

April 8, 1930.

J. R. RICHER

1,753,476

ROTARY PUMP OR BLOWER

Filed June 29, 1927

2 Sheets-Sheet 1

Fig. 1

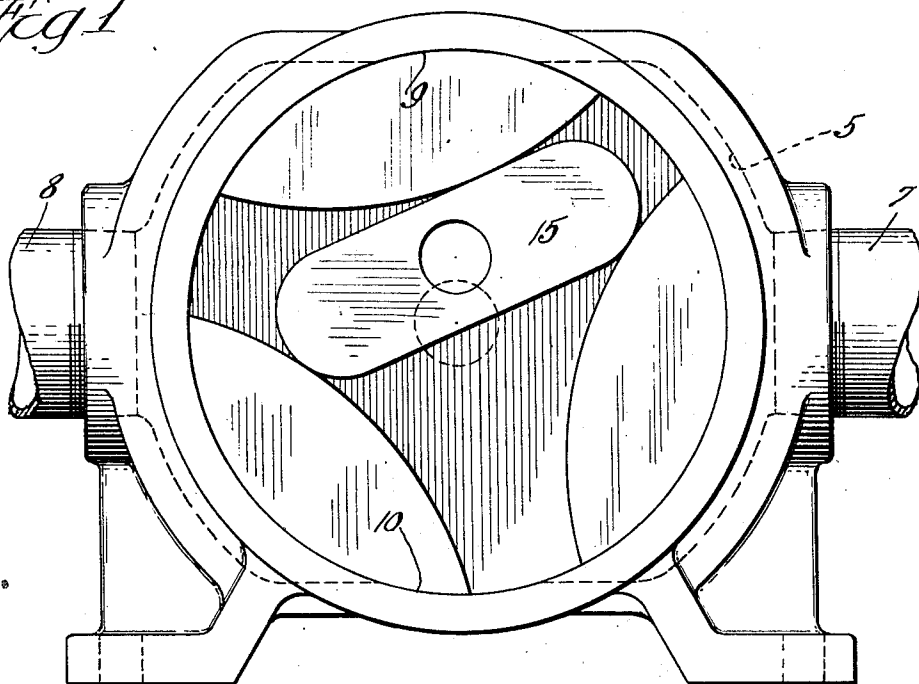


Fig. 2

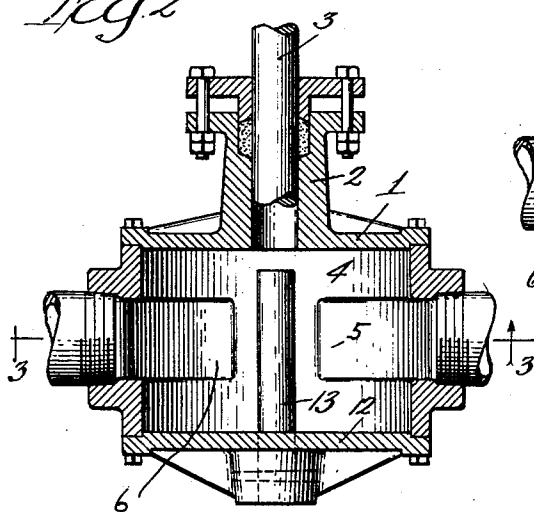
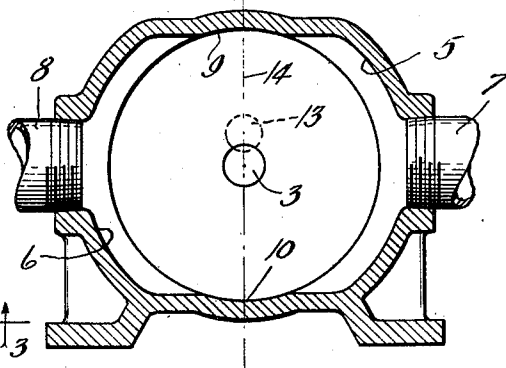


