May 26, 1959 A. P. DAVIDSON 2,887,958

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Filed June 30, 1952 4 Sheets-Sheet 1

Fig. 1

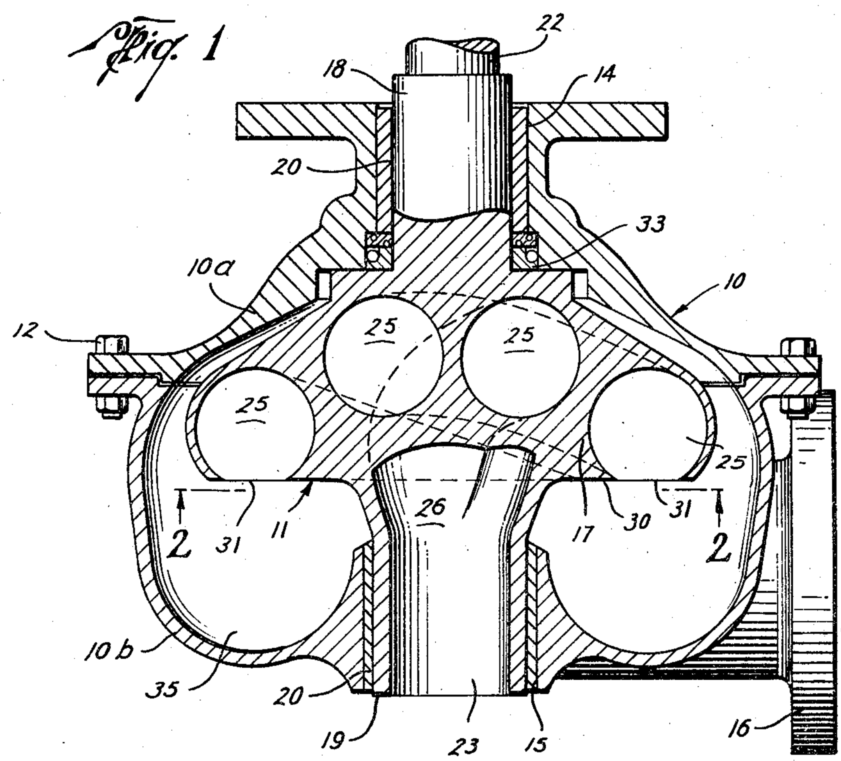
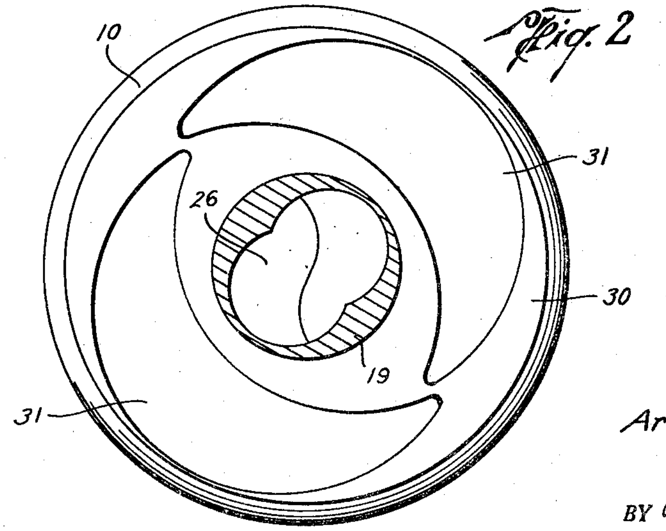


Fig. 2



Arthur P. Davidson
INVENTOR.

