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Steinwart

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[54] **ROTARY PISTON COMBUSTION ENGINE OF TROCHOID TYPE**

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[52] **U.S. Cl.** **418/99**; 418/100

[51] **Int. Cl.²** **F01C 21/04**

[58] **Field of Search** ..... 123/8.01, 196 R; 184/55 R; 418/83, 84, 87, 97, 99, 100

[56] **References Cited**

UNITED STATES PATENTS

3,771,903 11/1973 King et al. 418/84

3,838,950 10/1974 Andriulis ..... 418/97 X

FOREIGN PATENTS OR APPLICATIONS

1,196,914 7/1965 Germany 123/8.01

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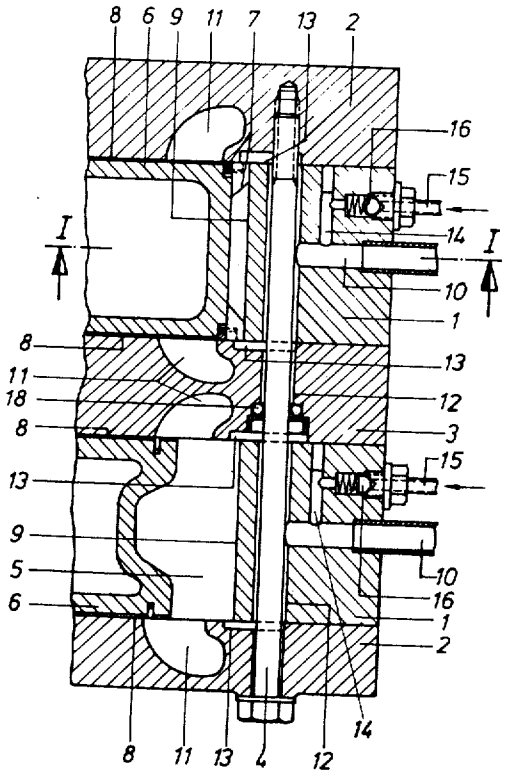
[57] **ABSTRACT**

A trochoid-type rotary piston combustion engine has a housing composed of at least one shell and at least two parallel end parts as well as an inlet and an outlet passage equipped with a throttle. Each shell is arranged between two end parts connected thereto by tension bolts to bound an interior space in which is rotatably arranged a multi-arcuate piston. The piston is provided with sealing members slidable along the inner faces of said housing. Lubrication of the housing inner face is in the form of a lubricating oil supply orifice opening into the intake chamber.

