United States Patent [19]

Bensinger

[11] **3,804,560**

[45] **Apr. 16, 1974**

[54] **OIL SHIELD ARRANGEMENT FOR ROTARY PISTON ENGINE**

[75] Inventor: **Wolf-Dieter Bensinger,** Stuttgart, Germany

[73] Assignee: **Daimler-Benz Aktiengesellschaft,** Stuttgart, Germany

[22] Filed: **Oct. 6, 1972**

[21] Appl. No.: **295,651**

[30] **Foreign Application Priority Data**

Oct. 8, 1971 Germany 2150256
June 7, 1972 Germany 2227566

[52] **U.S. Cl.** **418/91,** 418/142
[51] **Int. Cl.** ... **F01c 21/02,** F04c 27/00, F04c 27/04
[58] **Field of Search** 418/61, 83, 91, 94, 142; 123/8.01

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Primary Examiner—Carlton R. Croyle
Assistant Examiner—John J. Vrablik
Attorney, Agent, or Firm—Craig & Antonelli

[57] **ABSTRACT**

A rotary piston internal combustion engine, especially of trochoidal construction which includes a piston that is rotatingly arranged on the eccentric of an eccentric shaft and rotates relative to the latter and to the housing; the engine further includes engine spaces provided on both sides of the piston hub which are sealed off by oil seals in the radially outward direction; oil is conducted out of the engine space containing a gear for the control of the piston rotation, through the piston into the opposite engine space and from there in the direction toward the lateral housing part; a shielding member is arranged between the hollow gear of the control gearing and the abutment surface at the piston, which projects into the engine space to provide a shielding effect against oil spraying and splashing out of the bearing of the piston onto the eccentric; a further shielding member which is provided in the other engine space, is secured at the end face of the eccentric and projects with a portion thereof that has a spacing with respect to the end face of the eccentric in the axial direction, over the bearing of the piston on the eccentric.

