May 5, 1964 L. PÉRAS 3,131,679

ROTORS OF ROTARY ENGINES

Filed Dec. 27, 1961 2 Sheets-Sheet 1

Fig-1

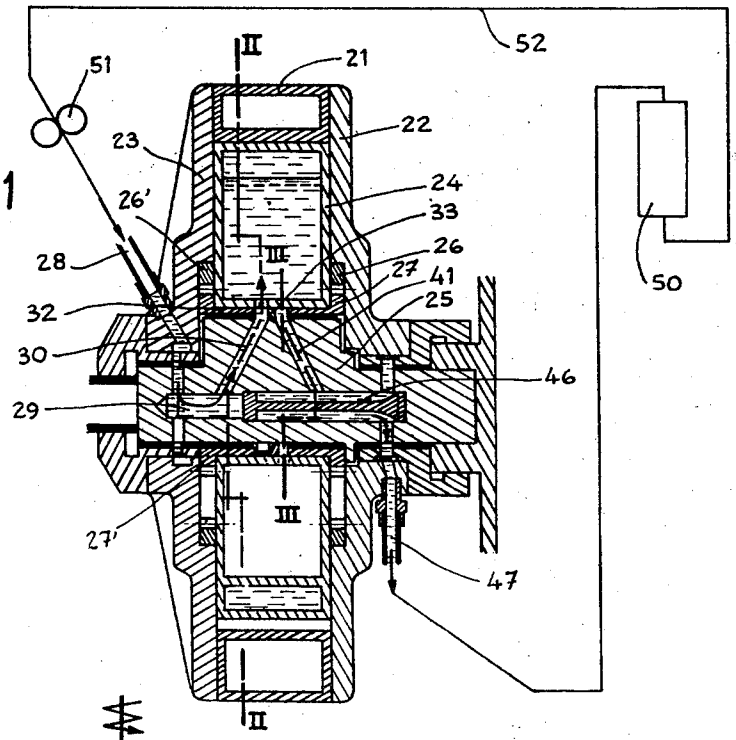


Fig-2

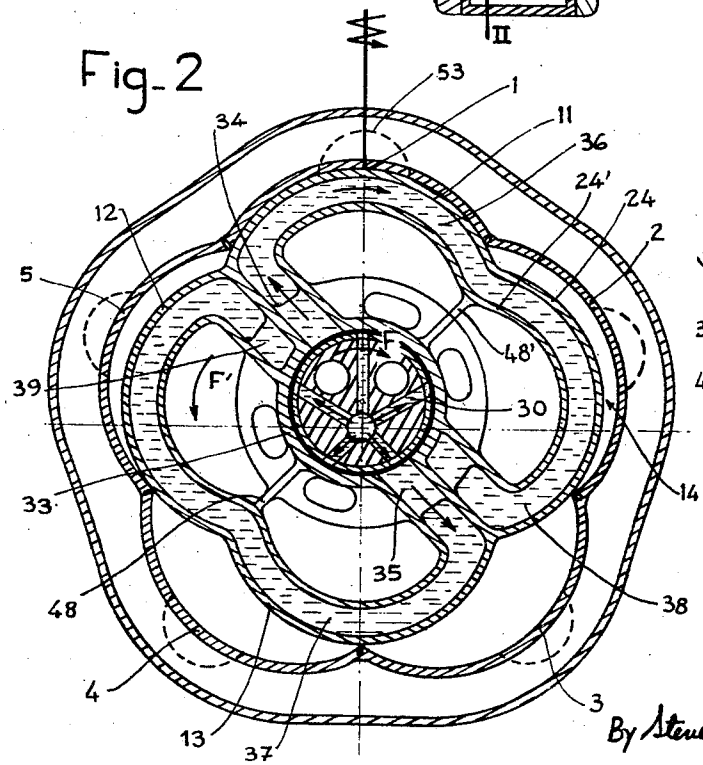
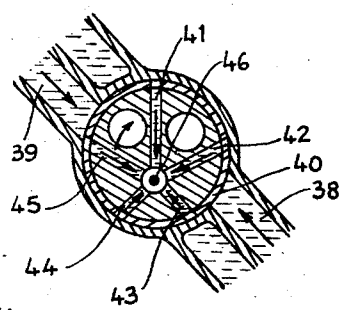


