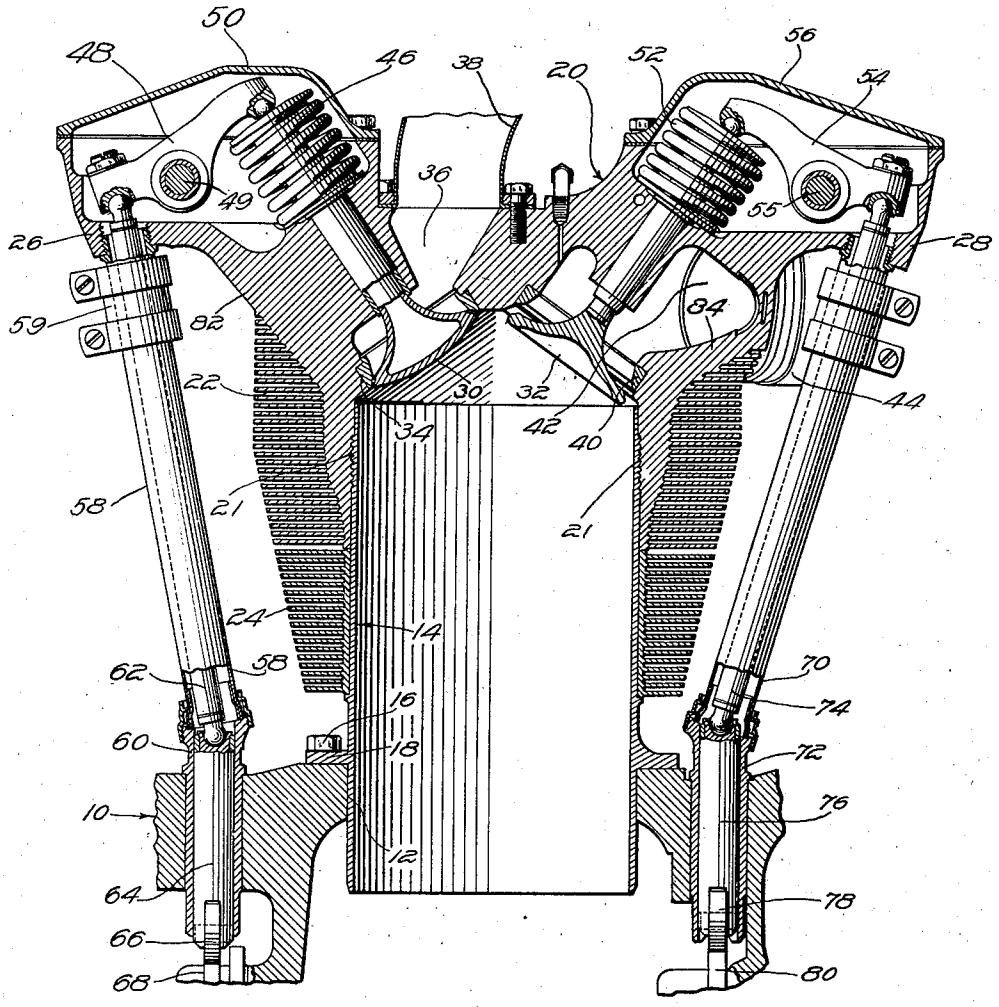
May 28, 1946. A. V. D. WILLGOOS 2,401,211

CYLINDER HEAD

Filed May 22, 1942 2 Sheets-Sheet 1

Fig. 1.



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Filed May 22, 1942 2 Sheets-Sheet 2

Fig. 2.

