June 29, 1937. M. MURAKAMI 2,085,505

ROTARY ENGINE

Filed Oct. 14, 1935

Fig. 1

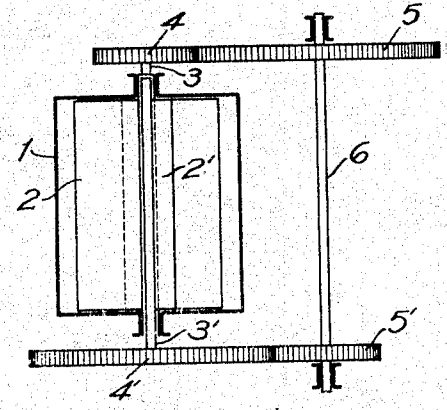


Fig. 4

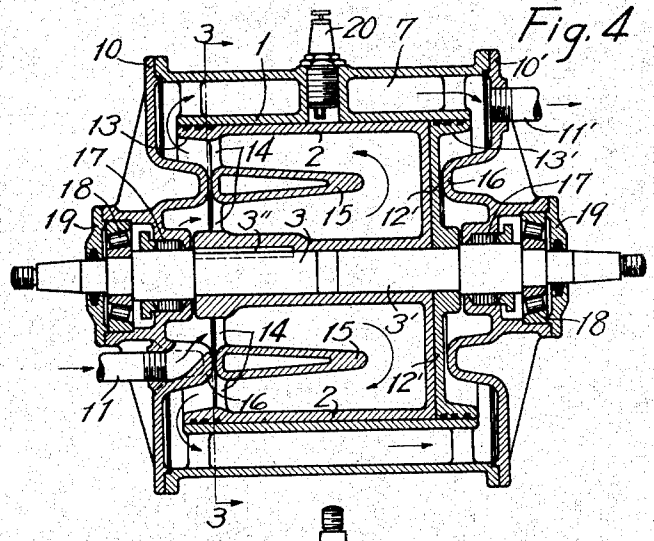


Fig. 2

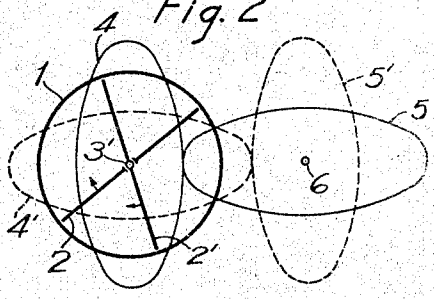


Fig. 5

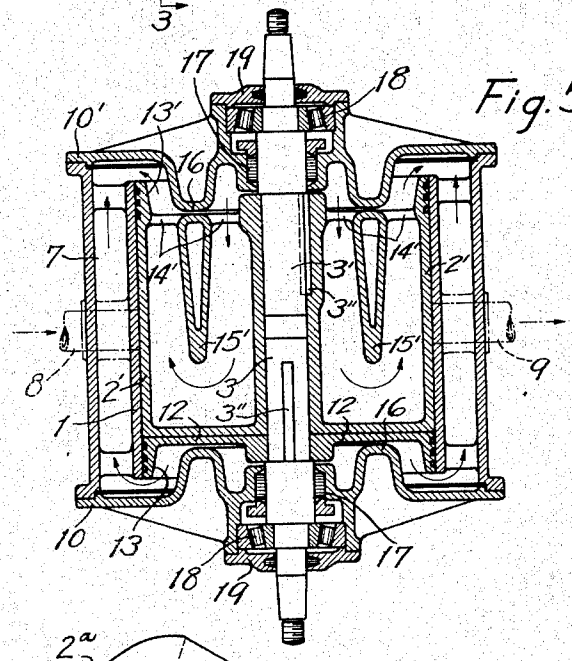


Fig. 3

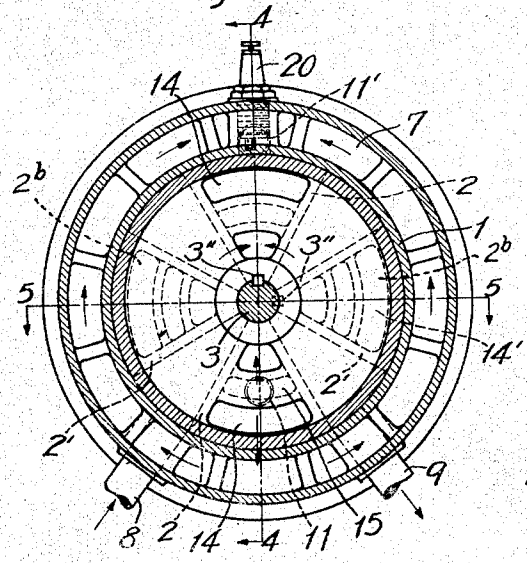
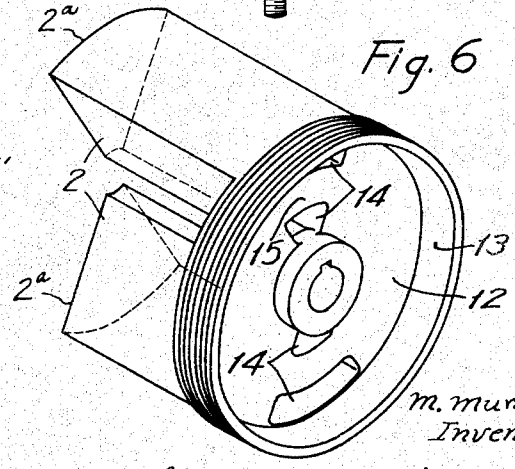