Fig. 3



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Fig. 4

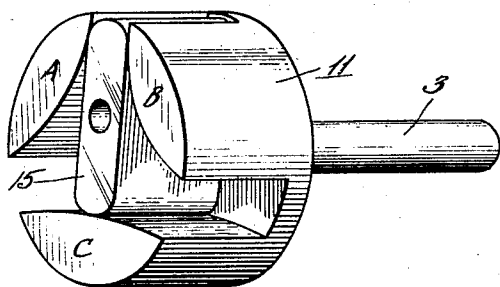


Fig. 5

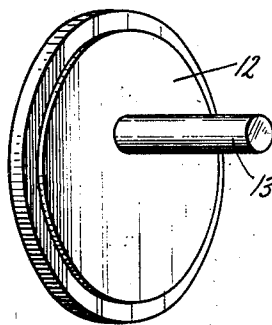


Fig. 6

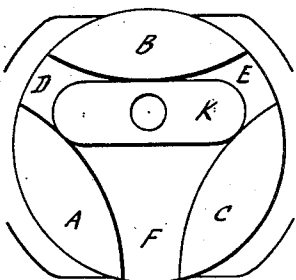


Fig. 7

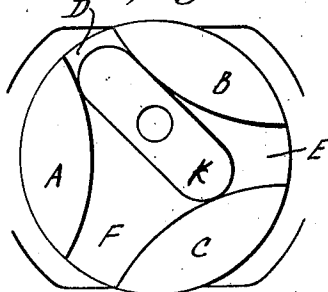


Fig. 8

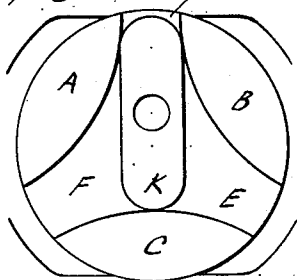


Fig. 9

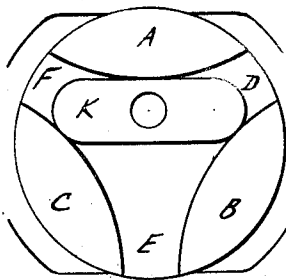


Fig. 10

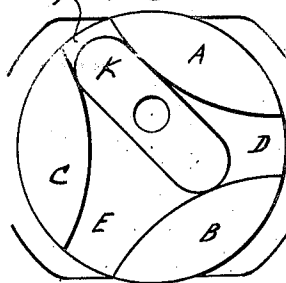


Fig. 11

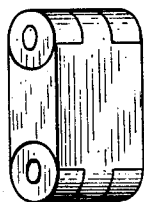
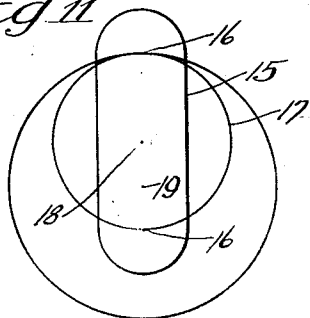


Fig. 12

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UNITED STATES PATENT OFFICE

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ROTARY PUMP OR BLOWER

Application filed June 29, 1927. Serial No. 202,261.

My invention aims to provide a simple and cheaply constructed, noiseless and gearless pump or blower which will have a high capacity in proportion to its size and speed of rotation, and which will produce relatively little friction even when moving viscous liquids.

More particularly, my invention provides a pump or blower in which a vane continuously forms a partition between three walls on a rotor, in which the vane is rotated by engagement with these walls without requiring interposed gears or other driving connections, and in which the vane continuously contacts with all three of the said walls. Moreover, my invention provides a pump or blower of this type in which the shape of the vane and of the vane-engaging walls can easily be designed with a high degree of accuracy; and in which the vane may be flat-sided, while the said walls may be portions of cylinders, thereby facilitating their accurate manufacture.

Still further and also more detailed objects will appear from the accompanying drawings and from the following specification, in which specification I am using the term pump in a generic sense in which it also includes blowers.

In the drawings,

Fig. 1 is an end elevation of a rotary pump embodying my invention, with the nearer end plate detached.

Fig. 2 is a central and vertical section through the pump casing at right angles to the driving shaft.