BY J. Vincent Martin
Joe E. Edwards
B. R. Pravel
ATTORNEYS

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Fig. 5

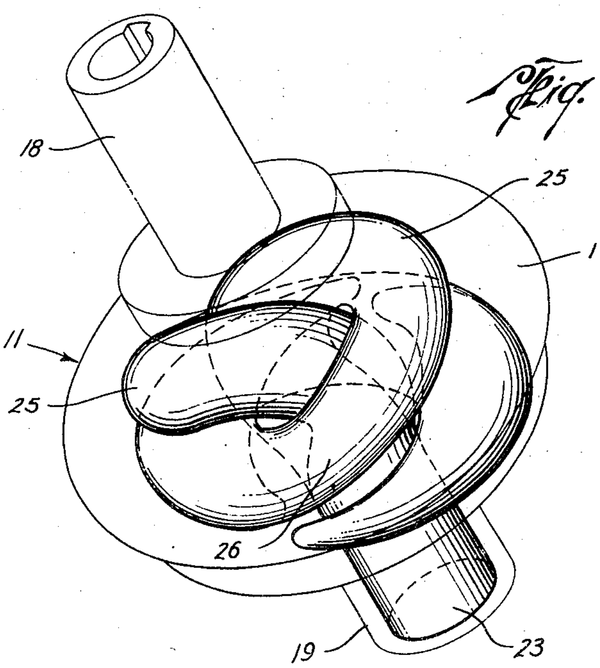


Fig. 3

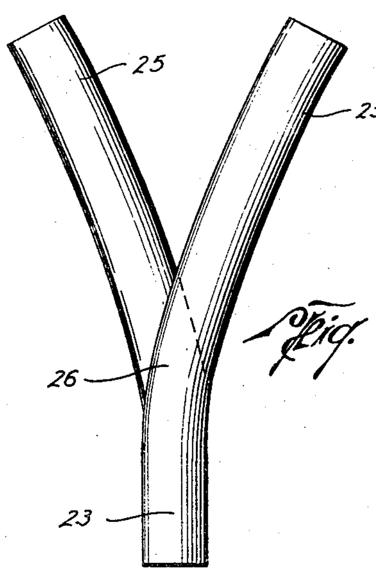
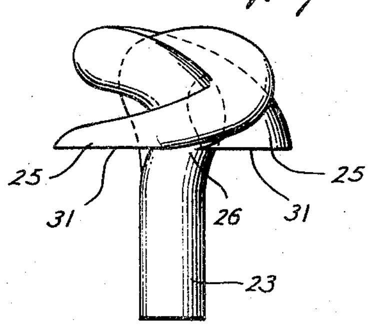


Fig. 4



Arthur P. Davidson
INVENTOR.

