March 30, 1965 L. PÉRAS 3,175,503

SEGMENTARY SEALING BLADES FOR ROTARY ENGINES

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FIG. 1

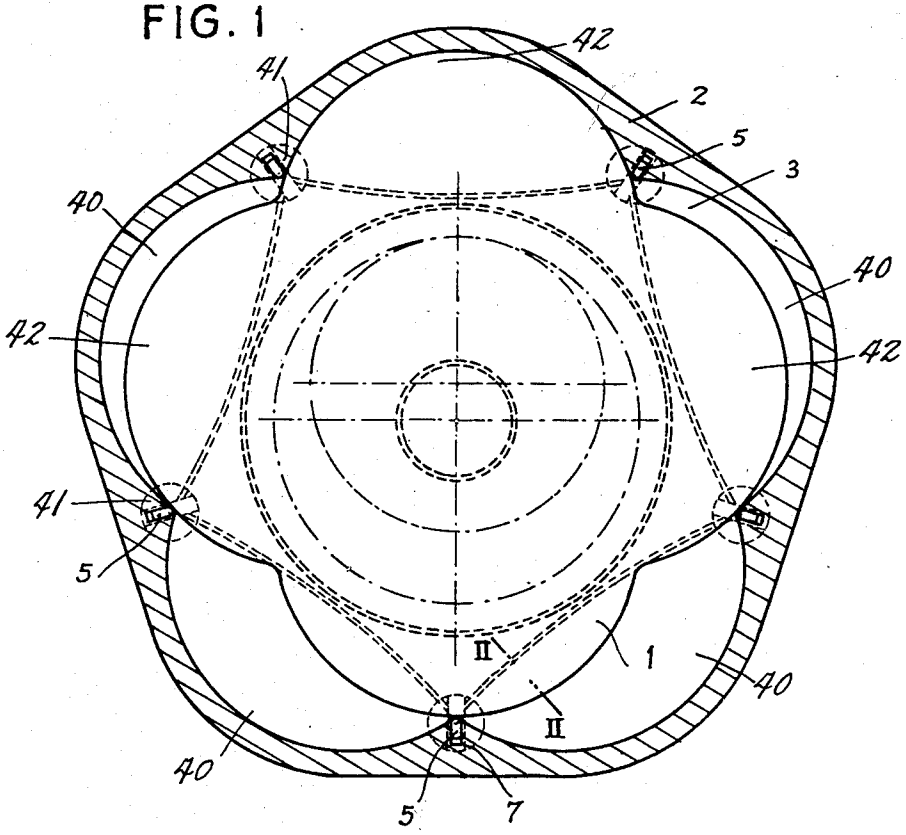


FIG. 2

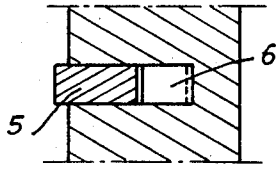
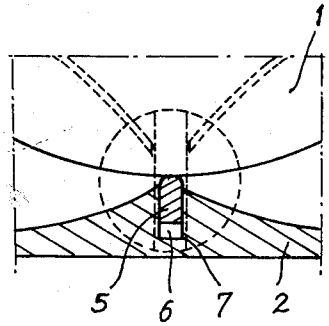


