Sept. 26, 1967 L. PÉRAS 3,343,526

LUBRICATION OF THE RADIAL SEGMENTS OF ROTARY ENGINES

Filed March 16, 1964 4 Sheets-Sheet 1

Fig. 1

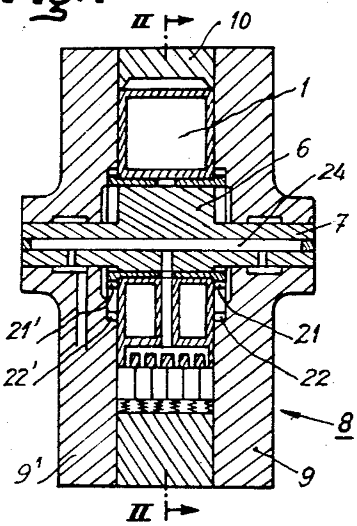


Fig. 2

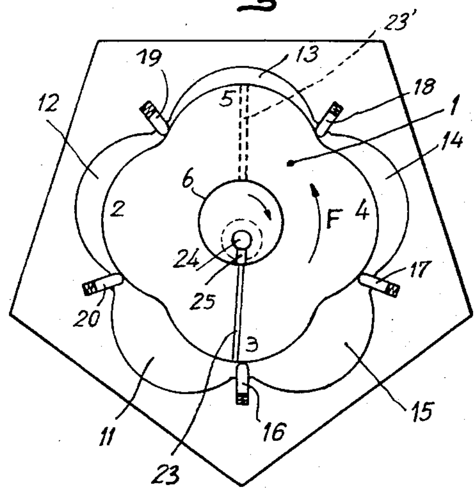


Fig. 3

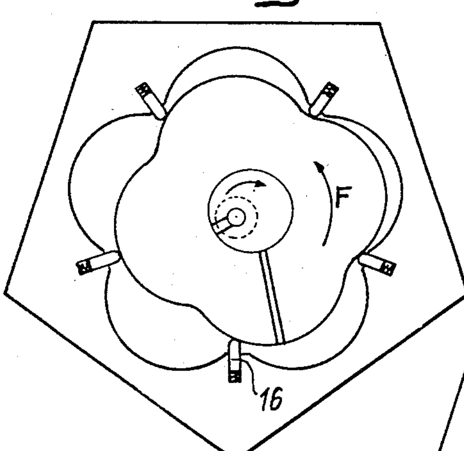
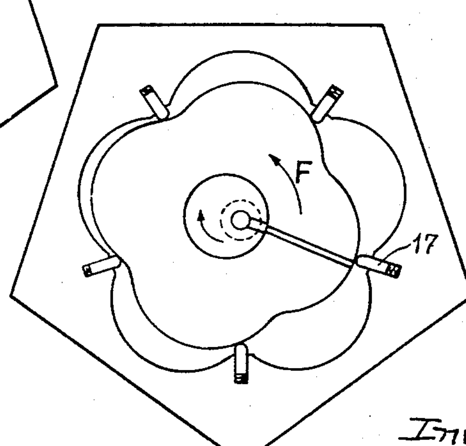


