United States Patent

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[54] **LUBRICATING SYSTEM FOR ROTARY PISTON INTERNAL COMBUSTION ENGINES**
9 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **123/196,** 123/8, 184/6
[51] **Int. Cl.** **F01m 3/00**
[50] **Field of Search** ..... 103/117R (Cursory); 123/8LL, 8CC, 196; 184/6, 6L; 230/145, 207, 210; 261/37

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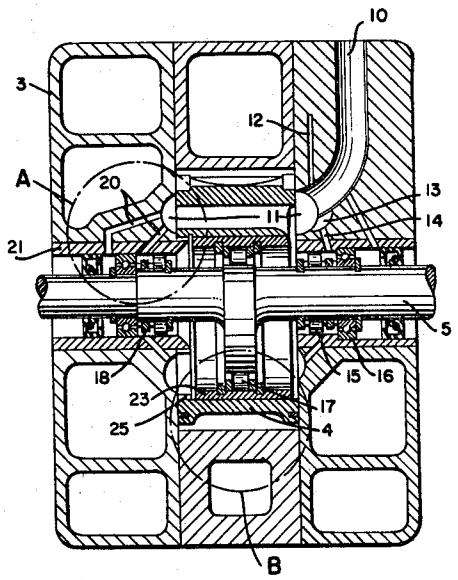
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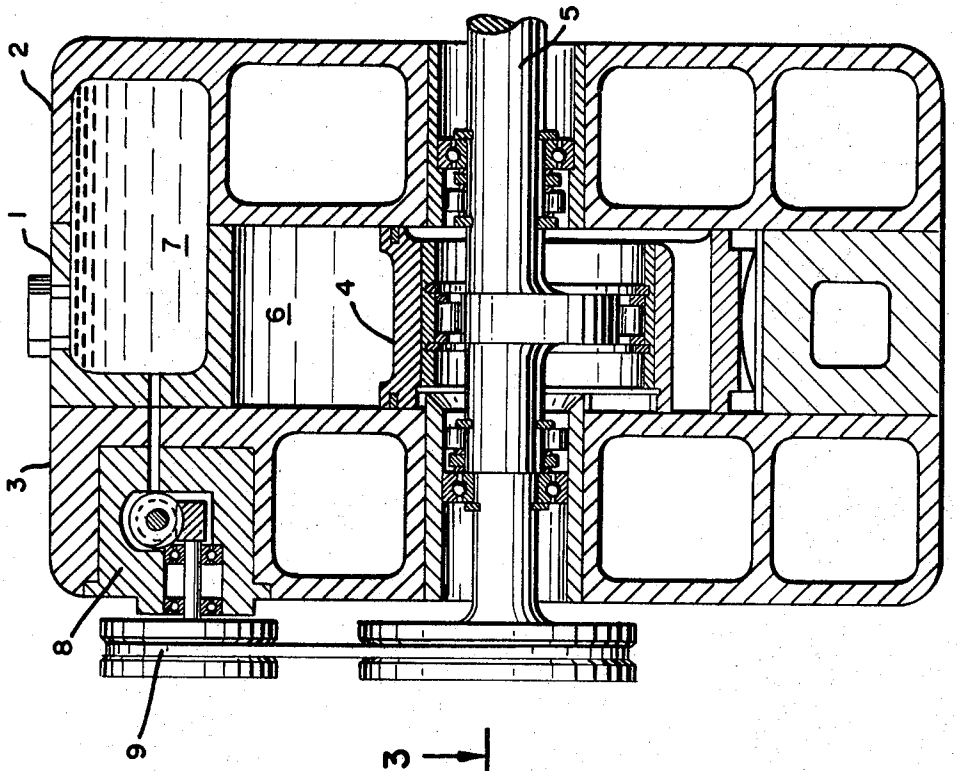
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ABSTRACT: A lubricating system for a rotary piston internal combustion engine wherein the oil compartment is located in the exterior housing jacket and a pump operatively connected to the mainshaft directs oil to the interior of the engine and to a lemon-shaped recess, the recess having pockets for collecting oil and having passages heading therefrom to the mainshaft bearings whereby oil will be collected and directed to the bearings from these pockets.



