Sept. 23, 1941. J. W. GURLEY 2,256,741

ROTARY PUMP

Filed Dec. 3, 1938 2 Sheets-Sheet 1

Fig. 1.

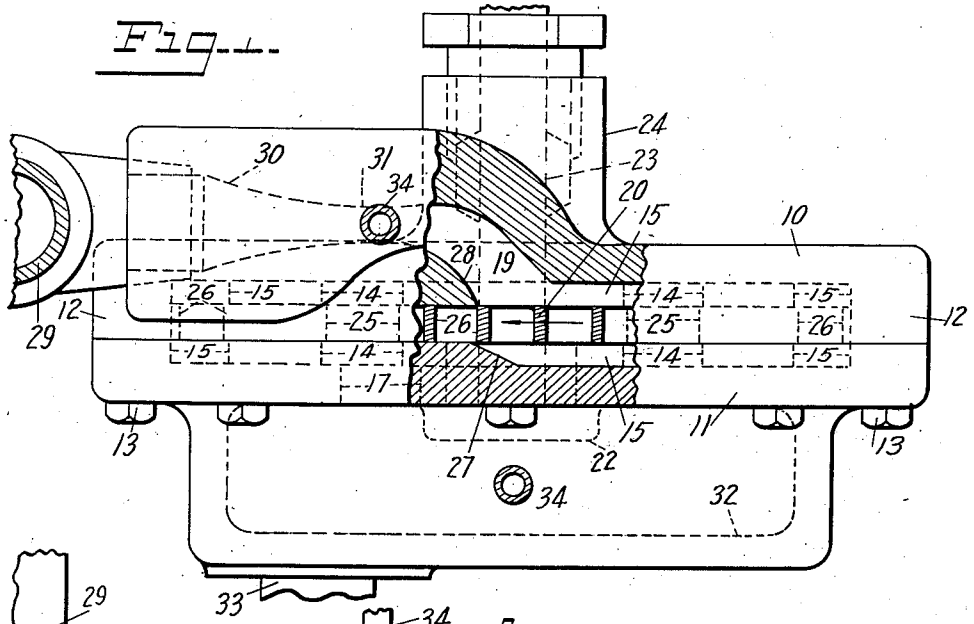
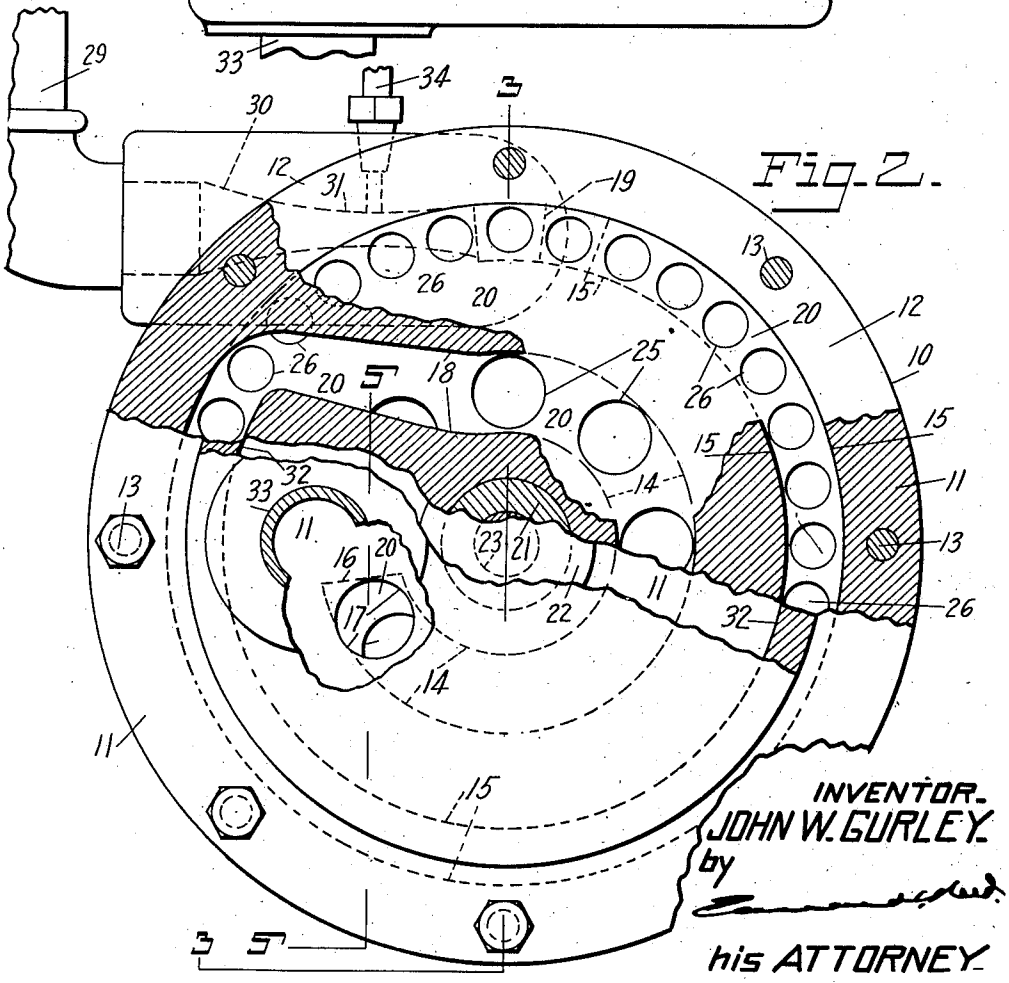


