

[54] **ROTOR FOR A ROTARY INTERNAL COMBUSTION ENGINE**

[72] Inventors: **Helmut Keller**, Garitz; **Franz Rottmann**, Schweinfurt am Main; **Helmuth Zickler**, Hambach; **Dieter Klauke**, Schweinfurt am Main, all of Germany

[73] Assignee: **Fichtel & Sachs AG**, Schweinfurt am Main, Germany

[22] Filed: **June 16, 1970**

[21] Appl. No.: **46,640**

[30] **Foreign Application Priority Data**
July 15, 1969 Germany.....P 19 35 827.1

[52] U.S. Cl.....**418/54, 418/61, 418/83, 418/179, 308/236, 287/52**

[51] Int. Cl.....**F01c 1/02, F04c 1/02, F16c 33/30**

[58] Field of Search**418/54, 61, 83; 308/236; 287/53, DIG. 7, 20, 92 B, 52**

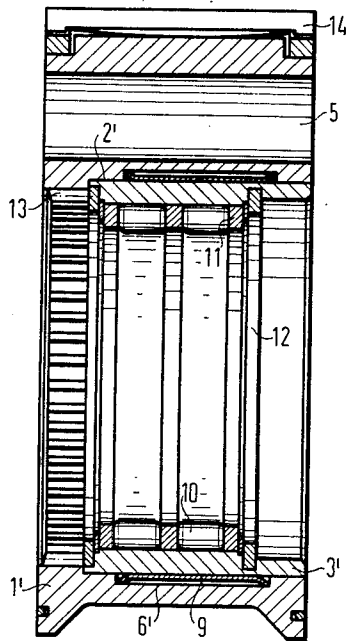
[56]		References Cited
		UNITED STATES PATENTS
3,319,612	5/1967	Hamada.....418/61
3,440,929	4/1969	Weissflog et al.....418/61
1,686,569	10/1928	McMillan418/54
2,650,866	9/1953	Knudson.....308/236
2,324,676	7/1943	Butterfield.....308/236
2,620,243	12/1952	Beatty.....308/236
3,489,125	1/1970	Fend.....418/61
1,906,521	5/1933	Boden.....287/52
2,532,779	12/1950	Parks.....308/15

Primary Examiner—Carlton R. Croyle
Assistant Examiner—John J. Vrablik
Attorney—Kelman and Berman

[57] **ABSTRACT**

The rotor of a rotary internal combustion engine has a lobed light metal body and a steel sleeve in a central axial bore of the body. The bearing which supports the rotor on an eccentric is mounted in the sleeve and protected against the heat absorbed from the burning fuel by the rotor body by a sealed annular chamber between radially opposite walls of the body and the sleeve.

