Sept. 6, 1955 E. A. CUNY 2,716,948

ROTARY PUMP

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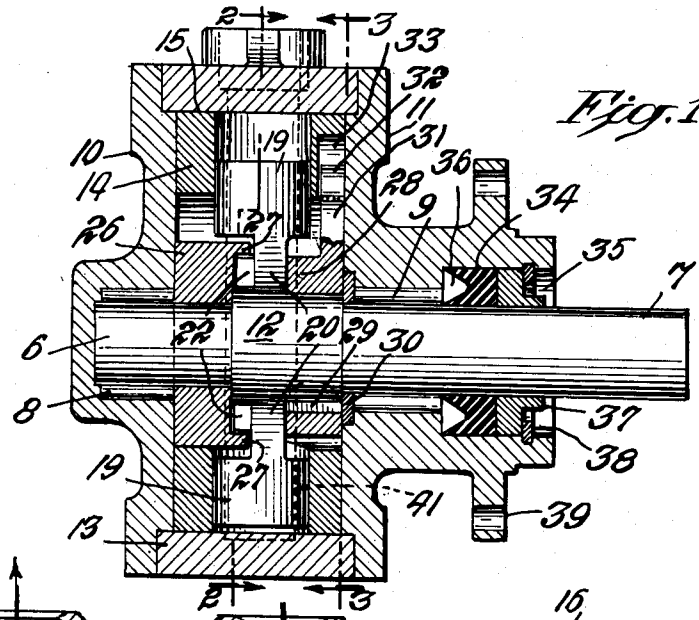


Fig. 1.

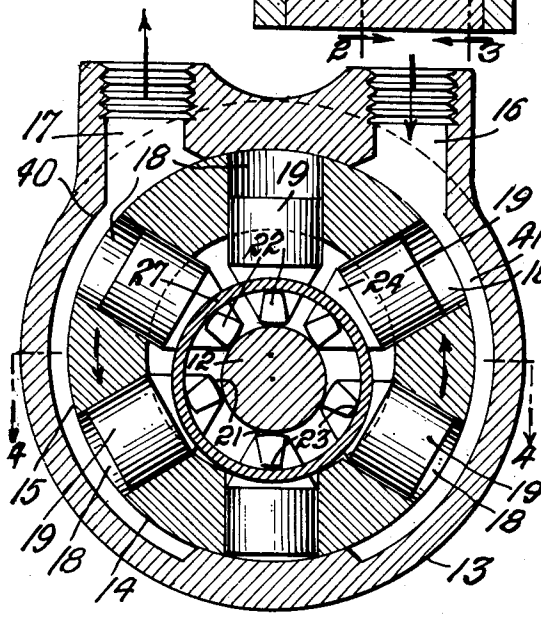


Fig. 2.

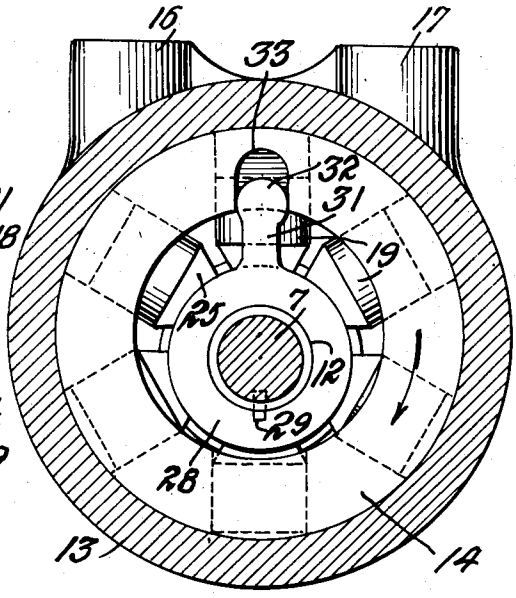


Fig. 3.

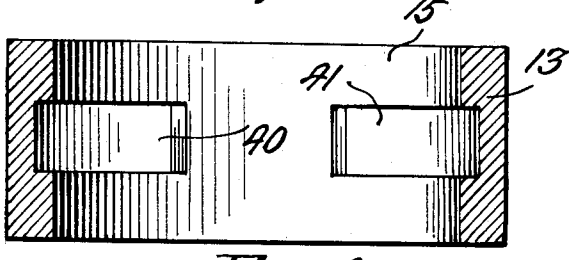


Fig. 4.

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Fig. 5.

