April 19, 1949. R. W. FERNSTRUM 2,467,524

ROTARY PUMP WITH SEIZURE PREVENTING MEANS

Filed Sept. 2, 1944 2 Sheets-Sheet 1

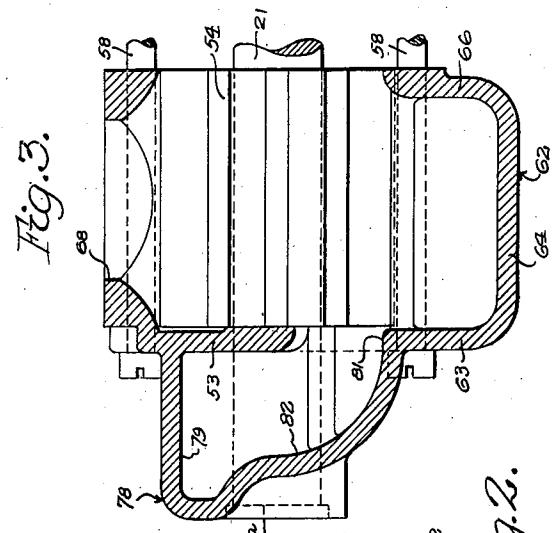

Fig. 3.

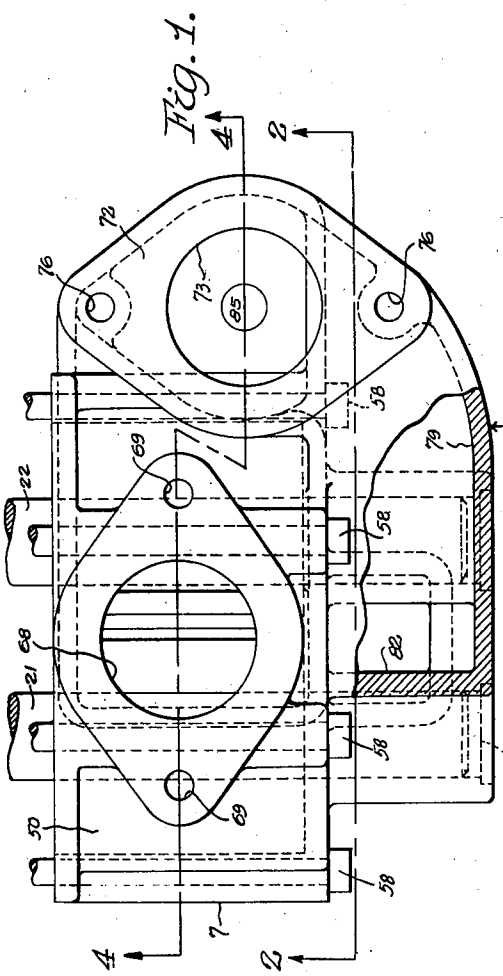

Fig. 1.

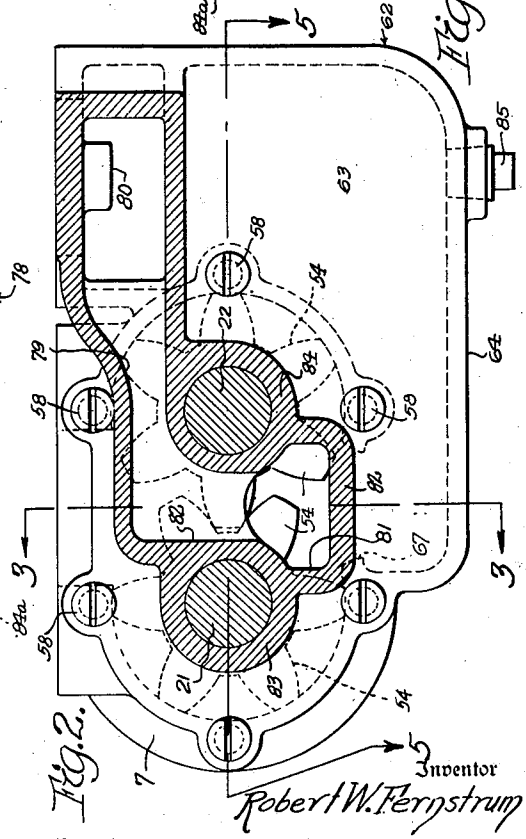

Fig. 2.

