Dec. 24, 1940. R. J. SMITH 2,225,803

ROTARY PUMP OR MOTOR

Filed Nov. 28, 1938

Fig. 1

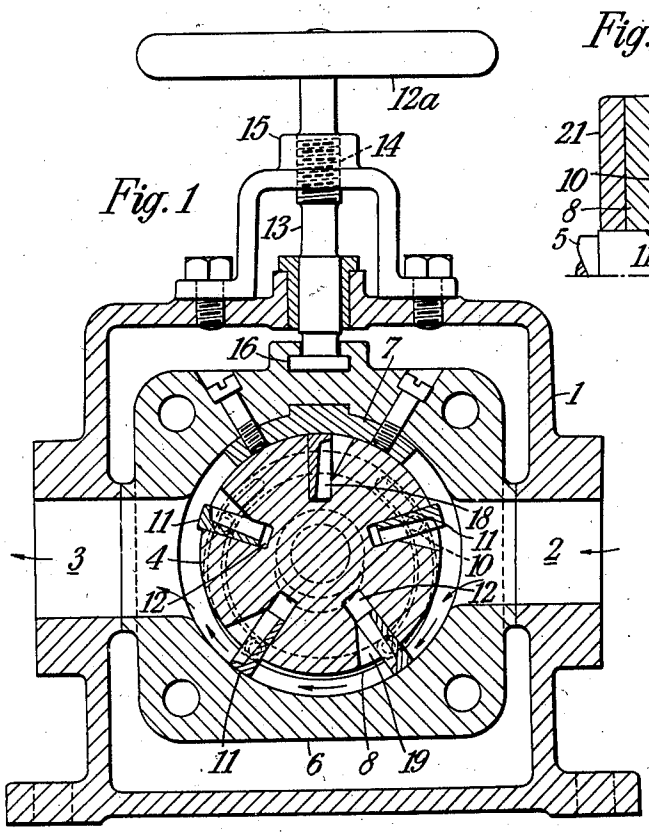


Fig. 2

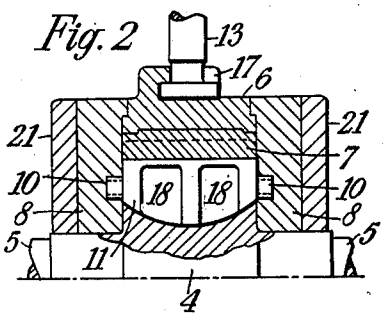


Fig. 4

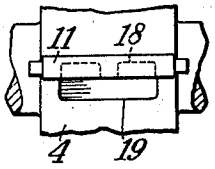


Fig. 3

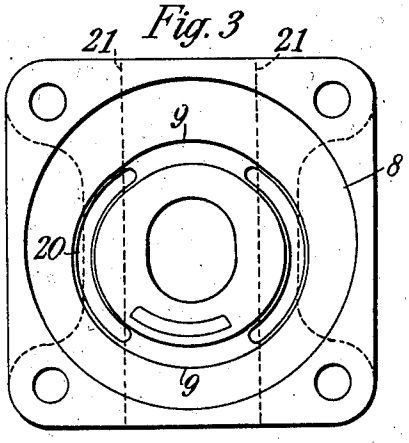
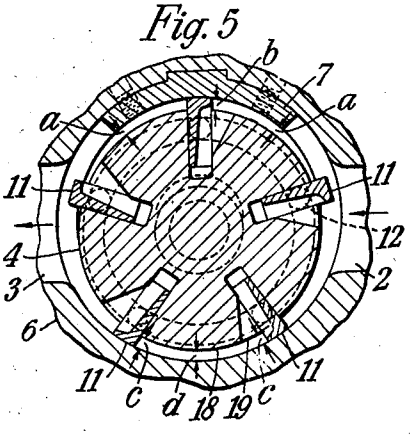


Fig. 5



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UNITED STATES PATENT OFFICE

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ROTARY PUMP OR MOTOR

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Application November 28, 1938, Serial No. 242,822
In Great Britain June 29, 1938

7 Claims. (Cl. 103—120)

This invention relates to rotary fluid pumps and motors (hereinafter for convenience referred to as pumps) of the type in which vanes move in slots in the rotor while the stator or casing is of two different radii with the inlet and outlet branches at the points where change of radius occurs and in which the fluid has access to the underside of the vane.

