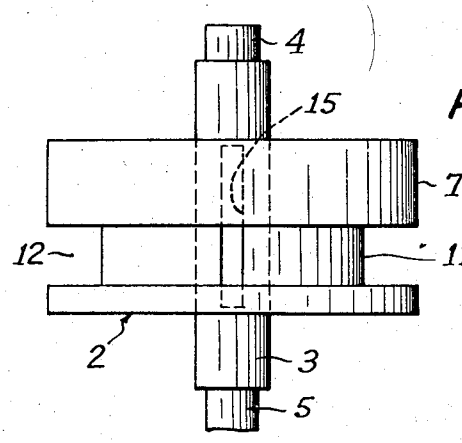


Fig. 8

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2,980,030

ROTARY VANE-TYPE HYDRAULIC MACHINE

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Claims priority, application France Sept. 6, 1955

3 Claims. (Cl. 103—139)

The present invention relates to a rotary vane-type hydraulic machine adapted to be operated either as a pump or as a hydraulic motor.

It is one object of the present invention to provide a hydraulic machine of the aforesaid type which is simple in construction, economical in its manufacture and reliable.

It is another object of the present invention to provide a rotary vane-type hydraulic machine wherein wear is localized on the outer edge of the vanes and does not interfere in any way with the efficiency and life of the machine.

It is a further object of the present invention to provide a rotary vane-type hydraulic machine in which the pressure prevailing in the recesses which contain the vanes does not interfere with the control of the vane movements.

With these and other objects of the prevent invention in view, which will become apparent in the following detailed description, the present invention will be clearly understood in connection with the accompanying drawings, in which:

Figure 1 is an elevational axial section along the lines I—I of Fig. 2 of one embodiment of a rotary vane-type hydraulic machine, according to the present invention;

Fig. 2 is a section along the lines II—II of Fig. 1;

Fig. 3 is a section along the lines III—III of Fig. 1;

Fig. 4 shows the stator only, as it appears in the axial section of Fig. 1;

Fig. 5 is a section of the stator along the lines V—V of Fig. 2;

Fig. 6 shows the rotor only, as it appears in the axial section of Fig. 1;

Fig. 7 is a section of the rotor only, along the lines VII—VII of Fig. 2; and

Fig. 8 is an elevational view of the rotor only, corresponding with the axial section shown in Fig. 7.

Referring now to the drawings, it should be stated first that the machine disclosed in the drawings is represented in a diagrammatical manner.

Broadly, the present machine comprises a stator **1** in which a rotor **2** is rotatably mounted. The rotor **2** is carried by a rotary shaft **3** journalled as at **4** and **5** in bearings of any conventional suitable type (not shown) mounted in the end walls of the stator **1**.

Both the stator **1** and the rotor **2** are bodies of revolution about the axis of the shaft **3**. The rotor **2** is adapted to rotate with its outer cylindrical surface **7** in sealing relation with the cylindrical bore **8** of the stator **1**. It is formed with an annular groove **11** of rectangular cross-section. The annular space confined between the walls of this annular groove and the corresponding portion of the stator bore forms an annular chamber **12** (see particularly Fig. 2). More precisely, the bore of the stator **1** has an annular ridge **13** protruding inwardly into the annular groove **11** of the rotor **2** only along a short radial portion of the depth of said groove, the axial

length of the stator ridge **13** being substantially equal with the width of the rotor groove **11**.

The rotor has a plurality of axial recesses **15** rectangular in cross-section and opening into the annular groove **11**, the embodiment shown in the drawing having two recesses **15**. A vane **16** of supplementary cross-section is slidably reciprocable in axial direction in each of the recesses **15**, so as to be moved either out of said recess for protrusion in sealing engagement into the annular groove **11** of the rotor **2**, or retraction into said recess. Furthermore, the distance of the lateral wall **17** of the recess **15** remote from the machine axis is substantially equal to the inner radius of the annular ridge **13** of the stator **1** in order to let the outer lateral edge of the vane **16** slide in sealing engagement with the bore of the stator ridge when said vane is protruding out of the recess **15** into the annular chamber **12**. Actually, the bore of the ridge and the lateral wall **17** of the recess **15** are accurately machined so as to leave a very thin clearance between the outer lateral edge of the vane **16** and the bore of the stator ridge in order to prevent any friction of the vane **16** against the stator **1** under the action of the centrifugal force being exerted upon the vane **16** during operation of the machine. In this manner, the stator **1** is not subjected to wear and the wear of the vane **16** has no detrimental effect upon the sealing engagement of the vane and the stator ridge, since the aforesaid clearance may be maintained substantially constant, provided the surface **17** of the rotor recess against which the vane slides is harder than the mating surface of the vane which, then, is the only surface subjected to frictional wear.

An abutment **18** is rigid with the stator **1** in the path of movement of the protruding vane **16** and extends radially in sealing engagement into the annular groove **11** of the rotor. On either side of this abutment **18**, an inlet port **21** and an outlet port **22** provide, respectively, for entrance and exit of a fluid into and out of the annular chamber **12**.

Each vane **16** is actuated by a cam device comprising a cam-follower **24** consisting of a rod rigid with the vane **16** and slidably mounted in axial direction throughout the end walls of the rotor **2**. One end of the rod **24** is in engagement with an annular cam **25** rigid with the corresponding end wall of the stator **1**, while the other end of the rod **24** is in engagement with a further annular cam **26** rigid with the opposite end wall of the stator **1**. The raised portion of the cam **26** is so positioned with respect to the abutment **18**, that as the rotor **2** is rotating and the vane **16** approaches this abutment, the raised portion pushes the rod **24** and the vane **16** rigid therewith in the direction which forces the vane **16** to a retracted position into the recess, so that the vane may pass the abutment as shown in the right-hand portion of Fig. 1.