BY J. Vincent Martin
Joe E. Edwards
B. L. Pravel
ATTORNEYS

Fig. 6

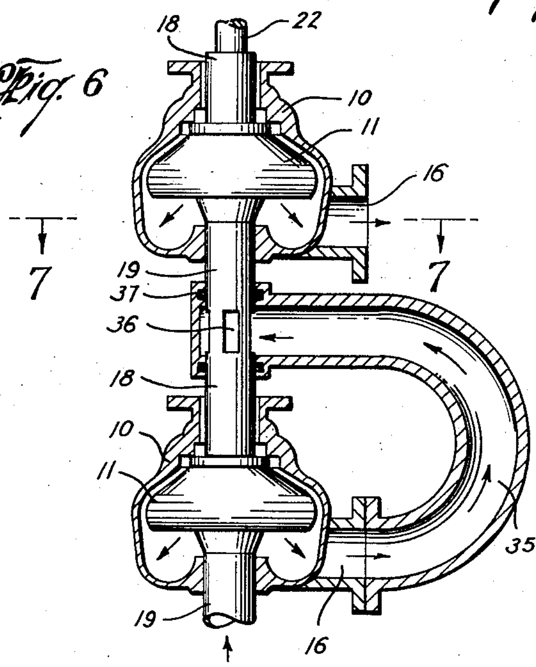


Fig. 8

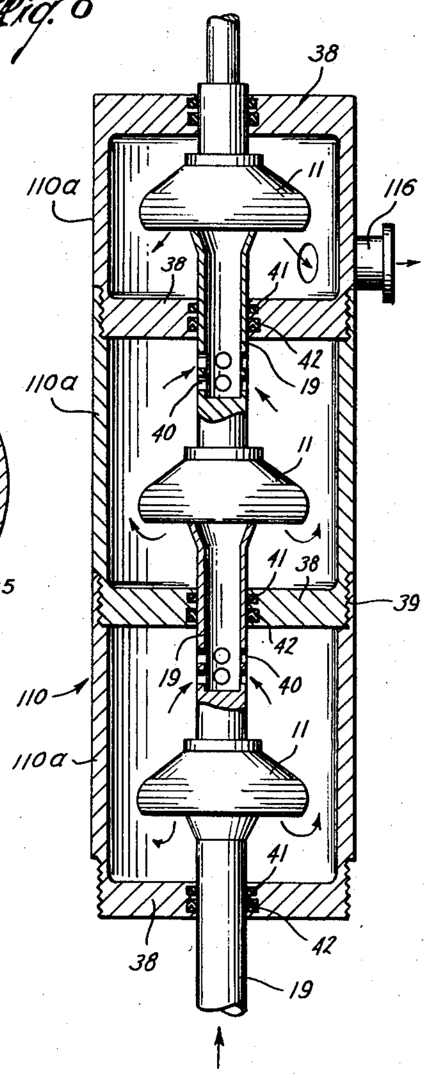
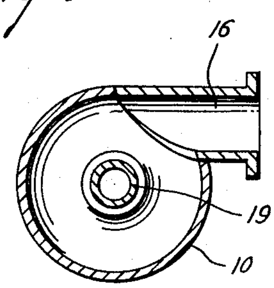


Fig. 7



Arthur P. Davidson
INVENTOR.

BY J. Vincent Martin
Joe E. Edwards
B. R. Pravel
ATTORNEYS

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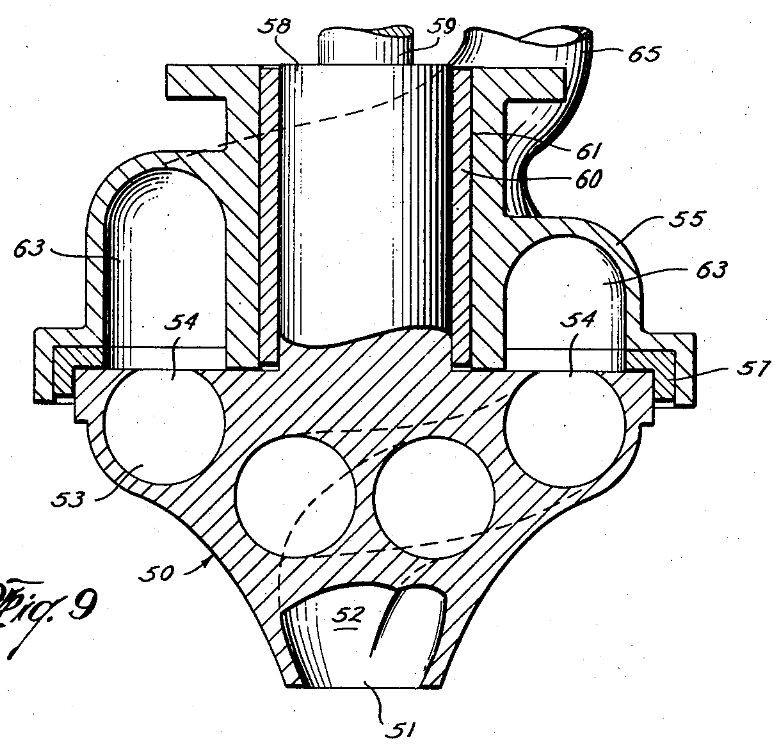

Fig. 9

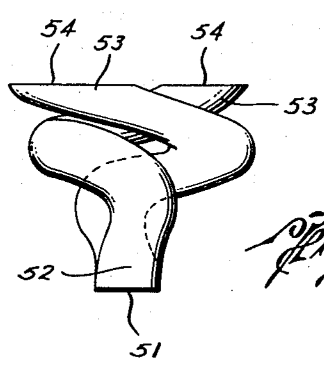

Fig. 10

Arthur P. Davidson
INVENTOR.

BY J. Vincent Martin
Joe E. Edwards
B. R. Pravel
ATTORNEYS

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Arthur P. Davidson, Edinburg, Tex.

Application June 30, 1952, Serial No. 296,389

1 Claim. (Cl. 103—103)

This invention relates to new and useful improvements in fluid pressure units, and particularly to pumps and fluid driven motors.

It is one object of this invention to provide a fluid pressure unit, such as a pump or fluid driven motor, which is capable of handling sewage without jamming even though solid objects such as rags and debris may be present in the fluids.

An important object of this invention is to provide a fluid pressure unit which includes a rotor having fluid channels therethrough which are substantially helical and are tubular in shape, such tubular channels being of smooth bore construction to permit the operation of the rotor even though solid objects may be carried therethrough with the fluid.

