Jan. 1, 1952 H. B. ADAMS ET AL 2,581,160

VARIABLE VOLUME PUMP

Filed Dec. 15, 1947 4 Sheets-Sheet 1

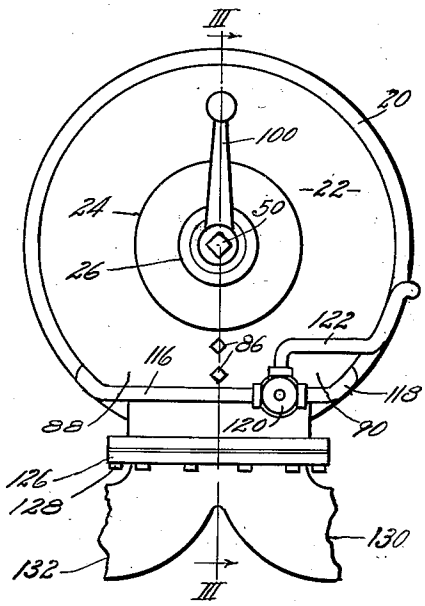


Fig. 1

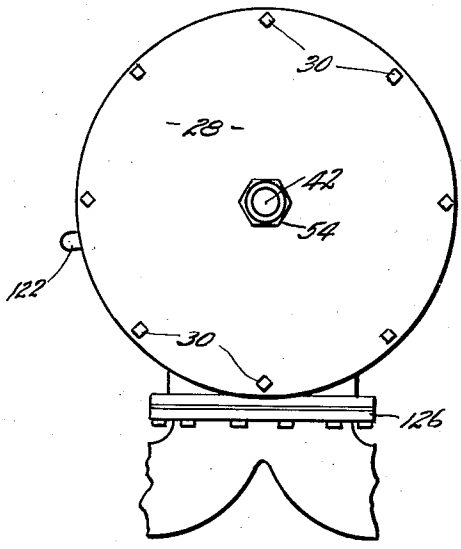


Fig. 2

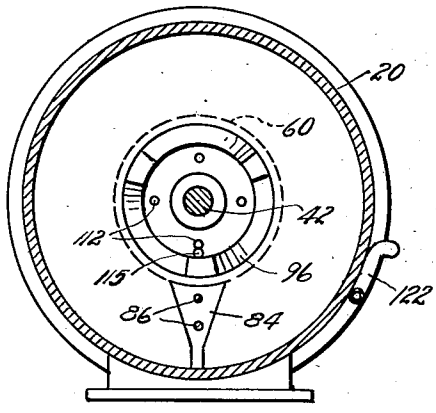


Fig. 7