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FIG. 2



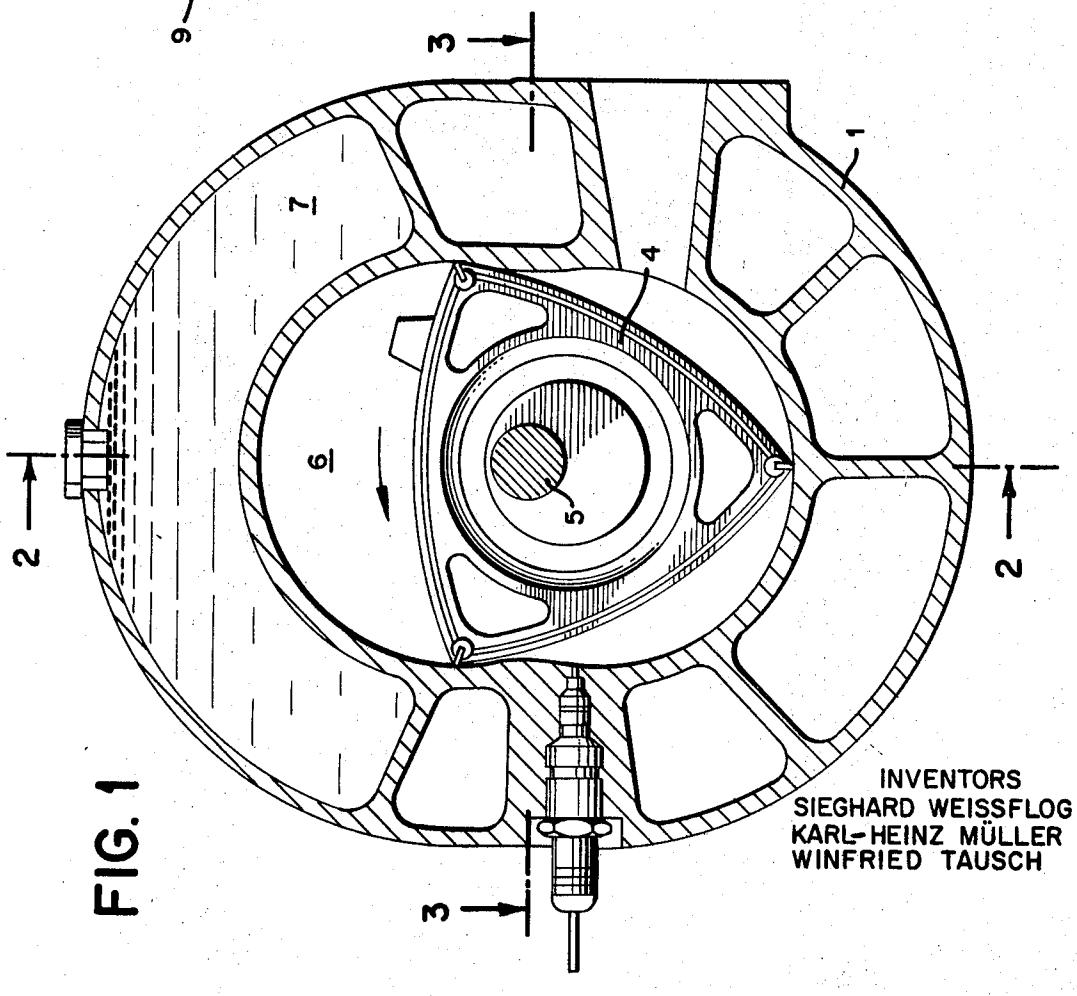


FIG. 1

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FIG. 3

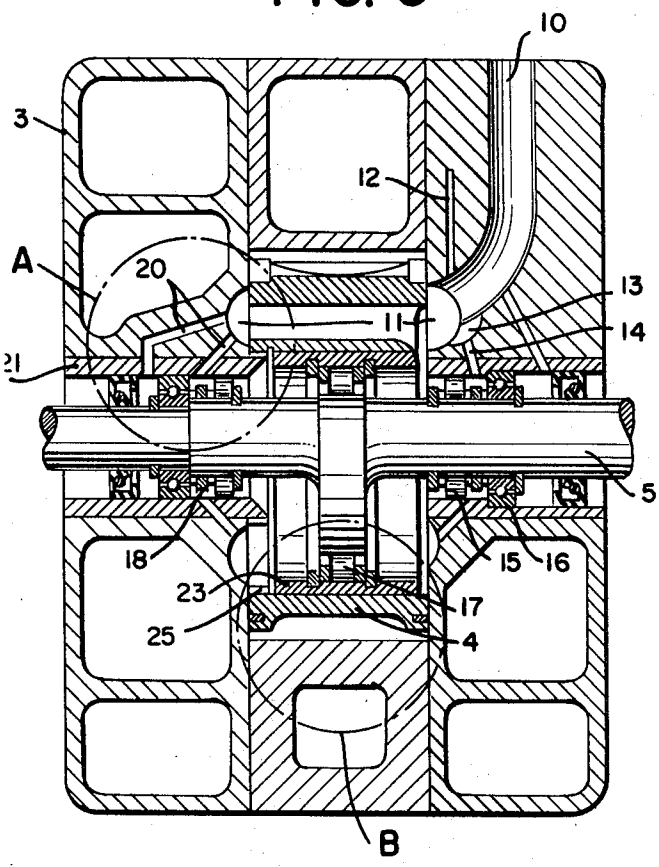


FIG. 4

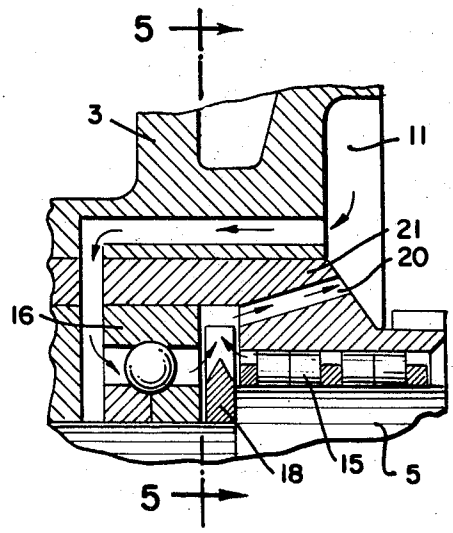


FIG. 5

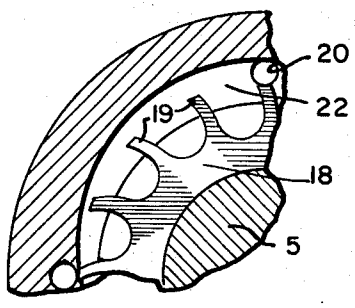
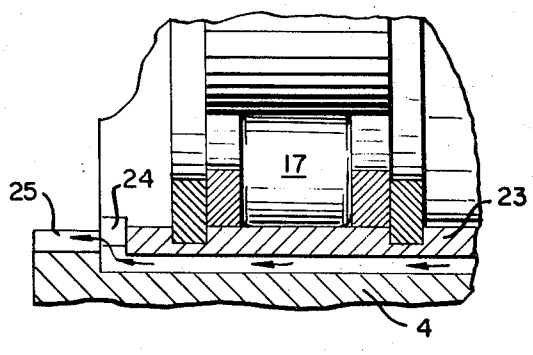


FIG. 6



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LUBRICATING SYSTEM FOR ROTARY PISTON INTERNAL COMBUSTION ENGINES

BACKGROUND OF THE INVENTION

The present invention relates to lubricating systems.

In particular, the present invention relates to lubricating systems for rotary piston internal combustion engines, preferably for internal combustion engines of this type which have pistons of trochoidal configuration and which are provided with a housing having a jacket formed with compartments for coolant. The housing is cooled either with liquid or with air and the drive for the mainshaft as well as the bearing means of the latter are cooled by the fresh gas which is sucked into the engine.