7 Claims, 3 Drawing Figures



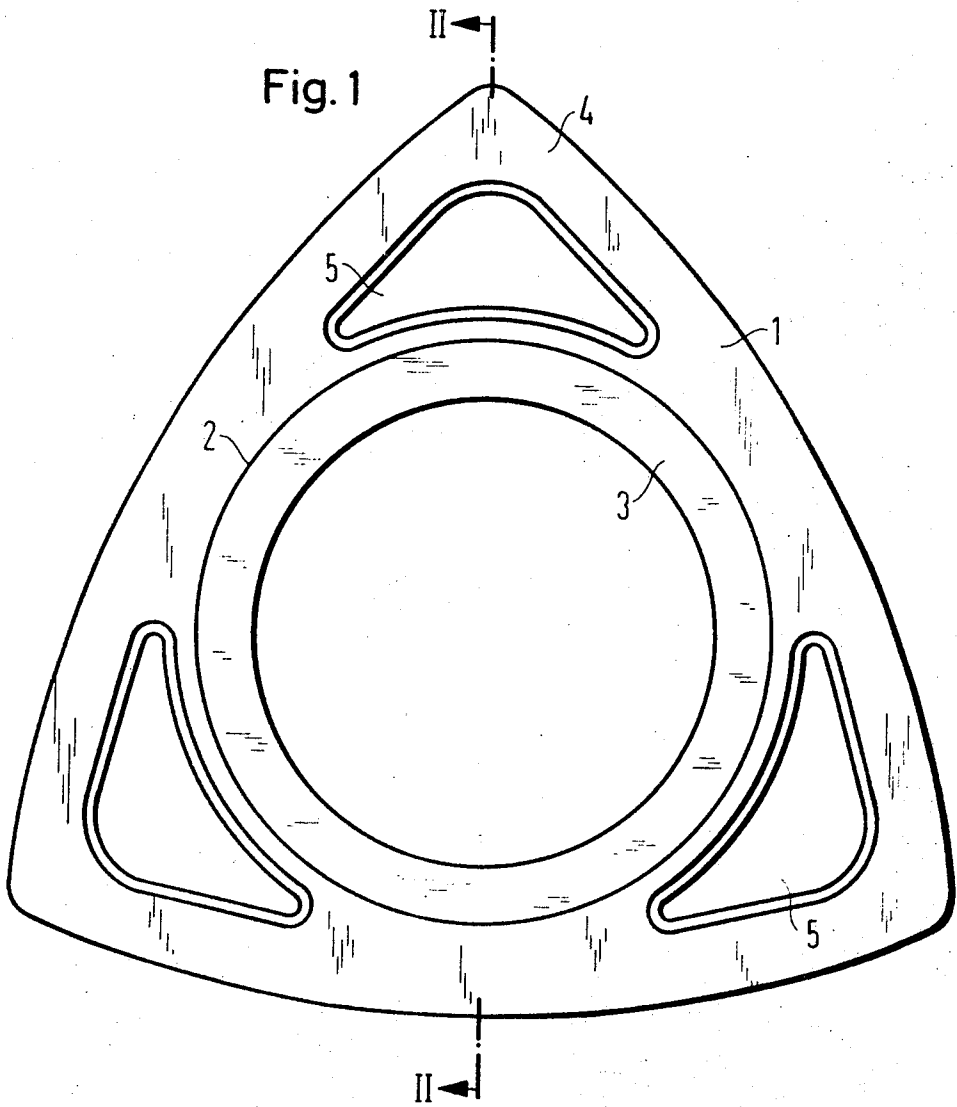


Fig. 2

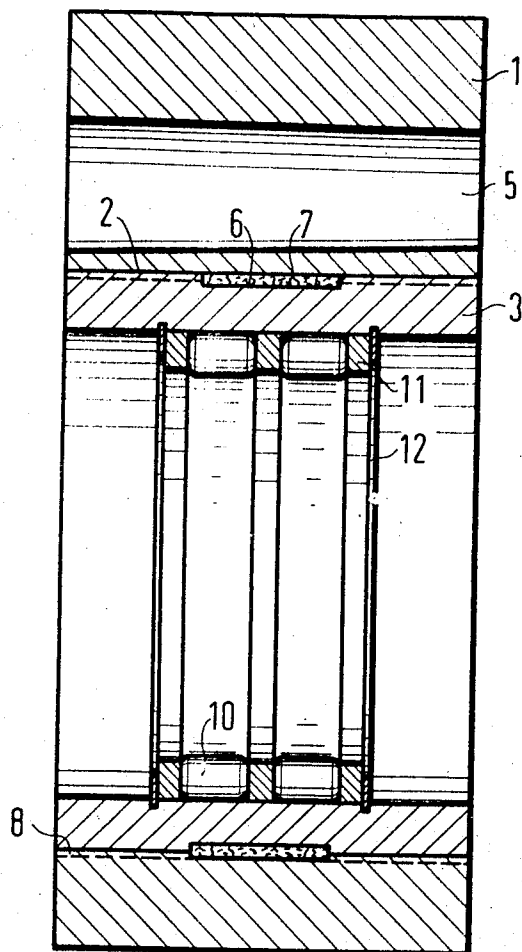
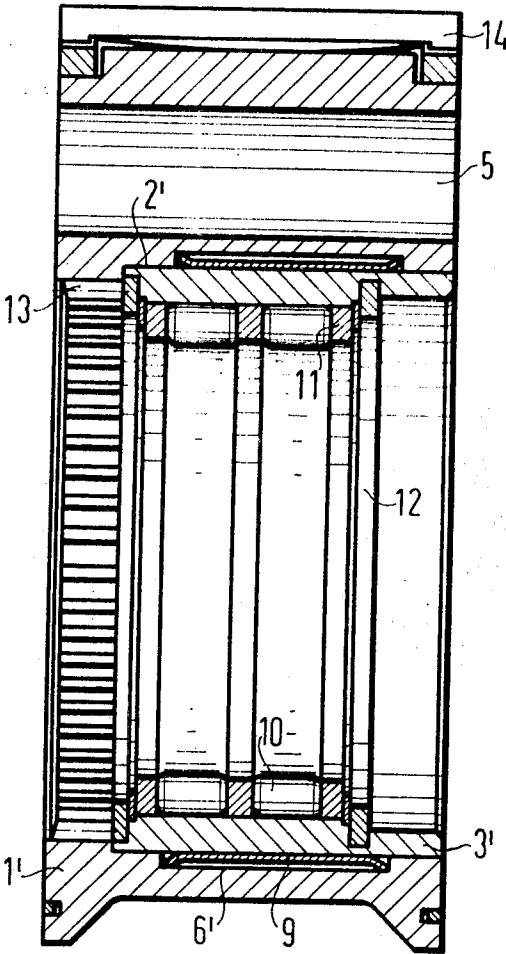


