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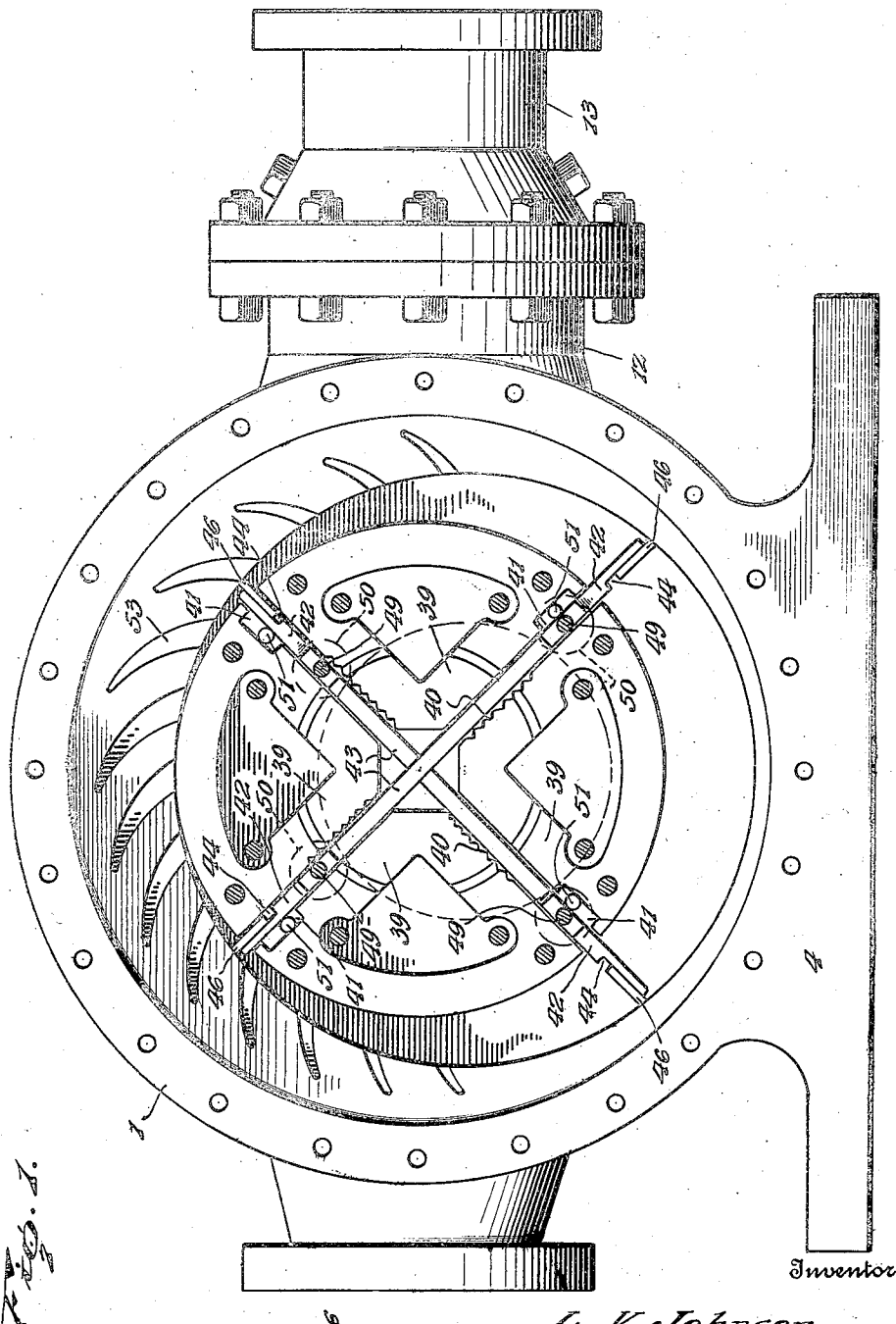
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1,974,112