Inventor
Robert W. Fernstrum
By Barthel & Bugbee
Attorneys

April 19, 1949. R. W. FERNSTRUM 2,467,524

ROTARY PUMP WITH SEIZURE PREVENTING MEANS

Filed Sept. 2, 1944 2 Sheets-Sheet 2

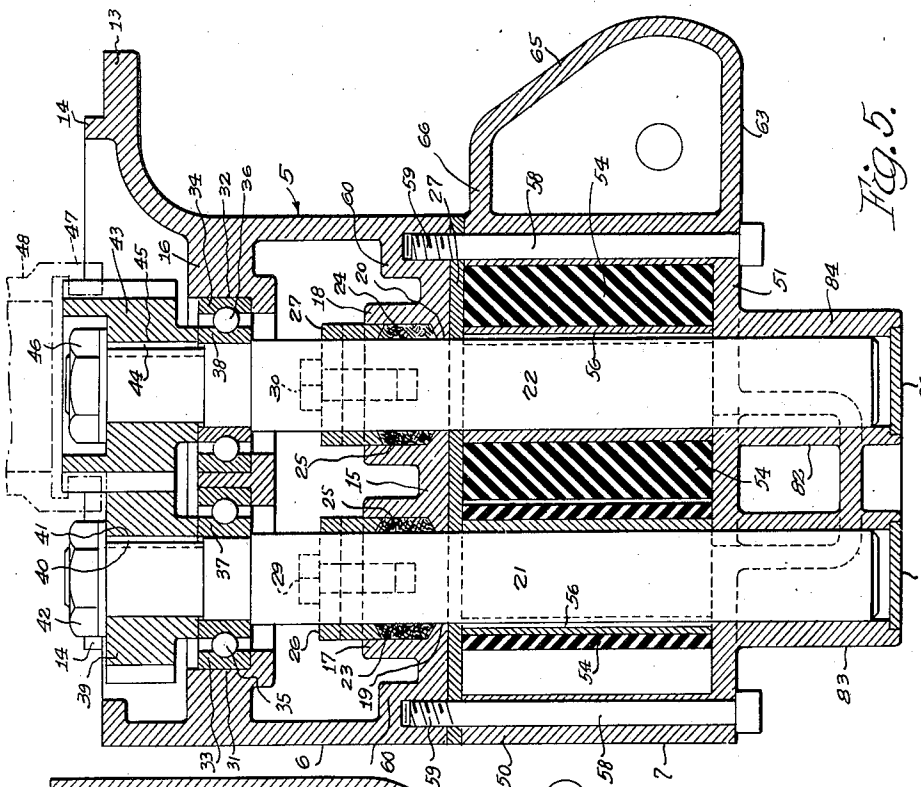

Fig. 5.

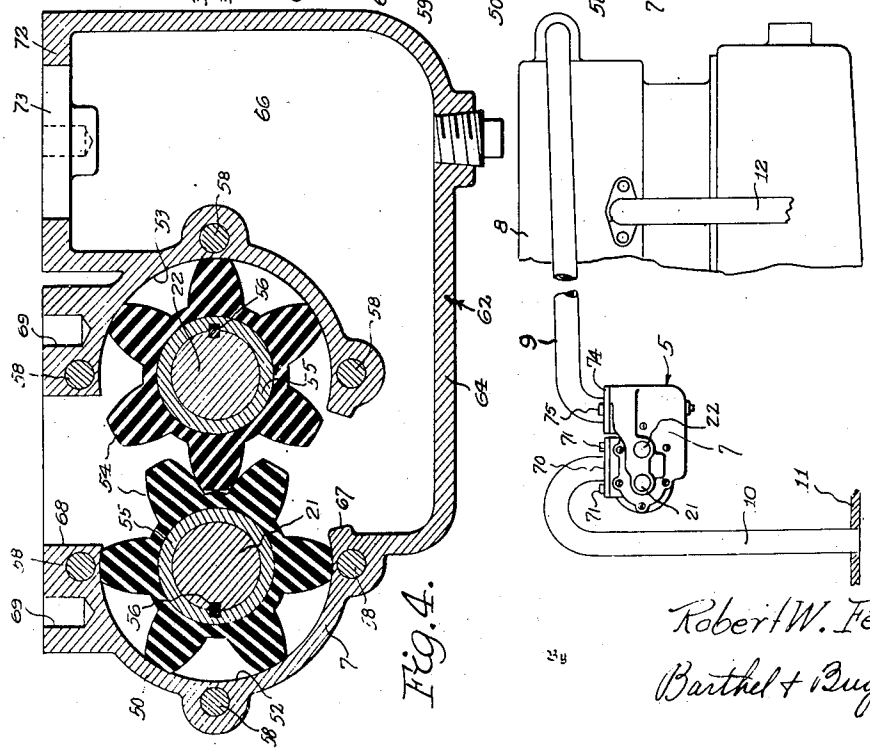

Fig. 4.

