Sept. 5, 1950 D. R. SPOTZ 2,521,420

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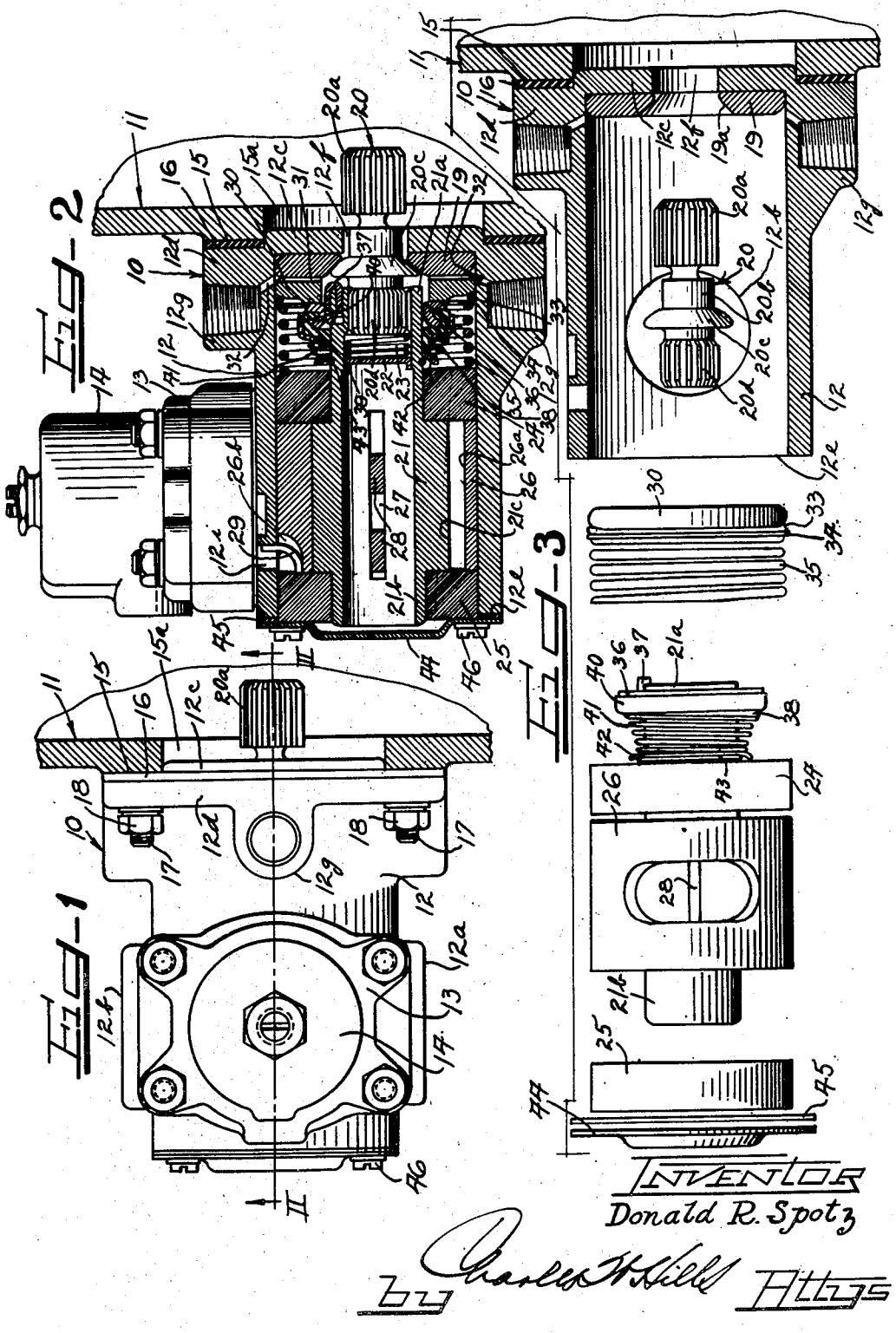


Fig. 2

Fig. 3

Fig. 1

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4 Claims. (Cl. 103—137)

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This invention relates to a simplified positive displacement vane type pump that is inexpensive and easy to manufacture.

Specifically, the invention relates to a vane type pump for mounting on a prime mover such as an aircraft engine to be driven thereby and having a casing equipped with a readily removable end cap on the end thereof remote from the prime mover mounted end together with pump parts inside of the casing adapted to be readily removed through said remote end upon removal of the end cap.

The invention will be hereinafter specifically described as embodied in an aircraft engine fuel pump of the type disclosed in the Russell R. Curtis Patent No. 2,268,805, dated January 6, 1942, but it should be understood that the principles of this invention are generally applicable to other types of pumps. It should also be understood that the pumps of this invention are useful for pumping many different types of fluids including water, solvents such as alcohol, gasoline, oil and the like.

