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VARIABLE DELIVERY VANE PUMP

Filed Aug. 3, 1944

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July 8, 1947.

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2,423,654

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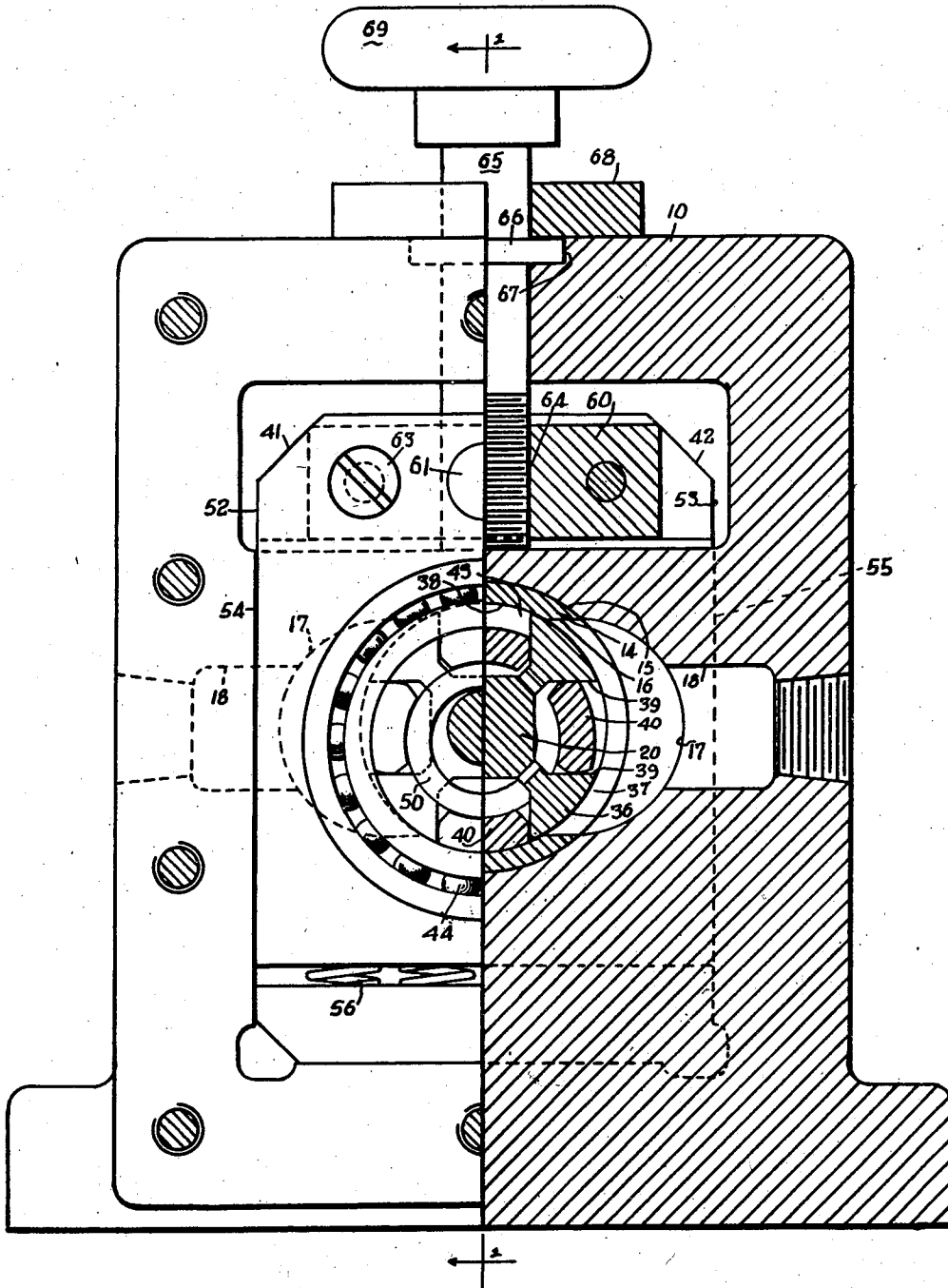


Fig. 2

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2,423,654

VARIABLE DELIVERY VANE PUMP

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Application August 3, 1944, Serial No. 547,829

9 Claims. (Cl. 103-161)

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This invention relates to variable delivery vane pumps.