Fig. 2.

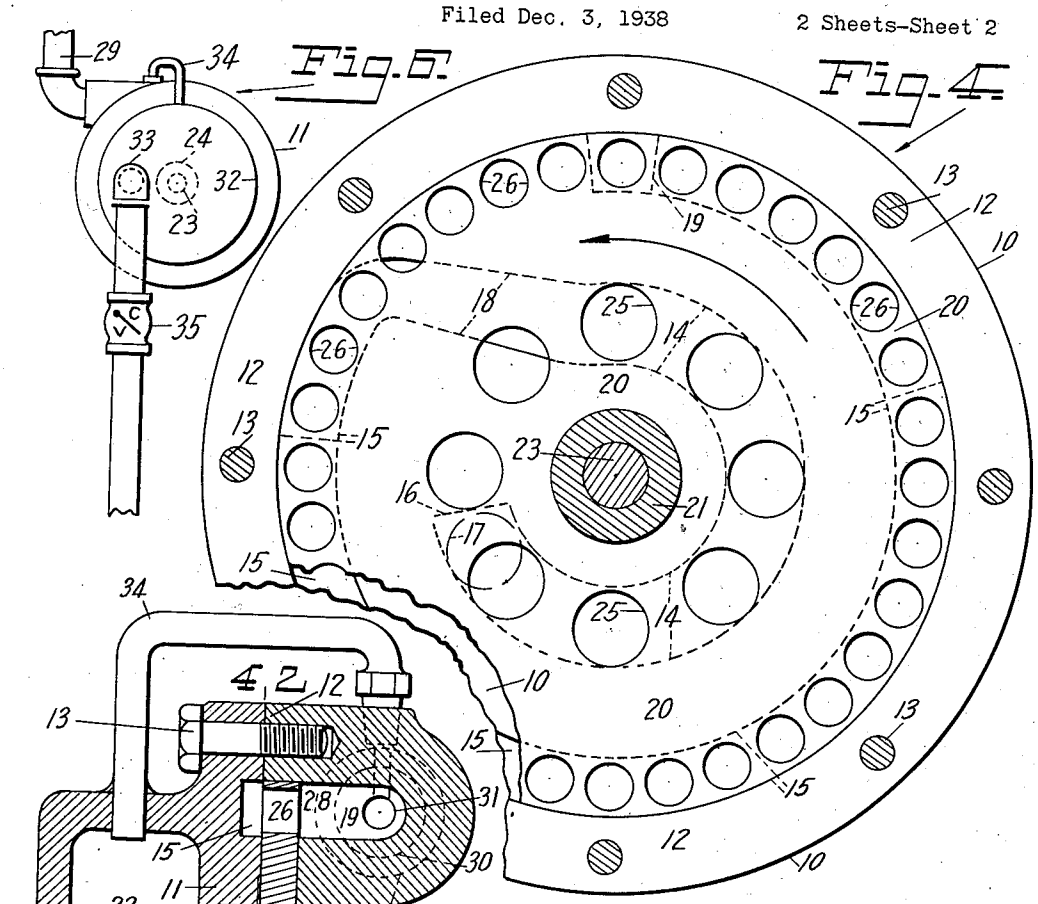


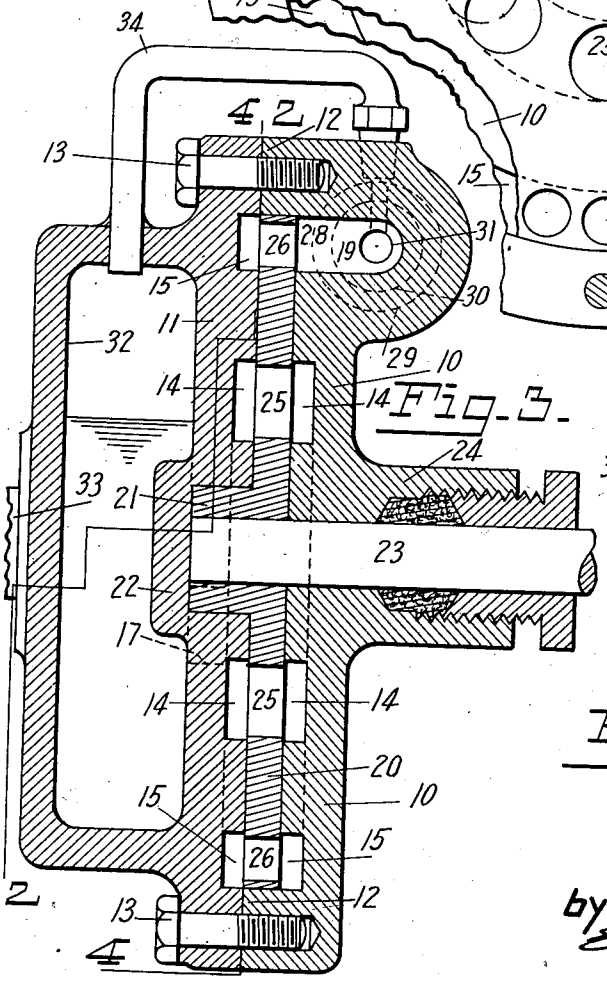
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his ATTORNEY.

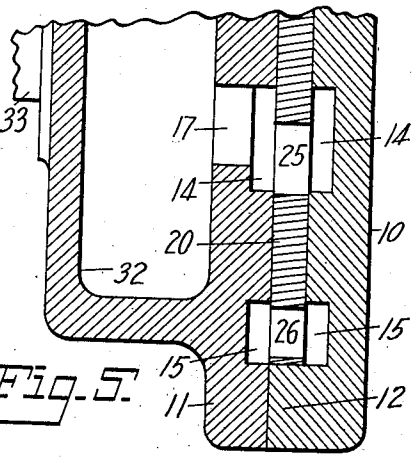
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ROTARY PUMP

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UNITED STATES PATENT OFFICE

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ROTARY PUMP

John W. Gurley, Dayton, Ohio

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10 Claims. (Cl. 103—110)

This invention relates to a rotary pump and one object of the invention is to provide a rotary pump which will be highly efficient in operation and simple in construction, and in which the costs of construction and maintenance will be low.

A further object of the invention is to provide a two stage rotary pump; and, further, provide such a pump in which the fluid will be delivered from the first stage to the second stage at a velocity approximately equal to the velocity existing in said second stage.

A further object of the invention is to provide a rotary pump in which the frictional resistance to the movement of the fluid will be low.

A further object of the invention is to provide a rotary pump in which the action of the fluid on opposite sides of the rotor will be substantially balanced to eliminate side thrust on the rotor.

A further object of the invention is to provide a rotary pump having means for increasing the pressure of the fluid discharged therefrom.

A further object of the invention is to provide a rotary pump having means for automatically priming the same.

Other objects of the invention may appear as the pump is described in detail.

