Oct. 25, 1966 L. PÉRAS 3,280,812

LUBRICATION OF THE GASTIGHT RADIAL SCRAPERS IN ROTARY ENGINES

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Fig-1

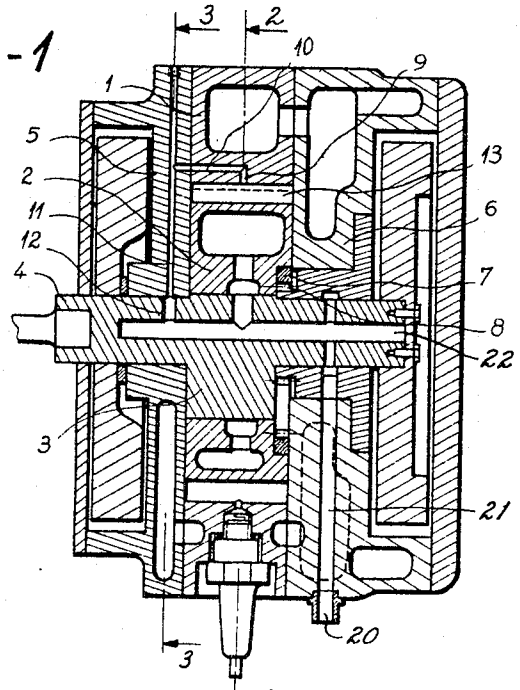
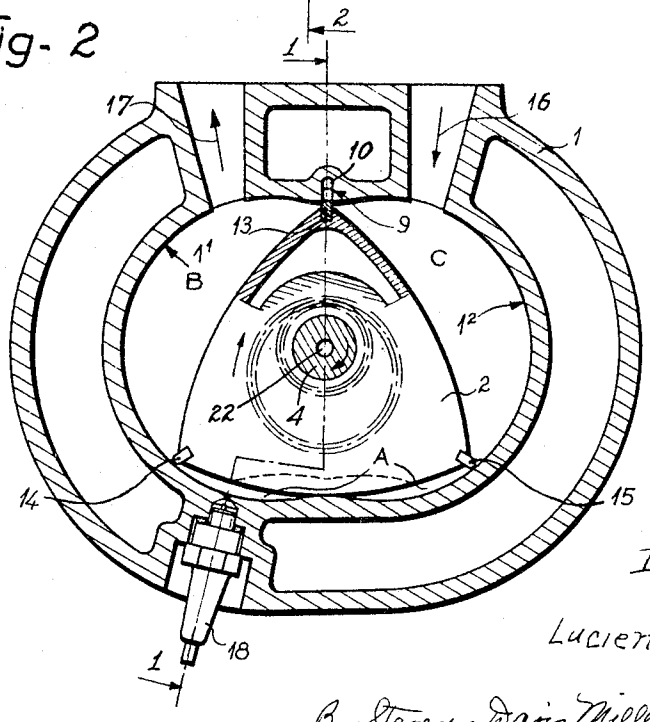


Fig-2



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Fig- 3

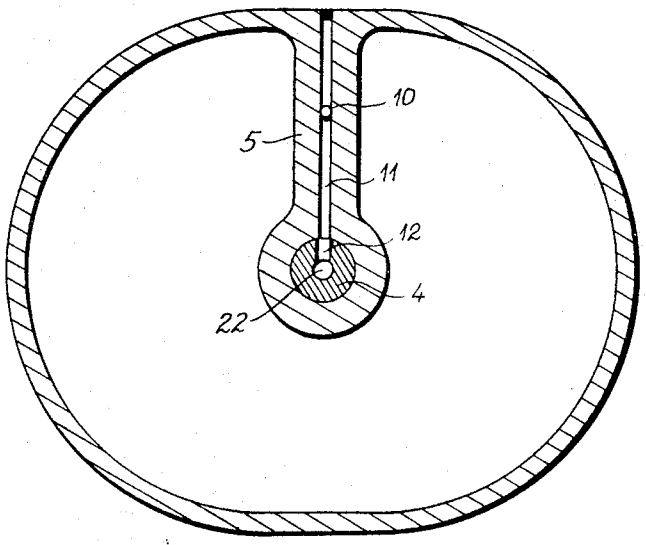


Fig- 4

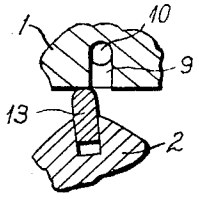


Fig-5

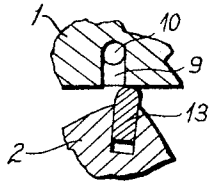


Fig-4'

