Dec. 2, 1958 J. DICKSON 2,862,655

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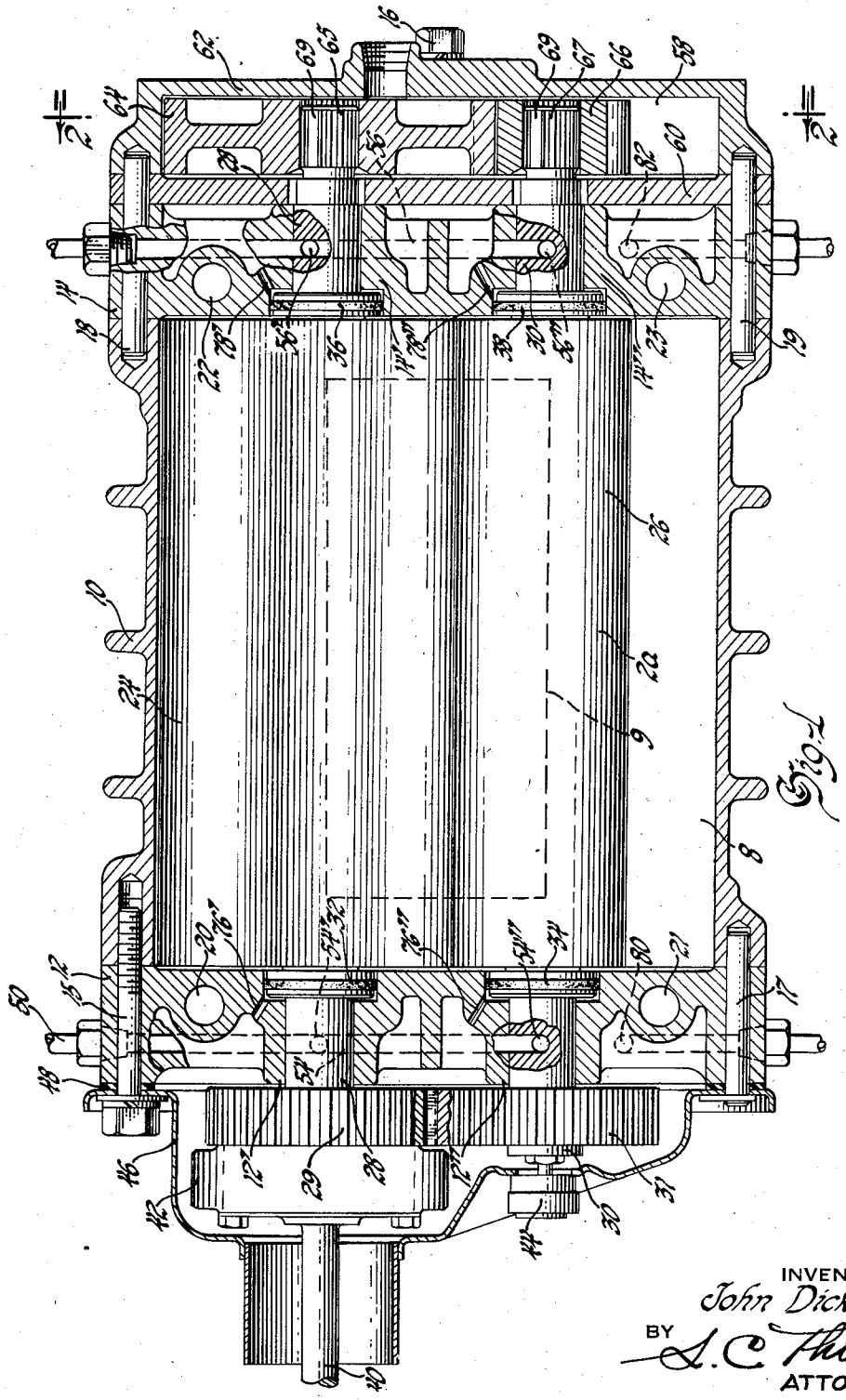


