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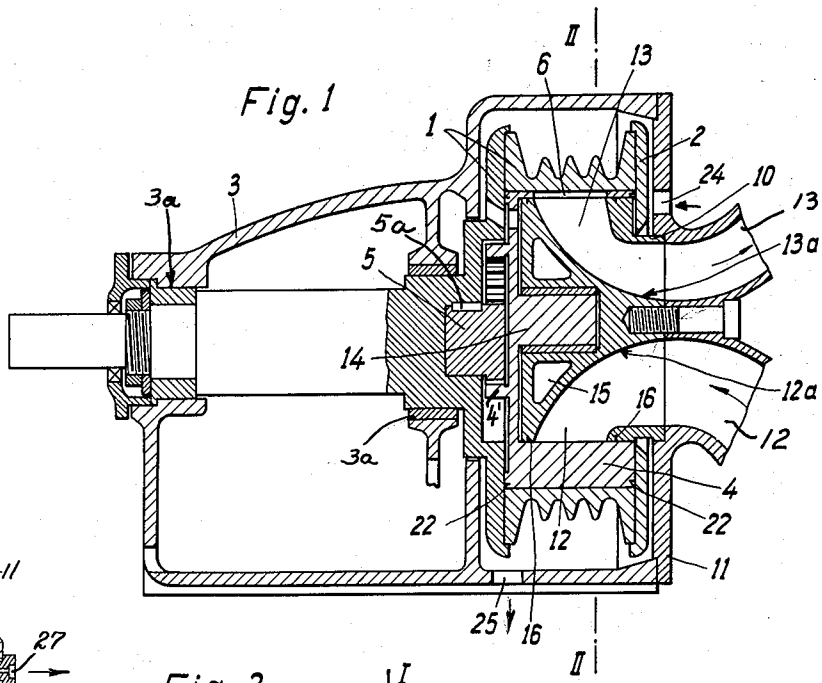
ROTARY PISTON ENGINE

Filed Jan. 28, 1960

Fig. 1



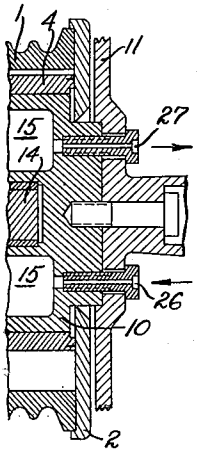
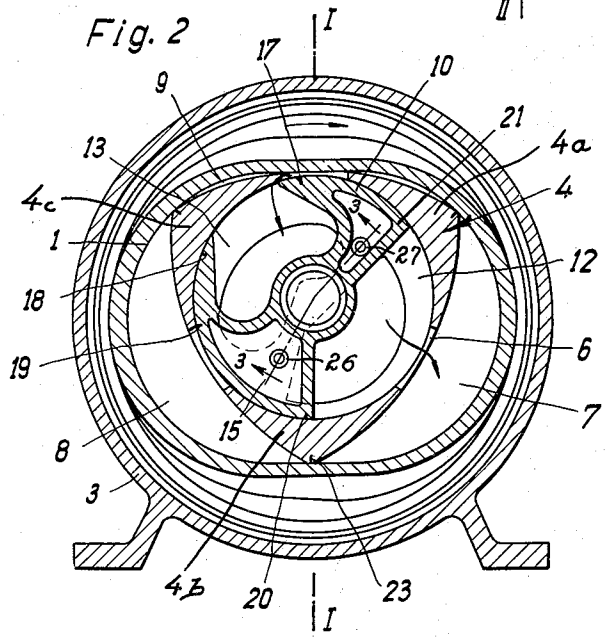


Fig.3

Fig. 2



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ROTARY PISTON ENGINE

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The present invention relates to rotary piston engines and, more specifically, concerns a rotary piston engine which comprises rotary pistons eccentrically mounted within each other and provided with teeth.

There are generally two kinds of rotary piston engines of the above mentioned type, namely a first type with closed outer rotary pistons, and a second type with open outer rotary pistons. With the first mentioned or closed type, the outer rotary piston completely surrounds the inner rotary piston and is journalled at both sides of the cylinder chamber. In contrast thereto, with the second or open type, the outer rotary piston does not completely surround the inner rotary piston and is journalled unilaterally, i.e., it is journalled in overhung position.