Fig-3



INVENTOR
Lucien Péras
By Stevens, Davis, Miller & Mosher
ATTORNEYS

May 5, 1964 L. PÉRAS 3,131,679

ROTORS OF ROTARY ENGINES

Filed Dec. 27, 1961 2 Sheets-Sheet 2

Fig. 4

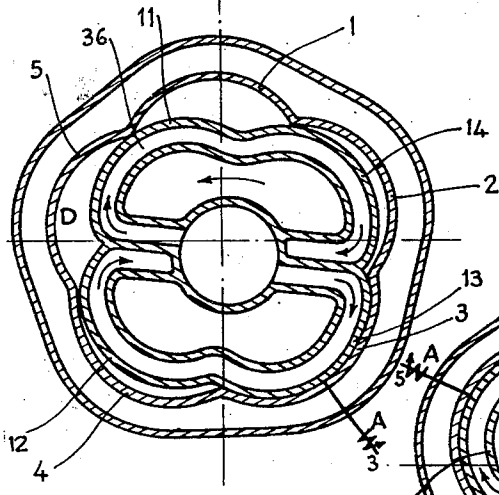


Fig. 5

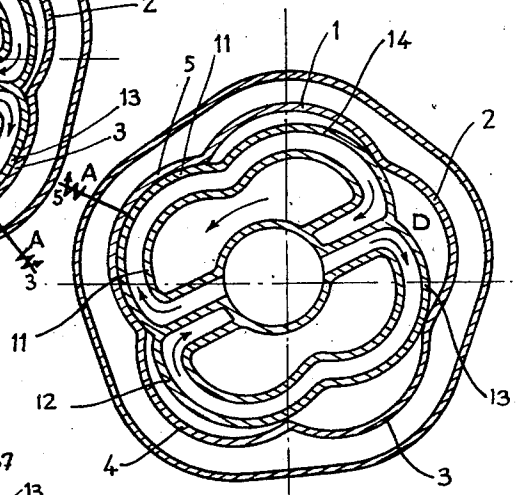
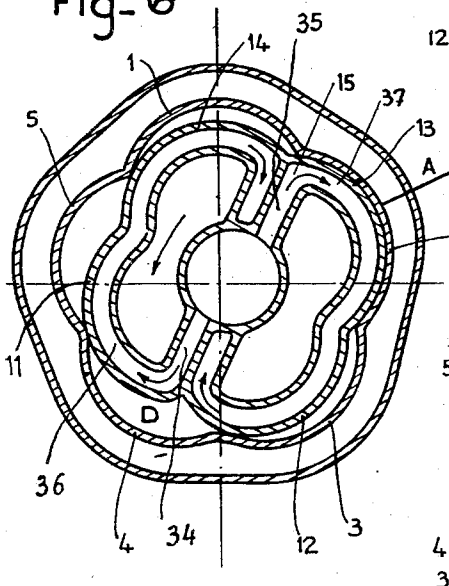


Fig. 6



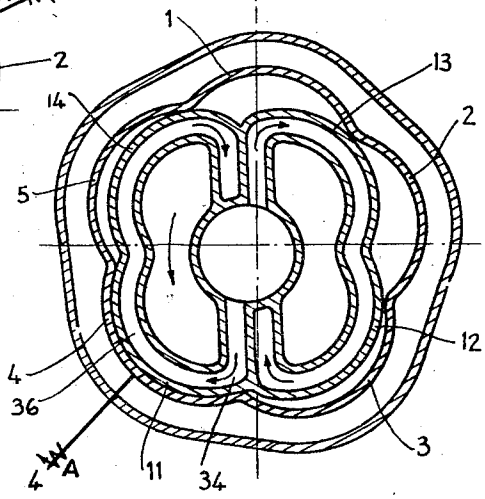


Fig. 7

INVENTOR
Lucien Péras
By Stevens, Davis, Miller & Mosher
ATTORNEYS

United States Patent Office 3,131,679 Patented May 5, 1964

3,131,679

ROTORS OF ROTARY ENGINES

Lucien Péras, Billancourt, France, assignor to Regie Nationale des Usines Renault, Billancourt, France

Filed Dec. 27, 1961, Ser. No. 162,540
Claims priority, application France Jan. 18, 1961
6 Claims. (Cl. 123—8)

This invention relates to rotary engines in general and more particularly to the rotors of such engines.

It is known that the component elements of rotary engines and more particularly the rotors subjected to a heat flux and to mechanical stress as a result of the explosion or fuel combustion, so that specific cares must be exerted with a view to ensure their proper cooling.

To this end, oil may be circulated through the rotor.

This invention is concerned with specific arrangements of the means for circulating lubricating and cooling oil in order to ensure the best possible protection of the most exposed portions of the rotor, these arrangements being described hereinafter with specific reference to a rotary engine comprising a stator divided into five working chambers and a four-lobed rotor.