23 Claims, 8 Drawing Figures

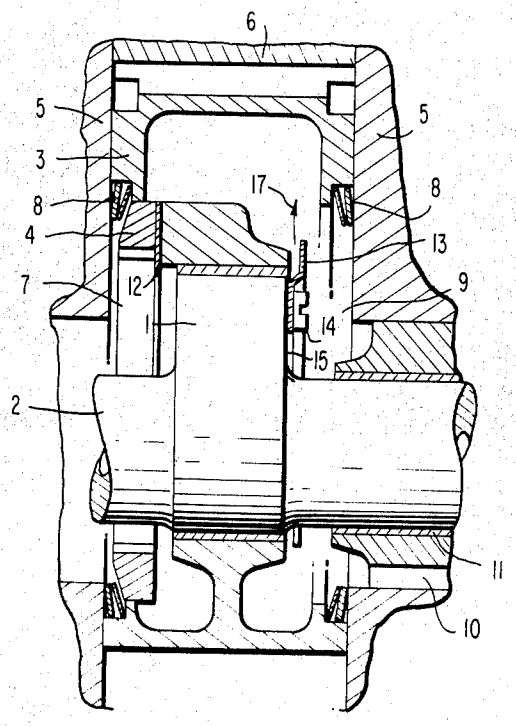


FIG. 1

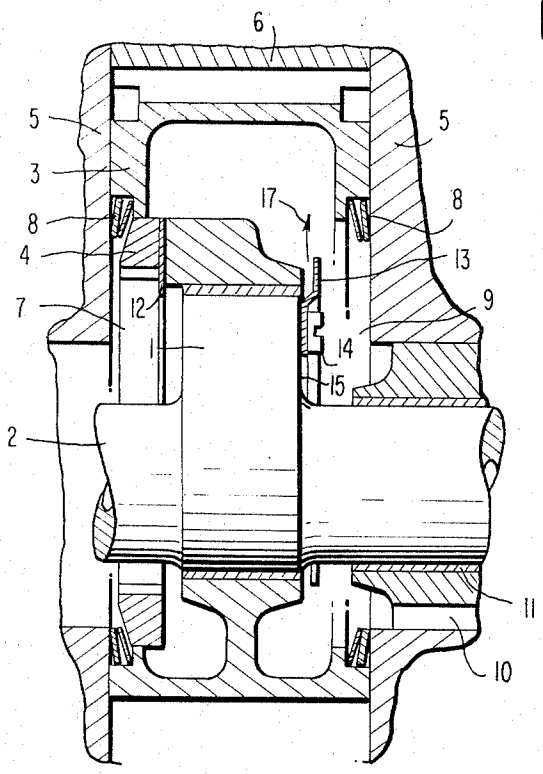


FIG. 2

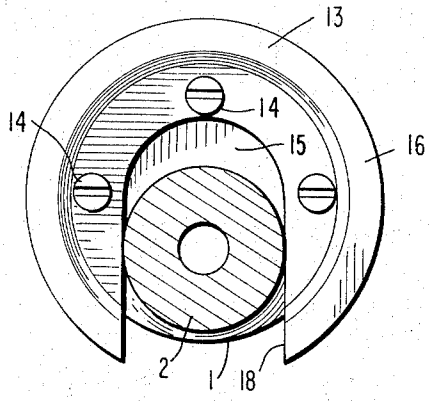


FIG. 3

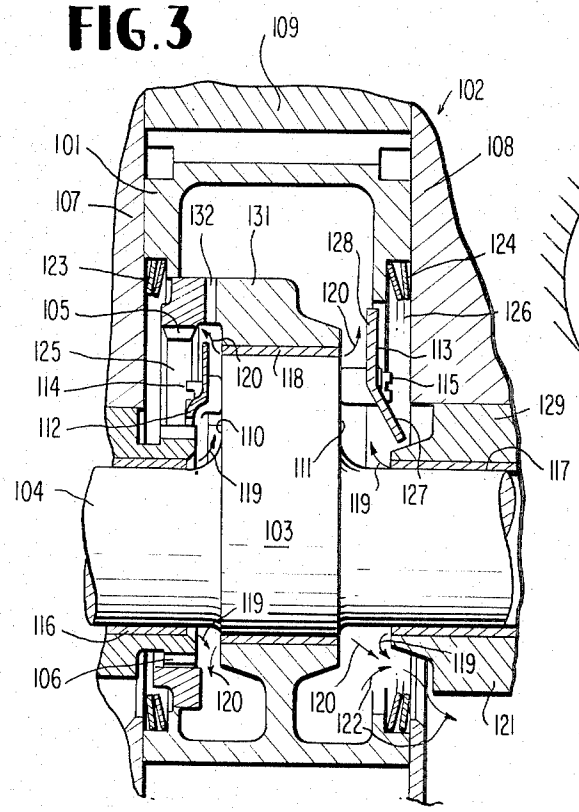
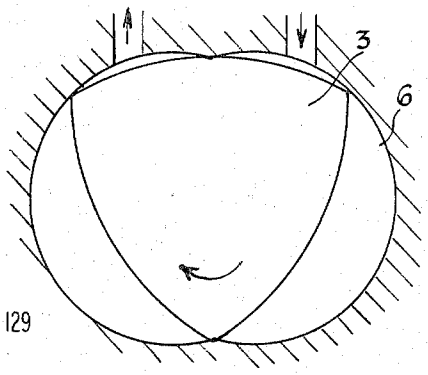


FIG. 8



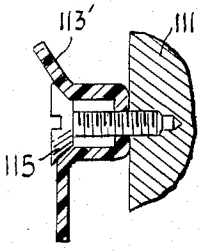


FIG 7

FIG. 6

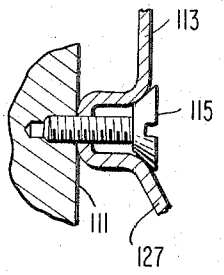
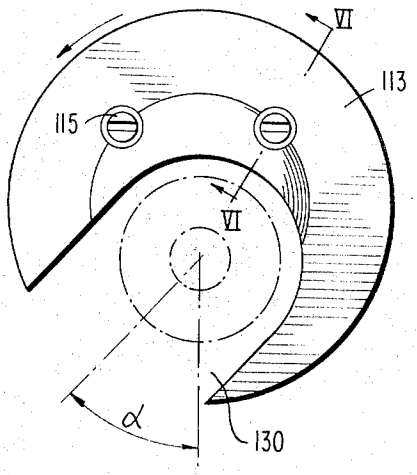


