July 5, 1932. J. F. N. CRAIG 1,866,398

COOLING OF ROTARY ENGINES

Filed March 4, 1930

Fig.1.

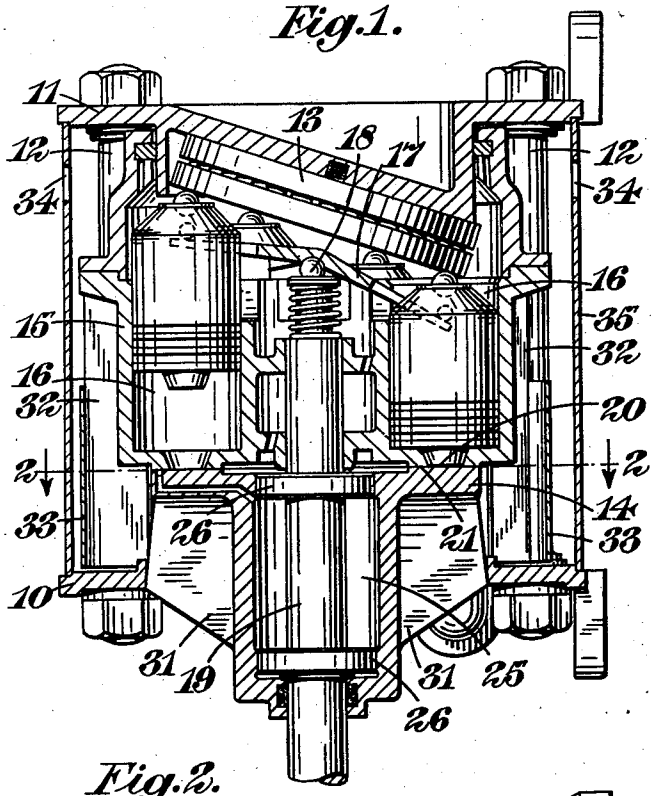
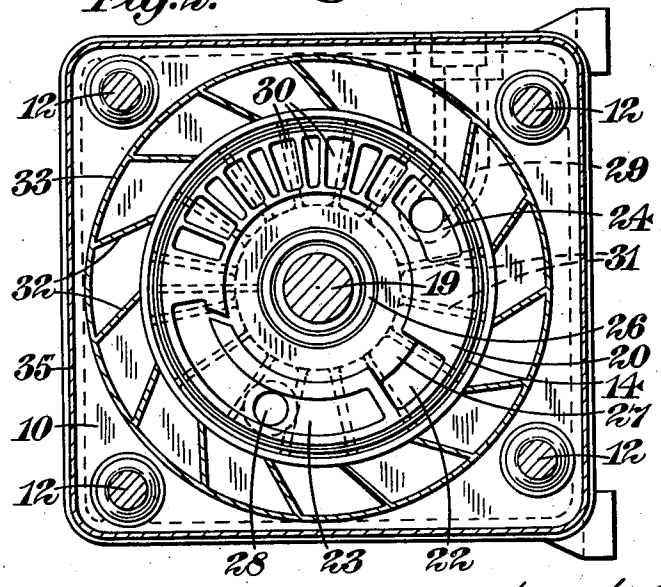


Fig.2.



INVENTOR

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Patented July 5, 1932 1,866,398

UNITED STATES PATENT OFFICE

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COOLING OF ROTARY ENGINES

Application filed March 4, 1930, Serial No. 433,128, and in Great Britain March 11, 1929.

This invention comprises improvements in or relating to the cooling of rotary engines and the like. The invention relates to rotary engines of the type in which a rotatable cylinder-block having a number of cylinder bores grouped about its axis of rotation is mounted to rotate relatively to a valve-plate against which it bears by pressure in an axial direction and which controls the operation of the cylinders.

It is an object of the invention to provide for efficient cooling of the valve-plate and the cylinder-block.