A further object of this invention is to provide a fluid pressure unit wherein a rotor is disposed in a housing, such rotor having helical fluid channels therein and a fluid inlet connected to such fluid channels, the fluid being discharged from said fluid channels in a direction substantially opposite to the direction of the fluid entering said inlet, said channels being of smooth bore construction and having no protruding vanes, whereby solid particles may pass through the unit with the fluid without stalling or jamming the rotor.

Another object of this invention is to provide in a fluid pressure unit, a rotor having fluid channels therein of tubular construction, a fluid inlet to said channels, said inlet and said channels being connected by a forked connection which is diverging and separates the flow of fluid from the inlet so that a portion thereof goes into each of the channels.

A still further object of this invention is to provide in a fluid pressure unit, a rotor which is circular in shape and has a lower transverse flat plane, such flat plane intersecting fluid channels in the rotor body to form discharge openings from said channels of quarter-moon shape so that substantially the entire flat plane is open for the discharge of fluid from the channels.

The construction designed to carry out the invention will be hereinafter described together with other features thereof.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings forming a part thereof, wherein an example of the invention is shown, and wherein:

Figure 1 is a longitudinal sectional view of the fluid pressure unit of this invention, illustrating details of the particular rotor construction.

Figure 2 is a horizontal sectional view of the rotor taken on line 2—2 of Figure 1.

Figure 3 is a diagrammatic view to illustrate the first stage of construction of the fluid passages in the rotor, if such fluid passages were formed from tubing.

Figure 4 is a diagrammatic view of the fluid passages in the rotor of this invention, considering such passages as having been formed from tubing.

Figure 5 is an isometric phantom view, illustrating the fluid channels or passages in the rotor body.

Figure 6 is a longitudinal sectional view illustrating one type of housing which may be used when the rotors are connected in tandem.

Figure 7 is a horizontal sectional view taken on line 7—7 of Figure 6.

Figure 8 is another form of housing which may be utilized when the rotors of this invention are connected in tandem.

Figure 9 is a view similar to Figure 1, but illustrating a modified rotor construction wherein fluids are discharged in the same direction as they enter.

Figure 10 is a view similar to Figure 4, but illustrating the modified tubular channels of the rotor of Figure 9.

In the drawings the numeral **10** designates the housing in which the rotor **11** rotates. The fluid pressure unit of this invention includes the housing **10** and the rotor **11** and their associated parts. This fluid pressure unit may be operated as a pump or as a fluid driven motor. If it is desired to operate the unit as a pump the rotor is driven by a drive means externally therefrom, so that fluid is drawn through the housing **10**. If the unit is to be operated as a motor, fluid under pressure is supplied to the rotor **11** whereby rotation is imparted thereto.

Referring now to Figure 1 particularly, therein it can be seen that the housing **10** is made up of an upper section **10***a* and a lower section **10***b*. These sections, **10***a* and **10***b*, are affixed together by the securing means **12** such as the illustrated nuts and bolts. It will be appreciated, of course, that sections **10***a* and **10***b* can be secured together by any other suitable securing means such as welding or clamps, if desired. The housing **10** has an upper shaft opening or bore **14** and a lower shaft opening or bore **15**. The housing also has a discharge or outlet **16** which is substantially perpendicular to the aligned openings or bores **14** and **15**. The rotor **11** includes a body **17** which has connected therewith shafts **18** and **19**. If desired, bearing rings **20** may be disposed between the shafts and the bores. Such bearings **20** may also include sealing members to prevent the escape of fluid between the bores and the shafts. The shaft **18** is adapted to be connected to a driving means such as a motor when the unit is to be operated as a pump. Also, the shaft **18** may be connected to a power output if the unit is operated as a fluid driven motor. To this end, a solid shaft **22** is keyed (Figure 5), or otherwise secured, to the shaft **18**, such solid shaft **22** extending to the driving or driven means.

The other shaft **19**, which is generally disposed below the body **17**, is hollow and has therefore an inlet passage **23** therein. This inlet passage **23** communicates with fluid channels **25** in the rotor body **17**. These fluid channels **25** and the fluid inlet **23** are connected through a forked connection **26**.

