Jan. 26, 1960 P. W. PERISH 2,922,374

PUMP MEANS

Filed March 14, 1955 3 Sheets-Sheet 1

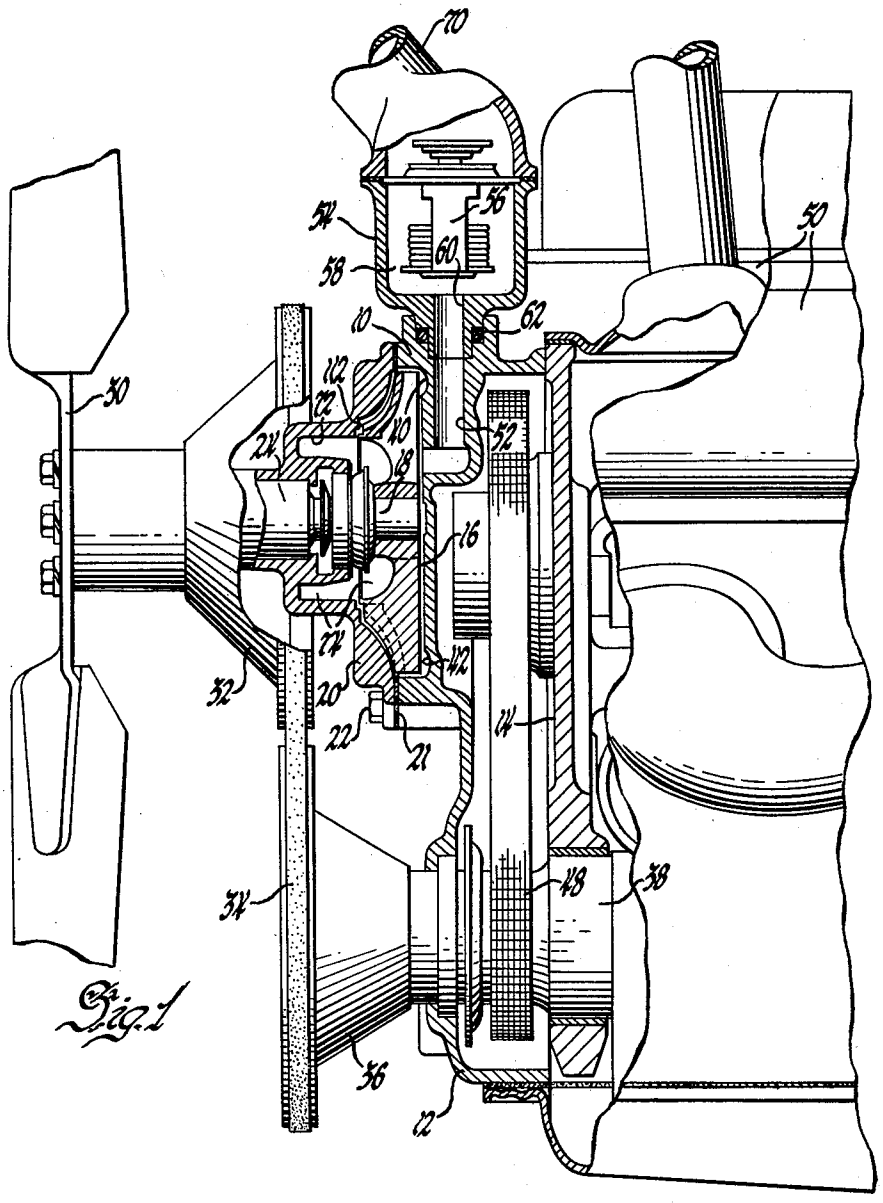


Fig. 1

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PUMP MEANS

Filed March 14, 1955 3 Sheets-Sheet 2

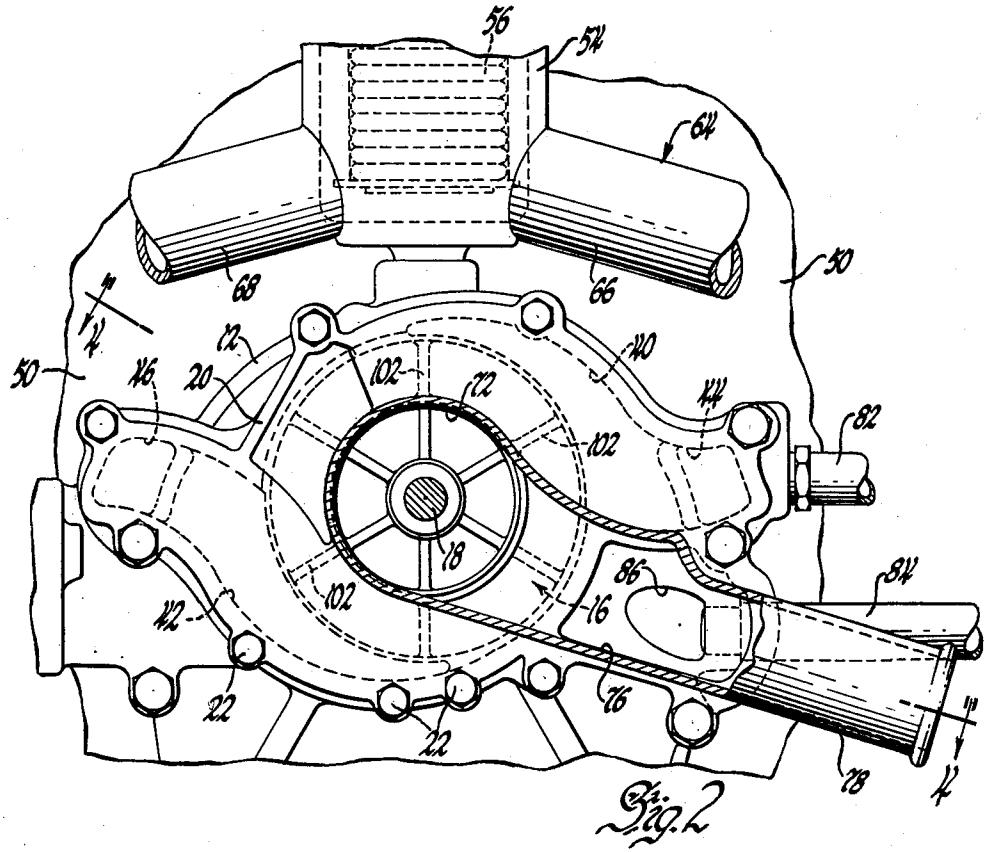


Fig. 2

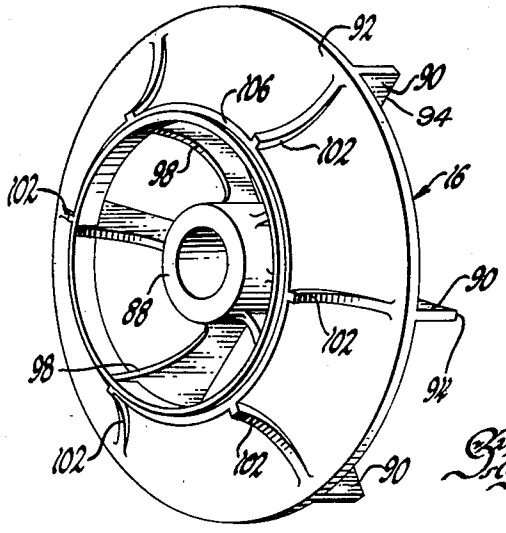


Fig. 3

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PUMP MEANS