FIG. 3



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

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FIG. 4

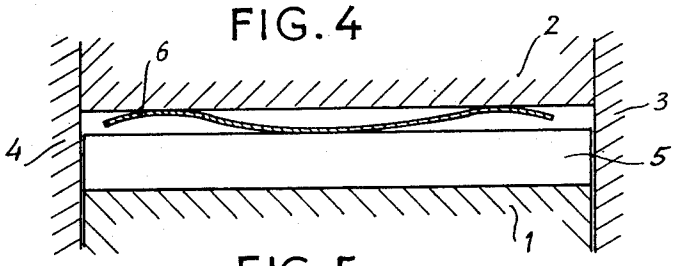


FIG. 5

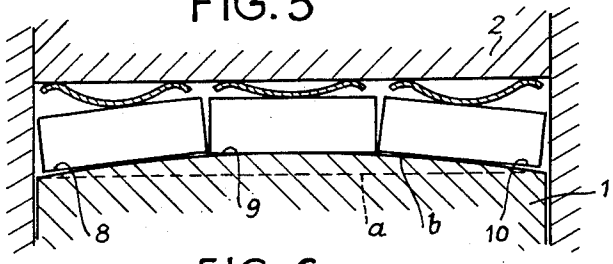


FIG. 6

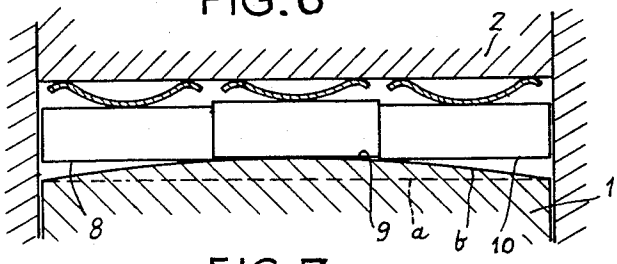


FIG. 7

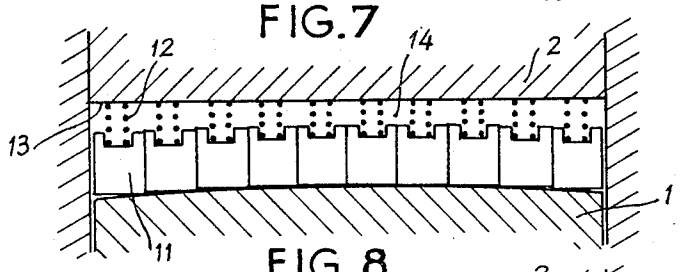
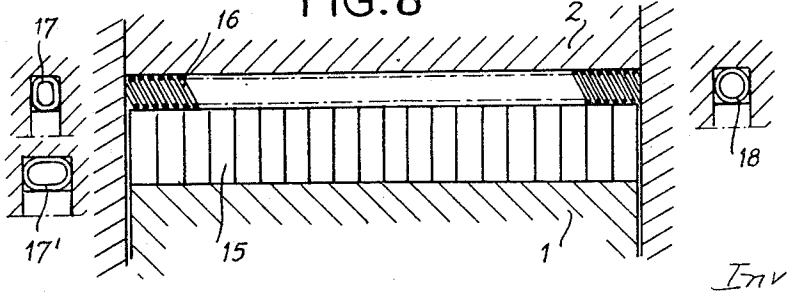