ROTARY PUMP

Filed March 14, 1932

7 Sheets-Sheet 1



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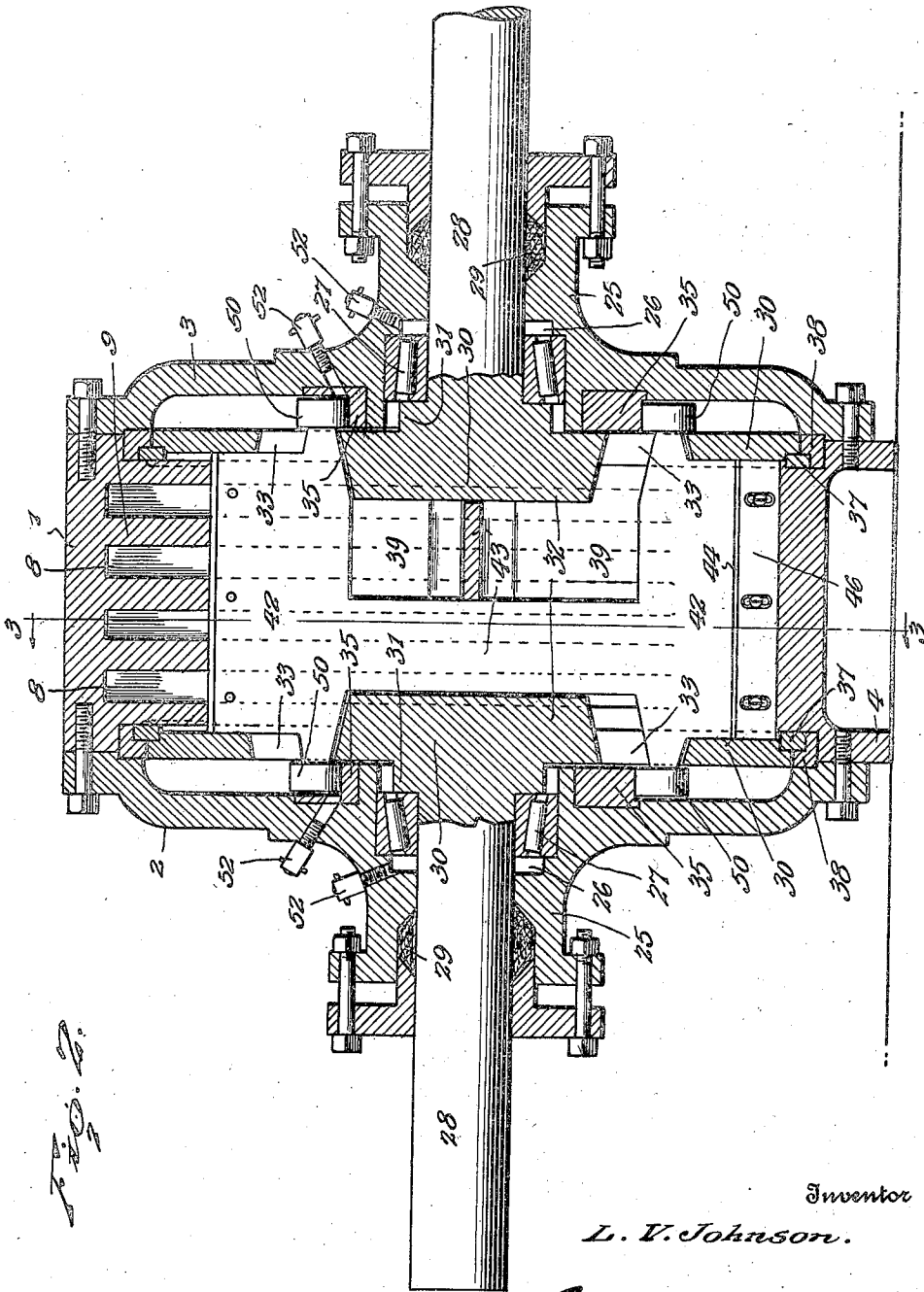


Fig. 2.

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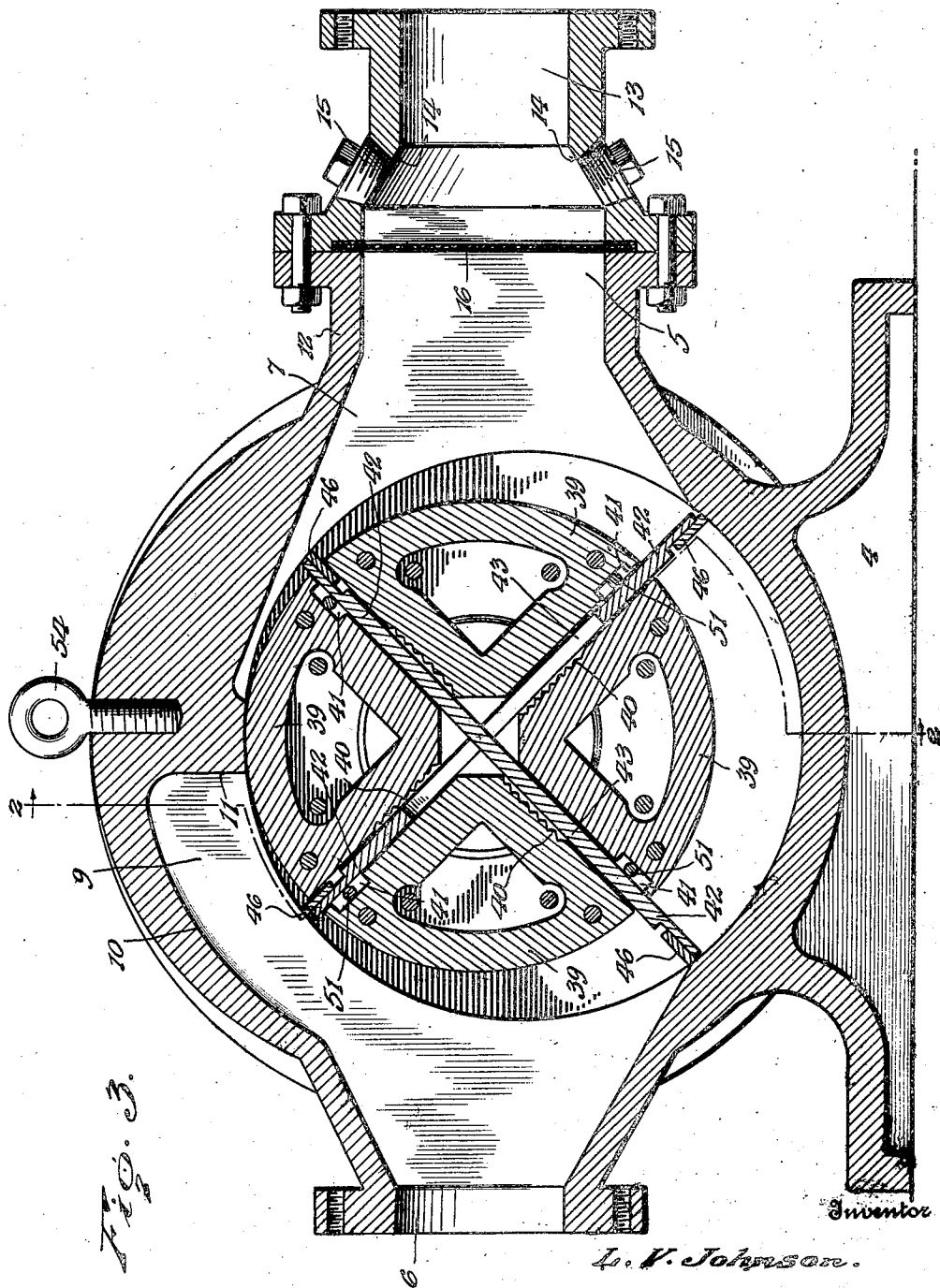
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Fig. 4.