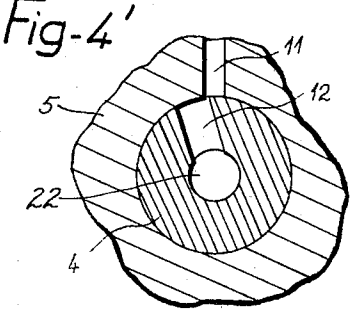
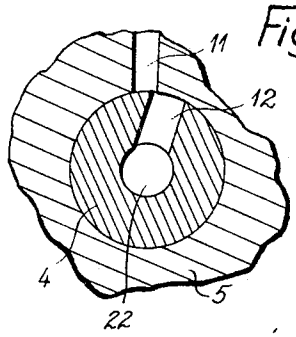


Fig-5'



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Fig. 6

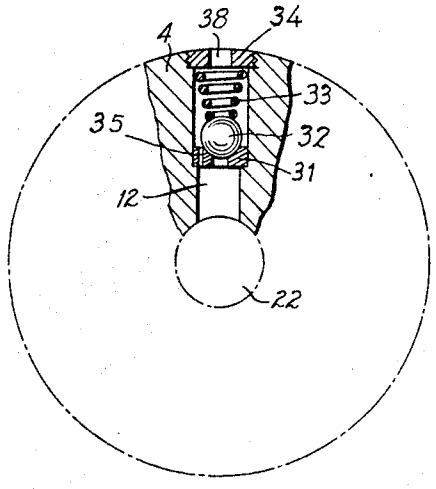
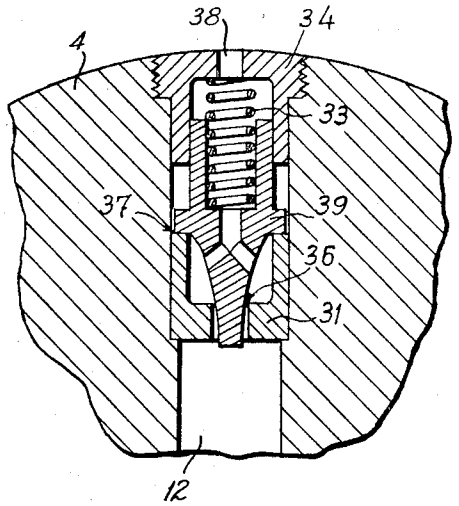


Fig. 7



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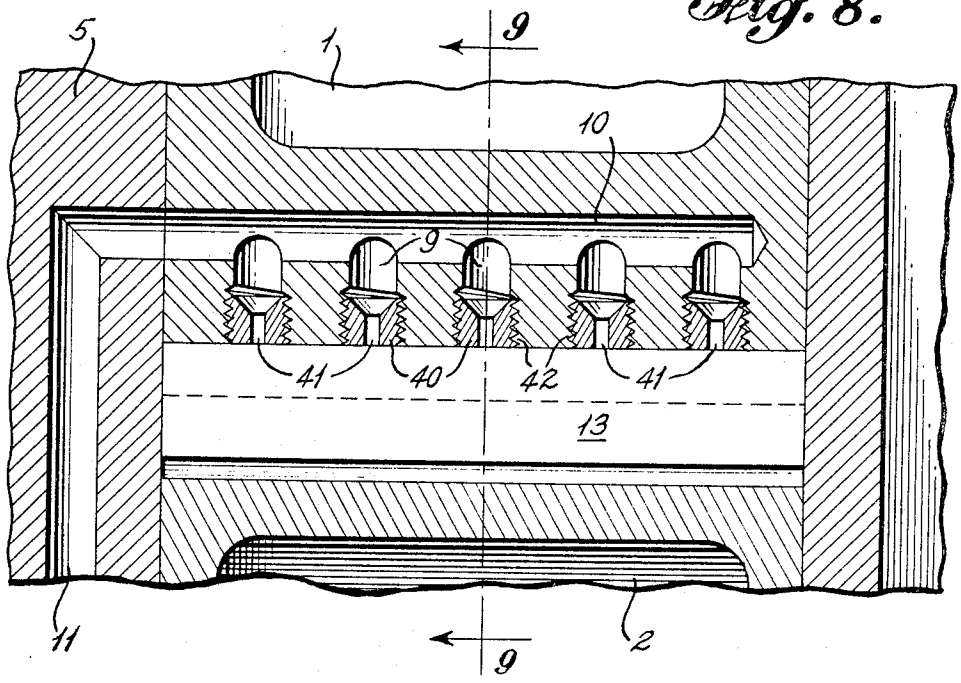
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LUBRICATION OF THE GASTIGHT RADIAL SCRAPERS IN ROTARY ENGINES