The principal object of the present invention is to effect improvements whereby with a constant speed of drive, infinite variation may be obtained in the pumping capacity of the pump.

Another object of the invention is to better impart the required movements to the vanes to cause them to follow the contour of the casing and the abutment which forms the part of the casing of reduced radius.

A further object of the invention is to ensure that projection of the vanes from the rotor does not of itself cause any variation in the volumetric capacity of the pump.

The invention is also directed to further ensuring smooth running of the pump under all conditions of volumetric discharge.

In accordance with this invention I provide or so arrange that the casing or stator can be adjusted relatively to the rotor, or vice versa, so as to bring their axes into and out of coincidence and thus to vary the volumetric discharge of the pump between zero and full capacity. The adjustment, which may be effected by any suitable known means, is made in a direction at right angles to the axis which extends between the inlet and outlet branches of the pump. The position of maximum delivery capacity is secured when the casing and rotor are co-axial so that the rotor periphery comes against the portion of the casing of reduced radius. The position of zero delivery is secured when the rotor periphery is approximately equi-distant between the parts of the casing of different radius, when the amount of fluid carried between the pump inlet and outlet is equal to that carried between the pump outlet and inlet, so that no external discharge occurs.

The number of vanes can be any desired odd number, odd numbers being necessary to ensure the fluctuations in volumetric capacity caused when pump is running at less than maximum output, being matched out. The vanes and the slots in the rotor are also cut away at the leading side of the vanes so that fluid can enter the slots and get beneath the vanes, the effect of this being that the varying extent of projection of the vanes from the rotor does not of itself affect the volumetric discharge of the pump.

The radial movements of the vanes are effected by pins and rollers thereon at opposite ends (sides) of each vane which ride in cam grooves or slots formed in the end covers of the casing or in parts spigoted to said end covers. The vane tips are, by said pins, roller and cam grooves, held in contact with the wall of the casing bore. To avoid trapping of the fluid between adjacent rollers when these move inward or outward, suitable connecting ports are provided for coupling two adjacent spaces, when moving inward or outward, on the delivery or inlet side of the pump.

The invention will be best understood from further description with reference to the accompanying drawing, wherein Fig. 1 is a transverse section through one constructional form of pump according to the invention, with the rotor in maximum delivery position;

Fig. 2 is a part sectional view at right angles to Fig. 1 of a portion of the pump;

Fig. 3 is a face view of an element not fully seen in Fig. 1;

Fig. 4 is a plan view of other elements of Fig. 2 isolated from the remainder for the sake of clarity; and

Fig. 5 is a view similar to Fig. 1 of part of the pump showing the rotor in or about the position of "no delivery."

As shown in said drawing, the pump comprises a main or outer casing 1 with an inlet 2 and an outlet 3 in line with each other, the common axis thereof being in the same plane as the axis of a rotor body 4, the shaft 5 of which latter is journalled in the casing 1 for driving in any usual or suitable way. Denominated by the numeral 6 is the central portion of an inner casing or pump stator which is bored cylindrically to a diameter larger than that of the rotor body 4, while 7 is a landing block curved interiorly to fit the body 4 and exteriorly to fit the bore in the stator portion 6, thus forming the pump chamber of different radii as stated hereinbefore.

The said inner casing or stator 6 is completed by a pair of side plates 8 (Figs. 2 and 3), each formed with a cam track 9 for rollers 10 which project from the sides or ends of vanes 11 adapted to slide radially in slots 12 in the rotor body, the arrangement being such that the vanes remain stationary in their slots while travelling circularly along or across the face of the landing block 7 and also while travelling along a similar region of the bore in the stator opposite thereto, as will be apparent from Fig. 1. The

stator is capable of being displaced, in this instance raised and lowered, by turning a hand wheel 12a fitted to a spindle 13 which is screw-threaded at 14 to work through a boss or nut 15 stationarily carried by the casing 1, said spindle having a head 16 fitting loosely in an engaging neck or yoke 17 of the stator part 6. From Fig. 1 it will be apparent that the parts are in the position of maximum delivery capacity. If the stator 6—8 is displaced, that is raised, the landing block 7 will as shown in Fig. 5 recede from the rotor 4 and the gap between the rotor and the stator at its lower region will be reduced, the vanes 11 however maintaining their same position or the positions in which their tips do not alter in relation to the circular portions of the landing block 7 and the stator part 6 with which they cooperate. The magnitude of the gap which is established between the rotor 4 and landing block 7 will determine the reduction in delivering capacity of the pump.