Frequently, also one end wall is omitted. With the engines of the open type without end wall, the working fluid passes in and out through the housing lid at one end face which lid closes the cylinder chamber. The inlet and outlet passages may in this instance be designed relatively large. This type, however, has the drawback that, when high speed engines are involved, it cannot properly be sealed by sealing elements, due to the high sliding speeds. On the other hand, in view of the high pressure conditions, it is indispensable to obtain a proper sealing by contact seals in order to obtain a satisfactory degree of efficiency.

With engines having a closed outer runner, the employment of such seals does not cause any difficulty. This closed runner type of rotary piston engines has, however, the drawback that it is rather complicated and difficult to assemble and disassemble.

It is, therefore, an object of the present invention to provide a rotary piston engine with rotary pistons arranged within each other, which will overcome the above mentioned drawbacks.

It is another object of this invention to provide a rotary piston engine having the rotary pistons arranged within each other, which, while being provided with large inlet and outlet openings, will nevertheless be simple in construction and will be easy to seal.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawing, in which:

FIG. 1 illustrates a longitudinal section through a rotary piston engine according to the invention, said section being taken along the line I—I of FIG. 2.

FIG. 2 is a section taken along the line II—II of FIG. 1.

FIGURE 3 is a section taken along line 3—3 of FIGURE 2.

General Arrangement

In view of the fact that large inlet and outlet openings are desired, it is advisable to employ a rotary piston engine with an open and unilaterally journalled outer rotary piston while the open side of said piston is closed by a cover, disc or the like. In conformity with the present invention, with a rotary piston engine of the above mentioned type, an insert member is arranged within the inner rotary piston and fills the entire inner space of said inner rotary piston while being fixedly connected with the housing cover by any standard connecting elements.

The inlet and outlet passages are arranged in the said insert member in such a way that the total mantle or peripheral surface of said insert member and also its entire end surface with the exception of the space required for the connecting elements will be available for said inlet and outlet passages. In this way, the passages are not impeded by the means for journalling the rotary piston shaft or other members.

According to the present invention, sliding sealing elements of any standard type may be mounted in the insert member without affecting the dimensions of the passages in a limiting manner. These sealing elements will be exposed to relatively low sliding speeds only inasmuch as they are located within the interior of the rotary piston.

Inasmuch as the inlet and outlet pasages and also the bearing for the inner rotary piston are mounted in one and the same member, it is advisable, particularly if said passages and said bearing are not or should not be separated from each other by hollow chambers interrupting the flow of heat, to coat the walls of said passages with an insulating lacquer as for instance an oven drying oil-base lacquer adapted to dam up the heat flow.

Structural Arrangement

Referring now to the drawing in detail, the rotary piston engine shown therein comprises an outer rotary piston **1** with two teeth which is unilaterally journalled in the housing 3 at 3*a*. The open end face of said rotary piston **1** has connected thereto a cover or disc **2**. The outer rotary piston **1** extends around an eccentrically journalled inner rotary piston **4** with three teeth **4***a*, **4***b*, **4***c*, said inner rotary piston **4** is provided with an inner gear ring **4'** meshing with a pinion **5** which is keyed by a key **5***a* to the outer rotary piston **1** so that the inner rotary piston **4** is rotated by the outer rotary piston **1** in the same direction. The peripheral portion or mantle of the inner rotary piston **4** is provided with cutouts or openings **6** through which the working fluid passes into and out of the working chambers **7**, **8**, and **9**. In the position shown in the drawing, the increasing working chamber **7** communicates with the suction line **12**. A compression will be effected in the decreasing working chamber **8**, and the working chamber **9** has just reached its smallest volume and is about to move away from the pressure passage **13**.

Within the inner rotary piston **4** there is arranged an insert member **10** which is fixedly connected to the housing lid **11**. The working fluid is introduced and discharged through the curved side passages **12** and **13** of the insert member **10**.