Fig. 4



Inventor

Lucien Péras

By Stevens, Davis, Miller & Mosher

Attorneys

LUBRICATION OF THE RADIAL SEGMENTS OF ROTARY ENGINES

Filed March 16, 1964 4 Sheets-Sheet 2

Fig. 5

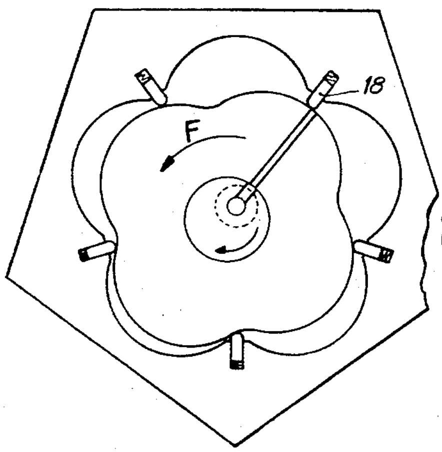


Fig. 6

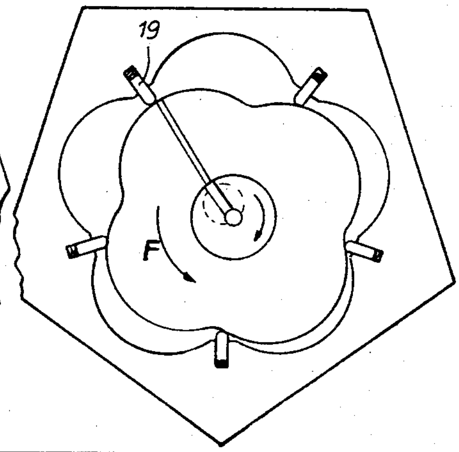


Fig. 7

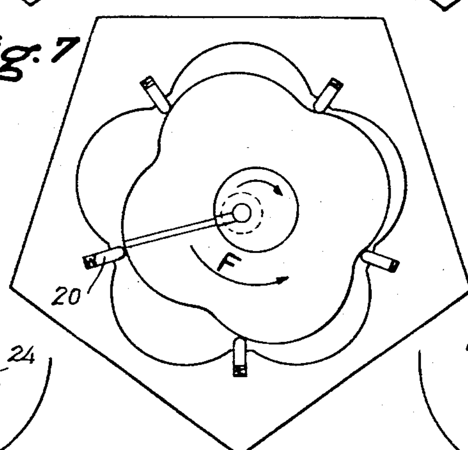


Fig. 8

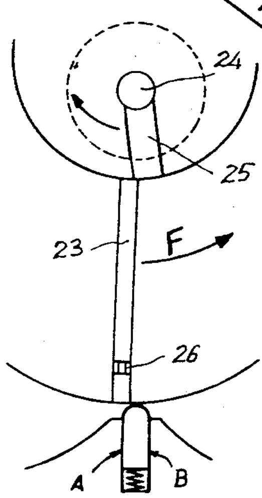
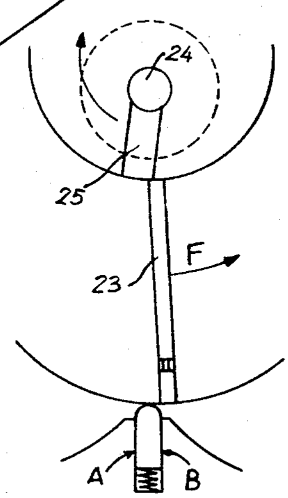