To understand the particular arrangement of the inlet **23**, the forked connection **26** and the fluid channels **25**, reference is made to Figures 3–5. Considering now that the fluid channels **25** are to be formed from a tubing, the initial step in obtaining the desired configuration would be to start with a Y-shaped tube such as shown in Figure 3. The fluid channels **25** would be entwined into the configuration shown in Figure 4. If fluid were to be passed through the tubing intertwined as shown in Figure 4, it would enter through the inlet **23**, then be diverged into two separate paths at the forked connection **26**, and then be discharged through the fluid channels **25** with a portion of the fluid passing through each of such channels. Actually, the rotor of this invention is not constructed of tubing as shown in Figures 3 and 4, but these have been illustrated to explain more clearly the construction of the rotor. In Figure 5, the actual construction of the rotor is better seen. Thus, the rotor body 17 would be a solid piece of material such as cast iron or any equivalent material which would have cast therein or bored therethrough the inlets 23, the Y-connection 26, and the fluid channels 25. Thus it can be seen that the fluid passage portions in the body 17 would have the same configuration as the tubing shown in Figure 4.

As best seen in Figures 1 and 2, the lower portion of the body 17 is formed in a flat transverse plane 30. This plane 30 intersects the fluid channels 25. Since the fluid channels 25 are tubular and are helical in their downward portion, the plane 11 intersects such fluid channels 25 so as to provide discharge ports 31 which resemble quarter-moons. As is evident from Figure 2, these discharge ports 31 provide a discharge opening from the fluid channels 25 which is substantially the entire area of the transverse plane 30.

It will be observed in Figure 1 that the upper portion 10*a* of the housing 10 substantially conforms to the outer surface of the rotor body 17. A thrust bearing 33 is provided between the housing portion 10*a* and the rotor body 17. The housing portion 10*b* is provided with an annular recess 35 which is adapted to receive the fluid from the ports 31 and carry it to the discharge opening 16 of the housing 10.

In operating the fluid pressure unit of this invention, the fluid would pass into the inlet 23 from a source external of the housing 10 and would be diverged in its flow at the forked connection 26 so that a portion of the fluid entering from the inlet 23 would be directed into each of the fluid channels 25. From the fluid channels 25, the fluid would pass outwardly through the ports 31 and to the annular recess 35 of the housing 10. Since the rotor 11 would be rotating during the travel of such fluid, either by rotation from a driving means through the shaft 18 or by force of the fluid being pumped through the inlet 23, the fluid being discharged from the ports 31 would follow a helical path and would flow outwardly through the discharge opening 16 to a point external of the housing 10. It will be observed that the fluid channels 25 have a smooth bore throughout and all projections such as vanes generally found in fluid pumps or fluid driven motors are avoided so that even objects such as rags and other debris often present in sewage may pass through the rotor with the fluid without impedance or sticking of such objects within the pump. Also, due to the large area of the plane 30 which is occupied by the ports 31, there would be no impedance of the fluid flow or sticking of solid objects in the fluid at the point of discharge from the rotor 11.

In Figure 6 is shown the contruction wherein a plurality of the rotors 11 are connected in tandem. This construction may be utilized where extremely high pressures are desired. Such tandem construction is accomplished by connecting the discharge of the lower unit to the intake of the upper unit. Thus the discharge 16 is connected by a U-shaped pipe 35 to the inlet pipe 19 of the upper unit. It will be observed that in this form of the invention, the shaft 18 on the lower unit is connected to the shaft 19 on the upper unit and inlet ports 36 are provided therebetween, with the shaft 18 being closed off so that fluid does not flow downwardly. Suitable sealing and bearing means 37 are provided on either side of the inlet ports 36. The last unit in the series is permitted to discharge through its discharge outlet 16 to a point external of the housing 10. The details of each of the units is the same as was described in connection with Figures 1–5. Likewise, with the exception of the discharge being directed from the first or lowest unit to the next unit in line at its inlet, the operation of these units is the same as was described in connection with the units of Figures 1–5.