FIG. 8



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

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SEGMENTARY SEALING BLADES FOR ROTARY ENGINES

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FIG. 9

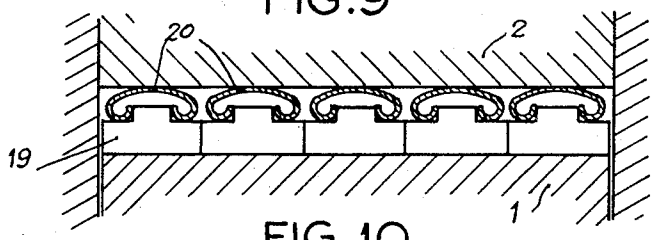


FIG. 10

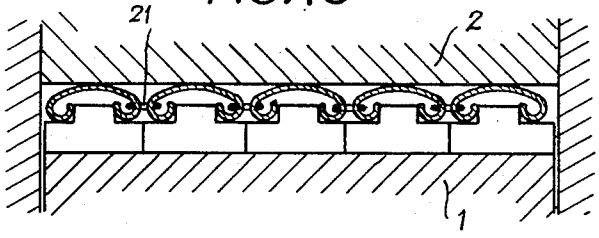


FIG. 11

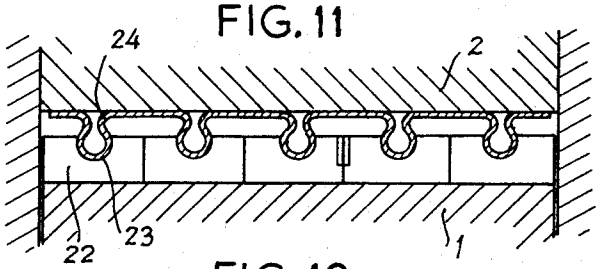


FIG. 12

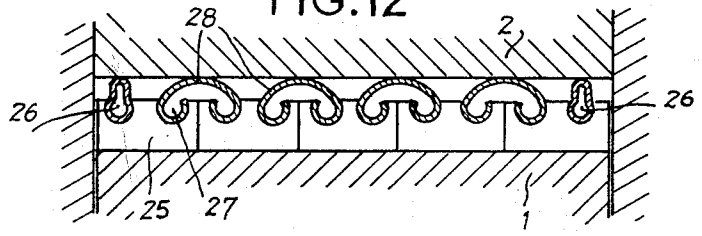
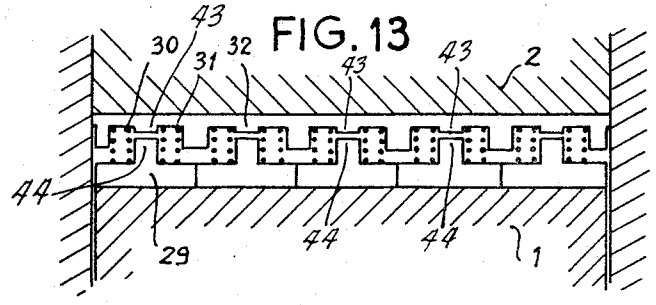


FIG. 13



Inventor
Lucien Péras
By Stevens Davis Miller & Mosher
Attorneys

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3,175,503

SEGMENTARY SEALING BLADES FOR ROTARY ENGINES

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

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Claims priority, application France, Mar. 31, 1961, 857,549, Patent 1,293,169
10 Claims. (Cl. 103—130)

This invention relates to blades adapted to seal the joint between the component elements of rotary engines which are subjected to the compression and expansion of the gases accomplishing their power stroke in working chambers.

It has already been proposed to use one-piece deformable sealing blades having properties enabling them to accommodate the deformations of the aforesaid component elements.

The sealing blades according to the present invention are segmented in order to accommodate as fully as possible the generatrices of the rotor or cases of rotary engines.

The blade may be segmented as simply as possible, that is, into two elements for very narrow rotors, but the higher the number of segments, the better the result, and this number is unlimited except for the complication arising from an excessive number of elements.

The invention will be described hereinafter with reference to the attached drawing wherein:

FIGURE 1 is a section taken across a rotary engine equipped with segmental blades;

FIGURE 2 is a fragmentary section taken upon the line II—II of FIG. 1;

FIGURE 3 is a fragmentary section showing on a larger scale a detail of the cross section of FIG. 1;

FIGURE 4 is a front view showing a unitary blade disposed between the rotor and stator of the rotary engine, and

FIGURES 5 to 13 are similar views showing different forms of embodiment of segmental joints fitted in corresponding slots of rotary engines.

In the drawings, FIGS. 1, 2 and 3 are shown only to remind the structure of a rotary engine. In the example illustrated the four-lobed rotor **1** revolves within a stator **2** formed with five chambers and provided with side flanges or plates. The stator **2** comprises in slots or grooves **7** sealing blades **5** adapted to isolate the chambers from one another by bearing against the rotor **1**. To this end, springs **6** fitted in the bottom of grooves **7** urge the blades against the rotor.

As is quite obvious from FIGURE 1, the stator has an inner wall which encloses a chamber within which the rotor can rotate. As is well known and as is also seen from FIGURE 1, the rotor and stator have parallel longitudinal axes. The stator inner wall specifically defines a plurality of concave recesses **40** adjoining each other at apices **41**. The rotor has a peripheral surface which defines in radial cross-section a plurality of convex lobes **42** whose convexity substantially corresponds to the concavity of the recesses **40**. As is also seen in FIGURE 1, the number of lobes **42** is one less than the number of recesses **40**. Each apex **41** comprises a groove **7** within which is located the sealing means comprising the aforementioned blades **5** and resilient biasing means **6**.

It will be seen from FIGURE 1, that as the rotor rotates, its peripheral surface will slide past and against each of the sealing blades or elements **5**. This continual contact between the rotor periphery and the blades **5** permits effective separation and sealing of the adjacent compartments formed between the rotor and stator wall.