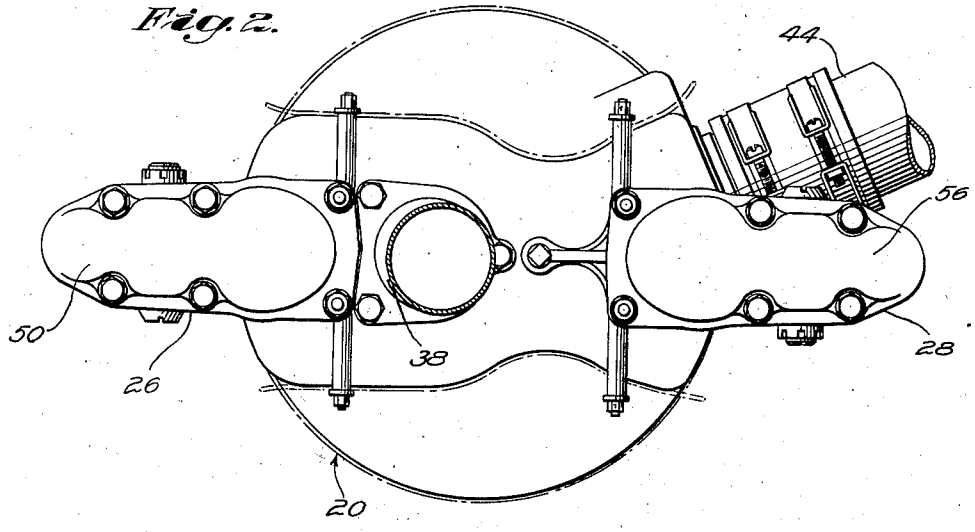
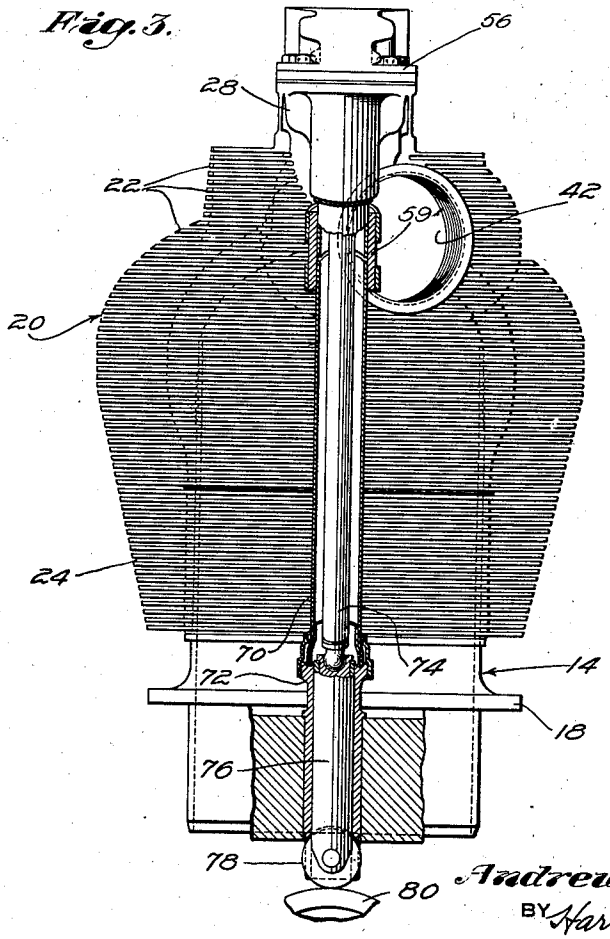


Fig. 3.



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UNITED STATES PATENT OFFICE

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CYLINDER HEAD

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Application May 22, 1942, Serial No. 444,033

5 Claims. (Cl. 123—90)

This invention relates to improvements in internal-combustion engines and has particular reference to an improved cylinder and valve construction particularly adapted for a radial, air-cooled, valve-in-head, type of engine.

An object of the invention resides in the provision of a valve and cylinder construction so arranged that the valve operating mechanism lies substantially in a plane including the longitudinal center line of the cylinder thereby eliminating to a large extent side thrust and bending forces imposed on the cylinder by the operation of the valve actuating mechanism.

A further object resides in the provision of an engine cylinder and valve construction having head-carried valve mechanism in closures arranged on opposite sides of the center line of the cylinder and adapted to occupy a substantially fore-and-aft position relative to the engine so that the cylinder heads may be closely grouped on a radial engine without interference between the valve mechanism enclosures or rocker boxes of adjacent cylinders, as disclosed and claimed in the concurrently filed application of Leonard S. Hobbs Serial No. 444,062.

Another object resides in the provision in an air-cooled engine cylinder, of rocker boxes arranged fore-and-aft in the direction of the cooling air flow, to provide for the possibility of assembling the cylinder on the engine crank-case in either of two positions one hundred and eighty degrees apart in order to obtain satisfactory cylinder cooling in installations wherein the air flow may be from either end of the engine as might be the case in pusher and tractor installations for aircraft. Thus, the same engine may be assembled either as tractor or a pusher, with consequent reversal of cooling airflow relative to the engine as a whole; yet the cooling airflow relative to the cylinder head and valves may be kept the same in either type of installation merely by reversing the cylinder and valve assembly relative to the crankcase.