Fig. 3 is a horizontal section taken along the axis of the driving shaft in Fig. 2 and looking upward.

Fig. 4 is a perspective view of the winged rotor.

Fig. 5 is a perspective view of the end plate of the casing, which has the stationary vane shaft attached to it.

Figs. 6 to 10 are diagrammatic views showing five consecutive positions of the winged rotor and of the pivoted vane with respect to the inlet and outlet chambers of the casing.

Fig. 11 is a diagram showing the method of generating the curvature of the inner or

vane-engaging faces of the wings on the rotor.

Fig. 12 is a perspective view of a modified form of vane, namely one provided with end rollers.

In the illustrated embodiment, the casing of my pump comprises a tubular portion 4 having two heads attached to it, including a head 1 carrying a journal 2 for the driving shaft 3. The tubular casing portion 4 has its major bore portion cylindrical but enlarged in diameter medially of the length of this casing portion to afford two diametrically opposite recesses 5 and 6 which respectively have an inlet pipe 7 and outlet pipe 8 connected to them, so that the said recesses respectively form the inlet and the outlet chambers of the pump. Each of these recesses extends for somewhat less than 180 degrees around the bore of the tubular casing portions, thus leaving between them two bore portions 9 and 10 of a common cylindrical curvature, which are diametrically opposite each other.

The driving shaft 3 which extends through the journal 2 is fast upon and may be integral with a disk 11 which fits the cylindrical bore of the tubular casing portion, and this disk carries three segmental wings A, B and C, each of which has its outer face of a cylindrical curvature rotatably fitting the said bore of the tubular casing portion. The three segmental wings are uniformly spaced circumferentially about the shaft 3 and present convex faces toward each other and towards the said shaft, and the shaft does not project beyond the wing-carrying disk portion of the rotor which comprises the said shaft, disk and wings.

The companion head 12 which is fitted and fastened to the other end of the tubular casing carries a fixed shaft 13 which has its axis parallel to the axis of the driving shaft 3 but spaced from the latter along the medial axis 14 of the cylindrically curved bore parts 9 and 10 of the tubular casing member. Pivoted at its own center on this stationary shaft 13 is a vane 15 which continuously has its periphery in engagement with all three of the inwardly directed faces of the wings on rotor, thereby continuously varying the relative

sizes of the three compartments (D, E and F) into which the partition-forming vane divides the substantially Y-sectioned interior of the rotor.

5 To secure this continuous contacting of the vane with the segmental wings, I form each end of the vane 15 as a hemisphere about an axis 16, as shown in Fig. 11, so that the circle 17 drawn about the pivot axis 18 of the vane
10 through the axes 16 of the vane will form the pitch line of the vane in rolling on the segmental faces of wings of the rotor. Then I generate the curvature of the inner segment faces by rolling this pitch circle 17 on the
15 inside of the pitch circle of the tubular casing, which is a circle centered at the driving shaft axis 19 and of a radius equal to the distance between this axis 19 and the further vane-end axis 16 along a line also extending
20 through the vane shaft axis 18.

In practice, I preferably proportion the parts so that the distance from 16 to 19 in Fig. 11 is just three times the distance between the driving shaft axis 19 and the vane
25 axis 18, and make the radius of each vane-end equal to the said distance between the axes 18 and 19. With these proportions, the generated curve (which is a hypocycloid) is a circle of a radius six times the distance between the
30 axes 18 and 19, so that each inner wing face can be turned on a lathe; and the main segment-engaging faces of the vane can be flat. By doing this I also cheapen the manufacture of the vanes, as only their ends need to be
35 milled and the needed cutter for the milling can easily be shaped with a high degree of accuracy.

Each of the opposed cylindrical bore portions 9 and 10 of the casing has a circumferential length somewhat greater than the
40 width of the vane, and hence greater than the gap between the ends of any two adjacent segmental wings, so that either of these bore portions will effectively close any of these
45 gaps in certain positions of the rotor.