Filed March 14, 1955 3 Sheets-Sheet 3

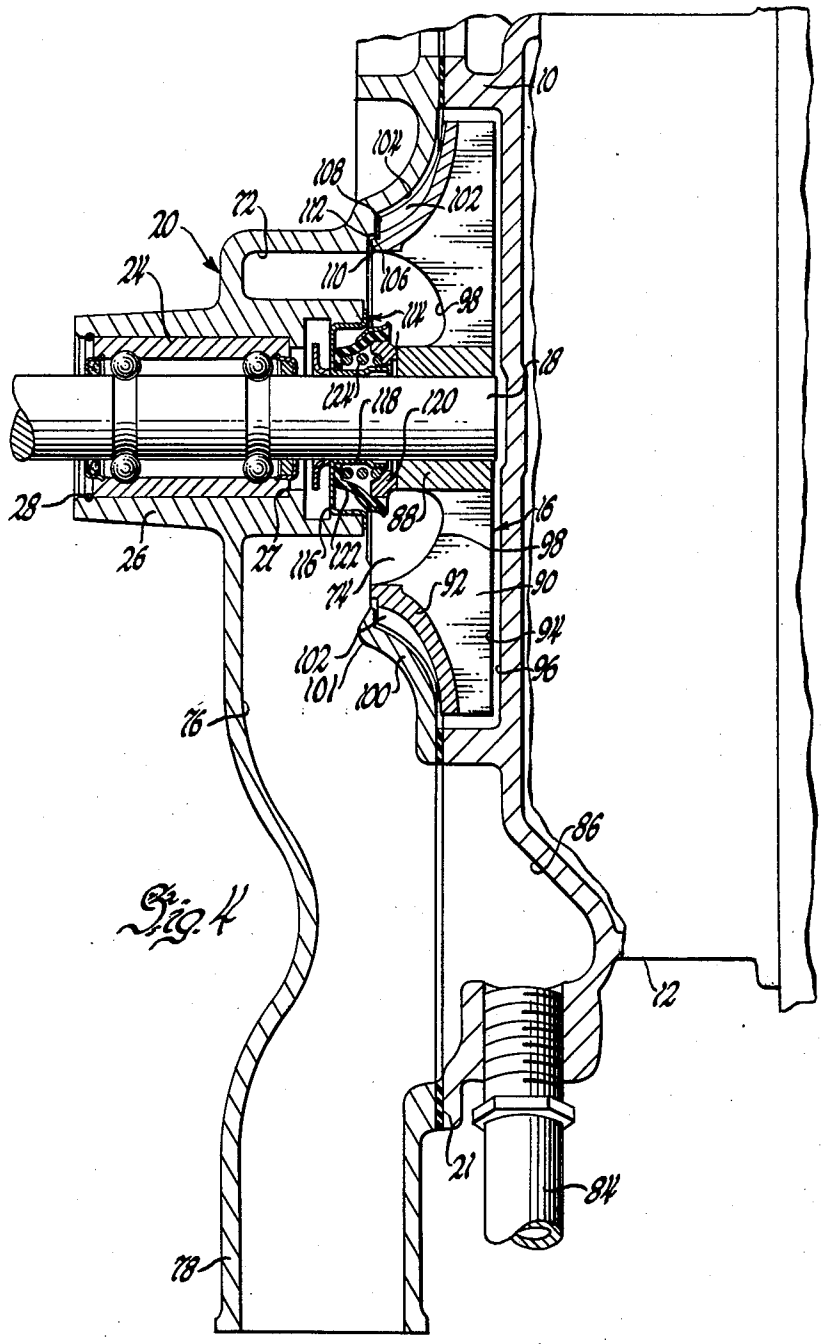


Fig. 4

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PUMP MEANS

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5 Claims. (Cl. 103—111)

This invention relates to pump means generally and more particularly to means for improving the performance and increasing the efficiency of fluid pumping means.

Improved performance and increased efficiency in fluid pumping means provides greater pump capacity without a material increase in pump size. This aspect of increased pump efficiency is most important where space limitations exist such, for example, as with water pumps used to circulate cooling water through automotive engines.