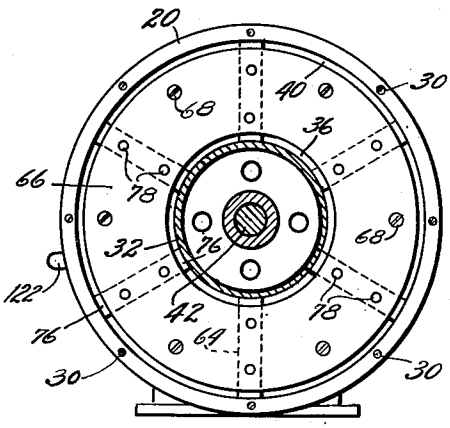


Fig. 6

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VARIABLE VOLUME PUMP

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Fig. 3

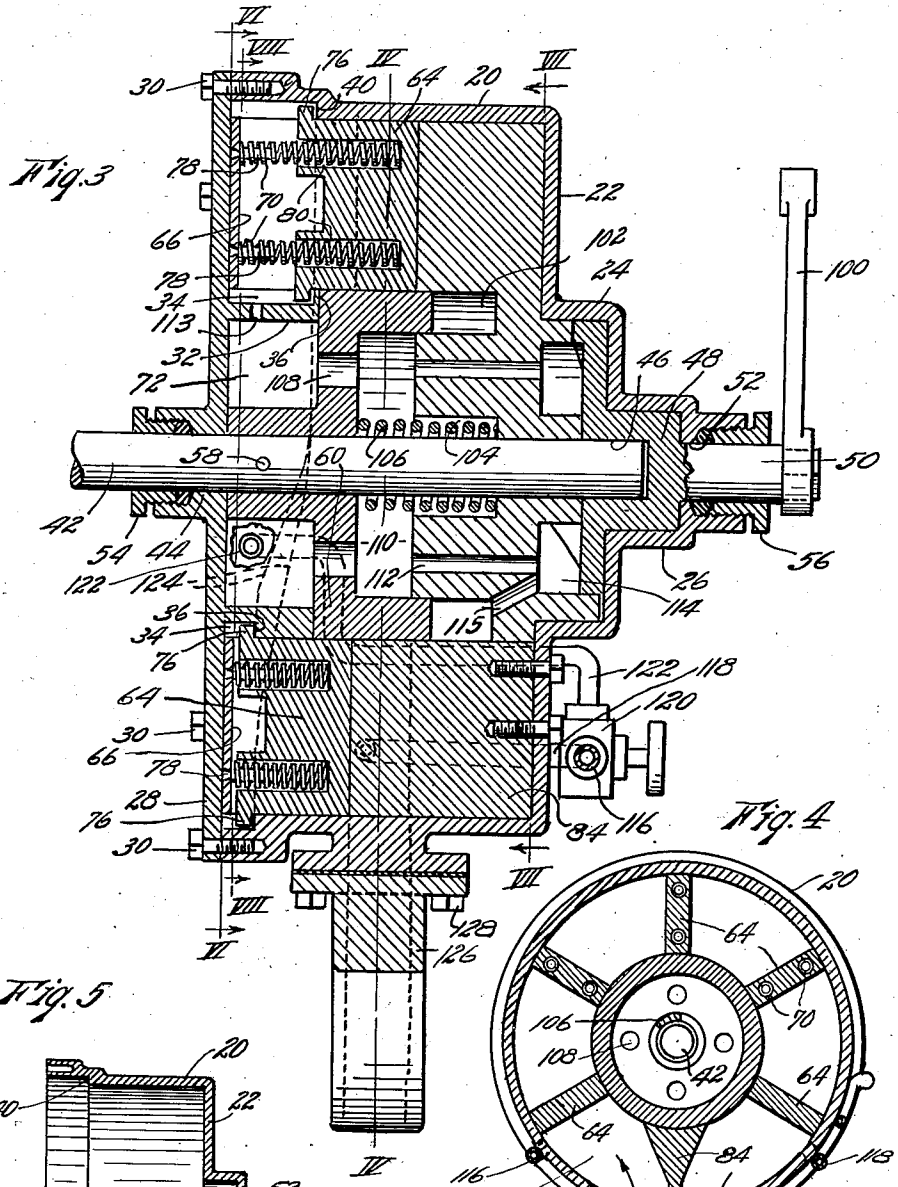
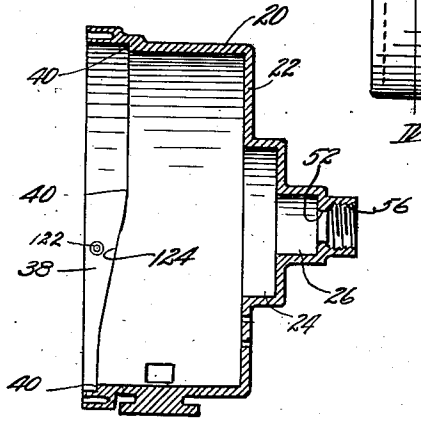