With the rotor rotating in a clock-wise direction and the inlet at the right, the inlet space E beyond the end of the vane is quite small when that end first reaches the inlet
50 chamber of the pump, as shown in Fig. 6. This space gradually increases—as shown in Figs. 7 and 8—and reaches its maximum when the said main member and the vane are in the positions shown in Fig. 9, in which position the lower end of the space E is closed
55 by the tubular bore portion 10, so that the space E holds its maximum capacity. As soon as this lower end of the space E passes beyond the left-hand end of the tubular portion 10 (of Fig. 3), this space opens into the outlet chamber 6. Then the continued movement of the vane gradually reduces this space until the parts reach the position of Fig. 10, in which position the vane has pushed almost all of the charge out of the space E.

The same action is repeated for each of the other spaces D and F, so that my simple pump has an intake and a discharge three times during every revolution. Moreover, the liquid storage space in the rotor is relatively large
70 in proportion to the diameter of this member, so that my pump has a large operating capacity in proportion to its size.

At the same time, the proportion of the pumped liquid which is adjacent to the periphery of the rotor is quite small, and the vane (which rotates three times for every two revolutions of the winged rotor) rolls to a large extent upon the segmental wings, so that the friction is quite small. Consequently, my pump is particularly advantageous for use with liquids of high viscosity, thus making it suitable for pumping heavy lubricating oils. However, it can also be used for other liquids and even for gases, as for example for
85 furnace blowers.

During the operation of the pump, it will be seen from Figs. 6 to 10 that the vane slides its end K consecutively into and out of the consecutive arms of the substantially Y
90 shaped interior of the rotor, and the same holds true of the other end of the vane. Each vane-end draws liquid into one arm of this Y shaped interior and then forces liquid out of another arm, so that the vane acts effectively
95 both as a partition and as a plunger or piston.

In practice, and particularly for use with viscous liquids, I desirably provide some clearance between the extreme outward position of a vane end (as shown by the top of the vane in Fig. 1) and the bore portions 9 and 10 of the casing. This is easily done by making these casing portions of a radius somewhat larger than the distance from the driving shaft axis 19 (in Fig. 11) to the top of the vane in that figure, and correspondingly increasing the diameter of the outer faces of the wings.

However, while I have illustrated and described my invention in an embodiment including a three-piece casing and a single-piece vane, I do not wish to be limited to the construction and arrangement thus disclosed, since many changes might obviously be made without departing either from the spirit of my invention or from the appended claims. For example, I may provide the vane with revolvable end portions as shown in Fig. 12, and the driving power might be applied to
120 the vane.

Since the winged rotor and the vane rotate conjointly, my pump may be driven from either of these two members, as the vane could obviously be fastened to a rotatably mounted shaft while leaving the rotor freely journaled. However, I preferably apply the driving power to the rotor which is much heavier than the vane. During the rotation, it will be noted from Figs. 6 to 10 inclusive that the
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vane always has a considerable portion disposed in one of the arms of the Y-sectioned chamber in the rotor, so that the vane is moved by power applied at a considerable distance from the pivot axis of the vane in directions substantially at right angles to the longitudinal medial plane of the vane taken through the semi-circles at its ends. Consequently, I transmit power to the vane with very little friction and without any material thrust toward the pivot axis of the vane.

Moreover, it will be understood that the simultaneous contacting of the vane with all three of the wings on the rotor, as shown in the drawings, is theoretical. In practice, I preferably provide a little clearance between these parts so as to allow a film of the oil or other pumped liquid to be disposed between them. I may also vary the shape of the ends of the inner wing faces, as the shape of these is relatively immaterial, as long as the intervening main portions of these inner wing faces are hypocycloidal.

I claim as my invention:

1. In a rotary pump, a rotor and a vane pivoted at its center on a stationary axis parallel to but spaced from the axis of the rotor, the said rotor including three equally spaced segmental wings having inwardly directed convex faces continuously engaging the vane, the vane having two flat and parallel edges constituting the major portion of its periphery and adapted to roll on the said convex faces, each such wing face being a portion of a cylindrical surface whose radius is six times the spacing between the axis of the rotor and the pivot axis of the vane.