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Fig. 8.



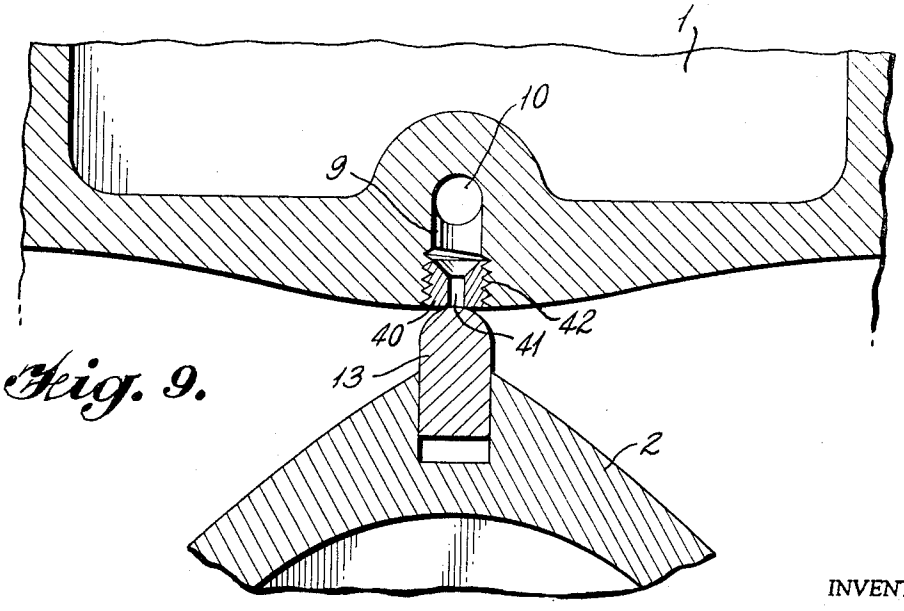


Fig. 9.

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United States Patent Office

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LUBRICATION OF THE GASTIGHT RADIAL SCRAPERS IN ROTARY ENGINES

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Claims priority, application France, Apr. 19, 1963, 932,149, Patent 1,397,918; Feb. 26, 1964, 965,255, Patent 1,394,949

8 Claims. (Cl. 123—196)

This invention relates to improvements in the lubrication of the radial scrapers of rotary engines of the type having a stator of epicycloidal or hypocycloidal profile with N lobes and a rotor of conjugate profile N+1 sides and N+1 corners.

These gastight radial scrapers, which are positioned on the rotor at each of the N+1 corners, function in contact with the epicycloidal stator profile and special steps must be taken for their lubrication.

Such steps may include:

Spraying oil into the air drawn in,

Mixing oil with the fuel, or

Conveying oil into the groove accommodating each scraper.

Of these possible methods, the first two lead to heavy oil consumption, the second being in addition inconvenient because it calls for operating with a mixture of fuel and oil.

The third method calls for an oil supply system in conjunction with an independent oilway and a highly gastight check valve for each groove; moreover, only a very small quantity of the oil led into the groove reaches the area where it would be most useful, i.e., that of contact between the scraper and the stator.

The present invention contemplates an arrangement obviating these drawbacks, namely one in which oil consumption is minimal, which dispenses with valves entirely and which enables the oil to be conveyed exactly where it is needed.

In accordance with this invention, the oil is conveyed through an orifice formed in the stator into a zone in which the prevailing pressure never exceeds atmospheric pressure, thereby making valves unnecessary, said orifice supplying the oil required for lubricating each rotor scraper at the precise moment when each scraper moves past it.