In general the pumps of this invention include a casing having an end wall portion adapted to fit into the aperture of a prime mover. This end wall has a small central aperture for receiving a shaft therethrough to be coupled with the prime mover. The casing has an open end remote from the end wall. A readily removable cap is provided for closing this open end. All of the pump parts are held in the casing between the end wall and the removable end cap, and are so designed that they can be retracted from the casing by removal of the end cap. The pumps of this invention, therefore, can be serviced without separating them from the prime mover on which they may be mounted.

It is, then, an object of this invention to provide a pump and casing assembly arranged for mounting on a prime mover and having a readily removable end cap closing an opening through which all of the pump parts can be retracted without disconnecting the assembly from the prime mover.

A further object of the invention is to provide a simplified positive displacement type pump and casing assembly arranged so that all of the pump parts in the casing assembly are held in position by a removable end cap and are removed from the casing through the end closed by the removable end cap.

A still further object of the invention is to provide a simplified positive displacement pump that is easily assembled and disassembled, and is inexpensive to manufacture.

A still further object of the invention is to provide a universal type pump adapted to handle fluids of all natures and adapted to be quickly repaired.

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A further object of this invention is to provide a pump and seal assembly for quick installation in a casing arranged to be readily removed from the casing upon removal of a single end cap on the casing.

Other and further objects of the invention will be apparent to those skilled in the art from the following detailed description of the annexed sheet of drawings which, by way of preferred example only, illustrates one embodiment of the invention.

On the drawings:

Figure 1 is a top plan view of a pump according to this invention mounted on an engine part shown in horizontal cross section.

Figure 2 is a vertical cross-sectional view, with parts in side elevation, of the assembly shown in Figure 1 taken along the line II—II of Figure 1.

Figure 3 is an exploded view illustrating the manner in which the pump parts are readily removed from the pump casing without removal of the casing from the engine.

As shown on the drawings:

The pump assembly **10** of this invention is mounted on an engine part **11** and includes a main pump casing or housing **12**, a by-pass and relief valve casing **13** mounted on top of the casing **12**, and a spring casing **14** mounted on top of the valve casing **13**. The casings **13** and **14** and the parts therein are described in the hereinbefore referred to Curtis Patent 2,268,805.

The pump casing **12** has an inlet port **12***a* and an outlet port **12***b* on opposite sides thereof together with an end wall **12***c* at one end thereof projecting forwardly from a surrounding mounting flange **12***d*. The casing **12** has an open end **12***e* remote from the wall **12***c* but in axial alignment therewith. The casing **12** thus defines a cylindrical chamber open at one end **12***e* thereof and closed at the other end **12***c* thereof. The end **12***c* has a central aperture **12***f* therethrough.

The engine part **11** includes a pad **15** with an aperture **15***a* therethrough receiving the end wall **12***c* in snug engagement therewith. This end wall **12***c* thus acts as a pilot portion for aligning the pump on the engine part. A gasket or sealing washer **16** overlies the pad **15** and is positioned between the pad and the mounting face of the mounting flange **12***d*.

Studs **17** project from the pad **15** at spaced intervals and extend through the mounting flange **12***d*. Nuts **18** threaded on the studs **17** clamp the flange in fixed relation on the pad, thereby securing the pump assembly **10** to the engine part **11**.

Bosses **12***g* are provided at spaced intervals around the flange **12***d* and are integral with the flange. These bosses are internally threaded to receive drain lines or screw plugs. The pump casing **12** is preferably an aluminum casting.

A thrust washer 19 composed of an oil-impregnated sintered bronze or other oil-retaining bearing material is seated in the casing 12 against the end wall 12c thereof. This washer 19 has a chamfered central aperture 19a therethrough.

A splined driver or pump shaft 20 has a first splined end 20a adapted to project into the engine part 11 to be coupled with the engine drive. The driver 20 has a shaft portion 20b which fits freely in the aperture 19a of the washer 19 and 12f of the end wall 12c. A rounded collar portion 20c is formed on the driver adjacent the cylindrical shaft portion 20b thereof and this collar rides on the chamfered aperture 19a of the washer 19, in rockable relation.

The driver has a smaller splined end 20d remote from the end 20a thereof which is splined into the hollow hub 21a of the pump rotor 21. The rotor 21 has a second hub 21b at the opposite end thereof.

The hub 21a is hollow and has a plug 22 pressed therein inwardly from its end. A coil spring 23 is compressed between the plug 22 and the splined end 20d of the driver 20 to urge the driver outwardly from the rotor hub so that its collar 20c will continually seat on the chamfered aperture 19a of the thrust washer 19. A ball and socket joint relationship between the driver and the thrust washer is obtained.