7 Claims, 7 Drawing Figures



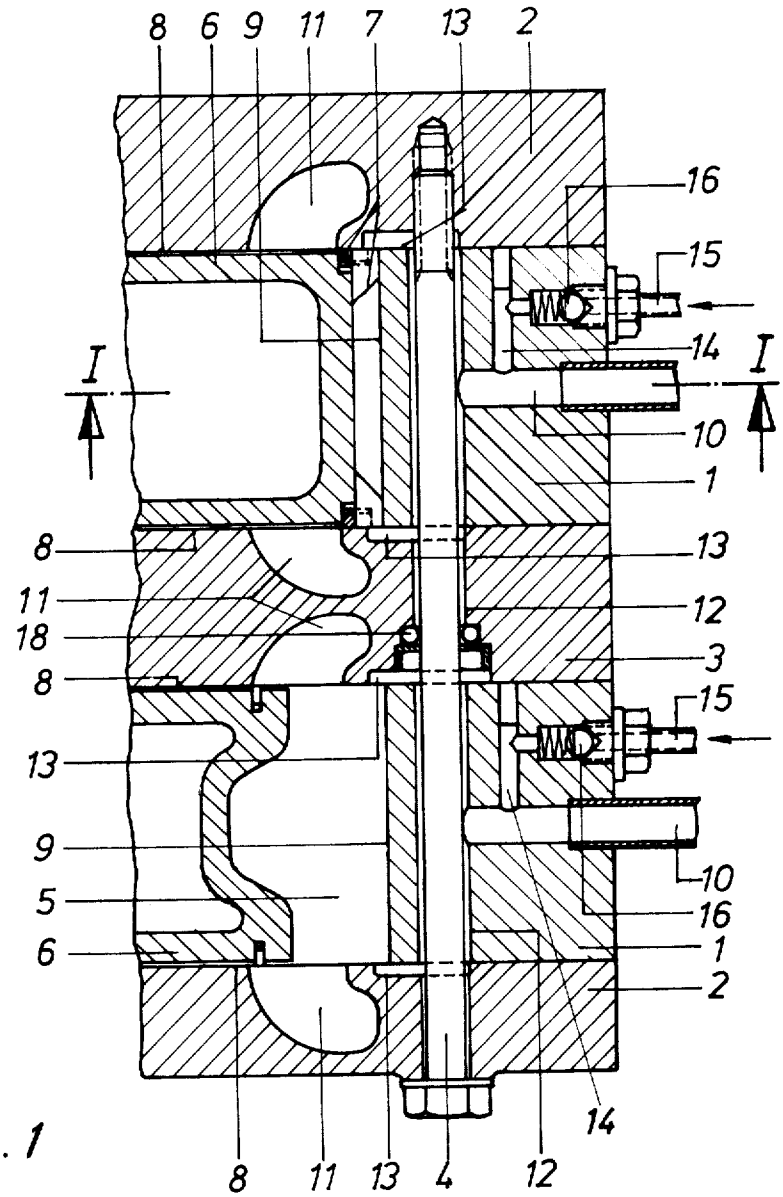

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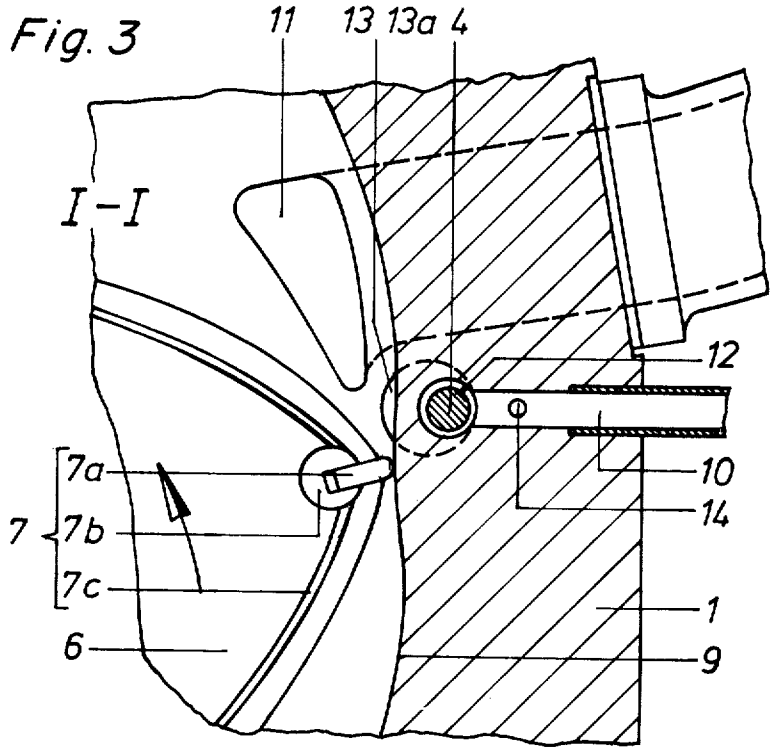
Fig. 1