The rotor in the example illustrated has five vanes 11, each of which is shaped as shown in Fig. 2, being recessed at 18 so that with recesses 19 in the body 4 at the leading side of the vanes, fluid has access to the inner ends of the vanes, thus preventing variation in extension of the vanes affecting volumetric discharge of the pump.

The reason for employing odd numbers of vanes will be apparent from a consideration of Fig. 5. Here it will be noted that the volumetric discharge to and from the delivery side of the pump, per increment of movement of the vane, when the axis of the rotor and stator are out of coincidence, is of a variable nature, as the width of the gap between the rotor and the stator is at a minimum when a vane is at either of the positions, marked (a) and at a maximum at the position marked (b), while on the opposing side it is at a maximum at either of the positions marked (c) and a minimum at the position marked (d).

Thus with odd numbers of vanes, when one vane is at the position (b) which equals the maximum width of the gap on this side, a vane on the opposing side, as at (c), is in a position approaching maximum width on this side. It will then be readily seen that the volumetric fluctuations, due to varying width of the gap are practically of the same magnitude on either side of the rotor at any given moment, whereas with an even number of vanes the conditions would be reversed and there would be fluctuations in the discharge outlet from the pump varying from zero at full delivery to a maximum at no delivery.

Since radial movement of the vanes 11 in relation to the rotor 4 is accompanied by variation in distance separating the rollers 10 in their cam tracks 9, relieving grooves 20 (see Fig. 3) are formed in the latter to establish communication between adjacent spaces in the tracks.

In Fig. 4 the vane 11 is shown minus its rollers.

In Fig. 2 the parts 21 represent rubbing cheeks upon the stator cam plates 8 engaging the sides of the main casing 1 and serving to guide the stator and steady it when adjusted.

What I claim is:

1. In a rotary fluid pump embodying a stator member having internal work surfaces composing arc portions of two concentric cylinders of different radii and a rotor body therein having radial slidably projecting and retracting vanes working endwise against said surfaces, the improvement which consists in the provision of means operable exteriorly of the pump for adjustably moving the stator member in variable relation to the rotor body, between position limits of coaxialty of the two wherein the periphery of said rotor body contacts the arc portion of smaller radius of the stator member and a maximum eccentricity or non-coaxialty wherein said rotor body lies substantially equidistant between the parts of the stator member of different radii, so as thereby to vary the volumetric discharge of the pump from full capacity to zero and vice versa.

2. In a rotary fluid pump embodying a stator member having internal work surfaces composing arc portions of two concentric cylinders of different radii and a rotor body therein having radial slidably projecting and retracting vanes working endwise against said surfaces, the improvement which consists in the provision of means operable exteriorly of the pump for adjustably moving the stator member in variable relation to the rotor body, between position limits of coaxialness of the two at which the pump has full discharge capacity and the maximum permissible displacement eccentrically from coaxialness at which the pump has zero discharge capacity, so as thereby to vary the volumetric discharge of the pump anywhere from its full to its zero capacity.

3. The improvement in a rotary fluid pump according to claim 1, additionally including a main stationary casing in which the stator member is movable and wherein the rotor body is axially fixed.

4. The improvement in a rotary fluid pump according to claim 1, additionally including rollers carried by the radial vanes and cam or guide tracks for said rollers in the stator member by which said vanes are operated and maintained with their tips in contact with the work surfaces of said stator member.

5. The improvement in a rotary fluid pump according to claim 1, additionally including cut away portions in the leading faces of said radial vanes and cut away portions or enlargements opposite thereto in the receptive slide spaces therefor in the rotor body whereby the pumped fluid may have access to said spaces and get beneath said vanes.

6. The improvement in a rotary fluid pump according to claim 1, wherein the radial vanes carried by the rotor body are of an odd as well as a plural number.

7. The improvement in a rotary fluid pump according to claim 1, additionally including rollers carried by the radial vanes and cam or guide tracks for said rollers in the stator member by which said vanes are operated and maintained with their tips in contact with the work surfaces of said stator member, together with relieving or counter-recessed grooves formed in said tracks coupling the adjacent spaces of such tracks.

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