In general, the oil circulates in a closed circuit of well known type comprising a cooling radiator and a pressure pump, so that it is delivered in its cooled condition to the front centre of the rotor-carrying crankshaft, this oil being forced through the rotor along a path to be defined presently and flowing to the rear end of the crankshaft before finally leaving the engine and returning to the cooling device.

In a rotary engine of the type comprising five working chambers, in the stator and four lobes in the rotor, five explosions take place during a half-revolution of the rotor.

It is known that in an engine of this type the number of chambers is necessarily an odd number; in the example considered herein this number is five; since the stator and rotor act like two toothed wheels having a one-tooth difference with each other, and since on the other hand the firing order is 1—3—5—2—4 and so forth, as in any four-stroke radial engine, it is obvious that only two lobes are affected by the engine explosions, so that these chambers are subjected to high thermal and mechanical stress while the other two lobes are less exposed to fatigue as a consequence of engine operation.

According to a specific arrangement provided by this invention, the cooled oil separates within the rotor into two circuits comprising each two radial ducts, that is, an inlet duct and an outlet duct, and a peripheral duct, each radial inlet duct leading respectively to one of the lobes subjected to the explosions, that is, substantially to one of the two most exposed zones of the rotor.

Then, the oil circulates in the peripheral ducts so as to contact the coldest portions which are the less exposed to the engine cycle before returning to the crankshaft through the second radial duct. Thus, the efficiency of this oil circulation will be clearly understood; the purpose is to firstly protect and cool the most exposed zone of the rotor in order to preserve as much as possible all its metallurgical properties necessary for ensuring a long useful life of the rotor, and secondly to thermally equalize or even reheat the other portions of the rotor.

Moreover, the oil ducts formed through the rotor are designed with a view to reduce to a minimum their cross-sectional area in order to maintain the oil flow rate at a value adapted to ensure a satisfactory cooling and reduce the quantity of oil which, in a rotor revolving eccentrically, is subjected to variable positive and negative accelerations tending to interfere with the rotor rotation.

The invention will now be described with reference to the accompanying drawings illustrating diagrammatically

by way of example a typical embodiment of this invention. In the drawings:

FIG. 1 is a longitudinal axial section showing a rotary engine constructed according to the teachings of this invention;

FIG. 2 is a cross-section taken upon the line II—II of FIG. 1 to show the engine stator and rotor, and the oil circulation;

FIG. 3 is a section taken across the crankshaft at position III—III of FIG. 1, to show the oil return path therein; and

FIGS. 4, 5, 6 and 7 are sections showing on a smaller scale the stator and rotor relationship during the different engine strokes, in order to afford a clearer understanding of this invention.

Referring to the drawings, FIG. 1 illustrates a rotary engine of the type comprising five working chambers in the stator and four lobes in the rotor; 21 is the stator ring, 22, 23 the stator flanges, 24 the rotor, 25 the crankshaft, 26, 26' the internally-toothed guide annuli rigid with the stator and 27, 27' the rotor driving gears and a sleeve 40.

As already explained, the engine rotor is cooled by an oil circuit comprising a radiator 50, an oil pump 51 and pipe lines 52 disposed externally of the engine.

This invention is concerned more particularly with the internal oil circuit of the engine which comprises on the flange 23 an inlet fitting 28 communicating with a longitudinal duct 29 formed along the crankshaft axis and communicating through lateral passages 30 with the rotor mounted on the crankshaft eccentric. Then the oil circulates through the rotor along a specific path to be described presently; the oil finally escapes from the rotor through radial holes 41, 42, 43, 44 and 45 (FIG. 3) leading into the rear axial duct 46 of the crankshaft, and is discharged through the fitting 47 of flange 22. As shown in FIG. 2, the crankshaft revolves in the clockwise direction and the rotor in the opposite direction; the firing order of the chambers is 1—3—5—2—4, the working chambers 1, 2, 3, 4 and 5 being numbered in the direction of rotation of the crankshaft.

The working chamber 1 is at firing point (FIG. 2) when the lobe 11 of the rotor fills nearly completely the working chamber 1, except the combustion chamber 53 shown in dotted lines.

Now the rotor and the oil circuit through this rotor will be described more in detail.

The rotor is of the double wall type, as shown at 24, 24', so as to leave a constant-width annular space therebetween. This double wall structure forms lobes 11, 12, 13 and 14.