An object of the invention is to provide an improved form of variable delivery vane pump.

Another object of the invention is to provide a variable delivery vane pump wherein the rotor of the pump is carried by the drive shaft and continuously rotates coaxial therewith, and wherein the vanes of the pump are carried by the end plates of the pumping chamber, which end plates are movable relative to the rotor to change the eccentric relationship between the vanes and the axis of the rotor to change the pumping capacity of the variable delivery pump.

Still another object of the invention is to provide a variable delivery vane pump wherein the end plates of the pump are movable for changing the pumping capacity of the pump.

Still another object of the invention is to provide a variable delivery vane pump wherein the vanes are composed of arcuately-shaped segments that are carried in a track provided in the end plates of the pump eccentrically relative to the rotor of the pump, and are driven in the track by the rotor, and wherein the track is movable relative to the axis of the rotor for changing the eccentric relationship between the track and the axis of the rotor to change the pumping capacity of the pump.

Still another object of the invention is to provide a variable delivery vane pump in accordance with any of the foregoing objects wherein the pump can have the flow therethrough reversed by changing the eccentric relationship between the rotor and the vanes of the pump.

Further objects and advantages will become apparent from the drawings and the following description.

In the drawings:

Figure 1 is a vertical cross-sectional view of the pump taken along line 1-1 of Figure 2.

Figure 2 is a vertical cross-sectional view taken along 2-2 of Figure 1, but showing one-half of the pump in elevation with the cover plate removed.

In this invention, the variable delivery pump consists of the casing 10 having the end plates 11 and 12 secured to opposite sides of the casing 10 by means of the cap screws 13.

The casing 10 is provided with a sleeve 14 that is inserted in a transverse bore 15 provided in the casing 10. The sleeve 14 thus forms the outer peripheral wall of the pumping chamber. The sleeve 14 has openings 16 on diametrically opposite sides thereof that communicate with fluid

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chambers 17 formed in the casing 10. The fluid chambers 17 are connected with the port passages 18 through which fluid is delivered or received into the pumping chamber, depending upon the direction of flow of fluid through the pump. Thus, either chamber 18 may be the discharge chamber or the inlet chamber.

A rotor 20 is integral with the drive shaft 21 that is supported upon the ball-bearings 22 and 23 positioned in the bearing-receiving chambers 24 and 25 provided in the end plates 11 and 12. An end cap 26 closes the bearing-receiving chamber 24 and engages the ball-bearing 22 to position the same in the bearing chamber 24. The end cap 26 is retained on the end plate 11 by the cap screws 27.

An end cap 28 is provided to close the bearing-receiving chamber 25, and engages the ball-bearing 23 to position the bearing in the bearing-receiving chamber 25. The end cap 28 is secured to the end plate 12 by means of the cap screws 29. The end cap 28 is provided with a transverse bore 30 that receives a sleeve 31 for supporting the drive shaft 21 and preventing loss of fluid within the drive shaft.

The ball-bearings 22 and 23 are retained in the end plates 11 and 12 by means of the retaining plates 32 and 33, respectively, these retaining plates being positioned within the recesses 34 and 35, respectively, by means of the end plates of the pump hereinafter described.

The rotor 20 is provided with a plurality of radially-extending arms 36 spaced from one another. The radially-extending arms 36 are provided with an arcuate surface 37 on the periphery thereof for engaging the inner surface 38 of the sleeve 14, thereby forming individual pumping chambers therebetween. Adjacent arms 36 are provided with surfaces 39 that are positioned in parallel relationship with respect to one another to form a substantially rectangular pumping chamber.