FIG. 4



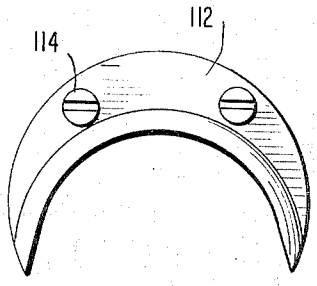


FIG. 5

OIL SHIELD ARRANGEMENT FOR ROTARY PISTON ENGINE

The present invention relates to a rotary piston internal combustion engine, especially of trochoidal construction with a housing casing and two lateral housing parts, with a piston that is rotatingly arranged relative to an eccentric shaft and to the housing on the eccentric of the eccentric shaft, with engine spaces provided within the area of the piston hub on both sides thereof which are sealed by oil seals in the radially outward direction, further with means operable to conduct oil out of that engine space, in which is arranged a gearing for the control of the piston rotation including a ring gear fast at the piston, through the piston into the oppositely disposed engine space and from there in the direction toward the lateral housing part, and with a shielding member arranged between the ring gear and the abutment surface thereof at the piston and projecting into the engine space against oil splashing out of the bearing of the piston onto the eccentric.

The present invention is concerned with the task to further improve the relief of the oil seal realized by the arrangement of a shielding plate in the engine space provided with the ring gear. Additionally, the present invention is concerned with taking measures in the opposite engine space which prevent that the oil splashing out of the bearings reaches the walls of the lateral parts and from there the oil seals.

The underlying problems are solved according to the present invention in that a shielding member in the form of a plate is also provided in the engine space not containing the ring gear, which is secured at the end face of the eccentric and projects with a part slightly offset in the axial direction over the bearing of the piston on the eccentric, and additionally, in that both shielding plate members are secured at the respective end faces of the eccentric with a spacing and are so constructed that they intercept the oil discharged out of the piston bearing as also out of the eccentric shaft bearings and conduct the same into the piston. By the arrangement of such a shielding member, the oil splashing nearly axially out of the bearing of the piston is prevented from wetting the oppositely disposed lateral disk of the internal combustion engine housing. The oil seal is thus effectively relieved. The intercepting and collecting effect of the shielding plate is particularly good because it rotates together with the eccentric of the eccentric shaft and thus with the customary construction of the internal combustion engine has three times the rotational speed of the piston.

In order to enable an easy assembly of the shielding plate, an assembly slot is provided according to a further feature of the present invention with a width corresponding to the diameter of the eccentric shaft, which is open opposite the direction of the eccentric. The assembly slot does not impair in any manner the intercepting and collecting action at this place because the lateral disk is sealed off at this place by the oil seal.

The arrangement of the shielding member in the engine spaces according to the present invention brings about such a favorable directional guidance of the oil that oil discharged out of the bearings does not splash against the lateral housing parts nor wets the oil seals, i.e., that the oil seals are no longer exposed to any loads. As a result thereof, oil seals can be used which can be constructed in a very simple manner and which are very inexpensive in manufacture.

In a preferred embodiment according to the present invention, an outer portion of the shielding member provided in the engine space may be arranged parallel to the end face of the eccentric at the height of the piston bearing and an inner poriton of the shielding member may be slightly offset in the axial direction toward the lateral part in such a manner that the shielding member nearly completely fills out the free space disposed between the piston and the fixed bearing.

In order to be able to conduct the oil reaching the piston into the lateral part, it is additionally proposed according to the present invention to provide the shielding member with an aperture which is arranged offset by a predetermined angle opposite the direction of the piston toward the side opposite the eccentric.

The aperture can be so dimensioned in its size according to the present invention that the width of this aperture corresponds to the diameter of the eccentric shaft in order to permit to assemble also the shielding member during the assembly of the housing parts to be connected with each other.

In an advantageous construction of the present invention, the shielding member secured in the engine space, disposed on the ring gear side, may be constructed sickle-shaped and may be so arranged that its free inner diameter lies by a slight amount above the pinion and its free outer diameter lies between the ring gear and the piston hub.

Accordingly, it is an object of the present invention to provide a rotary piston internal combustion engine which avoids by simple means the aforementioned shortcomings and drawbacks encountered in the prior art.

Another object of the present invention resides in a rotary piston internal combustion engine of trochoidal construction in which the oil seals are far-reachingly relieved.

A further object of the present invention resides in a plate-like shielding member for a rotary piston internal combustion engine of trochoidal construction which prevents oil splashing out of the bearing of the piston from reaching the opposite lateral housing disk of the internal combustion engine.