Fig. 9

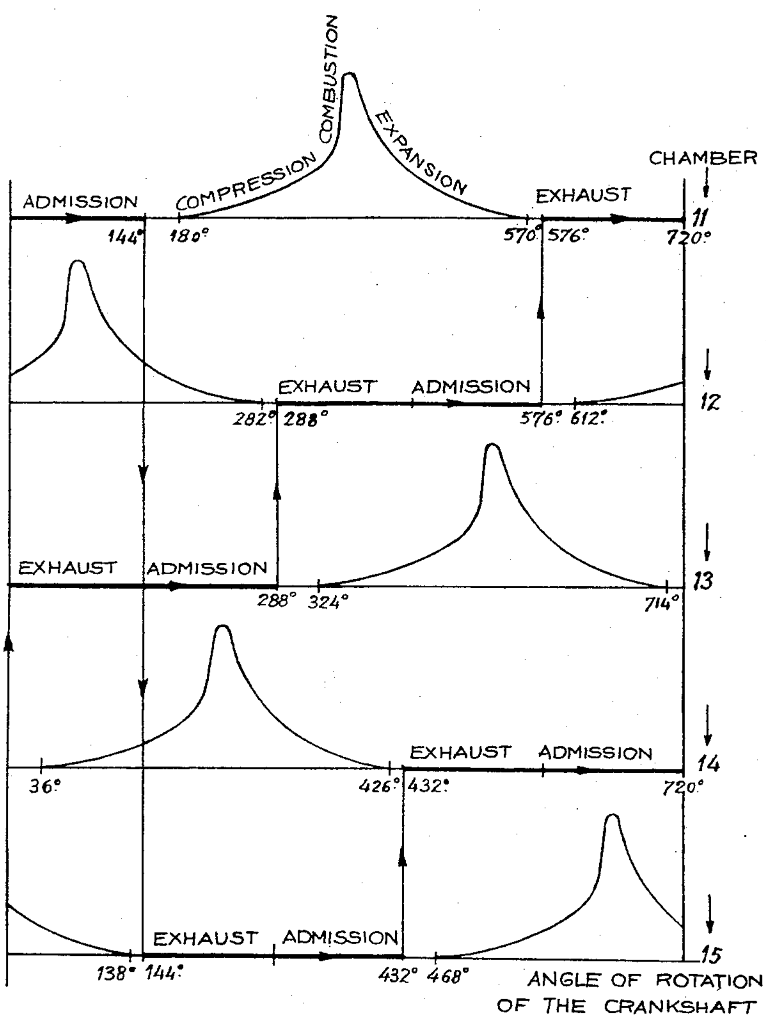


Inventor
Lucien Péras
By Stevens, Davis, Miller & Mosher
Attorneys

LUBRICATION OF THE RADIAL SEGMENTS OF ROTARY ENGINES

Filed March 16, 1964 4 Sheets-Sheet 3

Fig. 10



Inventor

Lucien Péras

By Stevens, Davis, Miller & Mosher
Attorneys

LUBRICATION OF THE RADIAL SEGMENTS OF ROTARY ENGINES

Filed March 16, 1964 4 Sheets-Sheet 4

Fig. 11

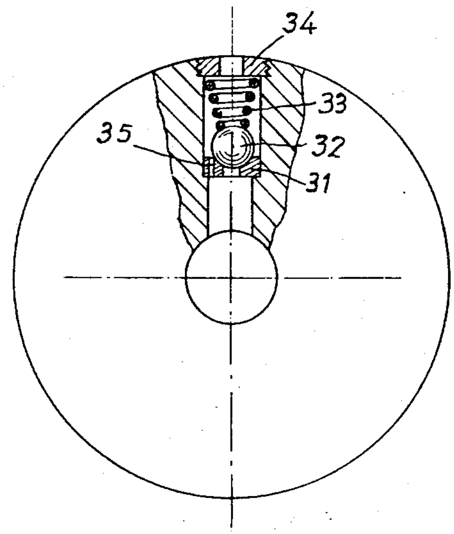
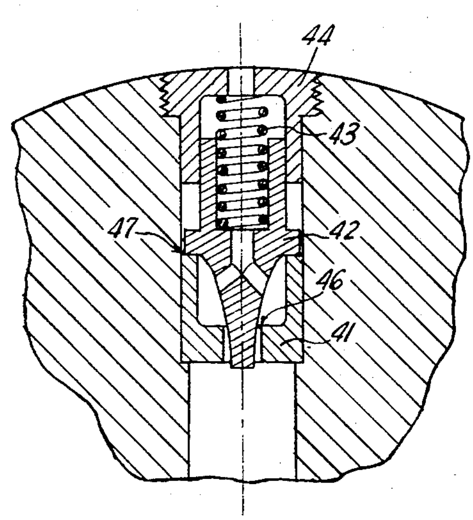


Fig. 12



Inventor
Lucien Péras
By Stevens, Davis, Miller & Mosher
Attorneys

United States Patent Office

3,343,526
Patented Sept. 26, 1967

3,343,526

LUBRICATION OF THE RADIAL SEGMENTS OF ROTARY ENGINES

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

Filed Mar. 16, 1964, Ser. No. 352,161
Claims priority, application France, Mar. 21, 1963, 928,785, Patent 1,369,351; Feb. 21, 1964, 965,255, Patent 1,394,949
6 Claims. (Cl. 123—196)

The present invention relates to improvements in the lubrication of radial segments of rotary engines of the type having a rotor with an epicycloidal profile comprising N lobes and a stator having an interacting profile comprising $N+1$ lobes and operating with a four-stroke cycle.