In the modification shown in Figure 8, the housing 110 is substantially cylindrical in construction and is composed of individual sections 110*a*. Each of these sections 110*a* has therewith a baffle plate 38 through which the shaft 19 is adapted to pass. These units or sections 110*a* are threaded together by threads 39 or any other suitable affixing means. It can be seen that by reason of the baffles 38 each rotor 11 is disposed within a separate housing section. The only communication from the fluid inlet which each of the rotors 11 has, is through their shafts 19. Thus the fluid discharge from the first or lowest rotor 11 passes into the housing and is then received by the second or next rotor 11 after it passes through the inlet openings 40 in the shaft 19. The flow of fluid is indicated by the arrows in Figure 8. The baffle plates 38 have bearings 41 and seal rings 42 associated with the shafts 19 to provide for frictionless rotation of the shafts 19 therein and to prevent the damage to the bearings by keeping such fluid therefrom due to the seals or sealing members 42. In operation, the fluid is admitted through the lower shaft 19 and passes upwardly through each of the rotors 11 until it is finally discharged through the discharge opening 116. The details of construction of the rotor 11 are identical with the details explained in connection with Figures 1–5.

In Figure 9, a modified form of the unit of Figure 1 is illustrated. In this form of the invention, the rotor 50 has an inlet 51, a forked passage 52 and fluid channels 53 similar to those shown in Figure 1 except that the fluid channels are helically spiralled to discharge upwardly, i.e., in the same direction as the incoming fluid entering inlet 51. The relationship of the tubular channels 53 can best be seen in Figure 10 wherein the channels are illustrated as tubes for clarity in the same manner as in the illustration of Figure 4. The discharge openings 54 are of the half-moon shape as are the openings 31 of Figure 2.

The rotor 50 has mounted therewith a housing 55 which is fixed relative to the rotor 50. A suitable bearing such as a brass seal ring 57 is provided for the support of the housing 55 on the rotor 50. The rotor 50 also has a tubular shaft 58 extending therefrom for connection with a solid shaft 59 by threads, wedging, or any suitable securing means. A bearing sleeve 60 is preferably disposed between the bore 61 of the housing 55 and the outer surface of the shaft 58. The housing 55 has an arched anular passage 63 which is of varying depth and which has an angularly extending discharge pipe 65 connected thereto at the portion of the passage 63 of greatest depth.

The operation of the unit of Figure 9 is substantially the same as that of Figure 1 except that the fluid is discharged from the unit in the same direction as it enters. Thus, when using the unit of Figure 9 as a pump, the shaft 59 would be driven by a prime mover to impart rotation to the rotor 50. The unit would preferably be immersed below the level of the liquid to be pumped so that fluid is drawn in at inlet 51, separates into two paths at the forked connection 52, flows through channels 53 and is discharged in a helical path from the outlets 54 into the annular passage 63 from which it is discharged through pipe 65. As will be observed, this form of the invention also eliminates vanes and other protrusions such as are ordinarily used in pumps, whereby solid objects such as rags are able to pass freely through the pump of this invention.

It will be appreciated that the unit of Figure 9 may be connected in tandem by simply substituting the rotor 50 for the rotor 11 as shown in Figure 8.

From the foregoing, it is believed evident that a fluid pressure unit such as a pump or fluid driven motor, has been devised which is capable of handling fluids such as sewage fluids which may have therein large solid objects, such as rags and the like, without danger to the pump itself and without operation failure thereof.

The foregoing disclosure and description of the invention is illustrative and explanatory thereof and various changes in the size, shape and materials, as well as in the details of the illustrated construction may be made, within the scope of the appended claims, without departing from the spirit of the invention.

What is claimed is:

A fluid pressure unit comprising, a rotor having an unobstructed central tubular inlet formed therein at one end and a shaft connected therewith at the other end, said rotor also having a plurality of tubular fluid channels formed therein in fluid communication with said inlet, said fluid channels having outlet ends disposed in a plane substantially perpendicular to the axis of said inlet for directing the fluid therefrom substantially parallel to the axis of said inlet, said outlet ends having a greater cross-sectional area than said fluid channels, a stationary housing, said housing being of substantially larger radial width than said rotor and having a chamber disposed adjacent the outlet ends of said rotor for receiving liquid discharged therefrom, said housing also having an outlet opening in communication with said chamber for the passage of fluid from said chamber, a shaft opening in said housing through which said shaft on said rotor extends for supporting said rotor during the rotation thereof relative to the housing, and said tubular fluid channels extending upwardly from said central tubular inlet and then following oppositely directed helical paths in a reverse downward direction which overlap to provide a compact rotor which has relatively long fluid channels therethrough.

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