A still further object of the present invention resides in a rotary piston internal combustion engine of the type described above which not only further improves considerably the catching action of the shielding member but also permits an easy assembly and installation of the parts.

Another object of the present invention resides in a rotary piston internal combustion engine of trochoidal construction in which the oil seals can be constructed relatively simply and their cost of manufacture can be kept relatively low.

These and other objects, features, and advantages of the present invention will become more apparent from the following description when taken in connection with the accompanying drawing which shows, for purposes of illustration only, two embodiments in accordance with the present invention, and wherein:

FIG. 1 is a partial somewhat schematic, longitudinal cross-sectional view through a rotary piston internal combustion engine of trochoidal construction in accordance with the present invention;

FIG. 2 is an elevational view on the eccentric shaft with a shielding member in accordance with the present invention;

FIG. 3 is a partial, somewhat schematic, longitudinal cross-sectional view through a modified embodiment of a rotary piston internal combustion engine in accordance with the present invention;

FIG. 4 is an elevational view on a shielding member on the side opposite the side with the ring gear as used in the rotary piston internal combustion engine of FIG. 3;

FIG. 5 is an elevational view on a shielding member on the side of the ring gear as used in the rotary piston internal combustion engine of FIG. 3;

FIG. 6 is a partial cross-sectional view, on an enlarged scale, illustrating certain details of the fastening of the shielding members in accordance with the present invention;

FIG. 7 is a partial cross-sectional view, on an enlarged scale, similar to FIG. 6 but showing a modified shielding member in accordance with the present invention; and

FIG. 8 is a schematic view showing the overall arrangement of the rotary piston and casing of the engine of the present invention

Referring now to the drawing wherein like reference numerals are used throughout the various views to designate like parts, and more particularly to FIGS. 1 and 2, reference numeral 1 designates in these figures an eccentric of an eccentric shaft 2. A piston 3 which is supported on the eccentric 1 of the eccentric shaft 2 is caused to rotate relative to the eccentric shaft 2 and to the housing consisting of the lateral housing parts 5 and of the casing 6, by means of a control gearing consisting of a hollow or ring gear 4 and of a pinion (not shown) meshing with the ring gear as is known in the art.

The hollow or ring gear 4 is secured at one side of the piston 3 and is arranged in the engine space 7 which is sealed in the radial direction toward the outside by the oil seal 8.

The piston 3 is so constructed that oil is conducted through the same out of the engine space 7 into the opposite engine space 9, from which it is conducted off through an aperture 10 within the area of the bearing 11 for the eccentric shaft 2.

In order that neither the oil seal 8 in the engine space 7 nor the corresponding oil seal 8 in the engine space 9 is loaded by oil, which sprays or splashes out of the bearing of the piston 3 on the eccentric 1 in the axial direction against the lateral housing parts 5, plate-like shielding members 12 and 13 are provided according to the present invention.

The shielding member 12 is constructed ring-shaped and is arranged between the ring gear 4 and the piston 3. The free, inner diameter of the shielding member 12 is larger by a small amount than the diameter of the eccentric 1.

The shielding member 13 is arranged in the engine space 9 and, as can be seen particularly well from FIG. 2, is secured at the end wall 15 of the eccentric 1 by means of screws 14. The shielding member 13 projects with a portion 16 thereof slightly offset in the axial direction in the radial direction over the bearing support of the piston 3 on the eccentric 2 so that oil is centrifuged out of this bearing in the direction of arrow 17 and cannot reach the lateral part 15.

In order to enable easy assembly of the deflection member 13, the latter is provided with an assembly slot 18 (FIG. 2) whose width is slightly larger than the diameter of the eccentric shaft 2. The assembly slot 18 is open opposite the direction of the eccentric 1. At this place, it does not impair the collecting action because at this location, as shown in FIG. 1, the lateral disk 5 is covered off by the oil seal 8.

Referring now to FIGS. 3–6, and more particularly to FIG. 3, a piston 101 of a rotary piston internal combustion engine generally designated by reference numeral 102 is supported on an eccentric 103 of an eccentric shaft 104; the piston 101 rotates relative to the housing consisting of the lateral housing parts 107 and 108 and of the housing casing part 109 by means of a gear formed by the hollow or ring gear 105 and the pinion 106.