These radial sealing segments, mounted in the stator, work in contact with the epicycloidal profile of the rotor and special arrangements must be made in order to ensure their lubrication.

To this end, it is possible:

to atomize the oil in the admission air,
to mix the oil with the fuel,
to feed oil into the groove of each segment.

The first two methods result in a large consumption of oil, the second being furthermore not very practical because it makes it necessary to employ a mixture of petrol and oil. The third necessitates an oil supply system with an independent conduit for each groove and a non-return valve which is specially gas-tight. In addition, the oil brought into the groove only reaches the zone in which it is most useful in very small quantities, this zone being the contact area between the segment and the rotor.

The invention is directed to an arrangement which does not present any of these disadvantages, that is to say with which the oil consumption is a minimum, which utilizes no valve and which enables the oil to be brought exactly where it is required.

According to the present invention, the oil-inlet orifice or orifices is or are arranged on the rotor in a zone which is never subjected to a pressure higher than atmospheric pressure, which renders any valve unnecessary, each orifice delivering the oil required for lubrication at the moment when it is located opposite the segments.

In accordance with a preferred arrangement, the oil arrives through the orifice of a radial conduit provided in the rotor and is supplied at the moment when the segment and the orifice are facing each other, this conduit being supplied in turn by a further radial conduit disposed on the upstream side, and with which it is only put into communication at the moment when the segment comes exactly opposite the orifice which delivers the oil.

In accordance with one form of construction, the upstream radial conduit is located in the crankshaft, the downstream conduit is located in the rotor (the segments being carried by the stator). When the oil is supplied at constant pressure, either by taking it from the general lubrication circuit or by means of a separate device, the rate of flow of oil supplied to the segment is proportional to the time during which the two conduits referred to are put into communication. As this time is itself inversely

proportional to the speed of rotation of the engine, it follows that the quantity of oil delivered through the lubrication orifice is also inversely proportional to the speed. This quantity has therefore a tendency to be superabundant at low speeds and on the contrary insufficient at high speeds.

An improvement also forming part of the invention consists in interposing on the upstream supply conduit formed in a rotating portion, a flow regulator responsive to the action of speed and arranged in such manner that the cross section of the passage for the oil through this regulator is substantially proportional to that speed and that, in consequence, the volume of oil finally delivered through the lubrication orifice at each passage in front of a segment is substantially constant, irrespective of the speed of the engine. This regulator, known per se, can be produced in various ways.

All the characteristic features of the invention will be better understood from the description which follows below and which relates, by way of example and without limitation, to a case of application to a rotary engine of the type having a rotor with four lobes and a stator with five working chambers.

In the accompanying drawings:

FIG. 1 is a longitudinal section of a rotary engine, in which the lubrication of the radial segments is effected by means of the arrangement forming the subject of the invention;

FIG. 2 is a transverse section taken along the line II—II of FIG. 1 for a position of the rotor ensuring the lubrication of one of the segments;

FIG. 3 shows this same section when the crankshaft has turned through a certain angle;

FIGS. 4, 5, 6 and 7 show the relative successive positions of the crankshaft, the rotor and the stator which correspond to the lubrication of the four other radial segments;

FIGS. 8 and 9 show the oil-inlet conduits to a large scale;

FIG. 10 is a diagram giving, for each of the working chambers, the pressures which exist in the chamber as a function of the angle of rotation of the crankshaft;

FIG. 11 is an axial section of a first form of embodiment of a flow regulator;

FIG. 12 is an axial section of a second form of construction of a flow regulator.