According to the present invention, the back of the valve-plate is provided with air-cooling passages which terminate near its periphery and the cylinder-block is provided with fan blades which are so located in relation to the air-cooling passages as to draw cooling air therethrough. The rotation of the cylinder-block therefore directs cooling air over the rear face of the valve-plate (including if desired the outer surfaces of any passages connected with ports in the valve-plates) and thereafter the same cooling air serves to act upon the cylinder-block, or at least the fan blades thereof, whereby the block itself is cooled.

Preferably, the valve-plate is mounted in, so as to be supported by, an end-plate of a framework for the engine, but is spaced therefrom to provide air-passages between the back of the valve-plate and the end-plate, while the fan blades upon the cylinder-block are designed to overhang the edges of the valve-plate and lie substantially in line with the said air-passages.

It is an advantage according to this invention, that the disposition of the fan blades on the cylinder-block facilitates the casting of the blades integrally with the block, as compared with the case where, as in my prior U. S. Patent No. 1,800,929, the cooling fins are circumferentially disposed.

It will be understood from the following description that the invention is not limited as regards the type of engines and that the expression "engine", as used alone herein, is intended to cover an internal combustion motor, a compressor, or any other arrangement of which the essential component parts include a plurality of cylinders with a plurality of pistons operating therein in timed relation.

The accompanying drawing illustrates the invention, by way of example, as applied to a swash-plate engine similar to that described in my prior U. S. Patent No. 1,800,929, and embodying the features forming the subject-matter of my co-pending application, Serial No. 431,557, filed February 26, 1930.

Figure 1 of the drawing is a longitudinal central section through the engine, and

Figure 2 is a transverse section through the engine taken along the line 2, 2 of Figure 1.

Like reference characters indicate like parts in the two figures of the drawing.

The engine comprises two substantially rectangular end-plates 10, 11, rigidly spaced apart by four parallel struts 12 which extend between the corners of the end-plates and together with them form a frame work for the engine.

The end-plate 11 supports an inclined swash-plate 13. The other end-plate 10 supports a valve-plate 14 in the form of a flat ring.

Between the valve-plate 14 and the swash-plate 13 there is rotatably mounted a cylinder-block 15 having a number of parallel cylinder bores 16 grouped about the axis of rotation.

Within these cylinder bores work pistons which are reciprocated in the cylinders as the cylinder-block rotates by the action of the swash-plate 13.

The pistons are all held up to the swash-plate by a retaining spider 17 universally mounted at 18 upon a central driving shaft 19 upon which the cylinder-block is mounted.

The valve-plate 14 has machined on it a valve-face 20 against which rotates a corresponding valve-face 21 machined on the cylinder-block. The valve-face 20 has in it two annular inlet-ports 22, 23 and an outlet-port 24.

Port 22 is shorter than port 23 and communicates, not with an external intake passage as does port 23, but with the interior

of a central oil-retaining-housing 25 enclosing bearings 26 supporting the shaft 19. Said inlet-port 22 communicates with the interior of the housing 25 by way of a shallow valley 27 formed in the valve-face 20.

Inlet-port 23 communicates with an external intake passage 28, and outlet-port 24 communicates with an external delivery passage 29.

The valve-face 20 also has formed in it a series of shallow radial pockets 30. These pockets are disposed, as shewn, around the valve-face between the inlet-port 23 and the outlet-port 24.

The provision of the aforesaid pockets and the additional inlet-port 22, forms the subject-matter of my co-pending application above referred to and the purpose of this provision is clearly described in the specification of that application.

As shewn, the wall of the bearing-housing 25 is integral with the valve-plate 14 and also with the rectangular end-plate 10 by reason of the interconnection between the ports which is afforded by a series of radial ribs 31 cast integral in the casting with the valve-plate 14, end-plate 10 and housing 25. The spaces between the ribs 31 form air-passages through the rectangular end-plate 10.

The cylinder-block 15 is formed with a number of radial cooling ribs 32 which project from it endwise over the edge of the valve-plate 14 and toward the end-plate so that they come substantially into line with the aforesaid air passages as shown.

Encircling the ribs 32 and extending about two-thirds along their length from the valve-plate end, is a circumferential shroud 33 which may if desired be cast integral with the cylinder-block.