FIG. 4 illustrates in fragmentary section a rotary engine wherein the generatrices of rotor **1** are not deformed and wherein a single blade can provide the fluid-tightness due to its efficient engagement with the rotor surface. In this figure **1** is the rotor, **2** the stator, **3** and **4** the end flanges, **5** the joint and **6** the blade spring.

FIG. 5 illustrates a rotor **1** of which the shape can be altered mainly by its expansion due to the gaseous combustion in the working chambers.

According to this invention, each sealing blade is divided into a plurality of blade segments resiliently urged by separate springs. These segments position themselves automatically along tangents to the curves of the rotor generatrices moving past the blade segments inserted in a stator slot or groove. FIG. 5 shows clearly the improvement resulting from this arrangement if there is considered the chord *a*, the deformed generatrix *b* and the tangents **8**, **9** and **10** to this generatrix.

FIG. 6 shows segments assumed to move parallel to their position in the cold state. In this case the advantage resulting from the segmental blade disposal is moderate for it is clear that the blade should be divided into a greater number of segments, as shown in FIG. 7. These segmental elements **11**, in the example illustrated in FIG. 7, are ten in number, each element being provided with a separate spring **12** engaging a recess formed in each segment **11** and bearing against the bottom **13** of the slot **14** formed in stator **2**.

FIG. 8 shows an embodiment comprising a great number of segmental elements **15**, a single-coil spring **16** of generally flattened cross-section ensuring the desired resilient engagement with the rotor generatrices. The reference numerals **17**, **17'** and **18** designate in cross-sections typical examples of the coil-spring cross-sectional shape, the first two examples showing flattened springs and the third example a circular spring.

FIG. 9 is another illustration of a deformable segmental blade wherein the segments **19** are of inverted T configuration and the springs **20** react against the side arms of each T and against the bottom of the stator groove.

It may be advantageous to provide a series of segments interconnected through flexible, spring-like members to facilitate the mass-production, storing and checking operations. The length of the segmental blade can easily be ascertained after assembly to check the axial plays between the assembled blade segments and the side flanges or plates.

FIG. 10 is a view similar to FIG. 9 and shows a modified embodiment wherein adjacent springs are linked by a ring **21**.

FIG. 11 shows another form of embodiment comprising a plurality of segments constituting a deformable sealing blade wherein each segment **22**, **22'** . . . is formed with a notch **23** on its upper face, each notch **23** being engaged by a correspondingly shaped portion of a single spring **24** consisting of a wire or a flat strip.

FIG. 12 illustrates another embodiment of a series of interconnected segments wherein each segment **25** is formed with two notches **26**, **27**, a spring **28** of adequate configuration engaging the adjacent notches of two successive segments.

FIG. 13 is another embodiment wherein the segments **29** also of inverted T configuration are each urged against the rotor by two coil springs **30**, **31** disposed on either side of the central member of the T and adapted to engage a correspondingly notched counter-plate **32** acting on the one hand as a spring-receiving member and on the other hand as a stop to limit the radial movement of the segments by reserving a predetermined clearance.

As will be seen in FIGURE 13, the counter-plate 32 and sealing elements 29 have corresponding abutment portions 43 and 44 which serve to prevent further outward radial movement of the blades 29 after the springs 30 have been compressed to a certain point.

Moreover, this counter-plate 32 fills the maximum volume of the blade-receiving groove, which may be advantageous for reducing dead space and thus prevent a non negligible fraction of gas from circulating along the groove.

The bearing of this invention is not limited by the specific forms of embodiment described with reference to the attached figures but extends to any other embodiment consistent with the spirit and scope of the patent, which resides in dividing a sealing blade into segments either free or interconnected by spring links in order to ensure a satisfactory and reliable fluid-tightness along the deformed generatrices of the rotor, or along the side flanges or plates of the stator in rotary engines.