In the accompanying drawings Fig. 1 is a plan view, partly broken away, of a pump embodying my invention; Fig. 2 is a side elevation of such a pump, partly in section on the line 2—2 of Fig. 3; Fig. 3 is a vertical section taken on the line 3—3 of Fig. 2; Fig. 4 is a section taken on the line 4—4 of Fig. 3; Fig. 5 is a detail section taken on the line 5—5 of Fig. 2; and Fig. 6 is a small scale elevation of the pump as a whole.

In these drawings I have illustrated one embodiment of the invention and have shown the pump as comprising a casing having opposed side members 10 and 11 substantially circular in shape and rigidly secured one to the other in such a manner that the inner portions of the opposed surfaces thereof will be spaced one from the other to form a working chamber. In the present arrangement the side member 10 is provided with a laterally extending peripheral portion or flange 12 which abuts against the peripheral portion of the side member 11 and is secured thereto by screws 13, this flange forming a closed peripheral wall for the work chamber. Each side member is provided with an inner channel 14 and an outer channel 15, said channels being arranged concentric one with the other and with the axis of the pump and each channel comprising the major portion of a circle. The inner and outer channels of the two side members are respectively opposed one to the other and open into the work chamber. Both inner channels are closed at one end thereof, preferably adjacent to or slightly below the horizontal diameter of the casing, as shown at 16, and are provided with an inlet 17. The other ends of the inner channels are connected by transverse and preferably tangential, channels 18 with the adjacent ends of the respective outer channels 15 and these outer channels are provided at their other ends with an outlet 19. In the arrangement here shown the inlet 17 is formed in the side member 11 and the outlet 19 is formed in the side member 10.

Mounted in the work chamber is a rotor 20, here shown as a flat disk having a hub portion 21 which is rotatably mounted in a bearing 22, formed in the side member 11, and rigidly secured to a shaft 23 journaled in a bearing 24 in the side member 10. This rotor has a snug running contact with the side and peripheral walls of the work chamber so as to provide for the free rotation thereof but to prevent any substantial leakage of fluid between the inner and outer channels of the side members or about the peripheral edge of the rotor. The rotor is provided with inner and outer annular series of openings, 25 and 26, which are concentric one with the other and with the axis of the rotor and which extend entirely through the rotor and communicate at their respective ends with the corresponding channels in the two side members. As the rotor rotates in the work chamber the openings or pockets of the inner series will pick up portions of the liquid entering through the inlet and will move the liquid in the inner channels, as well as the liquid in the openings, through said channels and through the transverse channels to the outer channels, where it will be picked up by the openings of the outer series and moved through the outer channels to the outlet.

The openings are preferably circular in form, thus providing the rotor with pockets of relatively large size and enabling each series to be provided with a relatively large number of openings and providing between adjacent openings solid portions of sufficient size to prevent undue wear thereof by contact with the casing. Inasmuch as the openings extend entirely through the rotor the pressure of the liquid in the opposed channels will be substantially balanced, thereby equalizing the pressure on the two sides of the

rotor, to prevent a side thrust thereon. The outer series of openings 26 are spaced from the peripheral edge of the rotor, thereby preventing the liquid therein from being thrown outward by centrifugal force and further reducing the frictional resistance to the movement of the liquid.

The openings 25 of the inner series and the inner channels 14 are of a size and capacity substantially greater than the size and capacity of the openings of the outer series 26 and the outer channels 15, and while the inner series of openings move at a speed less than the speed of the outer series they will move substantially the same quantity of liquid. The transverse channels 18 are of a shape, such as tapered, which will convert a portion of the pressure energy of the fluid passing through the same into velocity energy and thus cause the fluid to be discharged from the inner channels into the outer channels at a velocity approximately equal to the velocity of the outer portion of the rotor, thereby reducing the load which would otherwise be imposed upon the rotor if the rotor itself was required to increase the velocity of this fluid. The fluid is thus moved through the outer channels at a relatively high velocity and is discharged through the outlet 19, the outer channels 15 being closed at points adjacent to the outlet by inclined abutments 27 and 28 arranged to deflect the fluid from the channels into the outlet. The abutment 27 which closes the channel in the side member 11 forces the fluid from that channel through the openings in the rotor into the channel in the side member 10 and inasmuch as this diversion of the fluid begins some distance in advance of the outlet the channel in the side member 10 must carry a constantly increasing volume of fluid until at the outlet it carries all the fluid which was initially carried by both channels. As a result the velocity in the channel leading to the outlet is greatly increased and the fluid is discharged through the outlet at a relatively high pressure. The outlet is connected with a discharge conduit 29 which includes a nozzle 30 having a constricted intermediate portion or throat 31, such as a Venturi tube which is here shown as formed in the side member 10.