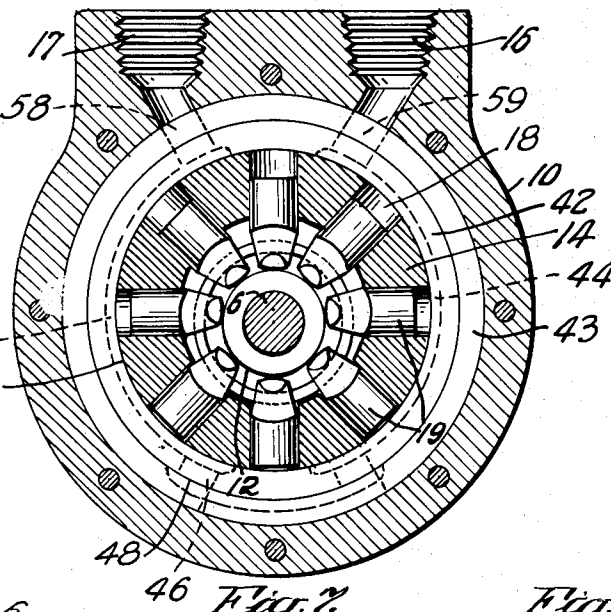


Fig. 6.

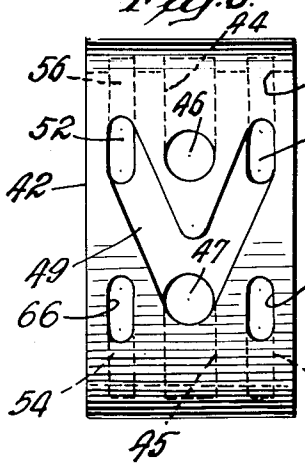


Fig. 7.

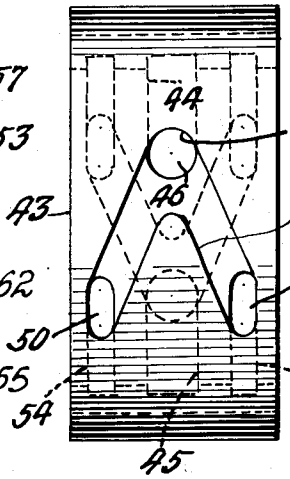
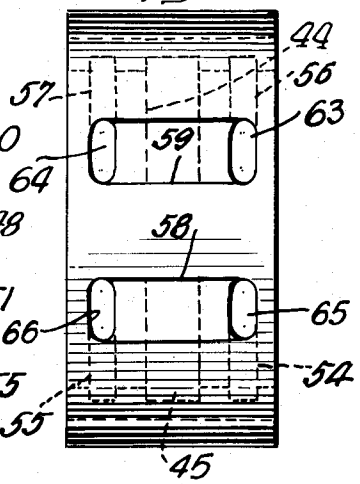


Fig. 8.



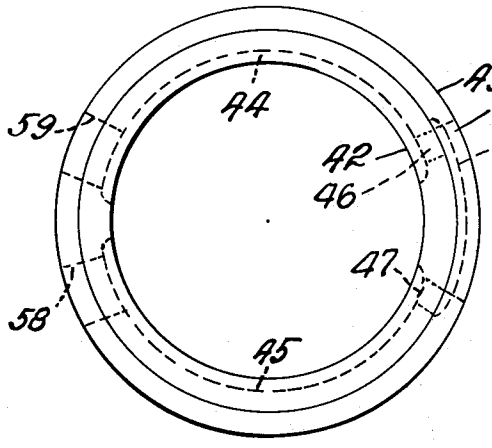


Fig. 9.

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United States Patent Office

2,716,948

Patented Sept. 6, 1955

2,716,948

ROTARY PUMP

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Application August 21, 1953, Serial No. 375,713

4 Claims. (Cl. 103—161)

The invention herein disclosed relates to fluid displacement machines in the nature of rotary pumps, compressors and the like.

Special objects of the invention are to provide a machine of this character of small size but relatively high fluid displacement.

Particularly, it is a purpose of the invention to provide such construction in a simple, compact design made up of but few, sturdy, easily assembled parts.

A further special object of the invention is to provide a pump of the radial piston type, which will be operable with a single one piece drive shaft.

Another object of the invention is to equalize pressures, particularly in a liquid pump, so that the parts will operate smoothly and freely in balanced relation.

Other desirable objects attained by the invention and the novel features through which the purposes of the invention are accomplished are set forth and will appear more fully in the course of the following specification.