In a preferred embodiment, the oil discharges through the orifice of a radial oilway in the stator and is delivered at the instant when the scraper and the orifice face each other, said oilway being itself supplied through another radial oilway upstream thereof and with which it is placed in communication only when the scraper is positioned exactly facing the orifice discharging the oil.

In one specific form of embodiment, the upstream oilway is located in the crankshaft and the downstream oilway in the stator (the scrapers being carried by the rotor).

When the oil is delivered at constant pressure either from the general lubrication circuit or from a separate system, the flow of oil supplied to the scraper is proportional to the time for which the two aforementioned oilways are placed in mutual communication. Since this time is itself inversely proportional to the rotational speed of the motor, this means that the quantity of oil delivered through the lubrication orifice is also inversely proporional to said rotational speed. This quantity thus tends to be overabundant at low r.p.m. figures and inadequate at high r.p.m. figures.

One improvement which likewise falls within the scope of the invention consists in inserting, into the upstream oilway formed in a rotating part, a flow regulator responsive to the rotational speed and devised in such manner that the passageway cross-section through it be substantially directly proportional to said speed and that the volume of oil finally delivered through the lubrication orifice at each passage before a scraper be consequently substantially constant irrespective of the rotational speed of the engine. Such a regulator, which is well known per se, may be devised in various ways.

These and other features of the present invention will be more clearly apparent from the following detailed description of a non-limitative example of application to a rotary engine of the type having a two-lobe stator and a rotor of curvilinear triangular shape.

Referring to the drawing filed herewith:

FIGURE 1 shows in longitudinal section through the line **1—1** of FIGURE 2 a rotary engine whose radial scrapers are lubricated by an arrangement according to the present invention;

FIGURE 2 is a cross-section taken through the line **2—2** of FIGURE 1;

FIGURE 3 is a cross-section taken through the line **3—3** of FIGURE 1;

FIGURES 4, 4', 5 and 5' show on an enlarged scale the positions of the oilways with respect to each other and to the scraper, at the start and end of lubrication thereof;

FIG. 6 is a fragmentary transverse sectional view through the crankshaft of a first constructional form of a flow regulator;

FIG. 7 is a view similar to FIG. 6, but showing a second constructional form of a flow regulator.

FIG. 8 is an enlarged fragment in FIG. 1 showing a modified lubrication system for the radical scrapers; and

FIG. 9 is a vertical sectional view taken through the line **9—9** of FIG. 8.

Referring first to FIGURES 1 and 2, reference numeral **1** designates the stator with its two lobes 1^1 and 1^2, and reference numeral **2** the rotor rotating on the eccentric **3** of crankshaft **4**.

The motion of the rotor within the stator engenders three working chambers A, B, C in which the four "strokes" of the engine cycle take place.

These working chambers are bounded laterally by the webs **5** and **6**.

The rotor is driven by a ring gear **7** which is rigid therewith and meshes with the teeth **8** of a pinion rigidly united with said stator.

In FIGURE 2, reference numeral **16** designates the inlet passage, numeral **17** the exhaust passage and numeral **18** the spark plug.

A part of that portion of the stator wall which is comprised between passage **16** and passage **17** is in no case subjected to a pressure greater than atmospheric pressure since it is always located in a working chamber in which either the inlet "stroke" or the exhaust "stroke" takes place.

The delivery oilway **9** consequently opens out at a point on said part of the wall that need not in fact be necessarily chosen midway between the two orifices of passages **16** and **17**.

This oilway **9** communicates through a transverse oilway **10** with a further oilway **11** drilled through the web **5** and terminating at the periphery of crankshaft **4**.

A radial oilway **12** formed in said crankshaft which communicates with the general lubrication circuit via inlet opening **20** and passage **21** in the stator casing, the passage **21** in turn communicating through suitable passages in the crankshaft bearing with an axial bore **22** in the crankshaft or oilway **12** may be fed by a separate circuit so drilled as to form an extension of oilway **11** when the rotor is in the position shown in FIGURE 2, i.e., when one of the three radial scrapers located at the rotor

corners (namely the scraper **13** in this instance) is facing the oilway **9**.