The inlet 17 may be connected with a source of supply for fluid in any suitable manner but, in the present instance, that inlet is connected with a suction chamber 32 which is here shown as formed in the side member 11 and as connected with a suction pipe 33 which leads to the source of supply. This suction chamber extends above and below the inlet 17 and when the pump is in operation the liquid will be maintained in the suction chamber at a level substantially above the inlet but the suction chamber will not be completely filled, a partial vacuum being formed in the upper portion thereof. As a result of this arrangement a constant uniform quantity of fluid is supplied to the pump and is substantially free from pulsation. A further and important advantage of this arrangement of the suction chamber is that it provides a very efficient seal for the port 17 which leads to the channels. As the liquid entering through the supply port 33 is withdrawn through the port 17, by the action of the rotor, a swirling motion is imparted to the liquid of the suction chamber and a vortex is created about the port 17 causing the liquid to press forcibly against the wall of the chamber around the port and to effectively seal the same against the entrance of free air. This vortex, and therefore the seal, will be maintained as long as there is a substantial quantity of liquid in the suction chamber, even though the quantity of liquid is such that if it was stationary the level thereof would be far below the port 17. Consequently a decrease in the quantity of liquid in the suction chamber, such as might result from air pockets in the supply line or from other temporary causes, will not cause air to enter the channels so as to interrupt the action of the pump.

The pump as here shown is also provided with means for automatically priming the same in the event the source of liquid supply is exhausted. In many installations the source of liquid supply is limited and may at times be exhausted. For example, if the pump formed part of a gasoline dispensing apparatus the suction pipe 33 would lead to an underground storage reservoir, and if the liquid in this reservoir was exhausted air or gas would flow through the suction pipe to the suction chamber and as soon as the level of the liquid in the suction chamber had fallen below the upper edge of the inlet 17 the suction in the pump would be destroyed and the delivery of liquid would cease. When the discharge of liquid through the outlet is interrupted the liquid in the discharge line will tend to flow back into the pump but the air which has accumulated in the pump will prevent sufficient liquid entering the pump and suction chamber to properly prime the pump. If the rotor remains in operation the rapid movement of the outer series of openings will prevent liquid entering the channels from the outlet. In order to automatically prime the pump I have connected the suction chamber 32, by means of a tube 34 or the like, with the constricted portion 31 of the nozzle 30 in the discharge line. The tube may be connected with the suction chamber at any suitable point but I prefer to connect the same with the upper portion of the vacuum space in the suction chamber, as shown in Fig. 3. When the pump is in operation the flow of liquid at high velocity through the nozzle will create a suction in the tube 34 which will tend to increase the vacuum in the suction chamber and will remove air entering with the liquid, but will not materially affect the level of the liquid in the suction chamber. When the vacuum in the suction chamber is broken and the discharge of liquid discontinued the liquid in the discharge line will flow into the nozzle but inasmuch as it cannot enter the pump it will pass through the tube 34 into the suction chamber and fill the latter to a level above the level of the inlet 17 and suction pipe 33, thus fully priming the pump so that as soon as the supply of liquid is replenished the pumping operation may be resumed. Should the rotor remain in operation while the supply of liquid is exhausted the priming liquid thus supplied to the suction chamber will be carried through the pump and discharged through the nozzle but as soon as the liquid has again fallen below the level of the inlet the pumping operation will cease and the pump will be again automatically primed. Ordinarily the discharge line is of such a capacity that sufficient liquid will flow through the tube 34 to prime the pump but should the arrangement be such that insufficient priming liquid would be supplied from the discharge line itself it is obvious the discharge line may be provided with an auxiliary receptacle in which liquid will be stored and will be delivered to the nozzle when the

flow of liquid through the latter is discontinued. Preferably the suction pipe 33 is provided adjacent the suction chamber with a check valve 35 which will prevent any substantial amount of the priming liquid entering the suction pipe.