An arcuately-shaped vane 40 is positioned between each pair of radially-extending rotor arms 36, these vanes extending through the rotor 20 and into the pump end plates 41 and 42 that are positioned adjacent opposite sides of the rotor 20 to thereby enclose the pumping chambers 43. The pump end plates 41 and 42 carry the ball-bearings 44 and 45, respectively, in the bearing recesses 46 and 47, respectively. The inner races 48 and 49 of the ball-bearings 44 and 45, respectively, engage the outer periphery of the arcuately-shaped vane segments 40 for supporting the same and also form the outer surface of a track in

which the vanes 40 rotate upon being driven by the rotor 20.

A pair of floating rings 50 and 51 are positioned respectively adjacent the ball-bearings 44 and 45 to engage the inner arcuate surface of the arcuately-shaped vane segments 40 to form the inner surface of the track in which the vanes 40 rotate when being driven by the rotor 20. The track in which the vanes 40 rotate, formed by the inner races 48 and 49 of the ball-bearings 44 and 45 and the rings 50 and 51, is thus positioned in the pump end plates 41 and 42 for movement therewith. Also, since the inner races of the ball bearings 44 and 45 are free to rotate, as are the rings 50 and 51, there will be substantially no wear on the ends of the vanes 40.

The pump end plates 41 and 42 are positioned between the casing 10 and the end plates 11 and 12 of the pump, and are movable relative to the casing and the end plates to change the eccentric relationship between the aforementioned track for the vane segments 40 and the axis of the rotor 20 for changing the pumping capacity of the pump. When the vane segments 40 are driven by the rotor 20, and are rotating coaxial with the axis of the rotor 20, the delivery from the pump ceases. However, when the vane segments 40 rotate eccentrically relative to the axis of the rotor 20, on either side of the axis, fluid will be discharged from one or the other side of the pump at a rate depending upon the eccentric relationship between the axis of rotation of the pumping segments 40 and the axis of the rotor 20.

The pump end plates 41 are provided with parallel sides 52 and 53 that engage the guide walls 54 and 55 provided upon opposite sides of the pump casing 10. The pump end plates are urged in one direction to change the eccentric relationship between the vane segments 40 and the rotor 20 by means of the springs 56 and 57 that engage the end plates 41 and 42 respectively, the springs being positioned between the end plates and the shoes 58 and 59 respectively.

The pump end plates 41 and 42 form opposite sides of a yoke that supports a shifting member 60 carried in the end plates 41 and 42 respectively, by the journals 61 and 62. The shifting member 60 is retained between the end plates 41 and 42 by means of the cap screws 63.

The shifting member 60 has a threaded bore 64 that receives the threaded end of a shifting screw 65. The shifting screw 65 has a flange 66 integrally therewith that is carried in a recess 67 provided in the casing 10 of the pump and is held in the recess by a cover plate 68 to thereby prevent axial movement of the shifting screw 65 upon rotation thereof. A suitable hand wheel 69 is secured to the end of the shifting screw 65 for rotating the screw to change the position of the pump end plates 41 and 42 within the casing 10. The springs 56 and 57 eliminate any play or looseness between the shifting screw 65 and the end plates 41 and 42 of the pump.

From the foregoing description, it is believed the operation of the pump can be readily ascertained, but in general, the operation is such that when the drive shaft 21 is rotated by any suitable power source, the vanes 40 retained between adjacent arms 36 of the pump rotor 20 are rotated in the track formed by the ball-bearings 44 and 45 and the rings 50 and 51. When the axis of the track referred to is positioned eccentrically relative to the axis of the rotor 20, the vane segments 40 will be reciprocated radially relative to the axis of the rotor 20 and thus pro-

duce a pumping action in the pumping chambers 43, receiving fluid through one of the port openings 18, and discharging fluid through the other port opening 18.

When it is desired to change the pumping capacity of the pump from zero, or neutral, to delivery in either direction from the pump, the hand wheel 69 is rotated to rotate the screw 65. Rotation of the screw 65 moves the shifting member 60 to cause movement of the pump end plates 41 and 42 relative to the rotor 20 to change the eccentric relationship between the aforementioned tracks carried in the end plates 41 and 42 relative to the axis of the rotor 20, and thus change the eccentric stroke of the vane segments 40 to change the pumping capacity of the pump.