Fig. 4

Fig. 5



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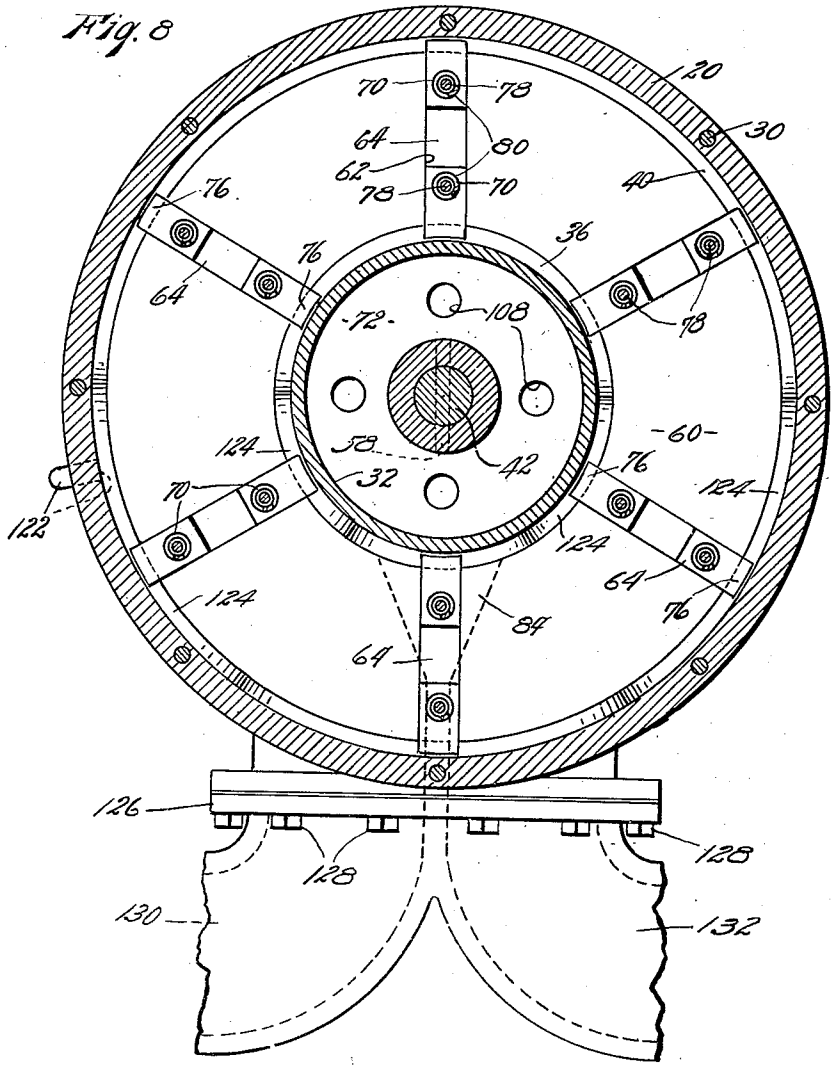
Jan. 1, 1952 H. B. ADAMS ET AL 2,581,160

VARIABLE VOLUME PUMP

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Fig. 8



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VARIABLE VOLUME PUMP

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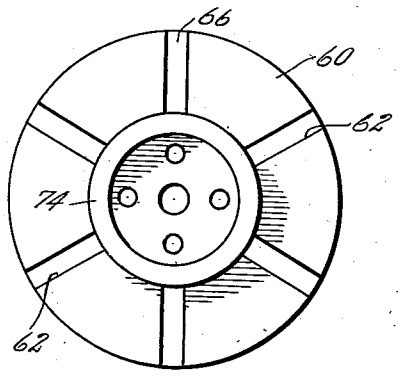