Fig. 3



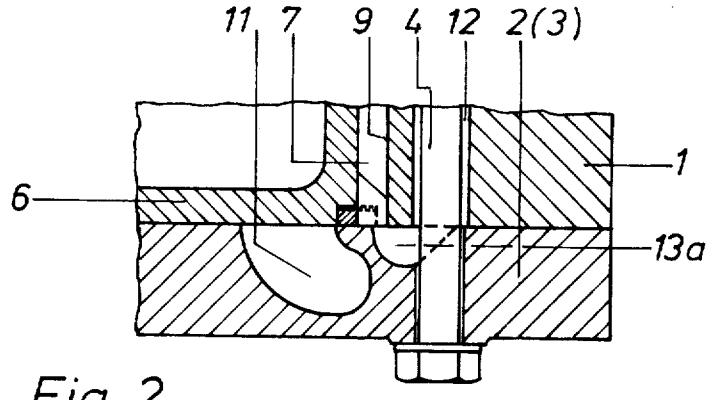


Fig. 2

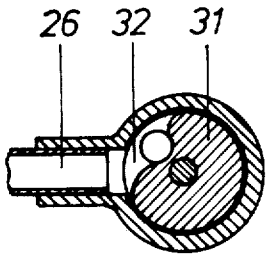


Fig. 7

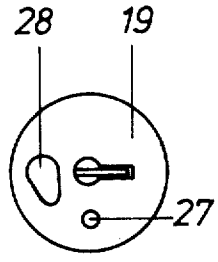


Fig. 5

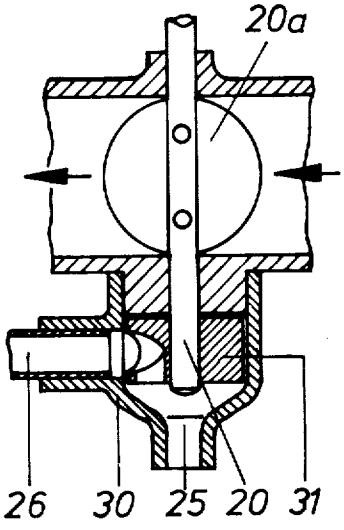


Fig 6

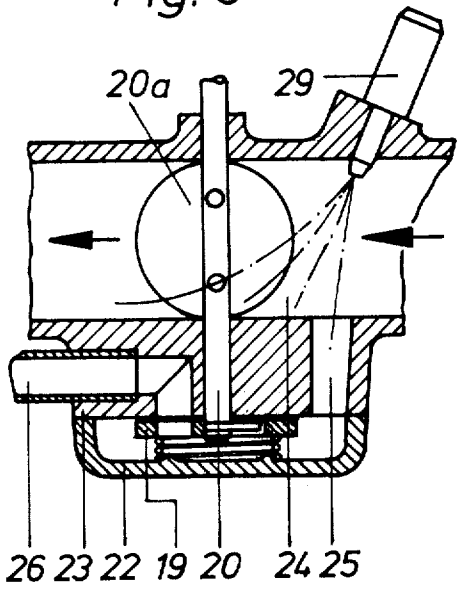


Fig. 4

ROTARY PISTON COMBUSTION ENGINE OF TROCHOID TYPE

BACKGROUND OF THE INVENTION

In known rotary piston combustion engines with inner face lubrication, lubricating oil is supplied through orifices arranged in the shell or end parts and opening into the angles between shell and end parts. The lubricating oil orifices are circumferentially arranged in a manner so that they are swept by the radial sealing strips of the piston either immediately before or after the inlet passage. In this mode of lubricant supply, however, some of the oil may be entrained by the fuel mixture, so that lubricating oil will burn unused together with the fuel mixture without having performed any lubricating function. This is the case especially when a high negative pressure prevails in the working chamber, sucking the oil, previously accumulated at low negative pressure, out of the orifices and swirling it into the working chamber. Furthermore, owing to the narrow lubricant orifice, uniform supply of lubricant on both sides of the ports may be jeopardized, since when the lubricant is cold a higher delivery pressure must be overcome, and deposits may clog the orifices. Any partial or total failure of lubricant supply may shorten the life of the inner faces of the housing and the sliding sealing members.

SUMMARY OF THE INVENTION

The object of the invention is to provide uniformly proportioned supply of lubricant to the inner faces of the housing and the sealing members sliding over them while preventing combustion of any major quantity of lubricant that may be unused.

This object is effectively accomplished by having the lubricant orifice opening into a passage communicating with the atmosphere at one end and opening into the intake chamber near the inlet passage at the other end. An air throttling means is coupled with the throttle and when the throttle is closed a small flow section is obtained and as the throttle progressively opens, a progressively large flow section results.

The oil entering the air passage is permitted to wet the passage walls with a film of oil by adhesion by the passing air. The film is evenly propelled all the way into the intake chamber separately from the fuel mixture. The stream of air propelling the oil is more or less effective and more or less vigorously entraining of a corresponding quantity of oil depending on the setting of the throttle.

The passage communicating with the atmosphere may lead from the axial midpoint of the outer shell surface in a radial direction and open into the enlarged tension bolt hole nearest the inlet passage. In each of the adjacent faces of the end parts a groove may be provided that extends from the bolt hole to a point in the intake chamber. The use of a bolt hole has the advantage that no additional holes in the shell will be required.