Known lubricating systems for two-stroke internal combustion engines provide lubrication by way of fresh oil which is mixed with the fuel-air mixture by a suitable metering pump which pumps the lubricant from a suitable oil container and which operates in accordance with the load and speed of rotation of the engine.

With a construction of this latter type it has already been proposed to heat the oil container with the cooling water of the internal combustion engine and to form the oil container in one unit with the cylinder block, so as to guarantee that even at relatively low temperatures the lubricant will have an approximately uniform viscosity. A further measure which has been proposed is to connect the oil pump directly to the oil container, so that the oil conduits can be maintained relatively short.

It has also been proposed to lubricate slot-controlled two-stroke internal combustion engines having crankcase scavenging by directing the lubricant into the intake manifold just ahead of the widened inlet window, so as to achieve an effective atomizing directly in front of the lubricating location.

For a rotary piston internal combustion engine whose piston is cooled by air or by the fuel-air mixture, it has already been proposed to add the lubricating medium to the mixture and to interconnect the intake manifold, the hollow spaces of the piston, and the like through passages with the bearings of the mainshaft and the piston so as to guarantee lubrication in this way.

While proposals of the above type are already known for two-stroke internal combustion engines and in the last case for a rotary piston type of internal combustion engine, this last solution does not provide a practical, useful solution since the high speeds of revolution and the correspondingly greater number of working strokes at present-day conventional, mean pressures result in a high thermal loading of the components of the engine. This latter problem has made itself known because up to now all known constructions having rotary trochoidal type of pistons in rotary piston engines used in automobile drives are provided with water cooled engine housings and oil-cooled pistons. The high construction costs involved in such structures for cooling the piston and for lubrication purposes (oil cooler, oil container, pump, feed and discharge passages, sealing glands) is highly disadvantageous for the manufacture of rotary piston engines as compared to reciprocating engines.

SUMMARY OF THE INVENTION

It is accordingly a primary object of the present invention to provide, for a rotary piston type of internal combustion engine having a drive mechanism which is cooled with fresh gas, a lubricating system which is compact, inexpensive, has a short path for the lubricating medium, and is capable of providing a highly favorable atomization of the lubricating medium as well as intensive lubrication and cooling of the bearings.

The solution provided in accordance with the present invention includes a lubricating system, for a rotary piston internal combustion engine, which has a combination of features, as follows:

a. The supply of fresh lubricating oil for lubricating the drive mechanism is arranged in the surrounding housing jacket or at a side portion of the engine housing namely in a cool region thereof.

b. The metering pump is arranged in a side portion of the engine housing and is driven in common with the spark-distributor or interrupter by way of a toothed belt or gear drive from the mainshaft of the engine.

c. The lubricating medium is delivered to the intake manifold for the air or fuel-air mixture just ahead of the mainshaft or piston bearings into the lemon-shaped recess formed in the side portions of the housing.

d. Between the lemon-shaped recess or between the piston and the mainshaft or piston bearing there are arranged, oil passages which extend from oil pockets formed in the surface of the lemon-shaped recess or in the piston.

A further feature of the invention, applicable to a driving mechanism of a rotary piston type of internal combustion engine which is cooled with fresh gas, particularly with the lubricating system of the present invention, resides in the provision of a disc between the bearing of the mainshaft which acts as a fan and which cooperates with a recess in the bearing flange as well as with connecting passages extending from the latter recess to the lemon-shaped recess in the side portion of the engine housing.

The outer bearing ring of the piston bearing is formed with recesses in its end faces so that that the stream of fresh gas also will supply the gear teeth with lubricating medium.

The advantages of the solution provided by the invention reside in the compact construction of the lubricating system, the heating of the lubricating medium by the temperature of the engine (particularly advantageous under cold operating conditions), as well as in the short oil conduits within the engine housing, so that a rapid response to load changes will take place.

The delivery of the lubricating medium into the lemon-shaped recess of the engine housing brings about a good, thorough turbulence, since at this location the stream of fresh gas has a high turbulence, and in addition deposits of oil in the intake manifold are avoided, so that through the oil passages, the connecting passages and recesses, a sufficient amount of lubricating medium can be reliably delivered by the fresh gas stream itself to the location of the bearings and to the teeth of the drive transmission.