This annular chamber is closed also on the sides and connected through hollow radial arms 38, 39 forming as many oil passages to the hub 33. These arms are disposed along a common diameter and open into the annular chamber at the joint between adjacent lobes. Each arm 38, 39 is divided into two halves by an intermediate longitudinal partition extending from the hub 33 to the outer wall 24. Moreover, reinforcing distance-pieces or ribs may also be provided notably between the hub and the other joints between adjacent lobes, as shown at 48, 48'. The oil flowing from the passages 30 formed in the eccentric penetrates into the rotor through the first radial duct 34 and circulates in the peripheral passage 36 which faces the combustion chamber and the working chamber 1, thus supplying cooled oil to the stressed zone of the rotor. This oil is gradually heated as it flows along the peripheral duct 36 wherein one fraction of the heat carried along by the oil propagates in the lobe 14. Thus, it will be seen that the oil tends the cool lobe 11 and heat lobe 14, so that thermal conditions are substantially equalized.

Subsequent to the explosion in chamber 1, the cooled oil still supplied through the peripheral duct 36 cools the

end portion of lobe **11** and the initial portion of lobe **14** moving past the working chamber **1** in which the gas expansion takes place.

Simultaneously, the oil cooled in radiator **50** is delivered through the other inlet duct **35** located shortly before the lobe **13** diametrally opposite to lobe **11**. This oil flows through the peripheral duct **37** and cools the lobe **13** so as to place it in the best thermal conditions and therefore in the best mechanical conditions, for as shown in FIG. 4, after lobe **11** it is the opposite lobe **13** that has to withstand the explosion taking place in working chamber **3** after the rotor has revolved through one-tenth of a revolution.

Then the working chamber **5**, FIG. 5, is at firing point and the explosion takes place in this chamber in front of the lobe **11** receiving again the explosion after another rotation through one-tenth of a revolution, that is, 36°. In FIG. 5 it will be seen that the cooling process is the same as that just described.

After another 36-degree rotation of the rotor (FIG. 6) the working chamber **2** is at firing point and the explosion takes place in this chamber in front of lobe **13** receiving another explosion. The radial passage **35** and the peripheral duct **37** deliver cooled oil as before.

Then, as shown in FIG. 7, the firing point has moved to working chamber **4** and the explosion takes place in this chamber in front of lobe **11**, after another 36-degree rotation of the rotor. The cooled oil is delivered through duct **34** and circulates in the peripheral circuit element **36**.

Thus, the explosions took place successively in the five working chambers in the predetermined order 1—3—5—2—4 and each time the rotor revolved through 36 degrees or one-tenth of a revolution to alternately present the lobe **11** and lobe **13** in each chamber at each explosion, while excluding lobes **12** and **14**. Thus, it will be seen that the rotor of this invention provides for the circulation of cooling oil a particularly advantageous arrangement permitting a rational cooling of the engine which is attended by a thermal balance whereby the useful life of the engine and notably of the rotor is increased considerably.

Although this invention has been described with reference to a single embodiment of the essential features thereof, it will be readily understood by anybody conversant with the art that many modifications and variations may be brought thereto without departing from the spirit and scope of the invention as set forth in the appended claims.

I claim:

1. A rotary engine comprising stator means having a plurality of chambers disposed therearound and internally thereof, eccentric means disposed within said stator means and coaxially therewith, rotor means having a plurality of lobes rotatably mounted on said eccentric means, said lobes cooperating with said chambers as said rotor means rotates; said rotor means including an outer wall and an inner wall defining a substantially constant width annular space therebetween, a hub member engaging said eccentric means, arms extending from said hub member to said walls thereby forming with said annular space two continuous passages; inlet means disposed in said stator means and said eccentric means for supplying cooling fluid thereto, outlet means disposed in said eccentric means and said stator means, said inlet means cooperating with each of said passages as said rotor means rotates to transmit said cooling fluid therethrough to cool one lobe and to partially heat the adjacent lobe, said outlet means cooperating with each of said passages as said rotor means rotates to receive the cooling fluid after cooling the one lobe and partially heating the adjacent lobe; and means connected between said inlet means and outlet means to supply and receive the cooling fluid.

2. A rotary engine according to claim 1, wherein said arms are disposed in diametrical relationship and each arm is divided into two halves one having an opening and one being closed.

3. A rotary engine according to claim 1, wherein said arms are disposed in diametrical relationship and each engage said walls at the junction of two lobes.

4. A rotary engine according to claim 3, wherein reinforcing means extend from said hub member to said inner wall intermediate said arms and at the junction of two other lobes to provide reinforcement to said rotor means.

5. A rotary engine according to claim 1, wherein said supplying and receiving means includes pump means connected between said inlet and outlet means.

6. A rotary engine according to claim 5, wherein cooling means are connected between said pump means and said outlet means to receive the cooling fluid therefrom and to cool same prior to being transmitted to said pump means.

References Cited in the file of this patent

UNITED STATES PATENTS

922,875	Fraser	May 25, 1909
3,042,009	Froede et al.	July 3, 1962