In rotation the ribs on the cylinder-block draw air through the air passages at the back of the valve-plate, which air passes along the spaces between the ribs within the shroud 33 and leaves by way of openings 34 in the casing 35 surrounding the cylinder-block.

The air thus drawn through the machine, first cools the valve-plate and then extracts heat from the cylinder-block, specially from that end thereof which is adjacent the valve-plate, which in practice is the end which most tends to become heated.

The shroud 33 function both as a deflector for the air and also as an additional cooling surface.

Advantageously, as shewn, the cooling ribs may be set at a suitable angle to the truly radial direction so that they act more effectively in drawing the cooling air through the passages.

I claim:—

1. In a rotary engine of the type described the combination of a framework comprising an end-plate, a valve-plate supported by the end-plate but spaced therefrom to provide air-passages between the back of the valve-plate and the end-plate, a cylinder-block, and fan-blades carried upon the cylinder-block and extending outside of and axially beyond the edges of the valve-plate into line with said air passages.

2. In an engine, the combination with a frame, a rotating cylinder block having a plurality of cylinders therein, said block being provided with ports communicating with the ends of the cylinders for the admission and delivery of fluid, a stationary ported valve plate having ports therein cooperating with the cylinder block ports, cooling fins on said plate, and fan blades on said cylinder block for drawing air over said fins and past said cylinder block.

3. In an engine, the combination with a frame, a rotating cylinder block having a plurality of cylinders therein, said block being provided with ports communicating with the ends of the cylinders for the admission and delivery of fluid, a stationary ported valve plate having ports therein cooperating with the cylinder block ports, cooling fins on said plate, fan blades on said cylinder block for drawing air over said fins and past said cylinder block, and a supporting frame for said apparatus having a portion thereof connected to said fins for positioning said valve plate within the frame, said fins serving to space said frame and valve plate to provide air passages therebetween.

4. In an engine, the combination with a frame, a rotating cylinder block having a plurality of cylinders therein, said block being provided with ports communicating with the ends of the cylinders for the admission and delivery of fluid, a stationary ported valve plate having ports therein co-operating with the cylinder block ports, cooling fins on said plate, fan blades on said cylinder block for drawing air over said fins and past said cylinder block, and a supporting frame for said apparatus comprising a casing therefor and having a portion thereof formed integrally with said fins for positioning said valve plate within the frame, said fins serving to space said frame and valve plate to provide air passages therebetween.

5. In an engine, the combination with a frame, a rotating cylinder block having a plurality of cylinders therein, said block being provided with ports communicating with the ends of the cylinders for the admission and delivery of fluid, a stationary ported valve plate having ports therein co-operating with the cylinder block ports, cooling fins on said plate, fan blades on said cylinder block for drawing air over said fins and past said cylinder block, and a circular shroud surrounding a portion of said fan blades and carried thereby for confining the moving air

to an annular path adjacent said cylinder block.

6. In an engine, the combination with a frame, a rotating cylinder block having a plurality of cylinders therein, said block being provided with ports communicating with the ends of the cylinders for the admission and delivery of fluid, a stationary ported valve plate having ports therein co-operating with the cylinder block ports, cooling fins on said plate, fan blades on said cylinder block for drawing air over said fins and past said cylinder block, and a circular shroud surrounding a portion of said fan blades and carried thereby for confining the moving air to an annular path adjacent said cylinder block, said shroud, fan blades, and cylinder block being formed integrally.

7. In an internal combustion engine, the combination with a frame, a rotating cylinder block having a plurality of cylinders therein, said block being provided with ports communicating with the ends of the cylinders for the admission and delivery of fluid, a stationary ported valve plate having ports therein co-operating with the cylinder block ports, cooling fins on said plate, and fan blades on said cylinder block for drawing air over said fins and past said cylinder block, said fan blades being formed integral with said cylinder block.

In testimony whereof I affix my signature.

JOHN FREDERICK NEVINSON CRAIG.