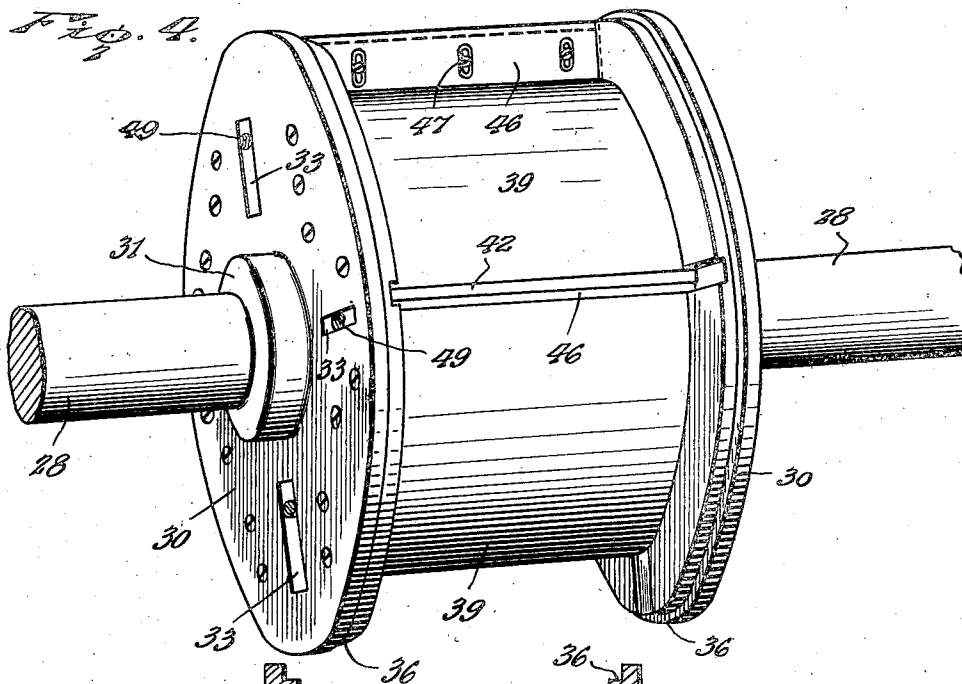
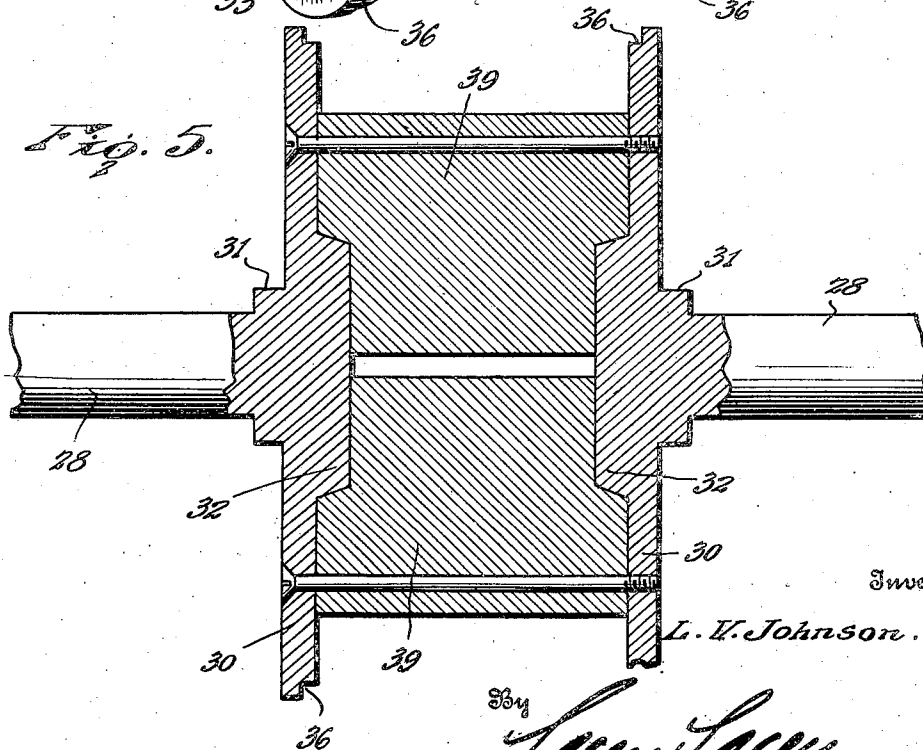


Fig. 5.



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Fig. 6.