In a further refinement of the invention the cross section of the groove in the end part may have a profile guiding the flow obliquely and radially outwardly towards the shell bearing surface. In this manner, the preponderance of the oil film traveling in the interior space may be guided onto the sliding surfaces of the sealing strips and so distributed by the incoming air and/or the fuel mixture that the sealing strips sliding

along the shell bearing surface receive adequate lubrication throughout their width.

According to another proposal, the groove may open into the intake chamber near the inlet control aperture in the region of the greatest angle of sweep of the sealing strips. By virtue of this arrangement of the lubricant delivery groove and owing to the setting of the sealing strips of the piston at a given time, the lubricant forced into the working chamber may be propelled along the sealing strips all the way to the axial sealing flanges of the piston.

The air throttling means may consist of a rotary control valve for determining the volume of air flow. The valve is mounted on the shaft of the throttle and is tightly enclosed by a housing having one air inlet and one air outlet, the outlet being connected by piping to the enlarged bolt hole. The air inlet may expediently be in communication with the fresh air flowing from the air filter into the air intake of the carburetor.

To prevent emptying of the lubricant orifice and interruption of further lubricant supply when the negative pressures in the working chamber are high, it is further proposed that a spring-loaded check valve opening under oil pressure be arranged in the lubricant orifice. Lubricant may for example be supplied by means of an intermediate-delivery oil proportioning pump with each shell receiving a separate proportion of comparable amount.

The passage communicating with the atmosphere may be connected to a source of fuel during cold starting of the engine. The result of this is that in cold starting a mixture made up of fuel and lubricant is formed, so that the high viscosity of the lubricant when the engine is cold is reduced, and the orifices carrying lubricant are cleaned in this phase. In a combustion engine with suction pipe injection having its own cold start assisting means, it is possible to arrange for some of the fuel jet to reach the air inlet beginning in the air intake pipe and arrive in the working chamber by way of the air throttling means and the passage.

The lubrication of inner housing surfaces according to the invention may be applied to rotary piston combustion engines with carburetor operation, but advantageously also to gasoline injection and gas operation.

An embodiment of the invention is represented by way of example in the drawing and will be described below.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a partial view of a longitudinal section of a rotary piston combustion engine having two working chambers.

FIG. 2 is a partial view of a longitudinal section similar to FIG. 1 showing a second embodiment.

FIG. 3 shows a cross-section of part of the housing taken along line 1—1 in FIG. 1.

FIG. 4 shows a section of a schematically represented air throttling means coupled with the throttle in accordance with one form of the invention.

FIG. 5 shows a view of the rotary control valve of the air throttling means of FIG. 4.

FIG. 6 shows a section of a schematically represented air throttling means coupled with the throttle in accordance with a second embodiment.

FIG. 7 shows a view of the rotary control valve of the air throttling means of FIG. 6.

DETAILED DESCRIPTION

Referring first to FIG. 1, the housing of a rotary piston combustion engine having, for example, double working chambers consisting of one shell 1 each and end parts 2 as well as a substantially parallel interposed part 3. The tension bolts 4 assemble the parts which bound an interior space 5 in which is rotatably arranged a multi-arcuate piston 6 provided with sealing members 7 sliding along the faces 8 of end parts 2 and between part 3 as well as the shell bearing surface 9. The passage 10 communicating with the atmosphere opens into the enlarged bolt hole 12 nearest the inlet passage 11 which hole is in communication at the adjacent faces 8, with grooves 13 extending in end parts 2 and between part 3 from bolt hole 12 into the interior 5 near the inlet passage 11. The bolt holes 12 in the two shells 1 are separated from each other by sealing means 18 to prevent them from affecting each other.

A stream of air generated by the negative pressure in the working chamber propels the lubricant emerging from orifice 14 along the walls of passage 10, bolt hole 12 and groove 13 into the working chamber inside the interior space 5 to lubricate the sealing members 7. The lubricant delivered, for example, by an intermittent delivery oil proportioning pump through piping 15 before it enters the lubricant orifice 14, passes a check valve 16 set to counteract a high negative pressure generated inside the working chamber and thus prevents exhaustion of the lubricant supply line and orifice.

It is possible alternatively in cold starting to connect the passage 10 communicating with the atmosphere to a source of fuel, for example, a cold start assisting means, so that in the starting phase a fuel-oil mixture passes directly into the working chamber and, at the same time, supplies the sealing members 7 with lubricant which is thusly flushed in.

