

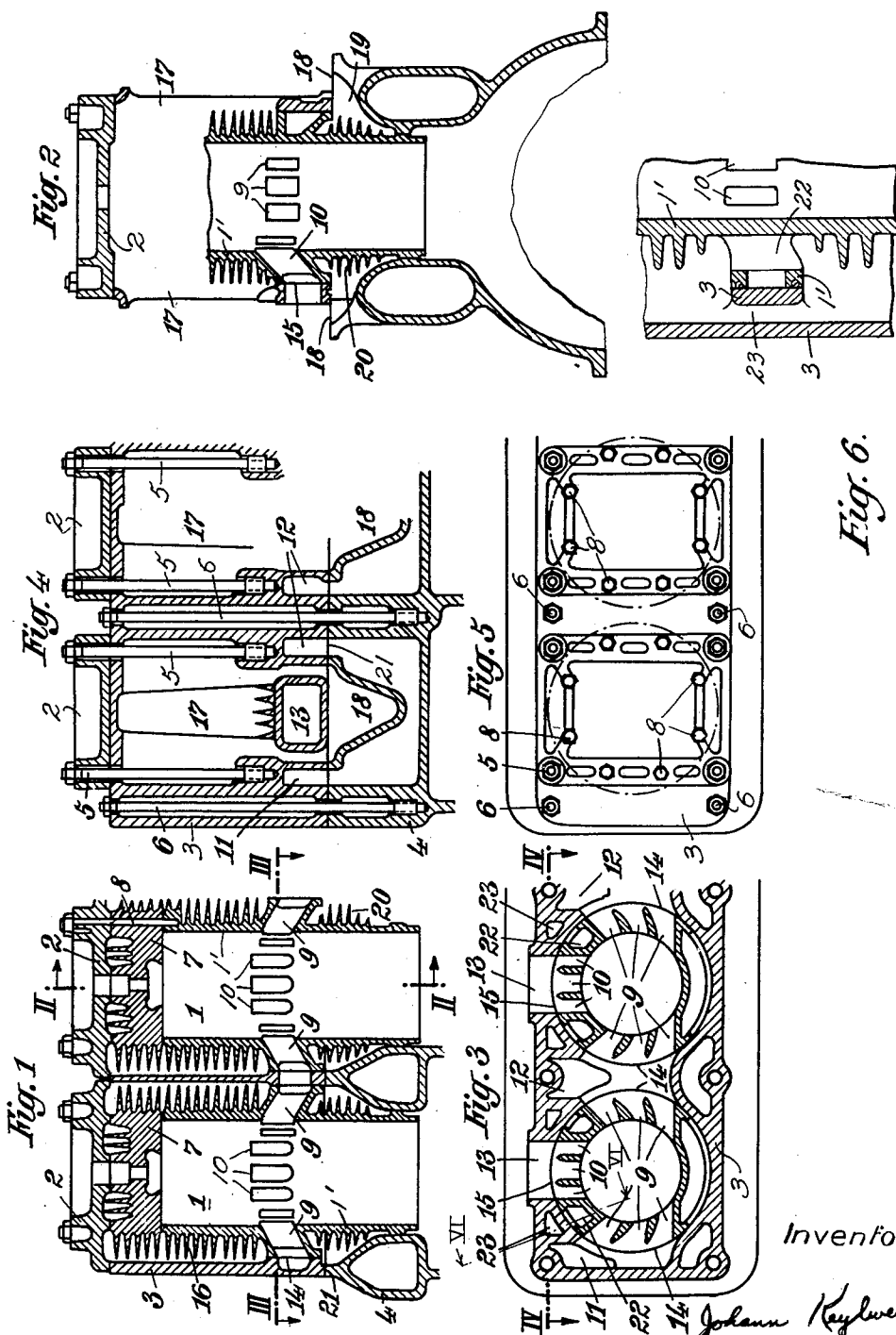
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AIR-COOLED TWO-CYCLE INTERNAL-COMBUSTION ENGINES

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AIR-COOLED TWO-CYCLE INTERNAL-COMBUSTION ENGINES

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My invention relates to air-cooled two-cycle internal combustion engines with piston-controlled scavenging and exhaust ports, in which the outside of the working cylinder, within the range of the scavenging and exhaust ports, is designed as a body of revolution and is closely fitted into the engine housing.

It is an object of the invention to improve the cooling of the working cylinder especially in its thermally highly stressed range of the exhaust ports, and it is also an object to avoid crowding the structural material near the scavenging and exhaust ports to minimize tendencies of the cylinder to become deformed under the effect of the thermal stresses.