If reference is made to FIGS. 1 and 2, there can be seen at **1** the rotor with its four lobes **2**, **3**, **4** and **5** which rotates on the eccentric **6** of the crankshaft **7**. The stator **8** constituted for example by two end-plates **9** and **9'** and a peripheral ring **10**, comprises five working chambers **11**, **12**, **13**, **14** and **15**, between which are arranged the radial segments **16**, **17**, **18**, **19** and **20**, the latter being biased into engagement with the lobes **2**, **3**, **4** and **5** by means of springs as shown in the drawings.

The rotor is guided in its rotation by the gears **21** and **21'** which are rigidly fixed to the said rotor and are in engagement with the rings **22** and **22'** rigidly fixed to the stator.

It is known that in an engine of the type shown, two opposite lobes of the rotor, always the same, for example **2** and **4**, are subjected to the effects of the explosion; the two other lobes **3** and **5** are never exposed to the explosion and for that reason they are generally known as "cold" lobes.

The diagram of FIG. 10 indicates, for each of the working chambers, the pressure which exists in the chamber as a function of the angle of rotation of the crankshaft. The pressure in each of the chambers is plotted on the ordinate and the angle of rotation of the crankshaft on the abscissa. Thus the pressure in any given chamber is shown at any given angle of crankshaft rotation. As the rotor revolves in the opposite direction to the crankshaft and at one-quarter of its speed, the summit of each cold lobe passes through each chamber while the crankshaft rotates through $72° \times 4 = 288°$, this travel being effected during the periods of admission and exhaust of the said chamber. The time passed by the summit of the cold lobe **3** in each chamber is marked on the diagram by a heavy line. At the summits of the cold lobes, there is therefore never applied any pressure greater than atmospheric pressure.

Thus, in one of the two cold lobes, for example **3**, there will be formed the oil-inlet channel **23** which terminates at the summit of this lobe.

The oil is led into the conduit **23** of the rotor by a longitudinal conduit **24** formed in the crankshaft **7**, into which opens a radial conduit **25** bored in the eccentric **6**.

The position of this conduit **25** is selected in such manner that it is located in the extension line of the conduit **23** when the eccentric and the rotor occupy the relative position shown in FIG. 2.

When the rotor has turned through 72° in the direction indicated by the arrow F so as to come into the position shown in FIG. 4, the crankshaft will have turned to 288° in the opposite direction and the conduit **25** will again be located in the line of extension of the conduit **23** so that the oil will be suitably distributed so as to terminate at the segment **17**. After a further rotation of 72° of the rotor, the segment **18** will be lubricated as shown in FIG. 5 and so on for the segments **19** (FIG. 6) and **20** (FIG. 7).

As can be seen from FIGS. 8 and 9 which show on a larger scale the oil-inlet conduits **23** and **25** at the moment when communication is established between them, then at the moment when this communication is interrupted, the sections of the said conduits which come to face each other are preferably chosen in such manner that the communication is established before the orifice of the jet **26** mounted in the conduit **23** is located in the plane of the flank A of the segment and so that this communication is only interrupted when the jet has come opposite the other flank B of the said segment. This arrangement permits simultaneous lubrication of the rubbing surface of the segment on the rotor and of its lateral faces engaged in the guiding groove.

The arrangement described in detail above corresponds to that of a single oil-inlet conduit **23** terminating at the summit of the cold lobe **3**. With this arrangement, each segment is lubricated once for every four revolutions of the crankshaft (the rotor turning at one-quarter of the speed of the said crankshaft), that is to say once every two cycles (the engine cycle being four-stroke).

In order to obtain lubrication of each segment at each cycle, it is only necessary to provide an oil-inlet conduit **23'** terminating at the summit of the cold lobe **5** opposite to the cold lobe **3**. This conduit is only shown in broken lines in FIG. 2. With such an arrangement, the segments are lubricated in the following order: **16, 19, 17, 20** and **18.**

The conduit **23'** is fitted with a jet as for the conduit **23**. By giving these jets, and also the conduit **25**, sections appropriate to the viscosity of the oil and to the speed of rotation of the engine, it is possible to regulate the flow-rate of the lubrication to the exact value necessary and sufficient, which corresponds to the minimum consumption of oil.