Fig. 1

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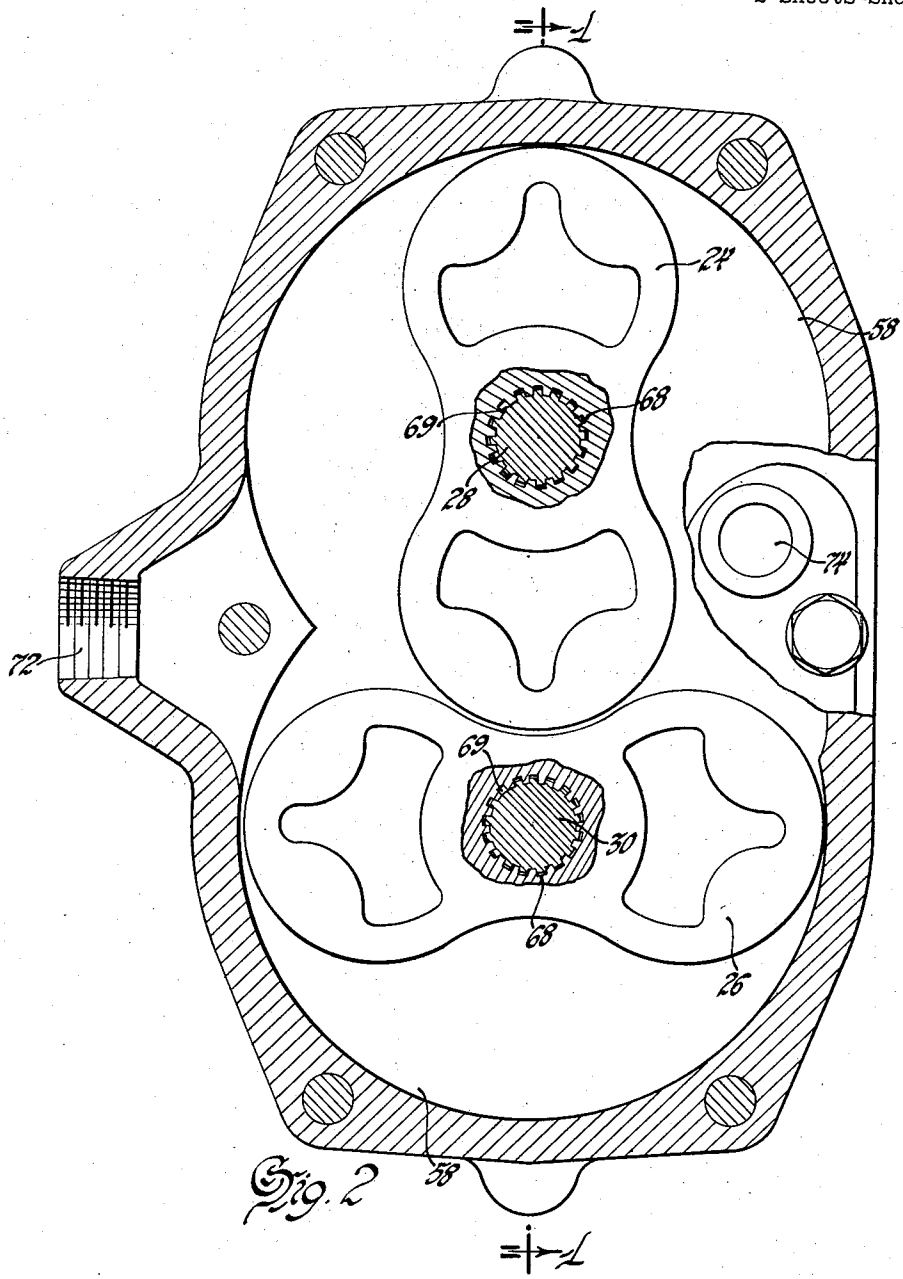


Fig. 2

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6 Claims. (Cl. 230—141)

This invention relates generally to a rotary fluid pump or blower and more particularly to a combined blower and pump of the rotary type, particularly adapted among other uses for supplying scavenging air to a two-cycle vehicular engine while at the same time serving as a source of suction for the operation of suction actuated vehicular accessories and devices.

An object of this invention is to provide an improved two-chamber pump or blower capable of pumping two fluids simultaneously.

A further object of this invention is to provide such an improved two-chamber pump with an improved lubricating means.

Still another and more specific object of this invention is to provide a combined blower and vacuum pump of the lobed impeller type with an improved means to supply lubricant to the journals of the blower and to lubricate and seal the pump.