A still further object resides in the provision of an engine cylinder and valve construction of the character indicated, so arranged that either the intake port or the exhaust port may open through the cylinder head between the rocker boxes.

Other objects and advantages will be more particularly pointed out hereinafter or will become apparent as the description proceeds.

In the drawings, there is illustrated one embodiment of the invention. The drawings, however, are for the purpose of illustration only and are not to be taken as limiting or restricting the invention since it will be apparent to those skilled in the art that various changes in the illustrated arrangement may be resorted to without in any way exceeding the scope of the invention.

Fig. 1 is a longitudinal sectional view through the engine cylinder and valve mechanisms.

Fig. 2 is a top plan view of the engine cylinder shown in Fig. 1, and

Fig. 3 is a view of the engine cylinder shown in Fig. 1 looking from right to left.

Referring to the drawings in detail, the numeral 10 generally indicates the crankcase of an engine of the air-cooled radial type. This crankcase is provided with apertures, one of which is indicated at 12, to receive the lower or skirt portions of cylinder barrels, one of which is generally indicated at 14. The barrel is secured to the crankcase in either of the two reversed positions referred to above by hold-down bolts 16 passing through a flange 18 integral with the barrel 14.

A cylinder head, generally indicated at 20, and disclosed and claimed per se in my concurrently filed application Serial No. 444,032 is threaded at 21 onto the outer end of the barrel 14 and is provided with cooling fins 22. Between the head and the flange 18 the barrel is surrounded by a fin muff 24 to complete the fin srtucture and dissipate excess heat from the cylinder.

The cylinder head 20 has two oppositely disposed extensions 26 and 28, which support the exhaust and intake valve mechanisms. An exhaust valve seat 34 is mounted in extension 26 and from this valve an exhaust port 36 passing through the top of the cylinder head opens into an external exhaust stack 38. Extension 28 is provided with an intake valve seat 40 and from this valve an intake port 42 opens through the side of the cylinder to the intake pipe 44. The upper part of extension 26 is made box-like to receive the valve spring 46, and rocker arm 48 pivoted at 49. The top of the rocker box is covered by a plate 50. Similarly, the upper portion of extension 28 is made box-like to receive the intake valve spring 52 and the intake valve rocker arm 54 pivoted at 55, and is closed by cover plate 56. The projecting portion of the exhaust rocker box receives the upper end of a push rod tube 58, the lower end of which is attached to a tappet guide secured in the crankcase 10. Tube 58 is provided with an expansion joint 59. Within tube 58 is a push rod 62, the upper end of which engages the rocker arm 48 and the lower end of which bears upon the valve tappet 64. The lower end of tappet 64 carries a roller 66 which rides

upon a cam 68 within the engine crankcase and concentric with the crankshaft. The projecting portion of the intake rocker box receives the upper end of a push rod tube 70, the lower end of which is secured to a valve tappet guide 72 secured in the engine crankcase. Within tube 70 is a push rod 74, the upper end of which engages the rocker arm 54 and the lower end of which bears upon the valve tappet 76. The lower end of tappet 76 carries a roller 78 riding upon cam 80 which is also concentric with the engine crankshaft.

With this arrangement, the center lines of the two push rods 62 and 74 are in a fore-and-aft plane which includes the center line of the cylinder. When the push rods are raised by the tappets against the resistance of the valve springs 46 and 52, the force exerted on the cylinder is substantially in the above mentioned plane so there are no twisting forces imposed on the cylinder, cylinder head, or rocker boxes. The only forces imposed on the rocker boxes are those due to push rod thrust since the arrangement of the rocker arms 48 and 54 compensates for the angularity of the thrusts occasioned by the outward inclination of the push rods in the same plane. These thrust forces on the rocker boxes are easily resisted by providing suitable web members such as 82, for the exhaust side, and 84, for the intake side. Although web 84 is somewhat distorted by the position of the intake port 42 and the intake pipe 44, it is easily made of adequate strength to effectively resist the forces imposed on the cylinder head extension by push rod 74.