It should also be stated that the conduit **23** can open out at the periphery of the rotor through one or a number of holes (an arrangement shown by way of example in FIG. 1) and that in this latter case the jets **26** can be placed either on the conduit **23** itself or on the small holes which terminate at the periphery.

The lubrication circuit of the segments may be common with that for lubricating the bearings of the crankshaft, as shown in FIG. 1, but it may also be provided as an independent circuit.

When the oil is provided at constant pressure, as is generally the case, it is an advantage to arrange in the upstream radial conduit **25** and as far away as possible from the centre of rotation, a regulator responsive to the centrifugal force which may be constituted by a seating **31** on which is supported a ball **32**. One type of a regulator is shown in FIG. 11 and is held applied against the seating by the spring **33** supported on the locking washer **34**.

The spring **33** is of variable flexibility, its strength increases as its height diminishes, in such manner that the cross section of the passage provided for the oil varies in a manner substantially proportional to the speed when the ball is subjected to the effect of centrifugal force.

The seating **31** may comprise one or a number of small holes **35** through which the oil passes when the speed of rotation of the crankshaft is insufficient to lift the ball from its seating.

The regulator may also be constructed as shown in FIG. 12 (on a larger scale than FIG. 11).

In the upstream conduit is mounted the seating **41**, the cylindrical passage hole of which is more or less closed by the needle **42**, the profile of which is formed in such manner as to produce the variation of section which corresponds to the variation of flow-rate which it is desired to obtain as a function of the speed.

The needle **42** moves away from the seating **41** under the effect of centrifugal force and acting against the spring **43** which is supported by the plug **44**. The needle comes into abutment against the seating at **45**, and in this position there remains a small passage at **46** so that there is obtained a small flow of oil even when the speed is still not sufficient to displace the needle **42** from the seating **41**.

I claim:

1. A rotary engine comprising a lobed stator; a rotatable crankshaft having an eccentric portion; a lobed rotor mounted on said eccentric portion of said crankshaft, said rotor rotating relative to said crankshaft in an opposite direction therefrom and shaped so as to form with said stator a plurality of chambers; a plurality of radial segments carried by said stator; means to bias said segments into engagement with the outer surface of the lobes of said rotor to define said chambers; a first oil passage formed in at least one cold lobe of said rotor; and a second oil passage formed in said crankshaft and communicating with an external oil source; said passages being located so, and said relative rotation being such, that when said first oil passage passes in front of each of said radial segments, said first and second passages register to lubricate said segments.

2. The improvement of claim **1** wherein said rotor has an epicycloidal profile of N lobes, said stator has $(N+1)$ lobes, and said engine operates on a four-stroke cycle.

3. The improvement of claim **1** further comprising a centrifugal type regulator provided in each of said second oil passages and providing passage of the oil proportional to the speed of the engine, whereby the quantity of oil supplied to each segment remains practically constant when the speed of the engine varies.

4. The improvement of claim **1** wherein said rotor revolves in the opposite direction to the crankshaft and at one-quarter of its speed.

5. The improvement of claim **1** wherein said external oil source is the general lubrication circuit for the engine.

6. The improvement of claim **1** wherein the diameters of said first and second oil passages are such that said registering occurs at the precise instant when the leading side of a scraper passes before said first oil passage.

References Cited

UNITED STATES PATENTS

2,050,533	8/1936	Huff	184—6 X
2,227,740	1/1941	Friedell et al.	230—207 X
2,476,383	7/1949	Porteous	230—149 X
2,648,952	8/1953	Dasher	103—123 X
3,082,747	3/1963	Luck	123—8
3,193,186	7/1965	Peras	123—8

FOREIGN PATENTS

1,145,428	3/1963	Germany.

LAVERNE D. GEIGER, *Primary Examiner.*

E. J. EARLS, *Assistant Examiner.*