Inasmuch as the passages have to be curved for fluid technical reasons, there will remain an unused space in the insert member which may be used for cooling purposes. This insert member is advantageously in conformity with the present invention employed for journalling the inner rotary piston by means of a stud extending into the central portion of the insert member **10**. More specifically, the inner rotary piston **4** is by means of a stud **14** which may be integral with or otherwise connected to the inner rotary piston **4**, concentrically journalled in the insert member **10**. The passages **12** and **13** and the bearing for the rotary piston **4** are separated from each other by a hollow chamber **15** which may be passed through by a cooling fluid. Hollow bolts **26** and **27** may be employed to supply fluid to chamber **15** and withdraw it therefrom as will be seen in FIGURE 3. Furthermore, the walls **12***a* and **13***a* of the inlet and outlet passages may be coated with a protective lacquer having heat insulating properties.

The peripheral or mantle surface of the insert member **10** has mounted therein strip-like sealing members **16**, **17**, **18**, **19**, **20** and **21**. Those strip-like sealing members **16** which extend parallel to the edges of the end faces of the

insert member 10 prevent leakage gases from escaping from the pressure passage 13 into the adjacent working chambers, while the sealing members 20 and 21 prevent the working fluid from passing from the working chambers 8 and 9 into the suction chamber 12.

Inasmuch as that peripheral section of the insert member 10 which is limited by the sealing members 18 and 20 exceeds in length that wall portion of the inner rotary piston 4 which is located between two cutouts 6, a further sealing member 20 is provided for preventing the working fluid from flowing from one working chamber into the adjacent working chamber or into the suction passage 12. The elements 18 and 19 become effective only when the rotary piston has moved on in clockwise direction beyond the position shown in the drawing.

Furthermore, sealing members 22 are arranged at the end faces of the inner rotary piston 4, while sealing members 23 are arranged in the tooth tips. The elements 22 prevent leakage gases from escaping from the working chambers into the atmosphere, whereas the elements 23 prevent a flowing over of leakage gases from one working chamber into the adjacent working chamber.

Rotary piston engines in which the flowing out and flowing in of the working fluid is effected through the inner rotary piston from the inside and into the inside can be cooled in a simple manner by making use of the centrifuging effect of the outer rotary piston. To this end, a gaseous venting fluid is passed through one or a plurality of openings in the housing lid to the end face of the outer rotary piston and is centrifuged by said end face radially outwards. The venting or cooling fluid flows around and cools the outer rotary piston and leaves the engine through an opening in the housing mantle or periphery. For purposes of improving the centrifuging effect and for increasing the cooling effect, the end face of the outer rotary piston may be provided with blades.

More specifically, the housing 3 and lid 11 are provided with openings 24 and 25 for introducing and discharging a cooling means. The cooling means enters through opening 24 into the housing 3, is caught by lid 2 of the outer rotary piston 1 and is centrifuged toward the outer periphery of the outer rotary piston 2 so as to pass around the outer rotary piston and leaving the housing through opening 25.

If desired, the rotary piston engine according to the present invention may be provided with cylindrical control means interposed between the inner rotary piston and the insert member. Furthermore, the rotary piston engine according to the present invention may be employed as prime mover and also as a motor.

It is, of course, to be understood that the present invention is, by no means, limited to the particular construction shown in the drawing but also comprises any modifications within the scope of the appended claims.

What I claim is:

1. In a rotary piston engine: a housing, an outer rotary piston having a shaft fixed thereto and unilaterally journalled in one side of said housing, a hollow inner rotary piston rotatable within said outer rotary piston and having a substantially cylindrical inner wall, said inner rotary piston having an integral stud of substantial length extending into the cavity of the inner piston on the axis of the cavity in the inner rotary piston, gear means interposed between and drivingly interconnecting said inner rotary piston and said shaft for rotating said pistons relative to each other, said inner and outer rotary pistons being eccentrically arranged with regard to each other and being equipped with cooperating teeth on the outside of the inner piston and on the inside of the outer piston, which teeth confine chambers with each other varying as to volume during the movement of said pistons relative to each other, and an insert member having one end fixedly connected to the side of said housing opposite the said one side of said housing and extending into said inner rotary piston and rotatably receiving substantially the full length of said stud, said insert member engaging substantially the entire length of said inner wall of said inner rotary piston, said insert member being provided with inlet and outlet passage means leading from the periphery thereof to the said one end thereof for admitting working fluid to and discharging working fluid from the engine, said inner rotary piston being provided with ports located between the respective teeth thereof adapted to communicate with and to be closed off from said inlet and outlet passage means in response to the respective relative position of said inner rotary piston with regard to said insert member.