While the construction of the pump disclosed and described herein constitutes a preferred form of the invention, yet it will be understood that the structure of the pump is capable of alteration without departing from the spirit of the invention, and that all modifications that fall within the scope of the appended claims are intended to be included herein.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A variable delivery pump that includes in combination, a casing having a chamber therein, a rotor positioned in said chamber rotatable coaxially therewith and having a plurality of radially extending arms forming individual pumping chambers in said chamber, arcuately shaped vane segments positioned in said individual pumping chambers and driven rotatively by said rotor, means forming circular track means to receive the arcuately shaped ends of said vane segments to guide rotation thereof about the axis of said rotor and cause radial reciprocation thereof in said pumping chambers, and means for moving said track-forming means relative to the axis of said rotor to change the eccentric relationship therebetween and thereby change the delivery from the pump.

2. A variable delivery pump that includes in combination, a pump casing having a chamber therein, a rotor rotatable coaxially in said chamber, end plates for said chamber co-operating therewith and with said rotor to form a pumping chamber, said rotor having a plurality of radially-extending arms to divide the pumping chamber into individual pump chambers, arcuately shaped vane segments positioned between adjacent arms and driven rotatively by said rotor upon rotation thereof, means in said end plates forming track means to receive the arcuately shaped ends of said vane segments to guide movement of said vane segments upon rotation thereof about the axis of said rotor and cause radial reciprocation thereof in said pumping chamber, and means for moving said end plates to change the eccentric relationship between said track-forming means and said rotor to change the radial reciprocal movement of said vane segments and thereby change the delivery from said pump.

3. A variable delivery pump that includes in combination, a pump casing having a circular chamber therein, a rotor rotatable in said chamber co-axial therewith and having a plurality of arms extending radially therefrom for dividing said chamber into a plurality of individual pumping chambers, end plates for said pumping chamber, arcuately shaped vane segments positioned between said radially-extending arms, circular

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track means in said end plates for receiving the arcuate ends of said segments to cause radial reciprocal movement of said vane segments relative to said rotor and thereby produce a pumping action upon rotation of said rotor, and means for moving said end plates relative to said rotor to change the eccentric relationship between said track means and the axis of said chamber between a position concentric with said axis to a position whereat the periphery of the track means is coincident with the periphery of said chamber to change the stroke of radial reciprocal movement of said vane segments and thereby change the delivery from the pump.

4. A variable delivery pump that includes in combination, a pump casing having a chamber therein, a rotor rotatable in said chamber coaxial therewith and having a plurality of radially-extending arms to divide said chamber into a plurality of individual pumping chambers, end plates for said chamber co-operating therewith and with said rotor to enclose said pumping chambers, independent arcuately-shaped vane segments positioned between adjacent radially-extending arms of said rotor and extending through said rotor into said end plates, means in said end plates forming a circular track to receive the arcuate ends of said vane segments to guide movement thereof upon rotation by said rotor and produce radial reciprocal movement of the vane segments relative to the rotor for causing a pumping action, and means for moving said end plates relative to said rotor to change the eccentric relationship between the axis of said circular track and the axis of said rotor to change the radial reciprocal stroke of said vane segments and thereby change the delivery from said pump.

5. A variable delivery pump that includes in combination, a pump casing having a chamber therein, a rotor rotatable in said chamber coaxial therewith and having a plurality of radially-extending arms dividing said chamber into a plurality of individual pumping chambers, end plates co-operating with said casing and said rotor to enclose said pumping chambers, arcuately-shaped vane segments positioned between said radially-extending arms of said rotor for radial reciprocal movement therebetween to produce a pumping action thereby, a transverse bore in said end plates to receive the ends of said vane segments and provide one surface of a track means for the same, a ring member positioned in engagement with the inner surface of said vane segments forming the co-operating track surface for said vane segments, said track-forming means being entirely positioned within said end plates, and means for moving said end plates relative to said rotor for changing the eccentric relationship between the axis of the track-forming means and the axis of the rotor to change the radial reciprocal stroke of said vane segments and thereby change the delivery from the pump.