Water circulating pumps used in engine cooling systems are generally of the centrifugal type having an impeller driven through belt means connected to the engine crankshaft. Cooling water is introduced at the center of the impeller and is forceably directed outward by the impeller blades. Known sources of inefficiency in such pumps include internal fluid flow restrictions and the tendency of the fluid to recirculate about the impeller blades.

It is now proposed to provide means for improving the efficiency of fluid pumping or circulating means and to thereby increase the capacity of such means without a material change in the size or shape thereof.

It is proposed to reduce internal fluid flow restrictions within pump means including an impeller by undercutting the base of the impeller blades at the inlet or eye of the impeller means and on the inlet side thereof.

It is also an object of this invention to minimize recirculation of fluid between the impeller tip and eye by reducing to a minimum the clearance provided between the pump housing and the impeller and by providing a stepped or labyrinth clearance space in combination with small vanes or impeller ribs provided on the back side of the impeller at the eye thereof.

It is proposed to provide back vanes or ribs which gradually diminish in size towards the outer periphery of the impeller to avoid unnecessary disturbance of the fluid in the volute portion of the outlet scroll of the pump means.

These and other objects will be made more apparent by the description which follows.

In the drawings:

Figure 1 is a side view of a part of an engine having parts broken away and shown in cross-section to more clearly illustrate the proposed pumping means.

Figure 2 is a fragmentary front view of the engine shown in Figure 1 having a part of the fluid inlet passage broken away and the fan means removed to more clearly show certain features of the proposed pump means.

Figure 3 is a perspective view of the proposed pump impeller showing the back vanes or ribs provided thereon.

Figure 4 is a cross-sectional view of the proposed pump means as taken in the plane of line 4—4 of Figure 2 looking in the direction of the arrows thereon.

The pump means proposed are here shown included within an engine cooling system similar to that of copending application S.N. 321,347, filed November 19, 1952, in the name of Joseph D. Turlay, now Patent Number 2,852,009, and titled "Cooling Liquid Circulating System for Engines."

The proposed pump means include an impeller housing 10 formed within the engine timing chain cover 12 which is secured to the front of the engine 14. An impeller 16 is disposed within the housing 10 and is mounted upon a shaft 18 journaled within the impeller housing cover 20. The impeller housing cover 20 is secured to the timing chain cover 12 upon a gasket 21 by fastening means 22 and includes a sealed double row ball bearing member 24 within which shaft 18 is rotatable. The ball bearing member 24 is held within the neck 26 of the housing cover 20 and against a shoulder 27 formed therein, by a snap ring retainer 28.

Fan means 30 and pulley means 32 are secured to the end of shaft 18. Pulley 32 is connected by belt 34 to a drive pulley 36 secured to the front end of the engine crankshaft 38.

The impeller housing 10 is formed to provide separate volute fluid outlet scrolls 40 and 42 by undercutting the wall of the timing chain cover 12 within the housing as shown in Figure 1. Outlet passages 44 and 46 are provided through the timing chain cover 12, at the ends of the volute outlet scrolls 40 and 42, respectively, beyond the path of timing chain 48, and communicate with inlet openings extending through the cooling jackets surrounding the engine cylinder banks indicated generally at 50.

A bypass passage 52 is provided through the upper wall of timing chain cover 12 and is formed to communicate with the inlet side of the impeller 16 on the side thereof opposite impeller housing cover 20. A thermostat housing 54 including temperature responsive valve means 56 disposed within chamber 58 formed therein, is engaged to the timing chain cover 12, with passage 60 formed therein communicating with bypass passage 52. A sealing ring 62 prevents leakage between the housing and cover members. The thermostat housing comprises part of the coolant manifold 64 which includes conduits 66 and 68, for the return flow of coolant fluid from the engine cylinder cooling jackets 50, and the radiator inlet conduit 70 through which coolant passes to the radiator when the valve means 56 is open.