Fig. 6.

Inventor
Robert W. Fernstrum
Barthel & Bugbee
Attorneys

Patented Apr. 19, 1949 2,467,524

UNITED STATES PATENT OFFICE

2,467,524

ROTARY PUMP WITH SEIZURE PREVENTING MEANS

Robert W. Fernstrum, Detroit, Mich., assignor to Gray Marine Motor Company, Detroit, Mich., a corporation of Michigan

Application September 2, 1944, Serial No. 552,440

3 Claims. (Cl. 103—126)

1

The present invention relates to improvements in fluid pumps, and more particularly to a fluid pump for the circulatory cooling system of marine engines.

The primary object of the invention is to provide a reservoir chamber for the pump of a marine engine circulatory cooling system to maintain a quantity of fluid in the pump casing and prevent damage to the impellers of the pump should the intake pipe of the marine engine circulatory cooling system be raised or elevated out of the water for any reason whatsoever.

Another object of the invention is to provide a rotary pump for the liquid circulatory cooling system of a marine engine in which flexible and compressible impellers are employed and in which a bypass from the reservoir is provided for maintaining said impellers lubricated by a small amount of liquid trapped in the pump casing so that when said marine engine and pump are operated the impellers will not be damaged when the intake of said pump is not in communication with a supply of cooling liquid.

Another object of the invention is to provide a pump for the liquid circulatory cooling system of marine engines and the like in which the pump casing is provided with a reservoir communicating with the pump chamber through a lateral port adjacent the exhaust port of the pump so that liquid will be pumped into said reservoir chamber and will pass from said reservoir to the impellers of the pump when the intake of the pump is out of communication with the circulatory cooling liquid.

Another object of the invention is to provide a pump of the above-mentioned character in which the impellers are formed of synthetic rubber interengaging gear members such as buna or butadiene to permit the passage of particles of sand and gravel therebetween without causing damage and breakage to said impellers when the marine craft is temporarily beached or driven through water near sandy beaches so as to expose the cooling system intake to water contaminated with sand, shell particles and gravel.

Another object of the invention is to provide a liquid pump for circulatory cooling systems of marine engines in which the pump may be conveniently located and affixed to the engine casting and drivingly connected to the timing gearing thereof so that the outlet pipe of the pump may be inclined to the water jacket intake of said engine whereby condensation in said outlet pipe will drain to the reservoir of said pump and assist in maintaining a liquid level therein to

2

lubricate the impellers and prevent damage and excessive wear thereto.

Another object of the invention is to provide a liquid pump for circulating cooling liquid through the water jacket of marine engines in which the synthetic rubber impellers will be automatically lubricated to prevent excessive wear should the cooling system inlet pipe of the marine craft be raised out of the water, with the engine in operation or the engine operated with the cooling system inlet pipe in communication with the atmosphere.

Another object of the invention is to provide a circulating pump for the cooling system of a marine engine in which the pump casing is provided with a reservoir chamber for feeding liquid to the pump impellers so as to initiate liquid flow therethrough when the pump is put into operation and thereby prime the pump without resorting to external priming means.

Other objects and advantages of the invention will become apparent during the course of the following description of the accompanying drawings, wherein:

Figure 1 is a top plan view of the pump structure embodying the invention, illustrating portions thereof broken away to show various structural details thereof;

Figure 2 is a vertical cross sectional view of the pump reservoir taken on line 2—2 of Figure 1, looking in the direction of the arrows to illustrate the relative position of said reservoir with respect to the pump impellers;

Figure 3 is a vertical cross sectional view taken on line 3—3 of Figure 2 looking in the direction of the arrows and illustrating the manner in which the reservoir is communicated with the pump chamber through a passageway offset from said reservoir chamber;

Figure 4 is a longitudinal cross-sectional view taken on line 4—4 of Figure 1 looking in the direction of the arrows illustrating the reservoir chamber in detail and showing the interengaging pump impellers;

Figure 5 is a horizontal cross sectional view taken on line 5—5 of Figure 2 looking in the direction of the arrows illustrating the manner in which the interengaging impellers are drivingly geared together and further showing various details of construction of the pump casing and drive gearing for said impellers; and

Figure 6 is a side elevational view of the liquid pump illustrating diagrammatically the manner in which said pump is coupled with the inlet and

exhaust pipes of a circulatory marine engine cooling system.