The drawings accompanying and forming part of the specification illustrate certain present practical embodiments of the invention. Structure, however, may be modified and changed in regards to the immediate illustration, all within the true intent and scope of the invention as hereinafter defined and claimed.

Fig. 1 in the drawing is a vertical sectional view of the pump.

Figs. 2 and 3 are vertical sectional views on substantially the planes of lines 2—2 and 3—3 respectively of Fig. 1.

Fig. 4 is a horizontal sectional view of the pump housing on substantially the plane of line 4—4 of Fig. 2.

Fig. 5 is a vertical sectional view of the invention embodied in a liquid displacement pump having a liner provided with pressure equalizing passages.

Figs. 6 and 7 are side views of the inner and outer rings forming the liner, Fig. 7 with broken lines indicating the inner ring in position within the outer ring.

Fig. 8 is an elevation of the opposite side of the outer ring, with the inner ring in position therein.

Fig. 9 is an end view of the complete liner.

As shown in Fig. 1, the pump is made with a single one piece shaft having end portions 6, 7 journaled in needle bearings 8, 9 in opposite end heads or covers 10, 11 of the pump casing and an intermediate larger portion 12 disposed within the central chamber forming portion 13 of the casing.

A rotor 14 in the form of a flat sided cylindrical ring operates with a free running fit in the cylindrical pump chamber 15 provided by the intermediate section and end covers. This circular pump chamber, as shown in Figs. 2 and 3, is eccentric with respect to the shaft and ported at opposite sides of the diameter of eccentricity to provide the reversible inlet and outlet passages 16, 17.

The rotor ring is shown as having radial pump cylinder passages 18 therethrough in which operate the piston forming plugs 19.

These piston elements are shown as having inwardly tapered extensions 20 at the inner ends terminating in rounded bearings 21 riding on the enlarged intermediate cylindrical shouldered portion 12 of the shaft and carrying laterally extended wrist pin lugs 22 at one side terminating at the outward edges in rounded bearing surfaces 23.

Opposite faces of the piston extensions 20 are shown as flat to provide bearing surfaces 24, 25 engageable by elements to hold the pistons against rotation on their axes.

The wrist pin lugs are shown in Fig. 1 as finished off with the inner ends of the piston extensions 20 to provide continuations of the inner rounded surfaces 21 bearing on the shaft enlargement 12.

A collar 26 engaged on the journal portion 6 at the inner end of the shaft, between the shoulder at the end of the shaft enlargement 12 and the cover plate 10 serves as a companion element to the shaft enlargement to effect reciprocation of the pistons in the radial cylinder forming pockets, said collar having a concentric annular flange 27 reaching in over the rounded outer bearing surfaces 23 of the wrist pins, in opposition to the side bearing surfaces 24, thus additionally to serve as means for preventing individual rotation of the pistons.

At the opposite side the flat bearing surfaces 25 of the pistons are engaged by the end of a sleeve or collar 28 fixed on the shaft enlargement by a key 29 rotating against the inner face of the cover 11. This second collar is shown positioned in this relation by a snap ring or washer 30 in engagement with the shoulder at this opposite end of the shaft enlargement.

Drive of the rotor is effected by a radial extension 31 of the keyed collar 28 terminating in a rounded head 32 having a rotary sliding engagement in the correspondingly rounded notch 33 in the adjoining end portion of the rotor.

Suitable packing for the drive shaft is provided, the same being shown as a resilient packing washer 34 seated in a packing chamber 35 provided in the end cover 11, this packing ring having a V-groove 36 in the inner face of the same providing flexible lips engageable respectively with the shaft and with the surrounding wall of the packing chamber.

This flexible packing ring is shown held in place by a gland ring 37 held in place by a snap ring 38.

The end cover 11 is further shown as having a mounting flange 39 by which the pump may be supported in any desired relation.

The central or intermediate ring section of the pump casing is shown as having arcuate grooves 40 and 41 in opposite sides in communication with the ports 16, 17 providing inlet and outlet manifolds for the pump cylinders.

The construction is particularly simple and rugged and consists of but few readily assembled parts. There is only one shaft and this may be all in one piece, with the center enlargement forming with the surrounding annular flange 27, retaining means for holding the pistons in concentric relation to the shaft while the rotor is turned eccentrically about the shaft. The shaft enlargement 12 serves as a cylindrical bearing land holding the pistons outward and the retainer ring 26—27 holds the pistons inward in cooperative relation to the bearing land. The rounded bearing surfaces 21 and 23 at the inner and outer edges of the wrist pin lugs may be designed to closely fit these inner and outer retaining elements, as indicated in Fig. 2.