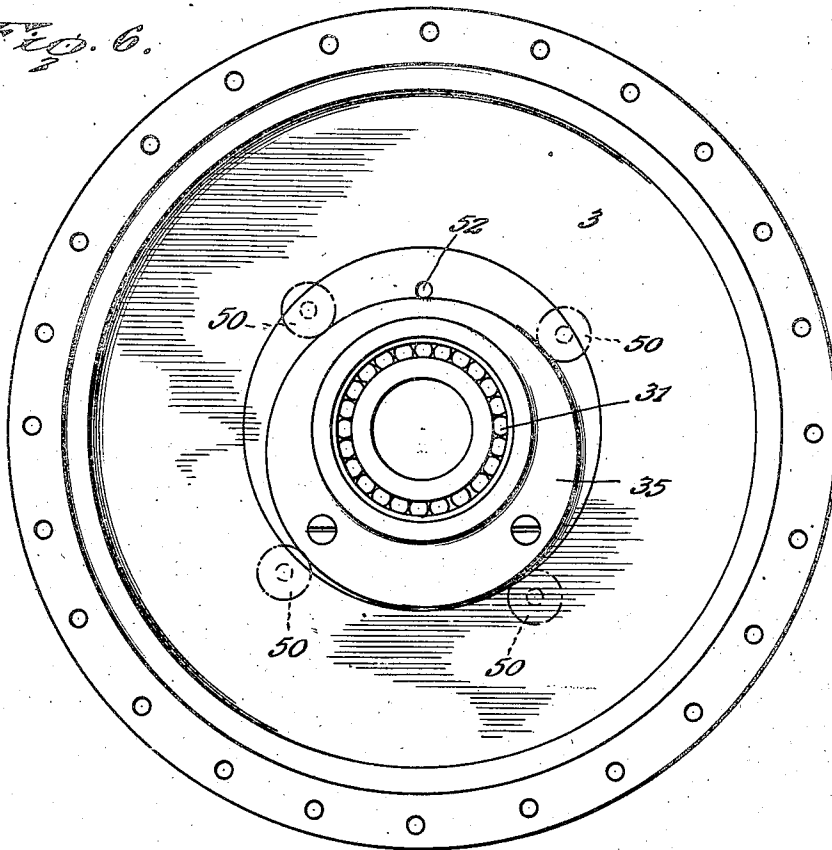
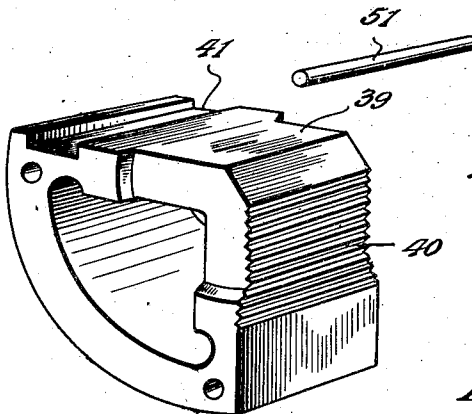


Fig. 7.

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Fig. 10.

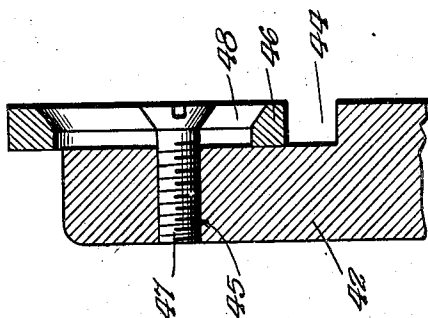


Fig. 11.

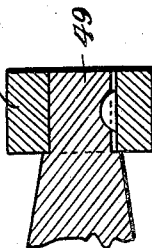


Fig. 9.

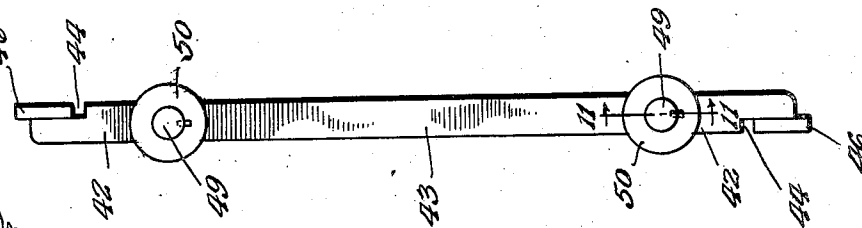
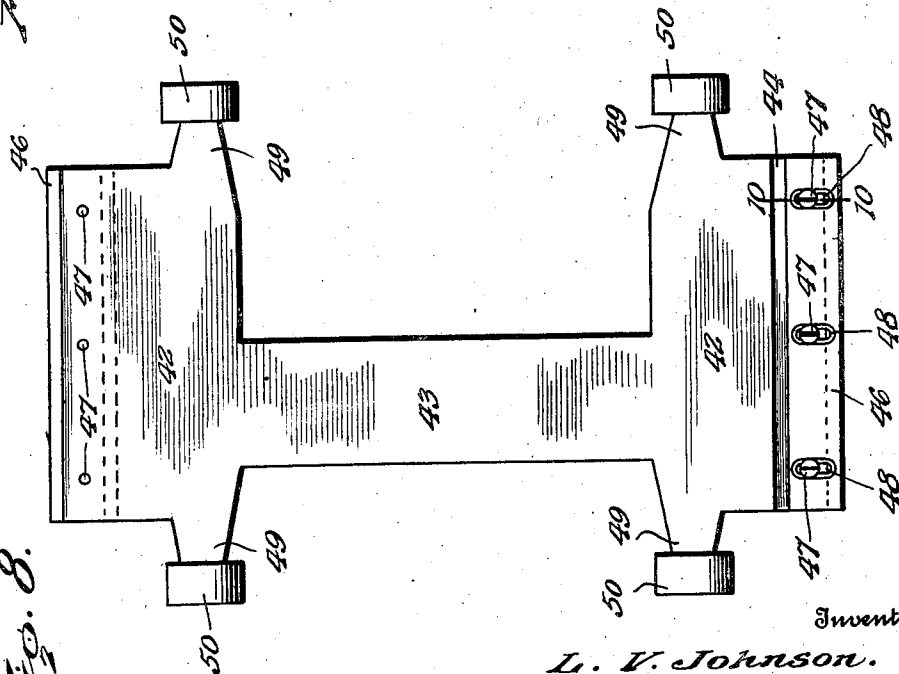