By forming the disc between the mainshaft bearings as a fan disc, the effectiveness and efficiency of the bearing lubrication and cooling is improved without increasing the cost of the structure, and in this way the structure of the invention is capable of operating properly under high thermal loads. This air-cooling of the bearing locations is suitable not only for lubrication with fresh oil but also for mixture-lubricated drive mechanisms of rotary piston internal combustion engines.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is illustrated by way of example in the accompanying drawings which form part of this application and in which:

FIG. 1 is a longitudinal sectional elevation of a rotary piston type of internal combustion engine according to the present invention, the plane of FIG. 1 being taken normal to the axis of the mainshaft and centrally through the engine housing midway between the opposed sides thereof;

FIG. 2 is a transverse sectional elevation taken in a plane which contains the mainshaft axis along line 2—2 of FIG. 1 in the direction of the arrows;

FIG. 3 is a sectional plan view, also taken in a plane which contains the mainshaft axis, along line 3—3 of FIG. 1 in the direction of the arrows;

FIG. 4 shows at an enlarged scale the detail A enclosed within the dot-dash line circle of FIG. 3;

FIG. 5 shows the structure of FIG. 4 in a fragmentary transverse section taken along line 5—5 of FIG. 4 in the direction of the arrows; and

FIG. 6 shows the detail B, indicated in the dot-dash line circle of FIG. 3, at an enlarged scale.

BRIEF DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to the drawings, the engine housing 1 shown in FIGS. 1—3 includes an outer jacket and has a central portion surrounding the rotary piston, shown in longitudinal section in FIG. 1, as well as a pair of opposed side portions 2 and 3, indicated in FIGS. 2 and 3, these side portions together with the central portion, which circumferentially surrounds the piston 4, forming an enclosure for the piston as well as the working chambers for the piston. Thus, the housing 1 forms during rotary movement of the piston 4 about the mainshaft 5 the working chambers 6 apparent from FIG. 1. Within the housing jacket there is situated in the side portion 2 of the housing the fresh-oil compartment 7 which contains a supply of fresh oil and which acts as a reservoir to deliver the oil to the suction inlet of the metering pump 8 which is mounted in the opposed side portion 3 of the housing. As is apparent from FIG. 2, the oil compartment 7 extends partly into the central portion of the housing as well as in the side portion 2 thereof, and the extent to which the oil reservoir compartment 7 extends around the axis of the mainshaft is indicated in FIG. 1. FIG. 2 shows the passage through which the oil flows from the compartment 7 to the suction inlet of the metering pump 8. This pump 8 is driven by way of a toothed-belt drive 9 directly from the mainshaft 5, as indicated in FIG. 2. The intake manifold 10, indicated in FIG. 3 communicates at the interior of the housing side portion 2 with a lemon-shaped recess 11 at which the oil supply passage 12 leading from the outlet of the pump 8 terminates. This recess is formed by substantially lemon-shaped pockets in the surfaces of the inner wall of the side portions of the housing not passed over by the outer packing strips of the piston in the eccentric movement of the piston around the shaft which communicate through the piston, as shown in FIG. 3. Within this recess the absorbed fuel-air-mixture may be conducted through the piston without getting directly to the working chamber. From this lemon-shaped recess 11 the stream of fresh gas is delivered by the piston 4 into the working chambers 6.

Within the lemon-shaped recess 11, at the surface of the latter, and at the surface of the piston 4, there are oil pockets 13 from which the oil passages 14 lead to the mainshaft bearings 15 and 16 as well as to the piston bearing 17.

Between the mainshaft bearings 15 and 16 in each housing side portion 2 and 3, is situated a rotary disc 18 which rotates with the mainshaft and which serves as a fan, this fan disc 18 having radial peripheral buckets 19 and acting as a two-sided radial fan impeller for drawing the air into the buckets axially from both sides of the disc 18 (FIG. 4) and for driving the air out circumferentially at the periphery of the fan disc 18 from the buckets 19 thereof which are slightly curved, as indicated in FIG. 5.