Fig. 6



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ROTARY ENGINE

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5 Claims. (Cl. 123—11)

My invention relates to rotary engines of co-operatively rotating disc type and more particularly to improvements in the device for circulating cooling water through the cylinder and other essential working parts, and has for its object to facilitate the easy manufacture of the engine by simplifying the construction and to effect automatic water circulation through essential working parts without using an independent cooling water pump.

What I consider to be novel and my invention will be better understood by the following description and appended claims when considered in connection with the accompanying drawing. In the drawing, Fig. 1 is a diagrammatic view of a simplest rotary engine to which the present invention is to be applied; Fig. 2 is a skeleton diagram for illustrating the principle of operation of the engine shown in Fig. 1; Fig. 3 is a cross sectional view of an internal combustion engine embodying this invention, the view being taken on line 3—3 of Fig. 4; Fig. 4 is a longitudinal sectional view taken on line 4—4 of Fig. 3; Fig. 5 is a horizontal section taken on line 5—5 of Fig. 3, and Fig. 6 is a perspective view of the rotor.

Referring to Figs. 1 and 2, the cooperating revolving discs or rotors 2 and 2' secured to the concentric shafts 3 and 3' respectively are arranged to hermetically fit in and rotate within a working cylinder 1. The shafts 3 and 3' are coupled respectively to a common side shaft or main shaft 6 by means of special transmission gears 4, 5 and 4', 5' consisting of an ellipse-like configuration set at the phase difference of 90° for transmitting continuously varying cyclic motion so that the rotors may cooperate with each other at the relation settled by the speed ratio of the transmission gears 4, 5 and 4', 5', and to rotate the main shaft with uniform revolving speed. Such rotary engines have been known to the art. Since such rotary engine requires no crank, connecting rod and valve devices which are necessary in an ordinary reciprocating engine, it gives a very compact construction developing a greater power with a smaller size. On the other hand, however, such engine should effect delicate operation and heavy duty in a very limited space. In order to obtain smooth operation of the engine it is absolutely necessary to prevent the over-heating of the cylinder and rotors as well as other working parts. The present invention is intended to obtain a perfectly cooled engine of the above mentioned type. For this purpose in accordance with this invention an end cover is fixed to each end of the cylinder forming a water tank and the rotors are operated within the water tank, thereby circulating cooling water by the rotation of the rotors without using a separate pump to cool essential working parts effectively.

The present invention is explained more completely by referring to Figs. 3 and 4. 1 represents the cylinder having a water jacket 7. An inlet pipe 8 for working fluid and an exhaust pipe 9 are attached to the cylinder. 10 and 10' are the end covers secured to the outer periphery of the cylinder 1 at its opposite ends so as to form a water tank or reservoir communicating with the cylinder jacket 7. A water inlet pipe 11 and the outlet pipe 11' are connected to the cylinder covers 10 and 10' respectively. 2 and 2' represent the rotors secured to the shafts 3 and 3', respectively. The rotors 2 and 2' are provided with circular end plates 12 and 12' respectively, at opposite ends. Flanges 13 and 13' project from the end plates 12, 12' to hermetically fit in the cylinder 1. The shafts 3 and 3' are keyed at 3'' to the rotors 2 and 2' respectively and fit hermetically with each other and can rotate independently at a definite relation settled by the transmission gearing. The inside of the flange portions 13 and 13' is tapered outwardly for facilitating the circulation of cooling water.

The rotors 2 and 2' include spaced hollow pistons 2a, 2b, respectively having openings 14 and 14' respectively at one end in the part of the end plates to allow the cooling water to flow therein. The openings 14 and 14' are preferably flared outwardly as shown in Fig. 3. Moreover, as shown in Fig. 5, a guide piece 15 of triangular section may be provided in the hollow pistons of each rotor and a cooperating projection 16 formed out of the end covers 10 and 10' respectively facing the guide piece 15 for improving the circulation of cooling water into the pistons of the rotors due to the centrifugal force. 17 represents a water tight packing for the shafts 3 and 3', 18 a roller thrust bearing and 19 its cover. When a plurality of cylinders 1 are arranged around the main shaft 6 all of the end covers 10 and 10' are respectively preferable to be made of one unit common to all of the cylinders.