Fig. 8.



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ROTARY PUMP

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Fig. 12.

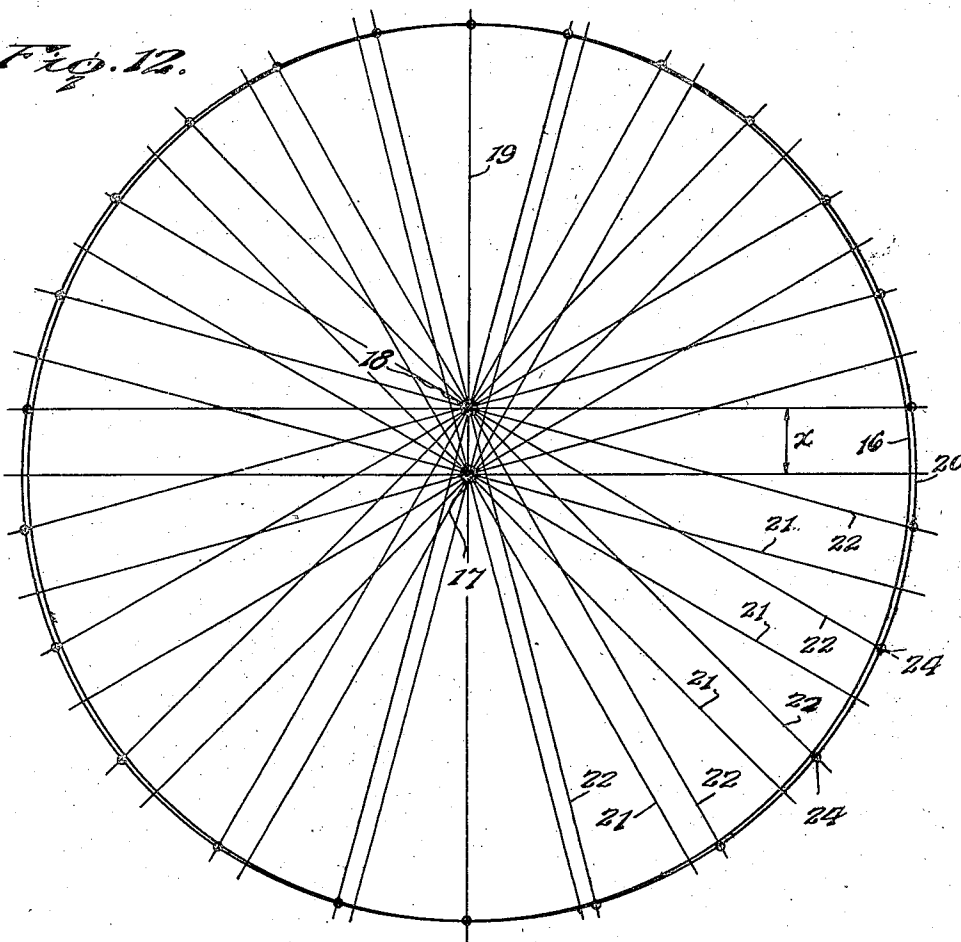
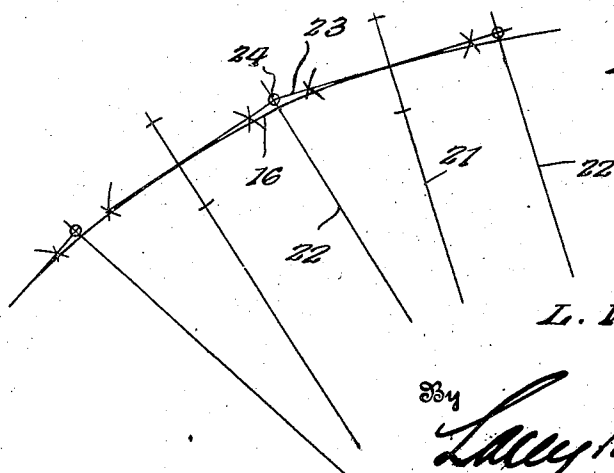


Fig. 13.

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UNITED STATES PATENT OFFICE

1,974,112

ROTARY PUMP

Louis V. Johnson, Houston, Tex., assignor of twenty-five per cent to Luella C. Johnson, five and five-ninths per cent to James E. Snow, seven and one-half per cent to James A. Kluever, and thirty-six and seventeen-eightieths per cent to Alfred John Shudde, all of Houston, Tex.

Application March 14, 1932, Serial No. 598,772

4 Claims. (Cl. 103—138)

My invention relates to rotary pumps and more particularly to rotary pumps of non-centrifugal type.