2. A rotary piston engine according to claim 1, in which first sealing means is provided arranged in the peripheral portion of said insert member on opposite sides of the said ports therein and extending in planes substantially parallel to the end faces of said inner rotary piston and engaging the said cylindrical bore on the inside of said inner rotary piston, and second sealing means also arranged in the peripheral portion of said inert member and extending substantially axially thereof and sealingly engaging the said cylindrical bore of said inner rotary piston and separating the inlet and outlet passage means in said insert member from each other for preventing gas flow from a region of higher pressure into a region of lower pressure.

3. A rotary piston engine according to claim 12 in which sealing means is arranged in the outer periphery of the said insert member adjacent the ends of said inner rotary piston and extending in planes substantially parallel to the end faces of said inner rotary piston and engaging the cylindrical wall of said inner rotary piston, and additional sealing means arranged in the tooth tip regions of the inner rotary piston and extending axially of the inner rotary piston and sealingly engaging the outer rotary piston.

4. A rotary piston engine according to claim 3 in which the said inner rotary piston also includes sealing means arranged in the end walls thereof and extending circumferentially about the inner rotary piston and sealingly engaging the outer rotary piston.

5. In a rotary piston engine: a housing, an outer rotary piston having a shaft unilaterally journalled in said housing, an inner rotary piston rotatably journalled within said outer rotary piston and having a substantially cylindrical inner wall, said inner rotary piston having a stud coaxially arranged therewith, gear means interposed between and drivingly interconnecting said inner rotary piston and said shaft for rotating said pistons relative to each other, said inner and outer rotary pistons being eccentrically arranged with regard to each other and being equipped with cooperating teeth confining chambers with each other varying as to volume during the movement of said pistons relative to each other, an insert member fixedly connected to said housing and rotatably receiving said stud, said insert member engaging said inner wall of said inner rotary piston and being provided with inlet and outlet passage means extending therethrough for admitting and discharging working fluid therefrom and terminating in circumferentially spaced ports at the peripheral surface of the insert member which engages the inner wall of said inner rotary piston, said inner rotary piston being provided with circumferentially spaced ports corresponding in number to the number of teeth on the inner rotary piston and adapted to communicate with and be closed off from said inlet and outlet passage means in response to the respective relative rotated position of said inner rotary piston with regard to said insert member, and additional passage means arranged in said insert member between said inlet and outlet passage means adapted for connection with a source of cooling fluid.

6. A rotary engine according to claim 5, in which the insert member for the working medium comprises gradually curved feeding and discharge passage of large cross section, while the entire wall surface and also the entire

front end face surface of the insert member with the exception of the space required for the connecting elements is available for the openings of the passage.

7. A rotary piston engine according to claim 5, which includes strip-like sealing means arranged in the periphery of and adjacent the end faces of said inner rotary piston and extending in planes subsantially parallel to said end faces of said inner rotary piston, said rotary piston engine also including additional sealing means axially arranged in the tooth tip area of one of said rotary pistons and sealingly engaging the other one of said pistons.

8. In a rotary piston engine: a housing, an outer rotary piston having a shaft unilaterally journalled in said housing, an inner rotary piston rotatably journalled within said outer rotary piston and having a substantially cylindrical inner wall, said inner rotary piston having a stud coaxially arranged therewith, gear means interposed between and drivingly interconnecting said inner rotary piston and said shaft for rotating said pistons relative to each other, said inner and outer rotary pistons being eccentrically arranged with regard to each other and being equipped with cooperating teeth confining chambers with each other varying as to volume during the movement of said pistons relative to each other, an insert member fixedly connected to said housing and rotatably receiving said stud, said insert member engaging said inner wall of said inner rotary piston and being provided with inlet and outlet passage means for admitting and discharging working fluid therefrom, said inner rotary piston being provided with ports adapted to communicate with and be closed off from said inlet and outlet passage means in response to the respective relative position of said inner

rotary piston with regard to said insert member, and additional passage means arranged in said insert member and extending between said stud and said inlet and outlet passage means for connection with a source of cooling fluid.

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