

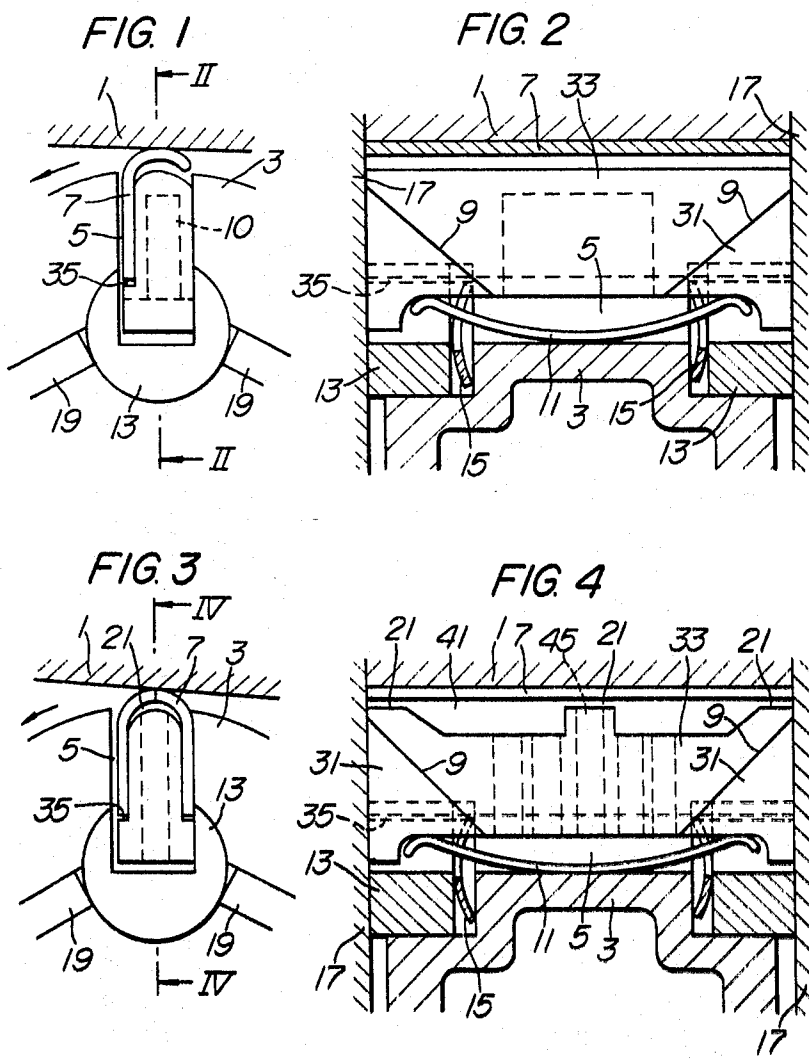
Nov. 22, 1966

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3,286,912

GAS-TIGHT SEALING DEVICE FOR ROTARY PISTON ENGINES

Filed March 2, 1966



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GAS-TIGHT SEALING DEVICE FOR ROTARY PISTON ENGINES

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Filed Mar. 2, 1966, Ser. No. 531,251

Claims priority, application Japan, Mar. 11, 1965,

40/18,652

1 Claim. (Cl. 230—145)

The present invention relates to a rotary piston engine having a casing consisting of a central housing and side housings disposed on opposite sides thereof, a rotary shaft extending through the center of the central housing, and a rotary piston of multi-cornered structure rotatably supported on an eccentric portion of the rotary shaft, and more particularly to a device for sealing gastight the angular portions or corners of the rotary piston in its axial direction.

In the rotary piston engine of the type described, spaces defined by the rotary piston and the inside face of the casing, that is, the inside faces of the central housing and the side housings form the operating chambers in which suction, compression, expansion and exhaust strokes are repeated as the rotary piston rotates. The above-described gastight sealing device comprises an axial groove provided at each corner of the rotary piston and an apex sealing means provided in each groove. The apex sealing means acts to separate the adjacent operating chambers from each other and to maintain a gastight seal between the adjacent operating chambers by being pressed against the inside face of the central housing by the pressure exerted on its bottom face from the operating chamber at higher pressure.

During operation of the rotary piston engine, impact is generated between the apex sealing means and the central housing due to machining errors and thermal deformation of the central housing and the sealing means, and static as well as dynamic variations and errors in the power transmission means for the rotary piston supporting the sealing means. This impact causes vibration, which in association with the sliding movement of the sealing means causes a periodic change in the contact pressure between the faces, and a resultant periodic change in the wear of the inside face of the central housing causes the so-called wavy wear of the inside face of the housing which is in sliding contact with the sealing means.

The primary object of the present invention is to provide an improvement in the sealing device of the type having an apex sealing means composed of an apex sealing member of thin-walled structure in order to relieve the impact as described above and a support block for the apex sealing member. According to the invention, the support block supporting the apex sealing member is split into three sections in order to minimize gas leakage that may take place through a gap between the inside faces of the side housings and the axial side faces of the apex sealing means when the engine is operating at low speed or when the axial side faces of the apex sealing means are caused to wear after operation over a long period of time. The sealing device of the invention is so arranged that the apex sealing member is supported solely by the central support block while the side blocks on opposite sides of the central block contact the latter with their slant faces and are urged radially outwardly by a spring disposed in the bottom of the above-described axial groove so that the side blocks can be urged axially outwardly by the reaction force caused by the above-described slant faces to completely seal the gap between the sealing means and the inside faces of the side housings. In this manner, the sealing action by the apex

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sealing means at its axial side faces can be completely effected and thus any lowering of engine output due to gas leakage can be prevented. In other words, the important feature of the present invention resides in that the apex sealing function (for peripheral sealing) and the side sealing function (for axial sealing) of the apex sealing means are shared by the apex sealing members and the side blocks respectively, and thus the block divided into three sections by the slant faces can attain the respective sealing functions.