2. In a rotary pump, a rotor, and a vane pivoted at its own center on a stationary axis parallel to but spaced from the axis of the rotor, the rotor including three wings having inwardly directed convex faces of arcuate circular section, and the vane being continuously in engagement with all three of the said wing faces, the cross-sectional shape of the vane transverse of its pivot axis comprising two semi-circles concaved toward each other and connected by parallel lines.

3. In a rotary pump, a rotor, and a vane pivoted at its own center on a stationary axis parallel to but spaced from the axis of the rotor, the rotor including three wings having inwardly directed convex faces of hypocycloidal section, and the vane being continuously in engagement with all three of the said wing faces, the cross-sectional shape of the vane transverse of its pivot axis comprising two semi-circles concaved toward each other and connected by parallel lines, the centers of the semi-circles being twice as far from the pivot axis of the vane as the latter axis is from the axis of the rotor.

4. A rotary pump comprising a rotor having three spaced peripheral wings, and a vane

pivoted at its own center on an axis parallel to but spaced from the axis of the rotor, the vane being disposed between the said wings, each wing having its inner and outer faces portions of cylindrical surfaces; in combination with a casing having opposed bore portions fitting the said cylindrical surfaces and having inlet and outlet connections between its said opposed bore portions, the radius of the outer face portion of each wing being two-thirds that of the inner face of the wing.

5. A pump as per claim 1, in which the radius of the outer cylindrical surface portion of each wing is two-thirds that of the inner cylindrical surface portion of the wing.

6. A rotary pump, comprising a casing having opposed bore portions of a common cylindrical curvature, and having inlet and outlet connections between the said bore portions; a rotor coaxial with the said bore portions and having three equally spaced segmental wings; and a bar-like vane journaled between the said wings on an axis parallel to but spaced from the axis of the rotor; the vane having flat sides connecting two semi-cylindrical ends, the radius of each vane end being equal to the spacing between the said axes, and the distance between the axes of the semi-cylindrical end curvatures being four times the said spacing; each wing having as its inner face a portion of a cylindrical surface whose radius is six times the said spacing.

7. A rotary pump comprising a stationary casing, a rotor mounted in the casing, the rotor having three symmetrically disposed and counterpart segmental wings, and a vane pivoted upon the casing on a pivot axis parallel to but spaced from the axis of the rotor; the segmental wings all having their outer faces in a common cylindrical surface coaxial with the rotor and of a radius four times the spacing between the said rotor and pivot axes; each segmental wing having its inner face in a cylindrical surface of a radius six times the distance between the rotor axis and the pivot axis of the vane; the vane having opposed flat and parallel edges spaced by twice the distance between the said axes, and having semi-cylindrical end edges connecting the said parallel edges, the axis of each semi-cylindrical end edge being spaced from the pivot axis of the vane by twice the distance between the said pivot axis and the rotor axis.

8. In a rotary pump, a rotor having adjacent to its periphery three counterpart and symmetrically disposed wings freely spaced from each other by openings and presenting inwardly bowed inner faces, and a vane pivoted on a stationary pivot axis parallel to the axis of the rotor; each of the said inner wing faces being a portion of a cylindrical surface of a radius six times that of the spacing between the rotor axis and the pivot axis of the vane, and each such inner wing face approaching the axis of the rotor to a minimum

distance twice the said spacing; the vane being shaped for continuously engaging all three segmental walls and so that a medial edge portion of the vane will move along one of the said walls with a combined rolling and sliding movement while one end of the vane moves away from one of the openings and the other vane end moves into the next opening.

9. A rotary pump comprising a rotor having three symmetrically disposed and counterpart segmental walls freely spaced from one another at their ends by openings each of a given circumferential length, the transverse section of each such wall in a plane at right angles to the axis of the rotor being a portion of a cylindrical surface whose radius is three times the said circumferential length; and a vane pivoted on a stationary axis spaced from the rotor axis by one-half the said length, the vane having two opposed parallel edges spaced by the said length and adjoined by semi-cylindrical end edges, the total length of the vane being three times the said circumferential length.

Signed at Chicago, Illinois, June 27th, 1927.

JOSEPH R. RICHER.

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