The impeller housing cover 20 is formed to provide an annular fluid inlet chamber 72 which communicates with the fluid chamber 74 of the impeller housing 10 within which the impeller 16 is disposed. A fluid inlet passage 76 is formed through the cover from chamber 72 terminating as a conduit 78 to which the outlet side of the radiator is secured.

Vehicle heater connections are made within the impeller housing 10 as by supply conduit 82 and return conduit 84 threaded within the side walls of the timing chain cover 12 forming the housing. The supply conduit opens within the outlet scroll 40 near the end thereof and the return conduit opens within a heater return chamber 86 formed below the impeller housing 10 and within the timing chain cover 12. Return chamber 86 is in open communication with inlet passage 76.

The impeller 16 comprises a hub or sleeve 88 secured by a press fit or other means to shaft 18, a plurality of spaced impeller blades 90 secured to the hub and extended radially outward, and an annular wall 92 spaced concentrically about the hub member and secured to the back sides of the impeller blades 90. Each impeller blade 90 includes a straight edge 94 disposed closely adjacent the back wall 96 of impeller housing 10 to provide minimum clearance therebetween, and an undercut portion, as at 98, at the eye or inlet of the impeller. The annular wall 92 terminates at the edge of the inlet chamber 72, rather than extending therein, to minimize flow restrictions. The pump cover wall 100 separating inlet pas-

sage 76 from the impeller chamber 74 is formed to the general contour of the impeller 16 and includes a rounded lip 101 which directs fluid flow over the part of the impeller eye which is in direct communication with the inlet passage 76. The fluid flowing against wall 100 is directed past this side of the impeller and no appreciable restriction to fluid flow is there realized.

A plurality of small ribs or vanes 102 are provided on the front side of the annular impeller wall 92, opposite the impeller blades 90 secured thereto, and extend outwardly towards the impeller housing cover 20 which has the inner surface 104 thereof formed to the general contour of the impeller wall 92, including the ribs 102, to provide minimum clearance between the cover 20 and impeller 16. The ribs or vanes 102 are formed to gradually diminish in height and merge into the annular wall 92 towards the outer edge of the impeller 16.

The impeller wall 92 includes an annular shoulder 106 near the impeller eye or inlet and on the back side thereof, at which the inner end of each back vane 102 terminates. The impeller housing cover 20 has the inner surface 104 thereof formed, near the impeller eye to include stepped shoulders 108 and 110 which lie closely adjacent shoulder 106 of the impeller and the end of the vanes 102, and in combination therewith form a labyrinth sealing or stepped clearance passage 112.

A fluid seal 114 is disposed about shaft 18 and within the neck or hub 26 of the impeller housing cover 20. The seal includes retainer walls 116 and 118 engaging the cover and shaft and a bearing ring 120 and sealing ring 122 held in engagement with the impeller hub 88 and retainer wall 116, respectively, by biasing means 124. The fluid seal 114 prevents leakage about the shaft 18 and is disposed so as to provide no restriction to fluid flowing from the inlet chamber 72 towards the impeller.

The proposed pump means as adapted for use in an automotive engine cooling system operates as follows. Fluid is received from the radiator (not here shown) through inlet passage 76. The fluid passes through inlet chamber 72, enters impeller chamber 74 and is picked up by the undercut edge 98 of the impeller blades 90.

The undercutting of impeller blades 90 assists greatly in minimizing the restriction to inlet fluid flow and also reduces the fluid pressure at the eye of the impeller 16 which otherwise would tend to build up as a result of the fluid shock loading of the impeller at that position.

Fluid is centrifugally forced outwardly towards the tips or ends of the blades 90 and is released into the volute outlet scrolls 40 and 42. The coolant then flows through outlet passages 44 and 46 directly into the engine cylinder cooling jackets.