The objects of my invention are to provide a device of this class which will produce more line pressure for a given amount of operating power than any pump now known; which will pump a greater volume of fluid for a given size of pump and a given amount of operating power than any pump known; which will be more positive in action and will produce a greater per cent of operating efficiency than any pump now known; which will be simple in construction, having few moving parts to become worn; the worn parts of which may be easily and quickly replaced at a comparatively small expense; which will be strong and durable; which will require no priming when a liquid is being conveyed; which will pump either liquids or fluids such as air, gas and the like, and which will operate with less vibration than any pump of equal capacity now used.

The invention is illustrated in the accompanying drawings and will be hereinafter fully described, the novel features being particularly defined in the appended claims.

In the drawings, Figure 1 is an elevation of the pump with one end removed, showing the rotor and impeller blades therein.

Fig. 2 is a transverse vertical section,

Fig. 3 is a longitudinal section on the line 3—3 of Fig. 2, the line 2—2 indicating the plane of the section shown in Fig. 2,

Fig. 4 is a perspective view of the rotor,

Fig. 5 is a diametrical section of the rotor, the impeller blades being omitted,

Fig. 6 is a view of the inner side of one side wall of the housing,

Fig. 7 is a perspective view of one of the rotor sections,

Fig. 8 is a plan view of one of the impeller blades,

Fig. 9 is an edge view of the same,

Fig. 10 is an enlarged section on the line 10—10 of Fig. 8,

Fig. 11 is an enlarged section on the line 11—11 of Fig. 9,

Figs. 12 and 13 are diagrammatic views of the bore in the housing and the guide cam, showing their development and relation.

The casing or housing of the pump consists of a circumferential wall 1 and end walls 2 and 3 which are rigidly secured to opposite edges of the wall 1 by bolts inserted through marginal portions of the end walls in an obvious manner. Preferably integral with the wall 1, a supporting base 4

is provided and said wall is also provided with an intake opening or port 5 and an outlet or discharge port 6 which are preferably diametrically opposite. The intake port communicates with the bore of the housing, and webs 7 are formed in the housing across the inlet passage to prevent the entry of any large foreign object which might prove destructive to the interior mechanism of the pump. Said webs form a smooth continuation of the interior surface of the housing so that the impeller blades may pass the port smoothly. The outlet port communicates with the bore of the housing through a plurality of slots 8 in the circumferential wall, ribs 9 between said slots conforming smoothly to the curve of the bore of the housing. Exteriorly of said ribs 9 is formed a cavity 10 terminating in an abrupt shoulder 11 adjacent the top of the housing.

Around the intake port, the circumferential wall of the housing is provided with an outwardly projecting neck 12 to which is bolted a short pipe section 13 having clean-out openings 14 normally closed by plugs 15. Between the outer end of the neck 12 and the inner end of the pipe 13 a removable screen 16 is clamped, as shown.

Referring particularly to Figs. 12 and 13, the cross-sectional contour of the bore of the housing will be made known.

The numeral 16 indicates a curve representing a true circular bore cut about the point 17 as its axis. The numeral 18 represents a point on a radial line 19 at a given or desired distance from said axis 17. This distance is represented as x . The outer curve 20 represents the finished bore which is developed as follows:—

A desired number of radial lines 21 are drawn through said axis 17, and a similar number of lines 22 are drawn through said point 18, each parallel to its next adjacent radial line 21. At the points at which said radial lines 21 intersect the curve 16, tangents 23 are drawn to intersect its adjacent parallel line 22. The points 24, determined by the intersection of said lines 22 and said tangents 23, are the points by which said line 20 is developed, and all lines drawn through the point 18 between any two points 24 will be equal in length. Comparison of the curves 16 and 20 will show that they coincide at top and bottom and the bore is slightly oblate in cross-section.

The end walls 2 and 3 are each provided with a central projection or nose 25 having an inner recess 26 to receive an anti-friction bearing 27. Shafts 28 are journaled in the bearings 27 and

project outwardly past the end walls to be driven by any convenient motor, stuffing boxes 29 being provided to prevent leakage of lubricant. On the inner end of each shaft 28 is a concentric disk 5 or head 30 which is formed with an outstanding annular shoulder or hub 31 and with an inner end heavy circular disk like shoulder 32. The hub 31 bears against the inner surface of the adjacent bearing 27, and the members 30, 31 and 32 are preferably integral with the shaft. In the head 30 are four equidistant radial slots 33 which constitute guides for the impeller blades, as will presently appear. On the inner faces of the end walls, around the recess 26, is an inwardly extending annular projection or rim 15 34 which bears against the outer face of the disk or head 30, and pressed firmly around the periphery of said annular projection 34 is a race sleeve or track 35 preferably made of some extremely hard metal and having its periphery slightly oblate to correspond with the cross-sectional outline of the bore of the housing, the distance between the track and the wall of the bore being the same at all points.

25 Said shafts 28 are in axial alinement, and their axes of rotation correspond to the point 18 in Fig. 12.

The periphery of each head or disk 30 is provided with an annular rabbet or recess 36 which 30 receives a sealing ring 37 which may rotate with the respective head and prevents leakage between the head and the adjacent end wall, a cooperating ring 38 being seated in the circumferential wall so that the joint between the walls is effectually covered. A slight clearance is provided 35 between the peripheries of the heads 30 and the rings 38 to avoid frictional resistance. The rotor includes approximately quadrantal sections 39 bolted flatly and rigidly to the inner faces of the heads 30 and engaged around the inner disks 40 32. One edge of each section 39 is provided with corrugations 40, and in the other edge is formed a rectangular transverse groove 41. Said sections, when attached to the heads 30, rigidly hold 45 the heads together and form between their opposed sides radial guide grooves which intersect at a central point and in which the impeller blades are fitted and operate.