In the drawings, the reference character 5 will generally be employed to represent a rotary pump of the interengaging impeller type and said pump comprises casing sections 6 and 7 separably connected to provide a pump unit capable of being used for circulating cooling liquid through the water chamber or jacket of a marine engine. In Figure 6, there is shown a marine engine 8 having a water inlet pipe 9 connected to the outlet of the pump 5 with the inlet 10 extending through the hull of the marine craft as at 11 so as to pump sea water through the cooling jacket of the engine 8 to thereby cool the engine during operation. The water jacket of the engine 8 is provided with an exhaust pipe 12 which may project through the hull of the marine craft above the water line thereof so as to discharge the cooling liquid after being circulated through the engine cooling jacket.

Generally, the intake pipe 10 is provided on its submerged end with a scoop positioned adjacent the propeller and rudder assembly so that as the boat is being propelled through the water, the water will be forced through the inlet pipe 10 to the pump and then circulated through the cooling jacket of the engine. In constructions of this type, considerable sand and gravel is collected and passed through the pump 5 when cruising near beaches and it is therefore necessary to employ pump impellers which will permit the passage of said sand and gravel particles without damaging or breaking the impeller parts. In the present structure, deformable impellers are provided so as to pass said sand particles without damaging the impellers or pump casing or other parts of the pump construction.

The construction shown in the drawings is adapted to be fastened or affixed and supported by the marine engine 8 and the section 6 of the pump casing is shaped to provide a flanged portion 13 and a rib portion 14 adapted to interfit with a recess and opening in the engine casing so that the section 6 may be bolted thereto by suitable machine screws or the like being passed through apertures in the flange 13. Also, the section 6 comprises a front wall 15 and a partition wall 16 adjacent the front and back of the oval-shaped casting or section 6. Formed in the front wall 15 is a pair of annular bosses 17 and 18 surrounding openings 19 and 20 respectively which are adapted to form bearing openings for a pair of rotary pump shafts 21 and 22 respectively. The bearing bores 20 are enlarged as at 23 and 24 for receiving a quantity of sealing material or packing 25. Gland nuts 26 and 27 are anchored in place by means of bolts or the like as at 29 and 30 so as to clamp the packing 25 about the shafts 21 and 22 and prevent the escape or passage of liquid between the sections 6 and 7 of the pump casing.

The partition wall 16 is provided with a pair of openings or bores 31 and 32 in axial alignment with the openings 19 and 20 to permit the passage of the shafts 21 and 22, and mounted in said openings or bores 31 and 32 are outer race members 33 and 34 of anti-friction bearings (Figure 5) including a series of ball-bearings 35 and 36 interposed between the race members 33 and 34 and shafts 21 and 22. The inner race members 37 and 38 are secured to reduced portions of the shafts 21 and 22 respectively and said shafts are extended to project a slight distance on the opposite side of the partition wall 16.

The shaft 21 has affixed to the inner end thereof a gear 39 by means of a key 40 and keyway 41 and said gear is held in place by a nut 42 threaded on a threaded portion of the shaft 21 as indicated in Figure 5. Similarly, a spur gear 43 is affixed to the inner ends of the rotary shaft 22 by means of a key 44 and keyway 45 and is likewise held in place by a nut 46 threaded on the screw-threaded end of said shaft. The spur gear 43 is slightly wider than the spur gear 39 so that a portion of the teeth thereof will project beyond the oval-shaped rib 14 and extend into the engine casting of the marine motor 8. The gear 43 is adapted to be driven by an internal gear 47 carried by the free end 48 of the cam shaft of the engine. The spur gear 43 is so positioned as to interfit with the teeth of the internal gear 47 and thereby permit removal of the section 6 of the pump casing to facilitate repair of the gears and various other parts of the pump structure. Also, it is noted that the spur gears 39 and 43 are positioned to be in driving engagement with each other whereby the shafts 21 and 22 will rotate in unison in opposite directions.