While I have shown and described one embodiment of my invention I wish it to be understood that I do not desire to be limited to the details thereof as various modifications may occur to a person skilled in the art.

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

1. In a rotary pump, a casing comprising side members having opposed surfaces spaced one from the other to form a chamber between the same and each provided with inner and outer channels concentric with the axis of the pump and spaced different distances from said axis, said casing having an inlet communicating with said inner channels near the outer ends thereof and having an outlet communicating with the outer ends of said outer channels, said inner channels being of greater capacity than said outer channels, means connecting the inner ends of said inner channels with the inner ends of the respective outer channels, a rotor mounted in said chamber and having a close running fit between said side members, said rotor having an inner annular series of relatively large openings extending through the same and communicating with both inner channels and also having an outer annular series of relatively small openings extending through the same and communicating with both outer channels, and means for rotating said rotor.

2. In a rotary pump, a casing having a bearing and comprising two side members having opposed surfaces spaced one from the other and having cooperating parts to provide a closed peripheral wall for the space between said members, a shaft mounted in said bearing, a rotor secured to said shaft and having snug running contact with said side members, said rotor having an annular series of large capacity openings extending through the same and arranged concentric with said shaft, said rotor also having an outer annular series of openings of smaller capacity extending through the same and arranged concentric with said shaft, the opposed surfaces of said side members being provided with inner opposed channels of large capacity arranged to register with the inner series of openings in said rotor and also being provided with opposed channels of smaller capacity arranged to register with the outer series of openings in said rotor, each inner channel being closed at one end, transverse channels connecting the other ends of said inner channels with the adjacent ends of said outer channels, said casing having an inlet leading to the inner channels near the closed ends thereof and having a lateral outlet connected with one only of said outer channels, and means for diverting liquid from the other of said outer channels through said openings in said rotor to the first mentioned outer channel and to said outlet.

3. In a rotary pump, a casing having a bearing and comprising two side members having opposed surfaces spaced one from the other and having cooperating parts to provide a closed peripheral wall for the space between said members, a shaft mounted in said bearing, a rotor secured to said shaft and having snug running contact with said side members, said rotor having an inner annular series of large capacity openings extending through the same and arranged concentric with said shaft, said rotor also having an outer annular series of openings of smaller capacity extending through the same, arranged concentric with said shaft and spaced from the periphery of said rotor, the opposed surfaces of said side members being provided with inner opposed channels of large capacity arranged to register with the inner series of openings in said rotor and also being provided with outer opposed channels of smaller capacity arranged to register with the outer series of openings in said rotor, each inner channel being closed at one end, means for connecting the other ends of said inner channels with the adjacent ends of said outer channels, one of said side members having an inlet port leading to the inner channel thereof near the closed end of said channel, the other side member having an outlet port communicating with the outer channel thereof, and an abutment in the channel on that side of said rotor opposite said outlet port having an inclined surface adjacent to said outlet port to divert the fluid from that channel through said rotor to the channel which communicates with said outlet port.

4. In a rotary pump, a casing comprising side members having opposed surfaces spaced one from the other to form a chamber between the same and provided with inner and outer channels concentric with the axis of the pump and spaced different distances from said axis, said casing having an inlet communicating with said inner channels near the outer ends thereof and having an outlet communicating with the outer ends of said outer channels, said inner channels being of greater capacity than said outer channels, means for delivering fluid from the inner ends of said inner channels to the inner ends of said outer channels at increased velocity, a rotor mounted in said chamber and having a close running fit between said side members, said rotor having an inner annular series of relatively large openings extending through the same and communicating with both inner channels and also having an outer annular series of relatively small openings extending through the same and communicating with both outer channels, and means for rotating said rotor.

5. In a rotary pump, a casing comprising side members having opposed surfaces spaced one from the other to form a chamber between the same and provided with inner and outer channels concentric with the axis of the pump and spaced different distances from said axis, a transverse channel connecting the inner end of each inner channel with the inner end of the outer channel in that side member, said casing having an inlet communicating with said inner channels near the outer ends thereof and having an outlet communicating with the outer ends of said outer channels, said inner channels being of greater capacity than said outer channels, a rotor mounted in said chamber and having a close running fit between said side members, said rotor having an inner annular series of relatively large openings extending through the same and communicating with both inner channels, and also having an outer annular series of relatively small openings extending through the same and communicating with both outer channels, said transverse channels being shaped to increase the velocity of the fluid passing from

said inner channels to said outer channels, and means for rotating said rotor.