6. A variable delivery pump that includes in combination, a pump casing having a chamber therein, a rotor rotatable in said chamber coaxial therewith and having a plurality of radially-extending arms dividing said chamber into a plurality of individual pumping chambers, end plates co-operating with said casing and said rotor to enclose said pumping chambers, arcuately-shaped vane segments positioned between said radially-extending arms of said rotor for radial reciprocal movement therebetween to produce a pumping action thereby, a transverse bore in

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said end plates to receive the ends of said vane segments and provide one surface of a track means for the same, a ring member positioned in engagement with the inner surface of said vane segments forming the co-operating track surface for said vane segments, said track-forming means being entirely positioned within said end plates, a shifting member extending between said end plates for moving the same together, and means engaging said shifting member for moving the same and the end plates relative to said rotor to change the eccentric relationship between the track-forming means and the axis of said rotor to change the radial reciprocal stroke of said vane segments and thereby change the delivery from the pump.

7. A variable delivery pump that includes in combination, a pump casing having a centrally arranged rib provided with parallel walls recessed from the adjacent face walls of said casing, a bore passing through said rib forming a chamber, end plates for said casing positioned on opposite sides thereof having bearing means therein supporting a shaft having a rotor thereon positioned in said chamber, end plates positioned between said rib and said end plates for said casing in engagement therewith and forming end walls for said chamber, said rotor having a plurality of radially-extending arms dividing said chamber into a plurality of individual pumping chambers, arcuately shaped vane segments positioned between adjacent arms of said rotor and extending into said second-mentioned end plates, means in said second-mentioned end plates forming an outer circular track surface for said vane segments and engaged thereby, ring means engaging the inner surface of said vane segments and forming the co-operating track surface for said vane segments, and means for moving said end plates radially relative to said rotor to change the eccentric relationship between the axis of the aforesaid track-forming means and the axis of the rotor to change the radial reciprocal movement of the vane segments and thereby change the delivery of the pump.

8. A variable delivery pump that includes in combination, a pump casing having a centrally arranged rib provided with parallel walls recessed from the adjacent face walls of said casing, a bore passing through said rib forming a chamber, end plates for said casing positioned on opposite sides thereof having bearing means therein supporting a shaft having a rotor thereon positioned in said chamber, end plates positioned between said rib and said end plates for said casing in engagement therewith and forming end walls for said chamber, said rotor having a plurality of radially-extending arms dividing said chamber into a plurality of individual pumping chambers, arcuately shaped vane segments positioned between adjacent arms of said rotor and extending into said second-mentioned end plates, means in said second-mentioned end plates forming an outer circular track surface for said vane segments and engaged thereby, ring means engaging the inner surface of said vane segments and forming the co-operating track surface for said vane segments, a shifting member extending between said second-mentioned end plates for interconnecting them for movement together, and means engaging said shifting member and for moving the same to thereby move the end plates connected thereto for changing the eccentric relationship between the track-forming means and the axis of said rotor to change the

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stroke of radial reciprocal movement of said vane segments and change the delivery from the pump.

9. A variable delivery pump that includes in combination, a pump casing having a chamber therein, a rotor positioned in said chamber and rotatable co-axially therewith, said rotor having a plurality of radially-extending arms dividing said chamber into a plurality of individual pumping chambers, vane segments positioned in said individual pumping chambers and extending beyond each side thereof, end walls for said first-mentioned chamber movable transversely relative to the same, antifriction bearing means in said end walls engaged by said vane segments and forming the outer periphery of a circular track for the same, floating ring means engaging said vane segments and forming the inner periphery of a circular track for the same, and means engaging said end walls for moving the same to change the eccentric relationship between the aforesaid track-forming means and the axis of

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said rotor to thereby change the radial reciprocal stroke of said vane segments and change the pumping capacity of the pump.

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