The above described structure also has the further advantage that it relieves the cylinder of continuously changing bending stresses since the relatively large overlap of the cams 68 and 80 produces only a substantially balanced outward thrust on the cylinder during the intervals when both valves are open. Also, the arrangement relieves the cylinder of a large portion of the stress occasioned by the usual arrangement in which both rocker boxes are on the same side of the cylinder whereby one side of the cylinder must at times resist the thrust of both push rods. In the present arrangement there is, at no time, applied to the same side of the cylinder, a force greater than that occasioned by the operation of one push rod. The present arrangement, therefore, tends to materially relieve the cylinder and cylinder head of stresses due to valve operation, thus reducing fatigue deterioration. These factors lead to a greatly increased cylinder life and permit a more economical engine construction. The arrangement also facilitates the baffling of a radial engine within its cowl and permits the use of a cowl of comparatively small diameter.

While the ideal fore-and-aft construction includes the valve, push rods, and the center line of the cylinder in a plane including the axis of rotation of the engine, it is to be understood that some deviation from those ideal conditions may be permitted without seriously affecting advantages above described.

It is to be understood that the invention is not limited to the specific embodiment herein illustrated and described, but may be used in other ways without departure from its spirit as defined by the following claims.

I claim:

1. In an air cooled internal combustion aircraft engine having a crankcase, valve tappets extending through said crankcase at spaced positions longitudinally thereof, a cylinder including a head having rocker boxes symmetrically disposed on opposite sides of said head, valve mechanism in said rocker boxes, cooling fins on said cylinder and head extending outwardly therefrom at substantially right angles to the axis of said cylinder, means for mounting said cylinder including said rocker boxes and said valve mechanism on said crankcase between said valve tappets in either one of two opposed positions relative to said valve tappets, whereby said rocker boxes may be interchanged, and means for operating said rocker box valve mechanism by said valve tappets in either of said cylinder positions.

2. In an air cooled internal combustion aircraft engine, a crankcase, a cylinder head having oppositely disposed intake and exhaust valve rocker boxes thereon, means for selectively mounting said cylinder head on said crankcase in either one of two positions one hundred and eighty degrees apart, valve rocker arms mounted in said rocker boxes, valve tappets extending through said crankcase at opposite sides of said cylinder, and valve rods operatively connecting said rocker arms with said valve tappets, said rocker boxes and said rocker arms being so disposed relative to each other and to said valve tappets that said cylinder head may be operatively associated with said valve tappets and valve rods in either one of said two positions, whereby said rocker boxes may be reversed in position with respect to said crankcase to accommodate said cylinder head to a reversal in the direction of cooling airflow relative to said crankcase.

3. A cylinder and valve mechanism combination for either pusher or tractor type air-cooled aircraft engine installations, comprising, a cylinder including a head having cooling fins arranged to provide for the flow of cooling air in a fore and aft direction, fore and aft rocker boxes projecting from said head, intake and exhaust valves mounted on said head and having stems extending one into each of said boxes, a valve operating rocker arm mounted in each of said rocker boxes and operatively associated with the respective valve stems, connecting means carried by each arm for engaging a respective valve operating rod, said rocker boxes and said rocker arms being symmetrically located on either side of a plane including the cylinder axis and perpendicular to a line joining said connecting means, whereby said intake and exhaust rocker boxes, valves and operating arms may be interchanged with respect to said valve operating rods to provide either a pusher or a tractor type cylinder installation.

4. In a reversible cylinder construction for an aircooled aircraft engine, a cylinder head having fore and aft valve rocker boxes symmetrically disposed on opposite sides thereof, a fluid passage extending through the top of said head between said boxes, a fluid passage extending through the side of said head adjacent one of said boxes, cooling fins on said head adjacent said valve passages, and valve rocker arms in said boxes adapted to be operatively connected, when said boxes are in either of two interchanged positions, with push rods respectively positioned fore and aft of said cylinder, whereby said cylinder may be reversed in accordance with a reversal in cooling air flow to maintain the same direction of cooling airflow over said cooling fins and relative to said fluid passages in either of said interchanged positions.

5. In a cylinder construction for aircooled aircraft engines, a cylinder head having integral fore and aft valve supporting extensions thereon,

a valve stem bore in each of said extensions, a fluid passage extending through the top of said head between said valve stem bores, a fluid passage extending in a generally fore and aft direction through the side of said head and one of said extensions, valve mechanism supported by each of said extensions including push rods respectively positioned fore and aft of said extensions, and cooling fins substantially completely covering those portions of said extensions containing said valve stem bores and said fluid passages, said cooling fins lying substantially in parallel planes normal to the centerline of said cylinder.

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