Shielding members 112 and 113 are secured by means of screws 114 and 115 at both end faces 110 and 111 of the eccentric 103 with a certain spacing, which shielding members 112, 113 are so constructed that both the spraying and splashing oil leaving the eccentric shaft bearing 116, 117 and the piston bearing 118, whose direction is indicated by the arrows 119 and 120 is intercepted and conducted off into the piston 101, from where it rotates and in a corresponding piston position is conducted off into the lateral disk 108 (direction of arrow 122).

The lateral parts 107 and 108 to be protected against spraying out and splashing out oil are completely covered off by the arrangement of the shielding members 112 and 113, which means that the oils seals 123 and 124 which seal off the engine spaces 125 and 126 in the radial direction toward the outside are relieved from splashing oil and accumulated static oil.

The shielding member 113 secured in the engine space 126 at the end surface 111 of the eccentric 103 includes a radially inner portion 127 and a radially outer portion 128 whereby the outer portion 128 is arranged parallel to the end face of the eccentric 103 and has a free diameter which is slightly smaller than the inner diameter of the piston 101 while the inner portion 127 is slightly offset in the axial direction toward the lateral part 108 and extends with its free inner diameter nearly up to the fixed bearings 129.

In order to be able to assure a trouble-free oil ejection from the interior space of the piston 101 toward the lateral part 108, the shielding member 113 may be provided with an aperture 130 which is arranged offset by an angle α toward the side opposite the eccentric 103 (FIG. 4). The angle α is so selected in its magnitude that, on the one hand, a collision of the ejected oil with the shielding member 113 rotating at the eccentric shaft rotational speed is precluded and that, on the other, an assembly of the shielding body on the eccentric shaft is possible.

The shielding member 112 mounted on the ring gear side is constructed sickle-shaped according to FIG. 5. In its inner diameter, it is slightly larger than the pinion 106 and in its outer diameter it is slightly smaller than the ring gear 105 —as can be readily seen from FIG. 3. The shielding member 112 is so offset in the axial direction that the free inner diameter lies above the teeth of the pinion 106. The construction of this shielding member 112 makes it possible that all of the oil from the eccentric shaft bearing 116 and 117 and from the piston bearing 118 is caught and is conducted through apertures 132 arranged between the ring gear 105 and the piston hub 131 into the piston 101. Within the open area of the sickle-shaped shielding member 112, the

lateral part **107** is covered off by the engaging teeth of the ring gear and of the pinion or by the piston **101** itself, which means that the lateral part **107** and thus also the oil seal **123** is protected against spraying oil.

The significant advantage of the arrangement of the shielding members **112** and **113** according to the present invention resides in that as a result of the conduction of the oil into the piston **101** and from there into the lateral part **108,** an optimum oil tightness is assured between the piston **101** and the lateral parts **107** and **108.**

The shielding members of the present invention such as the shielding members **13, 113** and **112** may be made of sheet metal or of synthetic plastic material, for example, of synthetic resinous material of any appropriate, known type.

FIG. **6** illustrates how the shielding member **113** is secured at the end face **111** and spaced therefrom by means of screws **115** with the use of pressed-out portions or embossments provided in the shielding member **113** within the area of the bores for the fastening screws **115.** A similar arrangement may also be used, of course, for the shielding member **112.**

FIG. **7** is a view showing similar features as in FIG. **6** except that a modified shielding member **113'** of synthetic resinous material is depicted in FIG. **7** while FIG. **6** depicted a shielding member **113** of sheet metal.

FIG. **8** is a schematic view showing the troichoidal construction of the casing and rotary piston of the engine illustrated in FIG. **1,** it being understood that the engine of FIG. **3** has a similar overall configuration of the piston and casing shape.

While I have shown and described several embodiments in accordance with the present invention, it is understood that the same is not limited thereto, but is susceptible of numerous changes and modifications as known to those skilled in the art, and I therefore do not wish to be limited to the details shown and described herein, but intend to cover all such changes and modifications as are encompassed by the scope of the appended claims.