By way of this rotary fan disc 18 sufficient cooling and lubrication of the bearings is achieved by a corresponding flow path for the fresh gas stream through the connecting passage 20 in the bearing flange 21, as indicated in FIGS. 4 and 5, this passage 20 leading from the outlet at the periphery of the fan into the lemon-shaped recess 11 which in turn delivers the air, which is rich in suspended lubricant, back to the bearings on the one hand through the flange and on the other hand through the space which accommodates the piston itself, as is apparent from the circuit indicated in FIG. 4. Within the bearing flange 21 there is formed, in addition, a circumferential recess 22 extending inwardly from the inner surface of the bearing flange and receiving in its interior the outer periphery of the fan disc 18, and in particular the outer tips of the buckets 19 thereof, as is apparent from FIG. 5. The circumferential recess 22 which accommodates the outer periphery of the fan disc 19 does not have a uniform radial dimension and instead has a radially increasing dimension from the inner diameter of the bearing flange 21 up to the connecting passages 20 in the direction of rotation of the fan disc 18.

The outer bearing race 23 for the piston bearing 17 is provided with recesses 24 at its end faces (FIG. 6) so that the stream of fresh gas will also supply the ring gear 25 with lubricating medium, as is apparent from FIG. 6.

We claim:

1. A lubricating system for a rotary piston internal combustion engine comprising a rotary mainshaft, a rotary piston seated on said mainshaft, a plurality of bearing means supporting said mainshaft for rotary movement, a housing housing said piston and said mainshaft and carrying said bearing means, said housing having an intermediate portion circumferentially surrounding said piston and a pair of side portions each carrying some of said bearing means and coacting with said circumferential portion for housing said piston and said mainshaft, said housing being formed with an exterior jacket defining in part a compartment for receiving lubricating oil, pump means carried by a side portion of said housing and communicating with said compartment for pumping lubricating oil therefrom, drive means operatively connected with said pump means and mainshaft for directly driving said pump means from said mainshaft, said housing being formed with a suction inlet for directing a fluid into the interior of said housing where said rotary piston is located, said inlet communicating with said pump means to receive lubricant therefrom and said housing being formed in the region of said bearing means with a lemon-shaped recess communicating with said suction inlet for receiving lubricant therefrom, said lemon-shaped recess being situated in at least one of said side portions of said housing, and said housing being formed at said lemon-shaped recess with oil-pockets for receiving oil and with passages communicating with said bearings and with said oil-pockets for directing lubricant to said bearings from said oil-pockets.

2. The combination of claim 1 and wherein said compartment in said jacket is situated at a relatively cool region of said housing.

3. The combination of claim 1 and wherein said compartment for the lubricant in said jacket is situated at least in part in one of said side portions of said housing.

4. The combination of claim 1 and wherein said mainshaft carries a piston bearing means surrounded by and supporting said piston on said mainshaft, and said piston bearing means including an outer race formed with end recesses for receiving lubricant.

5. In a lubricating system for a rotary piston internal combustion engine, a rotary mainshaft, a plurality of bearing means supporting said mainshaft for rotary movement, a housing carrying said mainshaft in said plurality of bearing means and housing a piston seated on said mainshaft, said housing being formed in the region of said bearings with a lemon-shaped recess for receiving lubricant, a rotary disc situated between a pair of said bearing means and having the structure of a fan, said housing including a bearing flange surrounding said fan disc and formed with an annular recess into which said fan disc extends, and said housing being formed with connecting passages communicating with said flange recess, into which said fan disc extends, and with said lemon-shaped recess.

6. The combination of claim 5, and wherein said rotary fan disc is in the form of a radial blower provided at least on one side with a passage through which air is supplied axially to said disc to be circumferentially discharged therefrom.

7. The combination of claim 6 and wherein said disc has at its periphery radially extending buckets.

8. The combination of claim 7 and wherein said radially extending buckets are slightly curved.

9. The combination of claim 5 and wherein said bearing flange recess becomes radially wider from the inner periphery of said flange in a direction away from the axis of said disc and in the direction of rotation of said disc toward said connecting passages.