FIG. 2 represents the second embodiment of a groove 13*a* arranged in end part 2 and between part 3, the conformation of which is such that the stream of air propelling an oil film is directed obliquely radially outward and thus principally reaches the shell bearing surface 9 so that the sealing members 7 arranged in piston 6 may thence be supplied with lubricant.

The arrangement represented in FIG. 3 exhibits the orifice located near an end inlet 11 of a groove 13 or 13*a*. Since the sealing members 7 arranged in piston 6 form their greatest angle of swing when sliding over groove 13 or 13*a*, the setting of sealing strip 7*a* may cause lubricant to be picked up from the mouth of groove 13 or 13*a* and delivered radially inward by way of sealing pin 7*b* as far as the sealing flanges 7*c*.

The air throttling means shown in FIG. 4 consists of a rotary control valve 19 arranged on the shaft 20 of the throttle 20*a* of the illustrated carburetor and an integrated housing 23 closed with a cover 22 and having an air inlet 25 connected to an air intake pipe 24 of the carburetor and an air outlet 26 connected to passage 10 in FIG. 1. The rotary control valve 19 has one face in tight contact with a radial inner surface of housing 23 whence the air outlet 26 proceeds. In idling, the air throughput is matched to the idling system of the carburetor, the rotary control valve 19 freeing only a small hole 27 shown in FIG. 5, so that little air can flow into air inlet 26 and thence to passage 10 in FIG. 1. As the throttle opens, an enlarging aperture 28 rotates in front of the air outlet 26 and thus permits a larger stream of air towards passage 10 in FIG. 1. In a combustion engine with suction pipe injection, a cold start assisting means 29 may be so arranged in the air intake pipe 24 of the carburetor so that in cold starting, its fuel jet will reach air inlet 25.

FIG. 6 shows an air throttling means in a second embodiment having a housing 30 in which a rotary control valve 31 is arranged on a shaft 20 of a throttle. As the throttle opens, the valve exposes an aperture 32 enlarging in circumferential direction on its peripheral surface as shown in FIG. 7, opposite air outlet 26.

The air inlet 25 of the air throttling means of FIGS. 4 and 6 is preferably connected by way of an air intake pipe 24 of the engine to an existing air filter (not shown).

What is claimed:

1. A rotary piston combustion engine of trochoid type having a housing composed of at least one shell and at least two parallel end parts and comprising an inlet passage provided with a throttle and an outlet passage, each shell being arranged between two end parts and being connected thereto to bound an interior space, a multi-apex piston rotatably arranged in the space and provided with sealing members sliding along the inner surfaces of the housing, an air passage communicating with the atmosphere at one end and opening into the intake chamber near the inlet passage at the other end, an air throttling means arranged within said air passage and coupled with the throttle, which means affords a small flow cross section when the throttle is closed, and a progressively enlarging flow cross-section as the throttle progressively opens, and lubricant supply means including a lubricant supply passage opening into said air passage for providing lubrication of said inner surfaces.

2. A rotary piston combustion engine according to claim 1 in which tension bolts assemble the shell and end parts and an enlarged hole receives each bolt, the passage in communication with the atmosphere leads from the axial midpoint of the shell outer surface in a radial direction and opens into an enlarged tension bolt hole nearest the inlet passage, and the adjacent faces of the end parts each provided with a groove extending from the bolt hole to a point in the intake chamber.

3. A rotary piston combustion engine according to claim 2 in which the cross-section of the groove in the end part has a profile guiding the flow obliquely radially outward towards the shell inner surface.

4. A rotary piston combustion engine according to claim 2 in which the groove opens into the intake chamber near the inlet port in the region where the tilting angle of the radial sealing strips is greatest.

5. A rotary piston combustion engine according to claim 1 in which the air throttling means includes a throttle and a rotary control valve determining the volume of air flow, arranged on the shaft of the throttle, the valve being enclosed by a housing provided with one air inlet and one air outlet coupled with the enlarged bolt hole.

6. A rotary piston combustion engine according to claim 1 in which a spring-loaded check valve opens under oil pressure arranged in the piping of the lubricant orifice.

7. A rotary piston combustion engine according to claim 1 in which means are provided for connecting the air passage to a source of fuel during cold starting of the engine.

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