The rotor 21 fits freely into the casing 12 and is rotatably supported therein on bearing rings 24 and 25 which can be formed of graphitic carbon or the like plain bearing material. The bearing 24 rotatably supports the rotor hub 21a while the bearing 25 rotatably supports the rotor hub 21b.

A pump liner 26 is snugly fitted in the casing 12 between the bearings 24 and 25 and around a central enlarged portion 21c of the rotor 21. The liner 26 has an eccentric inner bore 26a cooperating with the exterior surface of the central hub portion 21c to define therebetween the pumping chamber for the pump. The liner has apertures aligned with the casing ports 12a and 12b so that the pumping chamber is in communication with these ports.

The central portion of the rotor 21 has a pair of slots such as the slot 27 therethrough in right angular relationship. These slots slidably support the pumping vanes such as 28. The pumping vanes have intermediate tongues but their peripheral portions provide continuous surfaces in the pumping chamber.

The liner 26 is held against rotation in the casing 12 by means of a lock clip 29 which fits in a recess such as recess 26b in the liner which can be conveniently formed by a milling cutter. The clip 29 is inserted through an aperture 12i in the casing 12.

A stationary seal ring 30 composed of graphitic carbon or similar material has a grooved end face seated on the thrust washer 19 and cooperating therewith to define grooves 31 which will drain any liquid which may leak past the end seal face of ring 30, to passageways 32 connecting the interior of the casing with the inner ends of the threaded plugs 12g.

An O ring 33, composed of resilient rubber-like material capable of resisting aromatic solvents is urged against the peripheral portion of the stationary seal ring 30 by a washer 34 acted on by a spring 35 which is compressed between the washer and the bearing 24. This O ring will seal the peripheral portion of the stationary seal ring 30 in the casing.

A rotating seal ring 36 composed of Monel metal or the like material is disposed around the hub 21a and has an end face riding on the stationary seal ring 30. A Phosphor bronze or stainless steel wire clip 37 is snapped into the hub 21a of the rotor and fits in an internal groove in the rotating seal ring 36 to form a key connection to drive the rotating seal ring with the rotor.

A synthetic rubber sleeve 38 embraces the rotating seal ring 36 and has a beaded end seated in a peripheral groove on the rotating seal ring 36. The sleeve 38 snugly engages the hub 21a and is tightly secured thereon by means of a lock wire 39. A metal cup 40 embraces the portion of the sleeve disposed around the seal ring 36 and is urged by a spring 41 to move the seal ring against the stationary ring 30. The spring 41 is bottomed on a washer 42 which is held against axial movement on the hub 21a by a lock wire 43.

The plug 22 prevents leakage through the rotor hub 21a. The seal assembly including the stationary seal ring 30, the rotating seal 36, and the rubber sleeve 39 prevents leakage of material around the rotor hub 21a. However, if the seal between the rotating and stationary seal rings should leak, the leaked material will be drained through the grooves 31 into a passageway 32.

The driver 20 is free to wobble, since it is rockably splined in the hub 21a, but wobbling movements of the driver will not unevenly load the bearings for the rotor. The driver at all times has sealing engagement with the thrust washer 19 although it is free to rock and tilt on this washer. This sealing engagement prevents leakage of lubricating oil from the engine driver into and through the pump drain grooves 31 and passageways 32. Likewise, this seal prevents any liquid leakage on the interior of the pump past the driver 20 to the exterior of the pump through the central aperture 12f.

The open end 12e of the casing 12 is closed by an end cap 44 which is in the nature of a stamped metal plate preferably composed of stainless steel. A gasket or sealing washer 45 is interposed between the end of the casing and the plate 44. Cap screws 46 are passed through the end cap 44 and are threaded into the casing to secure the end cap to the casing. The end cap abuts the bearing 25 and cooperates with the end wall 12c of the casing to clamp all of the pump parts therebetween.

When the end cap 44 is removed from the casing 12, as illustrated in Figure 3, all of the pump parts are readily retracted through the open end 12e of the casing and can be replaced or repaired without disconnecting the casing from the engine part 11.

The spring 35 acts as a resilient take-up means for the O ring seal 33 should this part take a compression set. When the end cap 44 is removed, the spring 35 aids in the removal of the pump parts, since it tends to force the bearing 24 toward the open end of the casing 12e and, in so moving the bearing, also moves the rotor, liner, and the seal structure on the rotor.

From the above descriptions it should be understood that the pumps of this invention are readily assembled and disassembled without dismounting their casings from a driver. The pump includes seal parts and pump parts which can be readily retracted out of an easily accessible end of a pump casing, and which can be repaired or replaced without difficulty.