Each impeller has two flat substantially rectangular end portions 42 which are of a length 50 slightly less than the distance between the inner faces of the heads 30, and are integrally connected by a flat bar or shank 43 which is considerably narrower than the length of the end portions 42 and is offset from the medial longitudinal line of the impeller. The length of the 55 shank 43 with the combined widths of the ends 42 make the over-all length of the impeller slightly less than the length of one of said lines 22 in Fig. 12. In other words, when the impeller is in an operative position, it will extend directly across the axis corresponding to the point 18, but its length will be insufficient to permit both its ends to simultaneously contact the wall of the bore of the housing. It is preferable that the 60 clearance between the ends of the impellers and the wall of said bore shall be approximately one-sixty-fourth of an inch. Each end of the impeller is provided with a transverse groove or recess 44 and with perforations 45, and a transverse sealing plate 46 is seated in each recess and is held in slidable engagement with the impeller by bolts 70 47 inserted through said perforations and slots 48 in the sealing plate, so that the plates are permitted a slight transverse movement and when

they are at the outer end of their throw their outer edges simultaneously contact with the wall of the housing.

Extending from the opposite edges of each of the end portions 42 are spindles 49, the distance 80 between the opposite ends of each pair of spindles being substantially equal to the distance between the inner faces of the end walls 2 and 3 at the point adjacent the tracks 35. Each of said spindles 49 is provided with an annular shoe 50 85 preferably made of some extremely hard metal, and keyed to the spindle. It may be found desirable, however, to substitute rollers for the shoes 50, and to eliminate the keys.

When the impellers are disposed in the guide 90 grooves between the rotor sections, they will be positioned inversely with relation to each other, so that the shank 43 of one impeller will extend transversely across the shank of the other impeller. The spindles 49 pass through the slots 95 33 in the heads 30 of the rotor, and the shoes 50 slidably rest on the tracks 35 so that, upon rotation of the shafts 28, and the consequent rotation of the rotor and said heads 30, said tracks will cause the impellers to move in the direction 100 of their own length so as to always bring said plates 46 into contact with the wall of the bore of the housing. It may be understood that, if desired, the plates 46 may be eliminated and the impeller blades constructed to a length causing 105 both ends of each to simultaneously contact the wall of the bore. It may also be seen that the tracks 35 may be omitted when sufficiently small pumps are being built. This could be done because of the fact that in small pumps the friction 110 between the wall of the bore and the ends of the impellers will not be so great as to require said tracks.

In order to lessen the friction between the sides of the impellers and the adjacent faces of the 115 sections of the rotor, rollers 51 may be fitted in the grooves 41 of said sections. The corrugated portions 40 of the rotor sections constitute means for permitting the free escape of any liquid which may enter between said sections and the impellers, 120 and prevent the pressure of such liquid from tending to retard the longitudinal movement of the impellers. They also act as a means for retarding movement of any such liquid longitudinally of said impellers. 125

A plurality of lubricating valves 52 are fitted in the end walls for supplying a lubricant to the bearings 27 and to the tracks 35.

In the sides of the circumferential wall 1, there are arcuate grooves or recesses 53 which open 130 into the bore of the housing, and in the top of said wall is fitted a suspending ring 54 to facilitate handling of the cylinder while boring and finishing the same.

The device is assembled substantially as follows:— 135

The impellers will be assembled complete as illustrated in Figs. 8 and 9; the rotor sections will be bolted rigidly to the face of one head 30; one impeller will be inserted in the slot between the 140 rotor sections with its spindles extending outwardly from said head; the other impeller will then be placed across the first impeller in the intersecting slot formed between said sections, and with its spindles extending through the radial 145 slots in said head; shoes 50 will be keyed to the projecting spindles of the impellers; one of said sealing rings 37 will be placed in the annular recess 36; and the device thus far assembled will be inserted into the bore of the housing, 150

said head 30 engaging at its edge portions the adjacent end of the circumferential wall. An anti-friction bearing will next be placed around the shaft and pressed into engagement with the adjacent hub 31. The end wall which has previously received a track 35 will then be placed over said shaft and pressed into engagement with the adjacent end of the circumferential wall and the securing bolts will be tightened down. The packing gland will then be placed around the shaft and bolted in place. At this point it may be noted that one end of the device is completely assembled.

The other end is assembled substantially as follows:—

The rollers 51 will be inserted into the grooves 41; one of the sealing rings will be placed in the annular groove 36 in the edge of the yet free head 30; said head with its shaft will be placed against the open end of the circumferential wall and will be rigidly bolted to the rotor sections, with the spindles of the impellers extending outwardly through the slots 33 in the head; the shoes 50 will be keyed to the protruding ends of said spindles; the bearing will be placed over said shaft 28 and pressed against the presented hub 31; the end wall which has previously received its track 35 will then be placed over the shaft, and will be rigidly bolted to the adjacent end of the circumferential wall; and, finally, the packing and gland will be placed over the shaft and drawn tightly into place.