The pump casing section 7 is of general ovate shape and includes an elliptical wall portion 50 having an end wall 51 and said section 7 is further shaped to provide semi-circular recesses 52 and 53 to form cylinders for a pair of interengaging impellers 54 formed of synthetic rubber such as buna or butadiene. The impellers 54 are provided with bronze sleeves or bushings 55 which are keyed as at 56 to their respective shafts 21 and 22. Interposed between the sections 6 and 7 is an end wall plate 27 so as to close the open end of the pump casing and said sections are held together by clamping bolts 58 having their threaded ends 59 threaded in suitable bosses 60 in the section 6.

Offset from the pump casing 7 and formed integral therewith is a collection chamber or reservoir 62 which is adapted to collect and store in reserve a quantity of liquid for the purpose of lubricating the impellers 54 and preventing deterioration thereof in the event that the pump is operated when the intake tube 10 is out of the water or when the marine craft is temporarily dry-docked so as to prevent injury to the impellers by excessive wear. The chamber 62 includes a side wall portion 63, bottom wall portion 64, and end wall portion 65. A rear wall 66 integrates the end wall portion with the bottom wall portion 64 to thereby form a closed reservoir chamber in communication with the impeller cavities 53 through an opening or passageway 65 forming an exhaust port 67 for the pump so that the fluid passing from the pump to the chamber will be normally under pressure. An intake opening or port 68 is formed in the pump casing section 7 and is adapted to communicate with the intake pipe 10 (Figure 6) in such a manner as to draw sea water therethrough when the pump impellers 54 are rotated in unison. Threaded bores 69 are formed in the pump casing section 7 to facilitate the bolting of the flange 70 of the intake pipe thereto by means of bolts or the like 71.

The reservoir chamber 62 is provided with a top wall portion 72 which is shaped to receive a pipe flange and said wall is provided with a port 73 communicating the interior of the chamber 62 with the intake pipe 9 of the water-cooling jacket 8. The pipe flange 74 of the intake pipe 9 is bolted in place by machine screws or the like 75 being received in threaded openings 76 in the top wall 72. The structure above described provides a reservoir chamber on the exhaust side of the pump and forms a trap having a relatively large volumetric area for containing a large

amount of sea water when the pump is out of operation.

In order to prevent the water trapped in the chamber 62 from being entirely blown out of the reservoir chamber, if for any reason whatsoever the pump is operated when the intake pipe 10 is not submerged, there is formed a chamberway or offset extension 78 integrated with the pump section 7 and reservoir chamber 62 and provided with a passageway 79 having one end communicating with the reservoir chamber through a laterally extending port 80 and the other end communicating with the pump chamber through a laterally extending port 81. The passageway 79 includes a vertical passageway portion 82 which extends upwardly between bearing bosses 83 and 84 for the ends of their respective shafts 21 and 22 and the lower end of said vertical passageway 82 is in communication with the pump chamber through the port 81 which is formed as shown in Figure 2 between the impeller cavities 52 and 53 at a point slightly below the axis of the shafts 21 and 22. The passageway 79 is slightly curved at the other end and terminates in the discharge port 80 located at the uppermost portion of the side wall 63 of said reservoir chamber 62. As shown clearly in Figures 1 to 3 inclusive, the offset extension 78 is formed integral with the front wall 63 of the pump chamber and reservoir and the port 81 is formed integral with the front wall 63 communicating with the interior of the reservoir chamber 62 through the fluid passageway 79. The division plate 27 is adapted to close the rear wall of the pump chamber and as shown in Figure 5, the rear wall of the reservoir chamber is integrated with the pump chamber so that when the bolts 58 are removed, the entire pump chamber and reservoir chamber comprising the pump section 7 may be removed as a unit. When removed, the section 7 is simply slid horizontally so as to be removed from the shafts 21 and 22, shown in Figures 1 to 3 inclusive.

Closure plugs 84*a* are fitted in the ends of the tubular bearing bosses 83 and 84 to close the same against the entrance of foreign matter, and a cleanout plug 85 is provided in the reservoir chamber 62 to facilitate the removal of foreign matter therefrom.