These and other objects of the invention are accomplished in a preferred embodiment of the invention by providing a blower having a pair of lobed impellers with shafts which are extended to drive a second pair of lobed impellers in a secondary vacuum pump housing mounted on the end of a main blower housing. The second set of impellers are splined on the shaft extensions to rotate in aligned relation with the blower impellers and serve as a secondary fluid pump. Lubricant supplied to the shaft journal bearings between the two pumps is delivered to both sides of the vacuum pump by permitting it to flow along the shaft into the secondary pump housing and through the splined connections between the impellers and the shafts. The lubricant is then carried radially outwardly of the secondary impellers by the rotation thereof to provide an effective lubricating seal between the mating surfaces of the secondary impellers and the secondary housing.

The above mentioned objects of the invention will be more thoroughly understood from the following description of a preferred embodiment thereof in which reference is made to the attached drawings, in which:

Figure 1 is a sectional view of a combined blower and vacuum pump constructed in accordance with my invention taken substantially on the line 1—1 of Figure 2.

Figure 2 is an end view of the vacuum pump with portions broken away and in section along the line 2—2 of Figure 1.

Referring more particularly to the drawings the combined pump includes a main casing **10** closed at each end by the end plates **12** and **14** to form the main pump or blower chamber **8** and having intake and discharge openings **9** on opposite sides thereof. The end plates are secured to the casing member **10** by a plurality of dowels and stud bolts as indicated at **15**, **16**, **17**, **18** and **19** and are provided with transverse bolt holes as indicated at **20**, **21** and **22**, **23**, respectively, for securing the combined unit to a mounting device, not shown, such as the cylinder block of a two-cycle vehicular engine. Two hollow lobed rotors or impellers **24** and **26** are rigidly

mounted on spaced parallel shafts **28** and **30** which are rotatably journaled in the end plates **12** and **14** as indicated at **12'**, **12''** and **14'**, **14''**, respectively. The upper rotor is adapted to be rotatively driven by the vehicular engine through a drive shaft **40** which is connected through a resilient coupling **42** to an upper rotor timing gear **29** secured to the drive end of the shaft **28**. The upper gear **29** in turn drives a lower rotor timing drive gear **31** mounted on the shaft **30** to rotate the lower rotor in phased relation to the upper rotator. The lower gear **31** is provided with a suitable drive coupling for a governor or tachometer as indicated at **44**. The shaft **40**, the resilient coupling **42**, and the gears **29** and **31** are enclosed by a cover plate **46** which is retained in sealing relation with a gasket **48** on the end plate **12** by the bolts and dowels **15** and **17**.

The opposite ends of the shafts **28** and **30** are extended to project within a secondary pump or blower chamber **58** aligned with the blower chamber **8** and formed of a cover member **60** for the end plate **14** and a secondary pump housing member **62**, both of which are secured to the end plate **14** by the bolts and dowels which secure the end plate to the main casing member **10**. It will be noted that the end member **14** and the cover member **60** combine to form a partition wall between the blower chamber **8** and the pump chamber **58**. The extended ends of the shafts **28** and **30** are connected to a pair of secondary lobed impellers **64** and **66** by means of splined connections **65** and **67**, respectively. The splined connections **65** and **67** may either be provided with sufficient clearance between the lands of the connection, as indicated at **68**, or by the elimination of one or more of the splined teeth from the shaft or impeller, as indicated at **69**, to permit the passage of a lubricant such as oil longitudinally of the shaft within the secondary pump, as more fully set forth below. The secondary pumping chamber **58** is provided with a suction intake at **72** which is connectable to a vacuum tank, not shown, and suction actuated vehicular accessories and devices, also not shown. The discharge **74** of the secondary pump is preferably connected to a means for separating the lubricating oil for the limited amounts of air discharged by the pump, e. g., the engine crankcase or an oil separator.

The rotor shaft bearings in the end plates **12** and **14** are lubricated by oil from a suitable source such as the valve operating mechanism or the crankshaft bearings of the adjacent engine, not shown, through conduits **50** and **52**. The conduits **50** and **52** are connected to passages **54** and **56** formed in the end plates **12** and **14**, respectively, which communicate with the shaft journals through ports indicated at **54'**, **54''**, and **56'**, **56''**, respectively. Since the spacing of the shafts and the phasing of the timing gears is such as to permit the lobes of the upper and lower rotors to revolve with close tolerances between the lobes of the rotors and the inner surface of the blower casing, the lobes of the upper and lower rotors of the blower do not touch at any time and lubrication between these two members is not required. Oil seals **32**, **34**, **36** and **38** are provided in the blower end plates **12** and **14** to prevent the oil used for lubricating the rotor shaft bearings from entering the blower compartment. This is essential when the blower is used for air scavenging purposes in a two-cycle compression ignition engine. The seals also serve to prevent air leakage from the blower along the rotor shafts.