It will, of course, be understood that various details of construction may be varied through a wide range without departing from the principles of this invention and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

I claim as my invention:

1. A pump comprising a pump casing having an apertured end wall and an open end in alignment with the end wall in spaced relation therefrom, a mounting flange on said casing surrounding said end wall, a pump shaft extending freely through the aperture in said end wall, said pump shaft having a shoulder disposed in the casing, a thrust washer bottomed on said apertured end wall, said thrust washer having a beveled aperture receiving said shoulder of the drive shaft in tiltable relation thereon, a stationary seal ring having one face thereof bottomed on said thrust washer, an O ring in said casing bottomed on the peripheral portion of the other face of said stationary seal ring, a washer overlying said O ring, a rotating seal ring having an end face riding on said other face of the stationary seal ring, a pump rotor in said casing having hubs at the ends thereof with one of the hubs extending through and keyed to the rotating seal ring, bearing rings seated in said casing rotatably supporting said rotor hubs, a pump liner between said bearing rings cooperating with said rotor to define therebetween a pumping chamber, pumping vanes carried by said rotor, a spring compressed between said washer overlying the O ring and the bearing ring adjacent said washer, a removable end cap secured to the open end of said casing thrusting against the other of said bearings cooperating with said apertured end wall to clamp the pump parts in the casing, and all of said parts in said casing being arranged for removal through the open end of the casing.

2. A pump comprising a casing having a peripheral wall, a flanged end with an apertured end wall and an open end opposite the apertured end wall, said flanged end being arranged for attachment to an engine pad, a liner in said casing, bearing rings in said casing bottomed on opposite ends of said liner, a pump rotor in said casing rotatable in said bearing rings, pumping vanes carried by said rotor, a hub on said rotor projecting through one of said bearing rings, a driver for said rotor projecting through the apertured end wall of the casing, said driver having a shoulder portion in the casing of larger diameter than the aperture in said end wall, means in said casing receiving said shoulder in tiltable relation, a stationary seal ring bottomed on said means, a rotating seal ring riding on said stationary seal ring, a washer on said hub of the rotor, a first spring bottomed on said rotating seal ring and on said washer to maintain the rotating seal ring in sliding sealing engagement with the stationary seal ring, a second spring compressed between said stationary seal ring and the adjacent bearing ring, and an end cap removably secured to the open end of the casing in thrusting relation to the other bearing ring whereby removal of said end cap allows said second spring to urge pump parts out of the open end of the casing.

3. A pump comprising a casing having a peripheral wall, a flanged end with an apertured end wall and an open end opposite the apertured end wall, said flanged end being arranged for attachment to an engine pad, a liner in said casing, bearing rings in said casing bottomed on opposite sides of said liner, a pump rotor in said casing rotatable in said bearing rings, pumping vanes carried by said rotor, a hub on said rotor projecting through one of said bearing rings, a driver for said rotor projecting through the apertured end wall of said casing, said driver having a shoulder portion in the casing of larger diameter than the diameter of the aperture in said end wall, means in said casing receiving said shoulder in tiltable relation, a stationary seal ring bottomed on said means, an O ring having one face bottomed on said stationary seal ring, a washer in surface engagement with the other face of said O ring, a rotating seal ring riding on said stationary seal ring, a second washer on said hub of the rotor, a spring bottomed on said rotating real ring and on said second washer to maintain the rotating seal ring in sliding sealing engagement with the stationary seal ring, a second spring compressed between said first washer and the adjacent bearing ring to maintain said O ring in sealing engagement with said stationary seal ring, and an end cap removably secured to the open end of the casing in thrusting relation to other bearing ring whereby removal of said end cap allows said second spring to urge pump parts out of the open end of the casing.

4. A pump comprising a casing having an apertured end wall with a mounting flange thereabout for attachment to an engine, said casing having an open end remote from said apertured end wall, a lubricated thrust washer seated against said end wall and having a chamfered aperture opening toward said open end and registering with the aperture of said end wall, a pump rotor rotatably disposed in said casing, pumping vanes carried by said rotor, a drive shaft for said rotor extending through said apertured end wall and said thrust washer, said shaft having a peripherally rounded circumferential collar seated in the washer aperture in relatively rotatable engagement therewith, and seal parts for said rotor and shaft in said casing, a spring in the casing adjacent the apertured end wall thereof and urging said rotor and said seal parts toward the open end of the casing, said rotor, drive shaft and said seal parts being so arranged as to be retractable through said open end, and an end cap secured to the open end of the casing for clamping said rotor and said seal parts between the end wall of the cap against the action of said spring, said chamfered washer aperture facilitating removal of said drive shaft and insuring sealing of said shaft upon assembly.

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