To this end, and in accordance with a feature of my invention, the outer openings of the scavenging and exhaust ports of the cylinder structure are located at about the same axial height of the cylinder structure and have substantially the same axial length. According to another feature of the invention, the just-mentioned port openings are located in an axially narrow cylindrical projection or shoulder portion of the cylinder structure, and the cylinder structure is equipped with cooling fins above and/or below this annular shoulder portion and within the tightly sealed cylinder cavity of the engine housing.

These and more specific features of the invention are apparent from the example described in the following with reference to the drawing which shows as much of an air-cooled two-cycle engine according to the invention as is necessary for the complete representation and understanding of the invention.

Fig. 1 shows a vertical longitudinal section through the common center plane of the engine cylinders;

Fig. 2 is a cross section of the same engine along the section line II—II in Fig. 1;

Fig. 3 is a horizontal cross section along the plane indicated in Fig. 1 by III—III;

Fig. 4 is a vertical longitudinal section through the engine along the line IV—IV in Fig. 3; and

Fig. 5 shows a partial top view of the engine.

Fig. 6 shows a cross section taken in Fig. 3 along the line denoted by VI—VI.

The illustrated air-cooled two-cycle engine has an in-line arrangement of several working cylinders, although it will be understood that the invention is also applicable to air-cooled two-cycle engines with only one working cylinder. Each of the two cylinder structures visible in the drawings is denoted by 1. Each cylinder structure has a single-piece cylinder barrel 1' and a two-piece cylinder head whose top portion 2 is seated on the upper portion 3 of the engine housing. The housing portion 3 is common to all cylinders and firmly joined with the bottom portion 4 of the engine housing by means of screws 6. Due to the fact that each cylinder structure is thus suspended from the top 2 of its cylinder head, the lower end of the cylinder barrel 1' is axially displaceable relative to the bottom portion 4 of the engine housing so that each cylinder structure, when heated, can freely expand in its axial direction. The top 2 of each cylinder head is connected with the up-

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per housing portion 3 of the engine by screw bolts 5. Each cylinder structure 1 and the lower portion 7 of the appertaining cylinder head are firmly secured to the top 2 of the cylinder head by means of screw bolts 8.

The scavenging ports 9 and the exhaust ports 10 of each cylinder structure are all located within an annular zone integral with the barrel 1'. The exterior of the shoulder zone is designed as a body of revolution and is closely fitted into a corresponding wall portion of the cavity formed by the upper portion 3 of the engine housing. Both portions 3 and 4 of the engine housing are equipped with channels 11, 12 and 13 for the supply of the scavenging agent and for the discharge of the exhaust gases.

In the illustrated air-cooled two-cycle engine, the exterior openings 14 of the scavenging ports 9 and the corresponding openings 15 of the exhaust ports 10 in the cylinder structure are located at the same axial height of the cylinder structure. Furthermore, the exterior openings 14 of the scavenging ports and the openings 15 of the exhaust ports have all substantially the same length in the axial direction of the cylinder structure, although the openings of exhaust ports 10 at the cylinder inside are longer in that direction than the scavenging ports 9. In this manner, a relatively narrow shoulder zone is formed whose peripheral cylindrical wall is traversed by the port openings and which is tightly fitted to a corresponding cylindrical surface portion within the cylinder-receiving cavity of the engine housing. Such a narrow peripheral shoulder permits arranging a relatively large number of cooling fins 16 in the interstice or air jacket above the scavenging and exhaust ports so that the effect of the cooling air on the cylinder structures in the vicinity of the scavenging and exhaust ports is considerably improved. Another advantage is the fact that a local crowding of material is avoided with the effect that the working cylinders, even if highly heated, maintain an accurately circular shape within the range of their scavenging and exhaust ports.

It is especially favorable to make the outer diameter of each cylinder structure 1 in the zone of its scavenging and exhaust ports about equal to the largest outer diameter of the structure, for instance, substantially equal to the diameter of the cooling fins 16. The exhaust ports 10 can then be given a favorable course and configuration. To prevent an escape of scavenging agent and exhaust gases at the fitting surfaces near the scavenging and exhaust ports, the cylinder structures are tightly sealed with the upper housing portion 3 around the annular shoulder closely above and below the scavenging and exhaust ports. The necessary tight fit can be secured by a matched machining of the mutually engaging surfaces of cylinder structure and engine housing. However, annular gaskets may also be inserted above and below the openings of the scavenging and exhaust ports.

The upper portion 3 as well as the lower portion 4 of the engine housing are equipped with openings 17 and 18 for the passage of the cooling air. The openings 18 are formed by channels 19 which are located in the bottom portion 4 of the engine housing and serve to pass cooling air around the portion of the working cylinders located underneath the scavenging and exhaust ports. To secure a good cooling of the lower parts of the cylinder structures, these structures are also equipped with cooling fins 20 below the scavenging and exhaust ports. The outer diameter of the cooling fins 20 is only slightly smaller than the outer diameter of the cylinder structure in the shoulder zone of its scavenging and exhaust ports. This permits disassembling the cylinder structures from the engine by lifting them out of the engine housing, aside from offering the advantage of securing best possible cooling of the lower parts of the cylinder structures.