Fig. 9

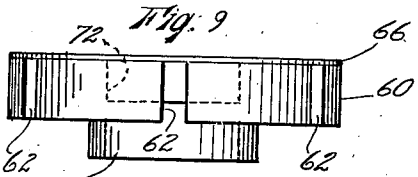


Fig. 10

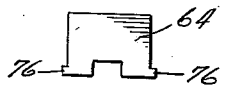


Fig. 13

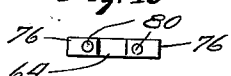


Fig. 14

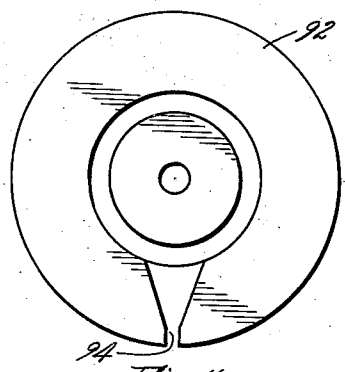


Fig. 11

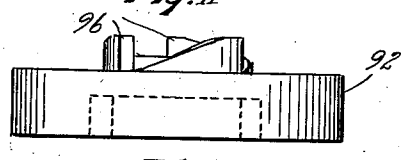


Fig. 12

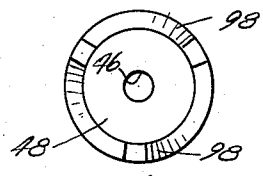


Fig. 15

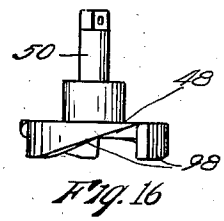


Fig. 16

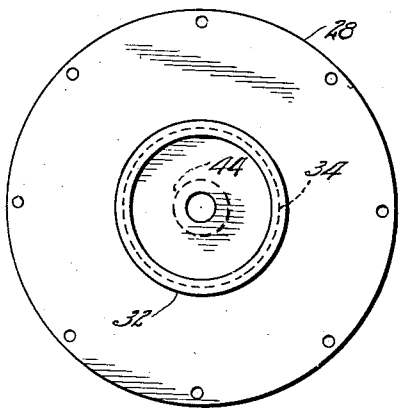


Fig. 17

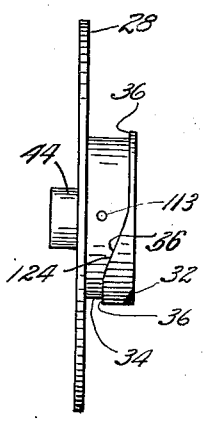


Fig. 18

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UNITED STATES PATENT OFFICE

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VARIABLE VOLUME PUMP

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Application December 15, 1947, Serial No. 791,876

4 Claims. (Cl. 103—120)

1

This invention relates to improvements in variable volume pumps, and has particular reference to a variable volume pump of the rotary type having vanes mounted for axial adjustment.

The principal object of the present invention is the provision of a variable volume rotary pump having axially adjustable rotary vanes whereby the volume of the pump is varied.

Another object of this invention is the provision of a rotary pump provided with axially slidable rotatable vanes having resilient means to urge them in one direction and cams to urge the vanes in the opposite direction against the action of said resilient means.

A further object of the invention is the provision of a rotary pump having a rotor mounted in a cylinder having an axially adjustable side wall whereby the cylinder volume may be varied.

Other objects are simplicity and economy of construction, ease and efficiency of operation, and means for maintaining proper pressures about the various working parts of the pump.

With these objects in view, as well as other objects which will appear during the course of the specification, reference will be had to the drawings wherein:

Figure 1 is a front view of a variable volume rotary pump embodying this invention.

Fig. 2 is a rear elevational view of the pump shown in Fig. 1.

Fig. 3 is an enlarged sectional view taken on line III—III of Fig. 1.

Fig. 4 is a reduced sectional view taken on line IV—IV of Fig. 3.

Fig. 5 is a detached reduced central sectional view of the housing positioned as shown in Fig. 3.

Fig. 6 is a reduced sectional view taken on line VI—VI of Fig. 3.

Fig. 7 is a reduced sectional view taken on line VII—VII of Fig. 3 with the cam member left in elevation.

Fig. 8 is a sectional view taken on line VIII—VIII of Fig. 3.

Fig. 9 is a front face view of the rotor.

Fig. 10 is an edge view of the rotor.

Fig. 11 is a rear face view of the movable side wall section of the pump.

Fig. 12 is an edge view of the side wall section shown in Fig. 11.

Fig. 13 is an elevational view of one of the pump vanes.

Fig. 14 is an edge view of the vane shown in Fig. 13.

Fig. 15 is an inner face view of the manually operable adjusting cam member.

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Fig. 16 is a side elevational view of the cam member shown in Fig. 15.

Fig. 17 is an inner elevational view of the cover member.

Fig. 18 is an edge view of the cover member.

Throughout the several views like reference characters refer to similar parts and the numeral **20** designates a cylindrical pump housing having a front end member **22** offset concentrically at **24** and **26** to receive certain parts as hereinafter set forth. The rear end of the housing is open and provided with a cover **28** secured adjacent its outer edge by means of a series of screws **30**. Cover **28** is circular in form and is provided with an inturned concentric annular flange **32** which is recessed at its periphery at **34** to present a continuous cam face **36**. The rear portion of the inner wall of housing **20** is circumferentially recessed at **38** to form a cam face **40**. It will be noted that cam faces **36** and **40** are disposed concentrical with their corresponding radial portions in perpendicular alignment with the axis of the cylinder **20**.