Fig. 3



ROTOR FOR A ROTARY INTERNAL COMBUSTION ENGINE

This invention relates to rotary internal combustion engines of the type developed largely by Felix Wankel, and particularly to an arrangement for protecting the rotor bearing against the heat generated by the burning fuel mixture.

In known rotary combustion engines of the aforesaid type which are air-cooled, the portion of the thermal energy which can be dissipated outwardly through the casing decreases with increasing engine power under otherwise analogous conditions, as the surface-to-volume ratio decreases. It becomes particularly difficult to cool the rotor bearing of such engines in which the rotor itself is cooled by the fuel mixture as it passes through axial ducts in the rotor lobes because the cooling effect is limited by load variations. The problem of cooling the rotor bearing is solved more readily in relatively large oil cooled rotors, though at substantial expense for relatively complex cooling devices.

The primary object of the invention is the protection of the rotor bearing against excessive heat during operation of a rotary internal combustion engine which is effective in air cooled rotors, but also suitable for other types of rotors in such engines.

With this object and others in view, the rotor of the invention has a body formed with a bore axially extending therethrough and a plurality of circumferentially distributed lobes. A sleeve is fixedly and coaxially fastened to the body in the bore of the latter so that an inner annular wall of the body envelops an outer annular wall of the sleeve. The outer ring of the rotor bearing is coaxially mounted in the sleeve for rotary engagement with an eccentric on the engine shaft. Respective axially coextensive portions of the aforementioned walls are radially spaced from each other to define an annular chamber which impedes heat transfer between the rotor body and the portion of the sleeve in which the bearing is mounted.

Other features, additional objects, and many of the attendant advantages of this invention will readily be apparent from the following detailed description of preferred embodiments when considered in connection with the appended drawing in which:

FIG. 1 shows a rotor of the invention in fragmentary axial end view;

FIG. 2 illustrates the rotor of FIG. 1 in section on the line II—II; and

FIG. 3 is a more complete view of a modified rotor of the invention corresponding to FIG. 2.

Referring now to the drawing in more detail, and initially to FIG. 1, there is shown the rotor of a Wankel-type rotary internal combustion engine which, as far as not illustrated, is conventional.

The rotor has a body 1 of cast aluminum alloy with three lobes or apex portions 4 which are equiangularly distributed about the rotor axis and give the rotor a cross section similar in shape to an equilateral triangle. A generally cylindrical coaxial bore 2 of the rotor body fixedly receives a steel sleeve 3. Axial ducts 5 pass through the rotor body in the lobes 4 respectively and provide passages for the mixture of air and fuel between ports in the axially terminal end walls of the engine casing omitted from the drawing, the rotor body 1 being cooled by the passing mixture. The structure described so far is known.

As is better seen in FIG. 2, the outer, otherwise cylindrical wall of the sleeve 3 has a shallow, annular groove or depression 6 which extends over the axially central third of the sleeve wall, and the chamber so formed encloses an asbestos ring 7. The interengaged projections and recesses of serrations 8 on the portions of the sleeve wall axially offset from the depression 6 in opposite directions and on the inner wall of the sleeve 3 conformingly engage each other for fixedly fastening the sleeve 3 to the rotor body 1 and to seal the chamber about the asbestos ring 7.

The rollers 10 of the roller bearing which connects the rotor to an eccentric on the engine shaft in the assembled condition of the apparatus are radially aligned with the depression 6 in

such a manner that a major portion of the depression is axially coextensive with the rollers. The latter are secured on the inner wall of the sleeve 3 in a cage 11 between snap rings 12.