The present rotary engine constructed as above described can be operated by feeding fuel from the inlet pipe 8 and causing combustion of the fuel in the space between the hollow pistons of the rotors 2 and 2' by igniting said fuel by means of the spark plug 20, thereby driving the rotors at a definite continuously varying cyclic speed.

The cooling water entering into the cylinder

end through the pipe 11 is circulated into the hollow pistons of the rotors and also passed through the cylinder jacket due to the centrifugal force produced by the rotation of the rotors and the convection of heat and then flows out of the pipe 11'. The warm water flowing out of the pipe 11' may be cooled by any suitable means and if desired, returned to the pipe 11. The additional power required for rotating the rotors within the water tank can be sufficiently compensated with the power necessary for driving a circulating pump.

Referring specifically to Figs. 3 and 4, it will be observed that cooling water enters into the end cover space from the pipe 11 and is distributed to the inner openings 14 and flows into the hollow space of pistons 2a and flows out of the outer openings 14 by centrifugal force when the pistons rotate, and then the water flows into the jacket chamber 7 and is taken out through the pipe 11'. At this time a similar inlet pipe (not shown) arranged at the opposite end of the cylinder 1 will introduce cooling water into the openings 14' of the pistons 2b and this water will also be discharged by centrifugal force from the pistons 2b into the water jacket chamber 7 and discharged through the discharge outlet 11'. The fuel or working fluid is supplied to the engine through the fuel inlet pipe 8 into the cylinder space between two pistons 2a, 2b, shown by dotted lines in Fig. 4, and the fuel is then compressed when these two pistons rotate at different relative speeds, and is ignited by the spark plug 20. Then the explosion and expansion take place to force apart these two pistons, thereby rotating the rotors 2, 2' and transmitting the power to the side shaft 6 through the ellipse-like gearings 4, 5 and 4', 5'.

The present engine has a comparatively simple construction consisting of almost symmetrical parts and can be easily manufactured.

Having thus fully described the invention what is claimed as new and desired to be secured by Letters Patent is:

1. An engine of the character described, comprising a stationary casing having a cylindrical bore, rotor members rotatably mounted in said bore, each of said members having an end plate at one end thereof, each rotor member also having a plurality of spaced hollow pistons projecting from said end plates into said cylindrical bore, the outer end of each piston being closed, said end plates having openings in alignment with the hollow pistons, a water jacket in the casing surrounding the cylindrical bore, means for feeding a cooling fluid to said water jacket, and means placing said water jacket in communication with the openings in said end plates.

2. An engine of the character described, comprising a stationary casing having a cylindrical bore, a pair of rotor members rotatably mounted in said bore, each of said members having an end plate at one end thereof, said plates being positioned at the opposite ends of the bore, each rotor member also having a plurality of hollow pistons projecting toward the end plate of the opposite rotor member, said end plates having openings in substantial alignment with said hollow pistons, a water jacket in the casing surrounding the cylindrical bore, means for feeding a cooling fluid to said water jacket, and means placing said water jacket in communication with the openings in said end plates.

3. An engine of the character described, comprising a stationary casing having a cylindrical bore, a pair of rotor members rotatably mounted in the bore, each of said members having an end plate at one end thereof, each rotor member also having a plurality of spaced hollow pistons projecting from said end plates, and adapted to extend into the cylindrical bore, said end plates having openings in substantial alignment with the hollow pistons, a partition arranged in each piston to cause cooling fluid entering a piston to travel in a circuitous path, means for feeding a cooling fluid to the openings in said end plates, a water jacket in the casing surrounding the cylindrical bore, and means placing said water jacket in communication with the openings in the end plates.

4. An engine of the character described, comprising a stationary casing having a cylindrical bore, a pair of rotor members rotatably mounted in the bore, each of said members having an end plate, said end plates being positioned at opposite ends of the bore, each member also having a plurality of hollow pistons projecting toward the end plate of the opposite member, each end plate having an intake port and an outlet port for each piston, a partition arranged in each piston to cause cooling fluid entering a piston to travel from the inlet port to the outlet port thereof, means for feeding a cooling fluid to the inlet ports, a water jacket in the casing surrounding the cylindrical bore, and means placing said water jacket in communication with some of said ports.

5. An engine of the character described, comprising a stationary casing having a cylindrical bore, end covers secured to said casing, a pair of rotor members rotatably mounted in the bore, each of said members having a disc at one end thereof, said discs being positioned at the opposite ends of the bore and spaced from the end covers of the casing to form a water tank between said end covers and said discs, each rotor member also having a plurality of hollow pistons projecting toward the disc of the opposite member, each disc having an intake port and an outlet port for each piston, said ports being in communication with the water tank, a partition arranged in each piston to cause cooling fluid entering a piston to travel from the inlet port to the outlet port thereof, a water jacket in the casing surrounding the bore, means placing said water jacket in communication with said water tank, means for feeding a cooling fluid to said water tank, and means for discharging said fluid from said water tank.

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