The circular drive head 32 carried by the fixed sleeve 28 has both a rocking and a sliding fit in the notch 33

in the rotor ring so as to couple these parts together with full freedom for their relative eccentricity.

The pump illustrated in Figs. 1 to 4 is particularly suited for use as an air compressor or the like.

The pump illustrated in Figs. 5 to 9 is designed particularly for handling liquids, it being provided with special passages for equalizing side pressure on the rotor.

This equalization of the pressure is accomplished in the illustration through the provision of a special liner disposed in the pump chamber and having passages to carry pressure developed at one side to the opposite side of the rotor.

Specifically, this liner is shown made in two parts, inner and outer rings 42, 43 respectively, fixed one within the other within the pump chamber.

The inner ring 42 is shown as having oppositely disposed, substantially semi-circular internal grooves 44, 45, the latter terminating at one end in a port 47 opening to the apex of the V-shaped groove 49 in the outer surface of the ring, the branches of this V-shaped groove, Fig. 6, terminating in ports 52, 53 opening to the ends of substantially semi-circular grooves 56, 57 on the inside of the ring at opposite sides of the center groove 44 in the intermediate section of the ring.

The intermediate groove 44 terminates at the end nearest the ported end 47 of the oppositely disposed groove 45 in a through port 46 which when the rings are assembled, Fig. 6, lines up with a port 60 in the outer ring 43 which is located at the apex of an oppositely extending V-groove 48 in the outer surface of the outer ring, the branches of the latter groove terminating in through ports 50, 51 opening to corresponding through ports 61, 62, Fig. 6, in the inner ring at the ends of substantially semi-circular pressure equalizing grooves 54, 55 at the opposite sides of the central or intermediate groove 45.

In this manner the intermediate groove 45 is connected by V-groove 49 with pressure equalizing grooves 56, 57 at opposite sides of the other, main intermediate groove 44 and the latter is connected by V-groove 48 with pressure equalizing grooves 54, 55 at opposite sides of the first mentioned intermediate groove 45.

The side grooves 56, 57 and 54, 55 are shown as of half the width of the intermediate grooves 44, 45 so that pressures applied, of opposite sign, will be substantially equalized and the rotor balanced in a more or less friction-free, floating condition.

Opposite ends of the paired side grooves 56, 57 and 54, 55 are connected by cross grooves 59, 58, Fig. 8, in the outer surface of the outer ring. These cross grooves have ports 63, 64 and 65, 66 at the ends of the same which open through corresponding ports in the inner ring into the ends of grooves 56, 57 and 54, 55, respectively.

The cross grooves 59, 58 in the outer surface of the outer ring are aligned with the inlet and outlet ports 16, 17 in the pump housing so that with rotation as indicated by the arrow in Fig. 5, liquid will be drawn in through parallel side grooves 56, 57 and the connected intermediate groove 45, taken in by pistons 19 operating in cylinder passages 18 and expelled at the opposite side of the top center into the other intermediate groove 44, flowing from the latter through V-groove 48 into the side grooves 54, 55 connected with the outlet cross groove 58, the oppositely disposed intermediate wider grooves in line with the pistons, serving as suction and discharge passages, depending on direction of rotation.

This two-part construction enables the inner section to be made of a material particularly suitable to cooperation with the rotor and the outer section to be made of a material which can be readily machined or otherwise properly formed to cooperate with the grooving and porting of the inner member. The construction disclosed enables the liner parts to be manufactured separately to suit special requirements to which the pump may be subjected and to permit replacement and substitution of liners that may become worn or require replacement.

What is claimed is:

1. A rotary pump comprising a pump casing having a cylindrical pump chamber, a cylindrical rotor ring fitted to and journaled in said cylindrical pump chamber, said rotor ring having radial pump cylinder passages therethrough, a shaft journaled in said pump casing on an axis eccentric to the axis of the cylinder pump chamber, a cylindrical bearing land on said shaft within the pump chamber, pistons in said cylinder passages in the rotor ring, said pistons having extensions at the inner ends of the same bearing on said land and provided with laterally projecting wrist pin lugs, an annular retainer concentric with the shaft and engaging over the outer edges of said wrist pin lugs to hold the pistons in substantially concentric relation to the shaft, said piston extensions having flat sides, means engaged with the flat sides of said piston extensions for holding the pistons against turning in the cylinder passages and for retaining the wrist pin lugs in cooperative engagement with the bearing land and retainer ring, a driving element on the shaft having a sliding rocking driving connection with the rotor ring and inlet and outlet ports for the cylindrical pump chamber disposed at opposite sides of a diameter intersecting the eccentrically related centers of the pump chamber and shaft.