A shaft **42** is centrally mounted in housing **20** with its one end portion mounted in a bearing **44** formed in cover **28**, and its other end is rotatably mounted in a recess bearing **46** formed in the body of a shifting cam block **48** which is rotatably fitted into the offset portions **24** and **26** of housing **20**. The cam block **48** is provided with a forwardly extending stem **50** disposed in axial alignment with shaft **42** and is extended through a bearing **52** in the front end wall **22** of housing **20**. Shaft bearing **44** and stem bearing **52** are respectively provided with stuffing boxes **54** and **56**.

Rigidly mounted on shaft **42** by pins **58** is a rotor **60** of a general cylindrical form and adapted to operatively engage the inner peripheral wall of housing **20**. This rotor **60** is radially slotted to present operating slideways **62** for transversely operable vanes **64**. The rear side of the rotor is provided with a removable annular ring cover plate **66** secured thereto by screws **68**, which serves as a bearing plate for the springs **70** which serve to urge the vanes forwardly at all times.

The rearward face of rotor **60** is recessed to form an annular groove **72** to receive the inturned flange **32** of cover **28**, while the forward face is provided with an integral annular ring **74** positioned in spaced apart concentric relation with said shaft **42**.

Vanes **64** shown detached in Figs. 13 and 14 are substantially rectangular in general shape to

snugly fit in slideways 62, and are provided at their opposite rearward corners with transversely disposed lugs 76 adapted to engage and ride respectively on cam face 36 and cam face 40 whereby as the rotor is moved about its axis the vanes will be moved transversely of the direction of rotation against the action of springs 70 which serve to constantly urge the lugs 76 against said cams or against an adjustable chamber wall as hereinafter set forth.

Each vane is provided with a pair of spaced apart recesses 80 extending inwardly from its rear edge. Each recess is adapted to receive one end portion of spring 70 while the other end thereof is positioned on cover plate 66 by a pilot pin 78 fixed in the cover plate. The operating chamber 82 is provided with a radially disposed partition 84 securely positioned in housing 20 by means of screws 86. An inlet port 88 is formed at one side of said partition while an outlet port 90 is formed at the opposite side thereof. Referring to Fig. 1 it will be noted that partition 84 fits snugly in the housing to rest against the inner side wall of the rotor 60 to normally hold it in operative relation relative to the housing 20.

An axially adjustable side wall member 92 of general cylindrical form slidably fitted into the forward end portion of housing 20 is radially slit at 94 to snugly fit about partition 84 to prevent rotation of said wall member relative to said housing.

The rear wall of wall member 92 is planar in form and disposed at a right angle to the axis of rotor 60 to form one side wall of the annular working chamber. The forward portion of side wall member 92 is provided with an axially disposed series of cam teeth 96 which are adapted to mesh with a series of cam teeth 98 formed on the inner face of manually operable cam block 48. The cam block stem 50 extends outwardly from housing 20 and is provided with a fixed crank arm 100 by means of which the cam teeth 98 may be moved relative to cam teeth 96 to force the wall member 92 rearwardly against the urge of springs 70 to narrow the operating chamber to reduce the axial movement of the vanes 64.

The inner face wall member 92 is annularly grooved at 102 to receive the annular ring 74 whereby the rotor 60 and wall member 92 are slidably joined together. The wall member 92 is further recessed at 104 to receive the end portion of a spring 106 disposed under compression against the forward wall of rotor 60.

The depth of recess 102 is sufficient to permit the movement of wall member 92 until its rear wall rests against the forward wall of rotor 60, thus totally eliminating the operating chamber or limiting it to any desired degree to regulate the pump capacity.

With the relative axial movement of the pump parts it is quite evident that the movement of compressed liquids between the parts must be provided for. The rotor 60 is provided with transverse holes 108 which communicate with recess 110 thence through holes 112 formed through the wall member 92 and into a chamber 114 formed between the wall member 92 and cam block 48. Openings 113 formed through the flange 32 interconnects recess 34 with annular grooves 72. An opening 115 in wall member 92 connects chamber 114 with annular groove 102.

The pressure of the liquid filling the voids between the moving parts is substantially the same as the pressure of the liquid being discharged from the pump. To obtain this pressure, tubes 116 and 118 communicate respectively with ports 88 and 90 and are connected with opposite sides of a three-way valve 120 which has a lead tube 122 communicating with annular groove 38 which interconnects with groove 72. By means of this tubular connection liquid may be fed from either port 88 or 90 by simple adjustment of three-way valve 120.