I claim:

1. A rotary engine comprising a stator having an inner wall which defines a hollow compartment, said wall defining in radial cross-section a plurality of angularly adjoining concave recesses and an inwardly protruding apex at each point of juncture between two adjoining recesses, a rotor mounted within said compartment along a longitudinal axis which is parallel to the longitudinal axis of said stator, said rotor having a peripheral surface which defines in radial cross-section a plurality of convex lobes, each lobe being curved substantially to the same curvature as each of said recesses, said stator comprising a longitudinal groove at each of said apexes, a sealing means in each of said grooves, each said sealing means comprising a plurality of separate sealing elements longitudinally aligned and abutting each other on adjacent radial faces, and biasing means in said grooves separately urging each of said elements radially inwardly in sealing contact against the peripheral surface of said rotor, said rotor being rotatable about its longitudinal axis with its peripheral surface sliding past each of said sealing elements, said peripheral surface of said rotor defining with said stator inner wall longitudinally extending chambers which are sealingly separated from each other by said sealing elements sealingly contacting said peripheral surface on said rotor.

2. The engine of claim 1, wherein said biasing means comprises a plurality of resilient spring members, each said spring member acting against a limited number of said sealing elements.

3. The engine of claim 2, including a counterplate member extending longitudinally along the bottom of each of said grooves, said spring members being coil springs and each said coil spring fitting in one of said notches and being compressed between said plate member and said sealing elements, said plate member comprising longitudinally aligned notches, said spring members being coil springs and each said coil spring fitting in one of said notches and being compressed between said plate member and said sealing elements, said plate member and said sealing elements comprising respective abutment portions radially aligned with each other and radially spaced apart, said abutment portions serving to limit the outward radial movement of said sealing elements by abutting against each other when the spring elements are compressed beyond a certain degree.

4. The engine of claim 1, wherein said sealing elements each have flat front faces which contact said rotor periphery, said sealing elements each having a recess in their rear faces, said biasing means being received in each of said recesses.

5. The engine of claim 4, wherein said biasing means in each of said grooves is a single blade-type spring extending substantially the full length of its associated

groove, said spring comprising straight portions which abut said stator and curved portions between said straight portions, each of said curved portions fitting into a one of said recesses in the back faces of said sealing elements.

6. The engine of claim 1, wherein said biasing means in each of said grooves is a single coil spring extending substantially the full length of said groove with its longitudinal axis being substantially transverse to the radial line of travel of said sealing elements, said coil spring being located between the bottom of said groove and the rear face of said sealing elements with its helical coils being transversely compressed between said sealing elements and the bottom of said groove.

7. The engine of claim 4, wherein the rear face of each of said sealing elements comprises two longitudinally spaced recesses, said biasing means in each of said grooves comprising a plurality of flat-type springs having an arch portion and opposite end portions, said arch portion abutting the bottom of said groove and the opposite end portions of any one spring being received in adjacent ones of said recesses in different ones of said sealing elements.

8. The engine of claim 2, wherein each of said sealing elements has an inverted T-shape and each of said spring members are blade-type springs, each of said blade-type springs abutting against opposite sides of the horizontal leg of the T, with the vertical leg of the T fitting between opposite ends of said spring.

9. A rotary engine comprising a stator and a rotor rotatable within said stator, said stator comprising an inner wall and said rotor comprising an outer peripheral surface, said rotor and stator defining between said wall and said surface a plurality of separate sealed chambers, each chamber extending longitudinally along the full axial length of said rotor surface, said chambers being disposed circumferentially adjacent to each other, sealing means sealingly separating adjacent chambers from each other, said sealing means comprising longitudinal grooves circumferentially spaced apart in said stator, a plurality of separate sealing elements in each groove, said elements being longitudinally aligned and abutting one another along radial faces thereof, each of said elements being separately slidable in a radial direction in said groove, resilient biasing means separately urging each of said elements inwardly towards said rotor, said elements sealingly contacting said rotor peripheral surface.

10. The engine of claim 9, wherein said biasing means comprises a blade-type spring for each of said sealing elements and wherein said sealing elements are in the form of an inverted T with each said spring bearing against opposite horizontal arms of one of said elements.

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JOSEPH H. BRANSON, JR., *Primary Examiner.*

LAURENCE V. EFNER, WILBUR J. GOODLIN, *Examiners.*