In operation, the impellers 54 are rotated in unison by means of the spur gears 39 and 43 when the pump casing 5 is assembled on a marine engine in the manner as set forth. When the impellers are rotated, sea water is drawn upwardly through the intake pipe 10 and forced through the circulatory system of the engine cooling jacket 8 by being passed through the reservoir chamber 62 and pipe 9. In the event that the marine craft is raised out of the water when the same is beached or in dry dock and the motor 8 is operated, the quantity of water or liquid trapped in the chamber 62 will be drained through the port 80, passageway 79 and port 81 and thence again to the interior of the reservoir chamber 62. The water trapped in chamber 62 thus flows to the synthetic rubber impellers 54 and thereby lubricates said impellers. The port 81 and passageway 79 permits air from said pump casing to be forced into the uppermost portion of the reservoir casing, thereby placing the liquid therein under a slight pressure head. The passageway or port 81 will not affect the normal operation of the pump, because in normal operation the sea water may flow through chamber 62 to outlet 73 and only a small quantity is circulated back through passageway 78 and port 81 to the discharge portion of the pump, and will enable the pump to be operated for a considerable length of time when the intake pipe 10 is not submerged without causing the impellers 54 to be burnt and scorched through excessive frictional heat. The circulating passageway 79 prevents the impellers 54 from blowing the trapped liquid out of the chamber 62 so as to permit feeding of said impellers with a small amount of water sufficient to lubricate the impellers and thereby prevent damage thereto.

The reservoir 62 may also be used in pumps having bronze or brass impellers with similar results. And while water is not a very good lubricant for metal and metal impellers such as bronze or brass, the reservoir 62 will feed said impeller with a slight amount of water to prevent excessive damage in the event the engine and pump are operated while the intake is out of communication with the source of liquid and exposed to the atmosphere.

It is to be understood that the form of the invention herewith shown and described is to be taken as a preferred embodiment of the same and that various changes may be made in the shape, size and arrangement of parts without departing from the spirit of the invention or the scope of the subjoined claims.

What I claim is:

1. A fluid pump comprising a casing having a pump chamber provided with inlet and exhaust ports and intake and exhaust passages communicating with said inlet and exhaust ports, a gear pump housed in said pump chamber, said exhaust passage having an outlet and being return bent and conducting the exhaust fluid in a direction opposite to the flow of fluid through said intake passage and said pump chamber, and said casing provided with a separate return passage offset to one side of said intake and exhaust passages, said return passage communicating at one end with said exhaust passage adjacent the outlet and at the other end with said pump chamber immediately adjacent to said pump chamber exhaust port whereby to provide a generally downwardly sloping passage permitting the fluid in said exhaust passage to flow by gravity to wet said pumping gears.

2. A fluid pump comprising a casing having a pump chamber provided with inlet and exhaust ports and intake and exhaust passages communicating with said inlet and exhaust ports, a gear pump housed in said pump chamber, said exhaust passage having an outlet and being return bent and conducting the exhaust fluid in a direction opposite to the flow of fluid through said intake passage and said pump chamber, and said casing provided with a separate return passage offset to one side of said intake and exhaust passages, said return passage communicating at one end with said exhaust passage adjacent the outlet and at the other end with said pump chamber immediately adjacent to said pump chamber exhaust port whereby to provide a generally downwardly sloping passage permitting the fluid in said exhaust passage to flow by gravity to wet said pumping gears, said exhaust passage comprising an enlarged intermediate portion whereby to provide a relatively large reservoir serving to provide a maximum of fluid for drawing through said return passage.

3. A fluid pump comprising a casing having a pump chamber provided with inlet and exhaust ports and intake and exhaust passages communicating with said inlet and exhaust ports, a gear

pump housed in said pump chamber, said exhaust passage having an outlet and being return bent and conducting the exhaust fluid in a direction opposite to the flow of fluid through said intake passage and said pump chamber, and said casing provided with a separate return passage offset to one side of said intake and exhaust passages, said return passage communicating at one end with said exhaust passage adjacent the outlet and at the other end with said pump chamber immediately adjacent to said pump chamber exhaust port whereby to provide a generally downwardly sloping passage permitting the fluid in said exhaust passage to flow by gravity to wet said pumping gears, said return passage emptying into said pump chamber through a side wall so that the fluid will flow across the gear teeth on its way to said pump chamber exhaust port.

ROBERT W. FERNSTRUM.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
703,511	Wood	July 1, 1902
877,903	Butler	Feb. 4, 1908
1,161,037	Dunham	Nov. 23, 1915
1,521,446	Hubbell	Dec. 30, 1924
1,823,098	Hargis	Sept. 15, 1931
2,028,414	Schneider	Jan. 21, 1936
2,115,193	Burris	Apr. 26, 1938
2,212,939	Irgens	Aug. 27, 1940
2,299,321	Hampton	Oct. 20, 1942

FOREIGN PATENTS

Number	Country	Date
1,392	Great Britain	1885
14,263	Great Britain	1887
184,397	France	1881
547,463	Great Britain	Aug. 28, 1942