A part of the outlet flow of fluid from scroll 42 is directed through heater feed conduit 82 and after passing through vehicle heating means (not shown) is returned through conduit 84 to the inlet passage 76.

The cooling fluid returns from the engine cooling jackets through the coolant manifold 64, comprising conduits 66 and 68, and when the thermostat 56 is open, flows through chamber 58 of the thermostat housing 54 and out radiator supply conduit 70. The coolant manifold 64 also serves as a crossover connection between engine cylinder cooling jackets.

When the thermostat 56 is closed the return flow of fluid through conduits 66 and 68 is directed through bypass passage 52 to the central area and consequently, the inlet side of the impeller 16. The impeller blades 90 pick up the fluid and discharge it, as before, in the outlet scrolls 40 and 42. Some fluid is also still received through inlet passage 76 from the heater return conduit 84.

The fluid passing over impeller blades 90 is prevented from recirculating along the front side of impeller 16, between the annular wall 92 thereof and the impeller housing cover 20, by the ribs or vanes 102 provided therebetween to discourage such fluid recirculation. The vanes

102 are formed to merge with the impeller wall 92 near the outer end thereof to prevent flow disturbance by interference with the fluid flowing through the outlet scrolls 40 and 42. The recirculatory flow about the impeller blades 90 is further discouraged by providing the stepped or labyrinth clearance space 112 which restricts both direct flow therethrough, from inlet chamber 72, as well as any recirculating fluid flow.

Having reduced internal fluid flow restrictions by removing the impeller eye from the path of fluid flow, undercutting the impeller blades, providing means to prevent recirculatory fluid flow, and generally providing smaller clearance between the impeller and its housing members, a pump means is provided having greater efficiency and consequently a greater pumping capacity without materially changing the size thereof.

The claims:

1. A fluid circulating pump which includes a housing, an impeller rotatably mounted within said housing, fluid inlet and outlet passage means formed through said housing on opposite sides of said impeller, and means for preventing the recirculation of fluid about said impeller between said outlet and inlet passage means which includes, a plurality of vane members formed on said impeller, and a labyrinth seal provided between said impeller member and said housing about said inlet passage means and formed by said housing and said impeller and said vane members, said vane members terminating near said inlet passage means and having the ends thereof forming at least a part of said labyrinth seal.

2. A fluid circulating pump as provided for by claim 1 which further includes having said vanes gradually merged into said impeller towards the outlet side thereof to reduce fluid flow disturbance within said outlet passage means.

3. A fluid circulating pump as provided for by claim 1 which further includes having fluid circulating blade means provided upon said impeller and having the leading edges thereof disposed downstream of said labyrinth seal for relieving fluid pressure otherwise present at said seal as a result of the fluid shock loading of said fluid circulating blade means.

4. A fluid circulating pump which includes a housing cover secured to a housing, fluid receiving chamber means formed within said housing cover and housing, an impeller member rotatably supported by said housing cover and disposed within said chamber means, fluid inlet passage means provided within said housing cover and fluid outlet passage means provided within said housing, said fluid inlet and said fluid outlet passage means being in communication with said chamber means on opposite sides of said impeller member, fluid circulating blades provided upon said impeller member and disposed on the side thereof adjacent said housing, and fluid sealing means provided between said impeller member and said housing cover which includes, stepped shoulders formed within said housing cover wall adjacent said impeller and about the inlet side of said chamber means, and rib projections formed from said impeller member and disposed on the side thereof adjacent said housing cover wall, said rib projections and said impeller member terminating in stepped shoulders mating with said shoulders of said housing cover for forming in combination therewith a labyrinth seal.

5. A fluid circulating pump as provided for by claim 4 which further includes having said rib projections tapering into said impeller at said fluid outlet passage means to prevent undue outlet flow disturbance and having the fluid receiving edges of said impeller blades disposed downstream of said seal to avoid fluid shock loading pressures at said seal.

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