In operation, power will be furnished to rotate the shafts in the proper direction, indicated by the arrow in Fig. 3. The conveyed fluid will enter through inlet 5, and will be exhausted through outlet 6 by the action of the impellers and by the action of the plates 46 upon the wall of the bore. It may be seen that it will be impossible for the impellers to carry any of the fluid past the upper radial center of the bore because, when they reach the shoulder 11, their ends will be exactly flush with the periphery of the rotor, and there will be no room between the wall 9 and the periphery of the rotor for the fluid to pass. The impellers will exert a squeezing pressure on the fluid as they approach the upper center of the cylinder, and this pressure will force the fluid into the cavities 10 and against said shoulder 11, and after said cavities are once filled with the fluid, the fluid therein will remain practically dormant due to the pressure to which it is being subjected. This condition then will cause all fluid which subsequently enters to flow out through outlet 6 without entering the upper portions of said cavities.

It may be seen that when the device is in operation, the rotor and impellers, and all other revolving parts of the device are at all times in a static balance, and that consequently the device will operate with very little vibration. It may further be seen that, due to the fact that each impeller is one solid unit and contacts different sides of the bore with its ends, the device is much more positive in action than any rotary pump now in use. The centrifugal force of the rotating impellers will cause said plates 46 to remain at the outer ends of their throw and in positive engagement with the walls of the bore. Any fluid which may pass up between the projecting sides of the rotor and the sides of the circumferential wall at the ribbed portion 9 will enter the recesses 53 and thence escape so that it will not tend to travel around with the roller flange and impede the operation.

The ends of the impellers are at all times in contact with the wall of the rotor chamber and travel smoothly thereover.

It is to be understood that an efficient power unit could be constructed along the principles involved herein without departing from the invention or the scope of the claims.

Having thus described my invention, what is claimed and desired to be secured by Letters Patent, is:

1. A rotary pump embodying a housing having a rotor chamber and having an inlet and an outlet communicating with said chamber, inner and outer laterally spaced vertical webs extending entirely across the outlet and having their inner ends conforming to and forming a part of the inner wall of the rotor chamber, the housing being cut away at said outlet to form a cavity defining an abrupt vertical shoulder integral with the top of the housing and adjacent the vertical axis thereof, there being spaced relatively shallow outwardly tapered grooves formed in the exterior faces of the outer webs and having their large ends communicating with said chamber and their small ends spaced from the annular wall of the housing, a rotor having its axis of rotation offset to the chamber, a pair of crossed impellers revoluble with said rotor and mounted thereon for movement longitudinally of themselves, and means for causing said impellers to move longitudinally for simultaneously engaging both ends of each with the walls of said chamber at all times during the rotation of said impellers.

2. A rotary pump embodying a housing having a closed ended rotor chamber and an inlet and an outlet spaced from each other circumferentially of the chamber and communicating with substantially opposite sides of said chamber, inner and outer laterally spaced vertical webs extending entirely across the outlet and having their inner ends conforming to and forming a part of the inner wall of the chamber, the housing being cut away to form a cavity at the center of the top thereof defining an abrupt vertical shoulder integral with the housing and disposed adjacent the vertical axis thereof, tapered segmental grooves in the outer faces of the outer webs and having their large ends communicating with the chamber and their small ends spaced from the housing, said chamber having its upper and lower diametrical points concentric and its intermediate points eccentric to the axis of said chamber, a rotor having its axis of rotation offset toward one of said concentric points, and a pair of impellers carried by and revoluble with said rotor, said impellers being mounted for movement with relation to said rotor in a direction longitudinally of themselves.

3. A rotary pump embodying a housing having an oblate rotor chamber and having an inlet port and an outlet port communicating with said chamber in spaced relation to each other circumferentially of the annular wall of the chamber, necks extending outwardly from said housing about said ports, a pipe section secured to the outer end of the inlet neck, the annular wall of the chamber being formed with laterally spaced vertical ribs extending entirely across the inlet and outlet ports and through the necks to the outer ends thereof, the inner ends of said ribs being arcuate and conforming to and forming a part of the annular wall of the chamber, a screen clamped about its margins between said pipe section and the outer end of the inlet neck and bearing against the outer ends of the ribs in the inlet

- neck whereby to brace the screen against inward thrust, the annular wall being also cut away to form an internal cavity extending upwardly from the outlet and terminating in an abrupt vertical
- 5 shoulder integral with the top of the housing adjacent the vertical axis thereof, a rotor in said chamber having its axis offset towards one end of the minor diameter of the chamber, and a pair of crossed impellers revoluble with said rotor and
- 10 mounted thereon for movement longitudinally of themselves to retain their ends in contact with the annular wall of the chamber during rotation of the rotor.
4. A rotary pump comprising a housing having
- 15 an annular wall defining an oblate rotor chamber having an inlet port and an outlet port spaced from each other circumferentially of the chamber and disposed at opposite sides of the major diameter of the chamber, inlet and outlet necks
- 20 extending outwardly from said housing about said ports, the annular wall being formed with transversely spaced circumferentially extending slots defining spaced webs extending entirely across the inlet and outlet and through the necks to the outer ends thereof, said webs having their inner ends arcuate and conforming to and forming a
- 80 part of the wall of the rotor chamber, a pipe section secured at the outer end of the inlet neck, a screen clamped between said pipe section and the outer end of the inlet neck and bearing against the outer ends of the webs therein, a portion of the annular wall of the housing between upper ends of the webs of the inlet and outlet ports being unbroken, a rotary shaft extending into said chamber through an end of said housing, a rotor in said chamber connected with the inner end of said shaft, and impellers slidably carried by said rotor and projecting from the periphery thereof with their ends contacting with the annular wall of the chamber.
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