Since the rotor rotates at one-third the speed of, and in the same direction as, the crankshaft, when the scraper **14** is facing the oilway **9**, i.e., when the rotor will have completed one-third of a revolution, the crankshaft will have completed a full revolution and the oilway **12** will be positioned opposite the oilway **11** anew, whereby the oil will reach the outlet of oilway **9** exactly at the right time to lubricate the scraper **14**.

After the crankshaft has completed another revolution, the scraper **15** will be positioned opposite oilway **9** at the precise instant when the latter is supplied anew with oil.

It will therefore be manifest that which each revolution completed by the crankshaft, the oilway **12** will coincide with the oilway **11** and deliver the oil required to lubricate whichever of the three radial scrapers is positioned opposite the outlet of oilway **9** at that particular instant.

Preferably, the cross-sections of oilways **12** and **11** are so chosen that when communication is established between them (FIGURE 4') the orifice of oilway **9** opens out onto the right side of the scraper as shown in FIGURE 4, and communication is cut off (see FIGURE 5') only when the oilway **9** is in a position facing the left side of said scraper, as shown in FIGURE 5.

The oilway **9** may be equipped with a jet of cross-section appropriate to the viscosity of the oil and the rotation speed of the engine, whereby to adjust the oil flow to the precisely required value and thereby reduce oil consumption to a minimum.

It is likewise specified that the oilway **10** may have a port on the stator wall through a single orifice **9**, as shown in FIGURE 1, or else through a plurality thereof arranged along a same generatrix, as shown in FIGS. 8 and 9. In the latter case a jet **40** having an orifice **41** and threads **42** may be positioned in each orifice **9** as shown.

When the oil is supplied at constant pressure in the customary way, it will be of advantage to provide, in the upstream radial oilway **12** and as remotely as possible from the centre of rotation, a regulator responsive to centrifugal force and consisting, say, of a seat **31** against which a ball **32** is urged into pressure contact by a spring **33** whose other end bears against a retaining end wall **34** in which an outlet orifice **38** is drilled.

The spring **33** is of variable flexibility and its tension increases as its height diminishes, in such manner that the passageway section offered to the oil varies substantially in direct proportion to the speed, as the ball is subjected to the influence of centrifugal force.

The seat **31** may comprise one or more small holes **35** through which the oil can flow when the rotation speed of the crankshaft is insufficient for the ball to lift from its seat.

Alternatively, the regulator may be provided in the form illustrated in FIGURE 7 (shown on a larger scale than in FIGURE 1).

In this constructional form, the seat **31** is mounted inside the upstream oilway and its cylindrical flow hole is

more or less plugged by the valve needle **39** whose profile is determined so as to provide the cross-sectional variation corresponding to the variation in rate of flow it is desired to obtain as a function of the rotation speed.

The valve needle **39** lifts from the seat **31** under the effect of centrifugal force, against the countering spring **33** which bears against the bush **34**. When said needle abuts against seat **31** at **37**, a small passageway is left at **36** in order to provide a small oil flow even when the engine speed is still insufficient to lift the needle **39** from the seat **31**.

I claim:

1. In a rotary engine of the type having a lobed stator, a crankshaft, and a rotor mounted on said crankshaft and so shaped so as to define with said stator a plurality of chambers on each crankshaft revolution; an improvement comprising a plurality of radial scrapers carried by said rotor and adapted to engage the inner surface of certain portions of said stator to define said chambers, a first oil passage formed in at least one of said portions of said stator, a second oil passage formed in one of the stator webs, and a third oil passage formed in said crankshaft and communicating with an external oil source, the relative locations of said passages being so that, at each crankshaft revolution, said passages register to lubricate a scraper adjacent the portion of said stator where said first oil passage is formed.

2. The improvement of claim **1** wherein said first oil passage is located between the inlet and exhaust passages of said stator in order to establish atmospheric pressure at said first oil passage.

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

4. The improvement of claim **1** wherein the diameters of said second and third 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.

5. The improvement of claim **1** further comprising a jet disposed in said first oil passage to regulate the oil flow therefrom.

6. The improvement of claim **1** wherein said first oil passage is formed by a plurality of orifices arranged along the same generatrix.

7. The improvement of claim **6** further comprising a jet disposed in said orifice to regulate the oil flow therefrom.

8. The improvement of claim **1** further comprising means responsive to centrifugal force disposed in said third oil passage for regulating the flow of oil therethrough in response to engine speed.

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