What I claim is:

1. Rotary piston internal combustion engine comprising housing means including lateral housing parts, piston means rotatingly arranged relative to the housing means on an eccentric of an eccentric shaft, engine spaces provided at both sides within the area of the piston hub which are sealed off by oil seal means in the radially outward direction, one of said engine spaces including gear means for the control of the piston rotation with a hollow gear secured at the piston means, means for conducting oil out of said one engine space through the piston into the opposite engine space and from there in the direction of the lateral housing part, and shielding means projecting into said one engine space and arranged between the hollow gear and an abutment surface at the piston to shield against oil spraying out of bearing means of the piston means on the eccentric, characterized in that a further shielding means is provided in said opposite engine space not equipped with the hollow gear, which is secured at the end face of the eccentric and which projects with a portion therof that has a spacing with respect to the end face of the eccentric in the axial direction, over the bearing means of the piston means on the eccentric and characterized in that the further shielding means is provided with an assembly slot having a width substantially corresponding to the diameter of the eccentric shaft and being open opposite the direction of the eccentric.

2. A rotary piston internal combustion engine according to claim **1,** characterized in that the engine is of trochoidal construction.

3. An internal combustion engine according to claim **1,** characterized in that the further shielding means abuts at the end face of the eccentric and in that the portion projecting over the bearing means of the piston means on the eccentric is offset.

4. An internal combustion engine according to claim **1,** characterized in that an outer portion of the further shielding means is arranged parallel to the end face of the eccentric at the height of the piston bearing means and that an inner portion of the same shielding means is slightly offset in the axial direction toward the lateral part.

5. An internal combustion engine according to claim **1,** characterized in that the assembly slot is arranged toward the side opposite the eccentric offset opposite the direction of rotation of the piston by a predetermined angle.

6. An internal combustion engine according to claim **1,** characterized in that the hollow gear is a ring gear meshing with a pinion.

7. An internal combustion engine according to claim **6,** characterized in that the further shielding means abuts at the end face of the eccentric and in that the portion projecting over the bearing means of the piston means on the eccentric is offset.

8. An internal combustion engine according to claim **1,** characterized in that the further shielding means is secured with a spacing at the end face of the eccentric and includes means for catching oil discharged out of both the piston bearing means and the eccentric shaft bearing means and means for conducting the oil into the piston means.

9. An internal combustion engine according to claim **8,** characterized in that the spacing of the further shielding means from the end face of the eccentric is assured by pressed-out portions provided therein within the area of bores for fastening screws.

10. An internal combustion engine according to claim **8,** characterized in that the first-mentioned shielding means is secured with a spacing at the respective end face of the eccentric.

11. An internal combustion engine according to claim **10,** characterized in that the first-mentioned shielding means is constructed sickle-shaped and is so arranged that it free inner diameter lies by a slight amount over the pinion and its free outer diameter lies between the hollow gear and the piston hub.

12. An internal combustion engine according to claim **1,** characterized in that both shielding means are made of sheet metal.

13. An internal combustion engine according to claim **1,** characterized in that both shielding means are made of synthetic plastic material.

14. An internal combustion engine according to claim **8,** characterized in that the first-mentioned shielding means is constructed sickle-shaped and is so arranged that its free inner diameter lies by a slight amount over the pinion and its free outer diameter lies between the hollow gear and the piston hub.

15. An internal combustion engine according to claim **8,** characterized in that the assembly slot is ar-

ranged toward the side opposite the eccentric offset opposite the direction of rotation of the piston by a predetermined angle.

16. An internal combustion engine according to claim **8,** characterized in that an outer portion of the further shielding means is arranged parallel to the end face of the eccentric at the height of the piston bearing means and that an inner portion of the same shielding means is slightly offset in the axial direction toward the lateral part.

17. An internal combustion engine according to claim **16,** characterized in that the assembly slot is arranged toward the side opposite the eccentric offset opposite the direction of rotation of the piston by a predetermined angle.

18. An internal combustion engine according to claim **16,** characterized in that the spacing of the further shielding means from the end face of the eccentric is assured by pressed out portions provided therein within the area of bores for fastening screws.

19. An internal combustion engine according to claim **18,** characterized in that also the first-mentioned shielding means is secured with a spacing at the respective end face of the eccentric.

20. An internal combustion engine according to claim **19,** characterized in that the first-mentioned shielding means is constructed sickle-shaped and is so arranged that its free inner diameter lies by a slight amount over the pinion and its free outer diameter lies between the hollow gear and the piston hub.

21. An internal combustion engine according to claim **20,** characterized in that both shielding means are made of sheet metal.

22. An internal combustion engine according to claim **20,** characterized in that both shielding means are made of synthetic plastic material.

23. A rotary piston internal combustion engine according to claim **20,** characterized in that the engine is of trochoidal construction.

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