2. A rotary pump comprising a casing made up of an intermediate section and end covers, the intermediate section having a cylindrical pump chamber therein, a shaft journaled in the end covers in eccentric relation to the pump chamber, a rotor ring journaled in said cylindrical pump chamber and having radial cylinder forming passages extending therethrough, a cylindrical bearing land on the shaft within the pump chamber, a retainer ring on the shaft at one end of said bearing land and a drive ring on the shaft at the opposite end of the bearing land, pistons in said passages having flat sided extensions at the inner ends of the same engaged between said rings, said piston extensions having laterally extending wrist pin lugs and the retainer ring having an annular flange engaging over said lugs to confine the pistons inwardly against the cylindrical bearing land, the rotor ring having a notch of radial extent and the drive ring having a circular drive head rotatively and slidingly engaged in said notch and inlet and outlet ports in said intermediate section of the casing opening to the pump chamber at opposite sides of a diameter passing through the centers of the eccentrically related pump chamber and shaft.

3. A rotary pump comprising a pump casing having a cylindrical pump chamber, a cylindrical rotor ring fitted to and journaled in said cylindrical pump chamber, said rotor ring having radial pump cylinder passages therethrough, a shaft journaled in said pump casing on an axis eccentric to the axis of the cylindrical pump chamber, a cylindrical bearing land on said shaft within the pump chamber, pistons in said cylinder passages in the rotor ring, said pistons having extensions at the inner ends of the same bearing on said land and provided with laterally projecting wrist pin lugs, an annular retainer concentric with the shaft and engaging over the outer edges of said wrist pin lugs to hold the pistons in substantially concentric relation to the shaft, said piston extensions having flat sides, means engaged with the flat sides of said piston extensions for holding the pistons against turning in the cylinder passages and for retaining the wrist pin lugs in cooperative engagement with the bearing land and retainer ring, a driving element on the shaft having a sliding rocking driving connection with the rotor ring, inlet and outlet ports for the cylindrical pump chamber disposed at opposite sides of a diameter intersecting the eccentrically related centers of the pump chamber and shaft and a liner for said cylindrical pump chamber, said liner having cir-

cumferentially extending suction and discharge pressure grooves in line with the outer ends of the cylinder passages and smaller pressure equalizing grooves at opposite sides of said suction and discharge pressure grooves, said pressure equalizing groove being connected together at opposite ends and having connections extending from one pair of said grooves to the discharge pressure groove and from the other pair of said grooves to the suction pressure groove and said liner being disposed in said pump chamber with said connections in communication with said outlet and inlet ports.

4. A rotary pump comprising a pump casing having a cylindrical pump chamber, a cylindrical rotor ring fitted to and journaled in said cylindrical pump chamber, said rotor ring having radial pump cylinder passages therethrough, a shaft journaled in said pump casing on an axis eccentric to the axis of the cylindrical pump chamber, a cylindrical bearing land on said shaft within the pump chamber, pistons in said cylinder passages in the rotor ring, said pistons having extensions at the inner ends of the same bearing on said land and provided with laterally projecting wrist pin lugs, an annular retainer concentric with the shaft and engaging over the outer edges of said wrist pin lugs to hold the pistons in substantially concentric relation to the shaft, said piston extensions having flat sides, means engaged with the flat sides of said piston extensions for holding the pistons against turning in the cylinder passages and for retaining the wrist pin lugs in cooperative engagement with the bearing land and retainer ring, a driving element on the shaft having a sliding rocking driving connection with the rotor ring, inlet and outlet ports for the cylindrical pump chamber disposed at opposite sides of a diameter intersecting the eccentrically related centers of the pump chamber and shaft and a pressure equalizing liner for said cylindrical pump chamber, said liner being composed of inner and outer annular sections, one within the other, the inner section having circumferentially extending discharge and suction pressure grooves at the inside of the same and pairs of pressure equalizing grooves at opposite sides of said discharge and suction pressure grooves, the outer and inner section, having transfer passages for connecting said pairs of equalizing grooves with the discharge and suction pressure grooves respectively and said outer liner section having cross grooves connecting the ends of each pair of equalizing grooves disposed in communication with said outlet and inlet ports.

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