6. In a rotary pump, a casing comprising side members having surfaces spaced one from the other to form a chamber between the same and provided respectively with channels concentric with the axis of said pump and opposed one to the other for substantially their entire length, a rotor mounted in said chamber and having a close running fit between said side members, said rotor having an annular series of openings extending through the same, each opening communicating at its ends simultaneously with the respective channels, means for rotating said rotor, and means for supplying liquid to said channels adjacent one end thereof, the side member on one side of said rotor having a lateral outlet communicating with the channel therein near the other end of said channel, the channel in the other side member having means adjacent said outlet for diverting the fluid therefrom through the openings in said rotor into the channel in the first mentioned side member, thereby increasing the velocity of the fluid which is delivered by the last mentioned channel to said outlet.

7. In a rotary pump, a casing comprising side members having surfaces spaced one from the other to form a chamber between the same and provided respectively with channels concentric with the axis of said pump and opposed one to the other for substantially their entire length, a rotor mounted in said chamber and having a close running fit between said side members, said rotor having an annular series of openings extending through the same, each opening communicating at its ends simultaneously with the respective channels, means for rotating said rotor, and means for supplying liquid to said channels adjacent one end thereof, the side member on one side of said rotor having a lateral outlet communicating with the channel therein near the other end of said channel, the channel in the other side member having means adjacent said outlet for diverting the fluid therefrom through the openings in said rotor into the channel in the first mentioned side member both at a point substantially in line with said outlet and at points in advance of said outlet.

8. In a rotary pump, a casing comprising side members having surfaces spaced one from the other to form a chamber between the same and provided respectively with channels concentric with the axis of said pump, and opposed one to the other for substantially their entire length, a rotor mounted in said chamber and having a close running fit between said side members, said rotor having an annular series of openings extending through the same, each opening communicating at its ends simultaneously with the respective channels, means for rotating said rotor, means for supplying fluid to said channels adjacent one end thereof, the side member on one side of said rotor having a lateral outlet communicating with the channel therein adjacent to the other end of said channel, and an abutment closing the channel in the other side member at a point adjacent said outlet and having an inclined surface to divert the liquid from said channel through the openings in said rotor into the channel in the first mentioned side member.

9. In a rotary pump, a casing comprising side members having opposed surfaces spaced one from the other to form a chamber between the same and each provided with inner and outer channels concentric with the axis of said pump and spaced different distances from said axis, the corresponding channels in the two side members being opposed one to the other for substantially their entire length, a rotor mounted in said chamber and having a close running fit between said side members, said rotor having an inner annular series of openings extending through the same and communicating simultaneously with both inner channels and also having an outer annular series of openings extending through the same and communicating simultaneously with both outer channels, means for rotating said rotor, means for connecting said inner channels near one end thereof with a source of fluid supply, and a channel in each side member connecting the other end of the inner channel therein with one end of the outer channel in that side member, one of said side members having a lateral outlet communicating with the other end of said outer channel in said side member, and the outer channel in the other side member having means adjacent said outlet for diverting the fluid therefrom through the openings in said rotor into the outer channel in the first mentioned side member.

10. A single unit, multi-stage rotary pump including a casing having two spaced opposed surfaces forming a working chamber therebetween, a single circular rotor therebetween and rotatable in the chamber and having a running fit with the opposed surfaces and peripherally with the chamber wall between the surfaces, said rotor having a plurality of concentric series of holes therethrough, the size of said holes in the several series progressively decreasing from the inner to the outer series, each surface having formed therein a plurality of channels concentric with the rotor axis but short of complete circularity, and spaced apart radially to simultaneously register with the respective series of holes in said rotor, said casing having an inlet communicating with one end of the innermost channel, and an outlet communicating with one end of the outermost channel, adjacent channels having the discharge end of the inner channel in communication with the inlet end of the outer channel, the last mentioned communication including a volume restricting means for velocity increase.

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