The raised portion of the cam **25** is complementary to the raised portion of cam **26**, i.e. it forces the vane **16** out of the rotor recess into the annular chamber **12**, which is visible in the left-hand portion of Fig. 1. The angular extension of the cams is arranged in such a manner that the axial movement of the vanes **16** takes place during about one sixth of a revolution of the rotor **2**.

Channels **28** extend throughout each vane **16** in a direction parallel with the direction of the reciprocating movement of the vane **16** in the rotor, in order to equalize the pressure between the bottom of the recess **15** and the vane **16** and the pressure which prevails out of the recess, so as to allow the vane **16** to reciprocate freely.

The position of the vane **16**, in relation to the wall against which it turns, is assured by engagement of the vane **16** with one or more surfaces which are connected with the member carrying the vane **16**. This engage-

ment is achieved by the pressure which is present in the bearing for the vane 16 and which remains always equal to the highest pressure of the chamber 12 in the machine due to conduits 34 and 35 provided in the rotor 2 and valves 36 and 37, respectively, arranged in the respective conduits 34 and 35.

A discharge channel 38 is disposed in the wall of the chamber 12 and connected with the deflector and the pressure action, which brings about the engagement of the vane 16, ceases upon passing in front of the discharge channel 38.

The operation of the machine is as follows:

If it is assumed, that the rotor 2 of the pump is rotatably driven in the direction of the arrow f_1 (Fig. 2) fluid is sucked through the inlet port 21 into the chamber 12 and upon dropping of one of the vanes 16 into the chamber beyond the abutment 18, the fluid entrapped between two consecutive vanes in the chamber 12 is carried around to the outlet port 22 and upon the leading vane being raised above the abutment, this fluid is delivered out of the pump.

The machine may be operated as a hydraulic motor and deliver a torque upon pressure fluid being fed to one of the ports 21 or 22, the rotational direction of the rotor corresponding to the port into which the power fluid is admitted.

As many changes could be made in the above construction, and many widely different embodiments of this invention could be made without departing from the scope of the claims, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense, the scope of the present invention being determined by the objects and the claims.

I claim:

1. A rotary vane-type hydraulic machine comprising a stator having a cylindrical bore, a rotor rotatably mounted in sealing relation within said bore of said stator and having an annular groove defining with a complementary portion of said stator bore an annular chamber, the outer cylindrical wall of said chamber, formed by said complementary portion of said stator bore, having a diameter slightly smaller than the diameter of said cylindrical bore, thus forming an annular ridge engaging said rotor in said annular groove, said rotor having a recess opening into said annular groove, a vane disposed in said recess for movement in substantially axial direction either out of said recess for protrusion in sealing relation into said annular chamber or retraction into said recess, the lateral outer edge of said vane sliding along said surfaces of the outer wall of said rotor recess and said cylindrical surface of said stator ridge, said surfaces being accurately machined, said stator having an abutment in the path of movement of said protruding vane and extending radially with sealing engagement into said annular groove of said rotor, said stator defining a fluid inlet port and a fluid outlet port on either side of said abutment and said ports communicating with said chamber, cam follower means movably carried by said rotor and operatively connected with said vane, said cam follower protruding out of said rotor, and said stator having cam means engaging said cam follower means for moving said vane into said recess as said vane is passing said abutment in the course of the rotational movement of said rotor and for moving and maintaining said vane out of said recess in said chamber during the remaining cycle of said rotor movement.

2. A rotary vane-type hydraulic machine comprising a stator having a cylindrical bore, a rotor rotatably mounted in sealing relation within said bore of said stator and having an annular groove defining with the complementary portion of said stator bore an annular chamber, the outer cylindrical wall of said chamber, formed by said complementary portion of said stator bore, having a diameter slightly smaller than that of said cylindrical bore, thus forming an annular ridge engaging said rotor in said annular groove, said rotor having a recess opening into said annular groove, a vane mounted in said recess for movement in substantially axial direction either out of said recess for protrusion in sealing relation into said annular chamber or retraction into said recess, the outer lateral edge of said vane sliding along the surfaces of the outer wall of said rotor recess and said cylindrical surface of said stator ridge, said stator having an abutment disposed in the path of movement of said protruding vane and extending radially in sealing engagement into said annular groove of said rotor, said stator defining a fluid inlet port and a fluid outlet port on either side of said abutment, and said ports communicating with said chamber, a cam follower rod longitudinally slidably mounted in said recess of said rotor and operatively connected with said vane, said cam follower rod protruding out of said rotor, and cam means carried by said stator and engaged by said cam follower rod for moving said vane into said recess as said vane is passing said abutment in the course of its rotational movement with said rotor and for moving and maintaining said vane out of said recess in said chamber during the remaining cycle of said rotor movement.

3. A rotary vane-type hydraulic machine, as set forth in claim 2, wherein both ends of said cam follower rod protrude out of said rotor and wherein said cam means have two conjugate cam surfaces respectively engaging the ends of said rod.

References Cited in the file of this patent

UNITED STATES PATENTS

2,426,491	Dillon	Aug. 26, 1947
2,685,255	Carner	Aug. 3, 1954
2,691,868	Nicolas	Oct. 19, 1954
2,783,614	Blair	Mar. 5, 1957