Due to the described division of the engine housing into

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a cylinder-accommodating upper portion 3 and a bottom portion 4, thermal stresses which especially occur near the exhaust ducts are prevented from being appreciably imparted to those parts of the engine housing in which the crank shaft and other movable members are journaled. The division gap 21 between the upper and bottom portions of the engine housing, as illustrated, lies below the scavenging and exhaust ports of the cylinder structures 1 and extends perpendicular to the common center plane of the cylinders, although, if desired, the division gap may also be located above these ports. In addition, it is also possible to divide the engine housing in two places, i. e. above as well as below the scavenging and exhaust ports perpendicularly to the common center plane of the working cylinders.

To secure an especially good cooling of the cylinder structures 1 within the range of the exhaust ports 10, the cylinder structures 1 and the upper housing portion 3 of the engine are equipped with passage ducts 22 and 23, respectively, which are located beside the exhaust ports 10 and extend lengthwise of the cylinder structures (Fig. 6). The provision of ducts 22 and 23 avoids an unnecessary crowding of material. These ducts extend through the upper and lower parts of the cylinder structure and are at both ends open toward the air jacket space so that cooling air may flow through the ducts 22, 23 in a direction determined by the pressure difference between the upper and lower jacket portions.

The general performance of the engine and the design of its non-illustrated parts may correspond to the conventional air-cooled two-cycle engines; and a study of this disclosure will make it obvious to those skilled in the art that, as regards design details, my invention permits of various modifications and can be embodied in structures other than those specifically shown and described, without departing from the objects and essential features of the invention and within the scope of the claims annexed hereto.

I claim:

1. An air-cooled two-cycle internal-combustion engine with piston-controlled scavenging and exhaust ports, comprising an engine housing having a cylinder cavity, a working cylinder structure disposed in said cavity and having a single-piece barrel forming an annular interstitial air space together with said housing, said barrel having one end portion rigidly joined with said housing so as to be capable of axial expansion, said barrel having an integral and radially projecting shoulder zone extending around said barrel, said shoulder zone having an outer peripheral surface of cylindrical shape in slidable sealing engagement with said housing, said scavenging and exhaust ports being located in said shoulder zone and having respective outer openings located in said peripheral surface at the same axial height, all of said outer openings having the same lengths respectively in the axial direction of said structure.

2. An air-cooled two-cycle internal-combustion engine with piston-controlled scavenging and exhaust ports, comprising an engine housing having a cylinder cavity, a working cylinder structure disposed in said cavity and having a single-piece barrel forming an annular interstitial air space together with said housing, said barrel having one end portion rigidly joined with said housing so as to be capable of axial expansion, said barrel having an integral and radially projecting shoulder zone axially spaced from said end

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portion and extending around said barrel, said shoulder zone having an outer peripheral surface of cylindrical shape in slidable sealing engagement with said housing, said scavenging and exhaust ports being located in said shoulder zone, said exhaust ports having at the inside of said barrel respective port openings of larger length in the axial cylinder direction than the respective inside openings of said scavenging ports, and said scavenging and exhaust ports having respective outer openings located in said peripheral surface at the same axial height, all of said outer openings having the same lengths respectively in the axial direction of said structure.

3. An air-cooled two-cycle engine with piston-controlled scavenging and exhaust ports, comprising an engine housing having a cavity, a working cylinder structure having a head portion and a cylinder barrel, said head portion being mounted on said housing and covering said cavity, said barrel being disposed in said cavity and being rigidly secured to and suspended from said head portion, said barrel having a radially projecting shoulder zone axially spaced from said head portion and extending around said barrel, said shoulder zone having an outer peripheral surface in slidable sealing engagement with said housing, said scavenging and exhaust ports being disposed in said shoulder zone and having peripherally aligned outer openings of substantially the same length in the axial cylinder direction, said cylinder structure being also in slidable sealing engagement with said housing along a periphery spaced from said shoulder zone at the side remote from said head portion so that said cylinder structure and said housing form together two annular cooling-air jacket spaces, said cylinder structure having cooling fins in said two spaces, and said cooling fins having an outer diameter at most as large as the outer diameter of said shoulder zone.

4. In an engine according to claim 3, said radially projecting shoulder zone of said cylinder structure comprising cooling-air ducts located beside said exhaust ports and extending through said shoulder zone in a direction parallel to the axis of said cylinder structure so as to interconnect said two jacket spaces, and said engine housing having cooling-air ducts also extending in said direction and interconnecting said two jacket spaces.

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