It is needless to say as described above that, during operation of the engine, gas pressure from the operating chamber at higher pressure is exerted on the bottom faces of the blocks in addition to the force exerted by the above-described spring.

Preferred embodiments of the present invention will hereunder be described with reference to the accompanying drawings in which:

FIG. 1 is a front elevational view of a corner portion of a rotary piston of a rotary piston engine, illustrating an embodiment of the apex sealing means according to the present invention;

FIG. 2 is a section taken on line II—II in FIG. 1;

FIG. 3 is a view similar to FIG. 1, but illustrating another embodiment of the invention; and

FIG. 4 is a section taken on the line IV—IV in FIG. 3.

FIGS. 1 and 2 illustrate one embodiment according to the invention. In FIG. 1, a groove 5 is provided in an angular or corner portion of a rotary piston 3 rotating in a direction of arrow within a central housing 1. The groove extends in the axial direction of the rotary piston 3 and contains therein an apex sealing member 7 and a support block. The support block is axially split into three sub-blocks, that is side sub-blocks 31 and a central sub-block 33 at slant faces 9 as shown in FIG. 2. The side sub-blocks 31 are urged by an apex sealing spring 11 so as to be pressed against the central sub-block 31 from below and at the same time to be urged sideways to make pressure contact with side housings 17 to effect the side sealing action.

Corner sealing members 13 and side sealing members 19 are provided on opposite sides of the rotary piston 3 to effect gastight sealing between the rotary piston 3 and the side housings 17. Reference numeral 15 designates a corner sealing spring which urges each corner sealing member 13 towards the side housing 17.

The apex sealing member 7 is supported by the central support sub-block 33 by being brought into contact at its top portion with a cut-out portion of the central sub-block 33. The apex sealing spring 11 disposed between the bottom of the support block assembly and the axial groove 5 of the rotary piston 3 urges the side support sub-blocks 31 radially outwardly, so that the side sub-blocks 31 support the central support sub-block 33 thereon and at the same time urge the apex sealing member 7 through the central support sub-block 33 onto the inside face of the central housing 1 for sliding contact therewith. A space 35 is provided between the bottom of the cut-out of each side sub-block 31 and the lower end of the apex sealing member 7, lest the side sub-blocks 31 should directly contact the apex sealing member 7 to urge the latter radially outwardly. A cavity 10 having an open lower end is provided in the central support sub-block 33 as a common technical means of reducing the weight of the block and for thereby minimizing the force of impact.

Another embodiment of the invention will next be described with reference to FIGS. 3 and 4.

The sealing means in this embodiment is provided with an apex sealing member 7 which is composed of two sections of line symmetry. The apex sealing member 7 has an arcuate top end and is fitted in an axial groove 5 in the rotary piston 3 and in an inverted U-shape by being

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brought into contact at its root portions with cut-out portions of a central support sub-block 33 and by being supported thereby. The apex sealing member 7 may be formed as a unitary body of inverted U-shape.

The upper end of the central support sub-block 33 is slightly spaced by a gap 31 from the apex sealing member 7 of thin-walled structure. The gap 21 is such that the apex sealing member 7 may not abut the central sub-block 33 even when it is deflected due to impact. It will be understood that this gap 21 serves to sufficiently maintain the shock absorbing action and to prevent gas leakage by virtue of its labyrinth effect. A plurality of axial recesses 41 are provided at the upper end of the central support sub-block 33, and a communication passage 45 extends through the central sub-block 33 in the radial direction of the rotary piston 3 in order to balance gas pressures in the spaces above the upper end of the apex sealing member 7. This is in order to prevent blow-through of gas which may be caused by deformation of the apex sealing member 7 due to gas pressure at the upper end of the central sub-block 33. Near opposite axial ends of the groove 5, side sub-blocks 31 are disposed in a manner to be freely axially movable between the apex sealing member 7 and the groove 5. Any further explanation will be omitted since this embodiment is similar to the previous embodiment except for the points described above.

In a conventional apex sealing means having a support block of unitary structure, side gaps are progressively enlarged to cause increased gas leakage therethrough as the support block gradually wears in its axial direction. In the inventive apex sealing means, however, the side support sub-blocks are always urged into intimate contact with the inside faces of the side housings by the action of the apex sealing spring and the slant faces as described above and act to take the greater portion of the gastight sealing action of the apex sealing means in its axial direction, with the result that any wear that may take place in the side sub-blocks does not bring forth an increase in the side gaps. Therefore, the inventive apex sealing means shows an improved gastight sealing action during

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operation of the engine at low speed and after operation of the engine over a long period of time compared with that of conventional apex sealing means having a support block of unitary structure.

What is claimed is:

A gastight sealing device for a rotary piston engine of the type having a casing consisting of a central housing and side housings disposed on opposite sides thereof, a rotary shaft extending through the center of said central housing, and a rotary piston of multicornered structure rotatably supported on an eccentric portion of said rotary shaft, for the purpose of sealing gastight the corner portions of said rotary piston in its axial direction, said device comprising apex sealing means including an axial groove provided in the corner portion of said rotary piston, an apex sealing member of thin-walled structure disposed in said groove and having a suitably curved top end, a support block for supporting said apex sealing member in said groove, said support block being axially split into three sections to form a central sub-block and side sub-blocks, on opposite sides of said central sub-block which contact with each other at their slant faces, said central sub-block supporting said apex sealing member thereon, and a spring disposed at the bottom of said groove for urging the lower ends of said side sub-blocks radially outwardly of said rotary piston.

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