Oil moving longitudinally of the shafts from the ports **54'**, **54''**, and **56'**, **56''** towards the oil seals is returned to chambers **12'** and **14'** formed in the space between the end plates **12** and **14** and the cover members **46** and **60**, respectively, by the passages **76'**, **76''** and **78'**, **78''**. Oil moving longitudinally of the shafts toward the timing

gears drains into the chamber 12' while oil moving longitudinally of the shafts 28 and 30 away from the seals 36 and 38 is continuously metered into the secondary pump through the cover plate 60. Drains 80 and 82 provided in the end plates return the oil collected in the chambers 12' and 14' to a lubricant sump, not shown, such as the engine crankcase. The drain 80 is so located that the oil collected in the chamber 12' will submerge the lower teeth of the gear 31 for the purpose of lubricating the meshing surfaces of the teeth of both timing gears with the oil elevated by the lower gear teeth.

The oil continuously metered into the secondary pump serves to provide a lubricating seal between the mating surfaces of the secondary impellers and the secondary housing. Such an oil seal in the secondary pump is necessary for the effective generation of a suitable vacuum for operating the various vehicular accessories. To insure the effectiveness of this seal the oil entering the secondary pump is delivered to both sides or end surfaces of the impellers 64 and 66; the clearances between the secondary impellers and the cover plate 60 are such that a portion of the oil initially delivered to the left side of the impellers, as viewed in Figure 1, is caused to pass through the clearances 68 or the openings 69 provided between the mating splines of the shafts and the impellers to the opposite end surfaces on the right side of the impellers thereby balancing the sealing lubricant supplied to both end surfaces of the impellers. The oil delivered to the end surfaces of the impellers is then directed outwardly from zones adjacent the mountings of the impellers on their respective shafts by the radial components of the centrifugal forces set up by the rotation of the impellers. It will thus be seen that the invention provides an effective means for metering a balanced and continuous lubricating and sealing film between the surfaces of impellers and the vacuum pumping chamber. The metering of the fluid to the vacuum pump by the journal portions of the partition and shafts prevents undesirable pumping of the lubricant which would bleed from other portions of the engine lubricating system by the vacuum pump. As indicated above, the lubricating oil supplied to the vacuum pump is preferably discharged to the engine crankcase along with the limited amounts of air withdrawn by the pump.

In view of the above description, it will be seen that a combined two-chamber pump of an improved and compact design is achieved by which the several objects of the invention and other advantageous results are attained.

As many changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense with respect to the appended claims.

I claim:

1. A combined scavenging air blower and a vacuum pump such as for supplying supercharging air to a vehicular engine and for supplying operating vacuum for vehicular accessories comprising a housing having a blower chamber and a vacuum pump chamber in axial alignment and separated by a partition wall, each of said chambers having a fluid intake port and a fluid discharge port, a pair of shaft members journaled in said partition and extending into said chambers, means for rotatably driving said shafts in phased relation to each other, cooperating impellers mounted on each of said shafts within each of said chambers and adapted to deliver fluid from said intake ports to said discharge ports upon rotation of said shafts by said driving means, a passage in said partition for supplying lubricant to the journal portions of said partition, said journal portions and the journaled surfaces of said shafts constituting means for continously metering lubricant to the adjacent end of said vacuum pump chamber adjacent the mounting of said impellers on said shafts, and passage means associated with the shaft mounting of each of said impellers for supplying portions of the metered lubricant to the opposite ends of said impellers whereby lubricant is evenly centrifuged radially outwardly of both end surfaces of said impellers to provide an effective seal between said impellers and said housing.

2. A combined blower and vacuum pump as defined in claim 1 and including sealing means carried by said partition and embracing said shaft intermediate said passages and said blower chamber to prevent the passage of lubricant into said blower pumping chamber and to prevent the passage of pressurized fluid from said blower chamber to said vacuum chamber through said journal portions.