Rotor elements omitted from the showing of FIGS. 1 and 2 for the sake of clarity, but seen in FIG. 3 include a coaxial internal gear rim 13 on the rotor which engages a pinion on the casing wall when the illustrated rotor is installed, and a spring-loaded sealing element 14 on the portion of each lobe 4 which is farthest from the rotor axis, the sealing elements slidingly engaging a circumferential wall of the trochoidally shaped cavity or combustion chamber in the engine casing (not shown), as is conventional. The known cooperation of the rotor elements with other parts of the engine is shown and described, for example, in Rottmann U.S. Pat. No. 3,369,738.

Except for details in the configuration of the rotor body 1' of magnesium alloy in whose stepped cylindrical bore 2' a steel sleeve 3' is received, the rotor illustrated in FIG. 3 is closely similar to that described with reference to FIGS. 1 and 2. The sleeve 3' has a smoothly cylindrical outer wall, and the opposite inner wall of the rotor body 1' is formed with a shallow depression 6' axially interposed between smoothly cylindrical wall portions which conformingly engage the outer sleeve wall. A spring ring 9 is sealed in the annular chamber defined between the two walls in the depression 6'. The bore 2' is axially longer than the sleeve 3', and the portion of the bore not occupied by the sleeve is of reduced diameter and accommodates the gear rim 13.

The principal elements of the rotor shown in FIGS. 1 and 2 were assembled by inserting the externally grooved and serrated steel sleeve 3 holding the asbestos ring 7 in the mold in which the rotor body was cast. In making the rotor illustrated in FIG. 3, the magnesium alloy body 1' was cast and finished separately, the ring 9 was inserted in the depression 6', and the sleeve 3' thereafter pressed axially into the wide end of the bore 2' and retained by the ring 9 which resiliently engages the body 1' and the sleeve 3' in radially abutting engagement.

In either arrangement, the chambers of the depressions 6, 6' are largely occupied by thermally insulating material, asbestos in FIG. 2, air in FIG. 3, which impedes the flow of heat from the light metal body 1, 1' to the rotor bearing, thereby protecting the bearing and favoring heat flow radially outward from the combustion chamber through the casing walls which are readily cooled by external fins and the like.

Since it is necessary for protection of the bearing that the insulating chamber be approximately axially coextensive with the bearing, a filler of poor heat conductivity capable of transmitting stresses between the sleeve 3, 3' and the rotor body 1, 1' is desirable in the groove 6, 6' for mechanical strength of the rotor. Both illustrated annular bodies 7, 9 have been found satisfactory for this purpose. It is preferred, however, that the depression 6, 6' have a radial depth not greater than a small fraction of its axial length.

It should be understood, of course, that the foregoing disclosure relates only to preferred embodiments of the invention, and that it is intended to cover all changes and modifications in the examples of the invention herein chosen for the purpose of the disclosure which do not constitute departures from the spirit and scope of the invention set forth in the appending claims.

What is claimed is:

1. A rotor for a rotary internal combustion engine comprising, in combination:

a. a rotor body having an axis and a plurality of circumferentially distributed lobes, said body being formed with a bore axially extending therethrough;

b. a sleeve coaxially received in said bore and fixedly fastened to said body, an inner annular wall of said body enveloping an outer annular wall of said sleeve;

c. bearing means coaxially mounted in said sleeve for rotary engagement with an eccentric,

1. respective axially coextensive portions of said walls being radially spaced from each other and defining an annular chamber about said axis;

d. a body of air largely occupying said chamber; and

3

4

e. a spring ring sealed in said chamber, said ring resiliently engaging said body and said sleeve in radially abutting engagement with a force sufficient axially to retain said sleeve in said body and for transmitting stresses between said sleeve and said body.

2. A rotor as set forth in claim 11, wherein said chamber has a radial depth not greater than a small fraction of the axial length thereof.

3. A rotor as set forth in claim 11, wherein each of said lobes is formed with a cooling duct axially therethrough and carries sealing means on the portion thereof farthest from said axis for engaging the inner wall of a casing of said engine, respective major portions of said chamber and of said bearing means being axially coextensive, and an internal gear rim on said body and centered in said axis.

4. A rotor as set forth in claim 11, wherein respective annular portions of one of said walls axially offset from said chamber in opposite directions engage the other wall and seal said chamber.

5. A rotor as set forth in claim 2, wherein one of said walls is formed with a radial depression forming said chamber.

6. A rotor as set forth in claim 11, wherein said body consists essentially of one metal, and said sleeve consists essentially of another metal, said one metal having better thermal conductivity and lower mechanical strength than said other metal.

7. A rotor as set forth in claim 8, wherein said metals respectively are aluminum or magnesium and steel.

* * * * *

15

20

25

30

35

40

45

50

55

60

65

70

75