It will be noted that this rotary pump is so symmetrically constructed that it may be driven in either direction to drive the liquid in either direction therethrough.

The actions of the vanes are controlled by the rotation of the rotor 60, the cams 36 and 40, and the springs 70. Each vane passes through the same sequence of movements with each full revolution of the rotor. Referring to Fig. 3 it will be noted that the upper lugs 76 are spaced apart from cams 36 and 40 so that the springs 70 will exert their entire force to urge the vane 60 tightly against the wall member 92; however, as the rotor moves on its axis to move the lugs in contact with the transversely inclined portions 124 of said cams then the vane will be moved axially against the springs 70 to separate the vane from wall member 92 to permit the passage of liquid therebetween. When the vane reaches the lower position in Fig. 3 the lugs 76 will rest against the cams to hold the forward edges of the vane in planar alignment with the rearward face of partition 84, whereby it may pass thereover.

Since the wall member 92 limits the forward movement of vanes 64 it is evident that the narrower the operating chamber 82 the farther lugs 76 will be spaced from the cams 36 and 40 when the vanes are in their top position as shown in Fig. 3, however they will always take the same lower position to clear radial partition 84.

An adapter 126 secured by screws 128 to housing 20 is symmetrical in form and has two passageways 130 and 132 to connect respectively with a suitable source of liquid to be pumped and a container for the pumped liquid (not shown).

What we claim as new and desire to protect by Letters Patent is:

1. A rotary pump comprising a cylindrical housing; an axially fixed rotor, having radial slots formed inwardly from its outer periphery, rotatably mounted in one end of said housing; an axially adjustable head wall member normally spaced from said rotor to form an operating chamber therebetween; vanes slidably mounted in the slots in said rotor; resilient means normally urging said vanes axially against said head wall member to close said operating chamber; and cams carried in fixed relation with said housing adapted to engage and force said vanes against the urge of said resilient means away from said head wall member as said rotor is moved on its axis.

2. A rotary pump comprising a cylindrical housing; an axially fixed rotor, having radial slots formed inwardly from its outer periphery, rotatably mounted in one end of said housing; a radially disposed partition member secured to said housing to abut against the forward wall of said rotor to preclude axial movement thereof; an axially adjustable head wall member normally spaced from said rotor to form an operating chamber therebetween having an inlet port and an outlet port; vanes slidably mounted in the slots in said rotor; resilient means normally urging said vanes axially against said head

wall member to close said operating chamber; cams carried in fixed relation with said housing adapted to engage and force said vanes against the urge of said resilient means away from said head wall member as said rotor is moved on its axis.

3. A rotary pump comprising a cylindrical housing having peripherally spaced apart inlet and outlet ports; an axially fixed rotor, having radial slots formed inwardly from its outer periphery, rotatably mounted in one end of said housing; a radially disposed partition member secured to said housing intermediate said inlet and outlet ports to abut against the forward wall of said rotor to preclude axial movement thereof; an axially adjustable head wall member normally spaced from said rotor to form an operating chamber therebetween having an inlet port and an outlet port; vanes slidably mounted in the slots in said rotor; resilient means normally urging said vanes axially against said head wall member to close said operating chamber; cams carried in fixed relation with said housing adapted to engage and force said vanes against the urge of said resilient means away from said head wall member as said rotor is moved on its axis.

4. A rotary pump comprising a cylindrical housing; an axially fixed drive shaft concentrically mounted for rotation in said housing; a rotor, having radial slots formed inwardly from its outer periphery, rotatably mounted in said housing to operatively fit against the inner cylindrical wall of said housing; an axially adjustable head wall member snugly fitted in said housing in spaced apart relation to said rotor to form a working chamber therebetween; means operable to adjust said head wall member toward and from said rotor whereby the volume of said working chamber is varied; a radial partition dividing said working chamber adjacent its lower portion and having a port adjacent each of its opposite sides connecting with said working chamber; vanes adjustably mounted for transverse movement in said rotor slots to move into and out of said working chamber to force liquid through said pump as said rotor is rotated in said housing.

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