3. In a combined blower and vacuum pump as defined in claim 1, the mounting of the impellers on said shafts within said vacuum pumping chamber comprising splined connections defining passages permitting the passage of portions of the metered lubricant longitudinally of said shaft to the opposite ends of said impellers.

4. A combined blower and vacuum pump comprising, in combination, a first housing member having a blower chamber therein, a secondary housing member mounted on one end of said first housing member and defining a vacuum pumping chamber therebetween in axial alignment with said blower chamber, each of said chambers having an intake port and a discharge port, a pair of shafts journaled in said first housing member and extending through said blower chamber and into said vacuum pump chamber, co-operating impellers mounted on each of said shafts within said blower chamber, secondary co-operating impellers mounted on said shaft extensions within said vacuum chamber, means for rotatably driving said shafts to maintain said impellers in phased relation to each other to thereby compressibly deliver a gaseous fluid between the intake to discharge ports of said blower chamber and to generate a vacuum at the intake port of said vacuum chamber, passages in said first housing member for supplying lubricant to the journal portions thereof, sealing means carried by said first housing member and embracing said shaft intermediate said lubricant passages and said blower chamber to prevent the passage of lubricant into said blower pumping chamber, said sealing means being adapted to prevent the passage of pressurized fluid from said blower chamber to said vacuum chamber through the journal portions intermediate said chambers, said last-mentioned intermediate journal portions and the surfaces of said shafts journaled therein constituting metering means for delivering lubricant longitudinally of said shaft to said vacuum pumping chamber, and said secondary impellers and said shafts defining passages therebetween for supplying equal portions of the lubricant supplied to said vacuum pumping chamber to the opposite ends of the secondary impellers adjacent their mountings on said shafts whereby the metered lubricant will be evently distributed on both sides of said impellers to provide an effective lubricant seal intermediate said impellers and said housing members.

5. In a vacuum pump, a housing having a vacuum pumping chamber therein, said chamber having an intake port and a discharge port, a shaft journaled in said housing and extending into said chamber, said shaft being connectable to a rotatable driving device, an impeller mounted on said shaft within said chamber and adapted upon rotation thereof with said shaft to deliver fluid from said intake port to said discharge port thereby generating a vacuum at said intake port, a passage in said housing for supplying lubricant to the shaft journal in said housing, said journal and the journaled surface of said shaft constituting a means for continuously metering lubricant longitudinally of said shaft to said vacuum pumping chamber adjacent the mounting of said impeller on said shaft, the mounting of the impeller on said shaft comprising a splined connection and defining at least one passage therebetween, said passage being adapted to deliver a portion of the metered lubricant longitudinally of said shaft to the opposite end of said impeller whereby

lubricant is evenly distributed and carried radially outwardly of both end surfaces of said impeller to provide an effective seal between said impeller and said housing.

6. A combined scavenging air blower and a vacuum pump such as for supplying supercharging air to a vehicular engine and for supplying operating vacuum for vehicular accessories comprising a housing having a blower chamber and a vacuum pump chamber in axial alignment and separated by a partition wall, each of said chambers having a fluid intake port and a fluid discharge port, a shaft journaled in said partition and extending into said chambers, means for rotatably driving said shaft, an impeller mounted on said shaft within each of said chambers and co-operating with their respective chambers upon rotation of said shaft to compressibly deliver a gaseous fluid between the intake to discharge ports of said blower chamber and to generate a vacuum at the intake port of said vacuum chamber, a passage in said partition member for supplying lubricant to the journal portion thereof, sealing means carried by said partition and embracing said shaft intermediate said lubricant passage and said blower chamber to prevent the passage of lubricant into said blower pumping chamber, said sealing means being adapted to prevent the passage of pressurized fluid from said blower chamber to said vacuum chamber, said journal portion and the surface of said shaft journaled in said partition constituting means for continuously metering lubricant to the adjacent end of said vacuum pump chamber adjacent the mounting of said impeller on said shaft, the mounting

of the impeller on said shaft comprising a splined connection and defining at least one passage therebetween, said passage being adapted to deliver a portion of the metered lubricant longitudinally of said shaft to the opposite end of said impeller whereby lubricant is evenly distributed and carried radially outwardly of both end surfaces of said impeller to provide an effective seal between said impeller and said housing.

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