

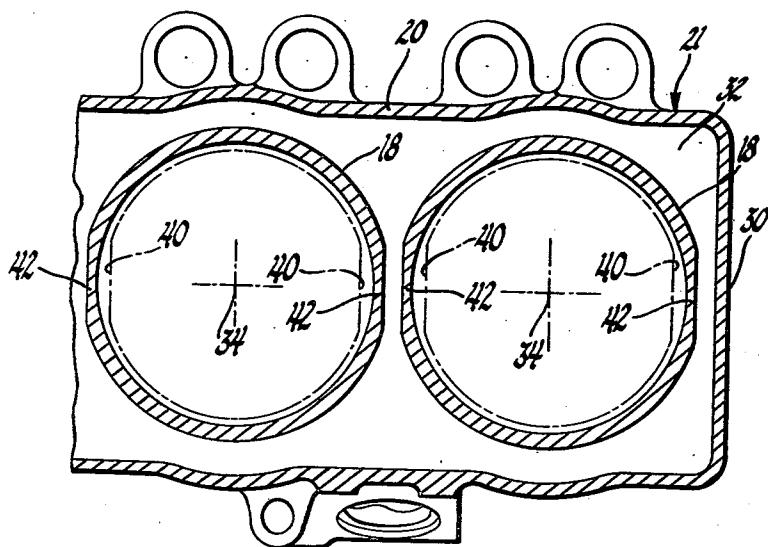
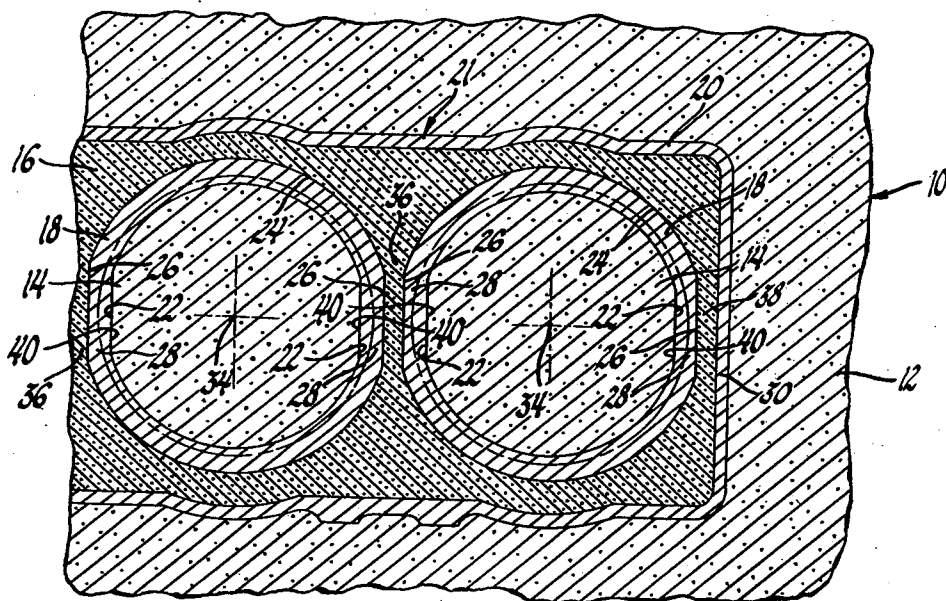
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CYLINDER BLOCK AND METHOD OF MAKING THE SAME

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1

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This invention relates to engines and the like, and more particularly to a cylinder block and a method of making the same.

Cylinder blocks, particularly those for water-cooled internal combustion engines, whether of the V or the inline type, normally comprise one or more rows of spaced cylinders disposed within an outer chamber for containing the cooling fluid. Where the cylinder block is a cast structure, the block is usually formed by pouring molten metal into a green sand mold having spaced baked cylinder or barrel cores supported therein, the cylinder cores being surrounded by a baked water jacket core having openings of sufficient diameter to receive the cylinder cores with clearance and being itself spaced from the green sand mold.

The cylinder cores and the openings in the water jacket cores are cylindrical in shape, the cast thickness of the cylinder walls being determined by the clearance between the cylinder cores and the water jacket core and the spacing between the outer surfaces of the cylinder walls depending upon the thickness of the portions of the water jacket core between the cylinder openings therein.

It has become more and more desirable to construct engines, and consequently the cylinder blocks thereof, as short as possible to conserve space in the engine compartment. To accomplish this, it is necessary to cast the cylinders as close together as possible. The obvious way of doing this, if the above method of casting is to be employed, is to decrease the cylinder wall thickness by decreasing the clearance between the cylinder cores and the water jacket core and/or to decrease the thickness of those portions of the water jacket between the cylinder openings therein.

The former expedient has limitations due to the minimum wall thickness that may be formed by sand casting methods; the latter expedient has limitations due to the difficulty of handling thin walled sand cores without damaging the same. Both of the above limitations, it will be noted, arise out of difficulties experienced in the foundry.

It is now proposed to combine certain novel foundry and machining practices in order to produce a shorter cylinder block in which the cylinders are more closely spaced without encountering the above limitations.

More specifically, the proposed cylinder block is cast by the use of cylinder cores having flattened surfaces disposed on opposite sides thereof and extending in a direction normal to a plane joining or substantially joining the axes of the cylinders. The water jacket core openings have similar and cooperating flattened surfaces. In this manner, cylinders having substantially uniform wall thickness with oppositely disposed flat portions may be cast. However, the axes of these cylinders may be more closely spaced than usual, without reducing the water jacket thickness between cylinder openings. The cylinders are then finished as usual by a boring or other machining operation by which the internal flattened portions formed by the flattened surfaces on the cylinder cores are removed. While this results in a finished cylinder wall that is thinner

2

between cylinders, this variation in wall thickness is not so great as to result in harmful consequences in operation of the engine.

In the drawings:

5 Figure 1 is a fragmentary cross-sectional view of a poured sand mold and core assembly taken in a plane normal to the axes of the cylinders and illustrating a method of casting a cylinder block embodying the invention.

10 Figure 2 is a fragmentary cross-sectional view of the cylinder block shown by Figure 1 and taken on the same plane as Figure 1. Figure 2 illustrates a method embodying the invention of finish machining the cast block shown by Figure 1.

Referring to the drawings in greater detail, Figure 1 illustrates a cross-section through a poured mold and core assembly 10 comprising the usual green sand mold 12, baked cylinder or barrel cores 14 and baked water jacket core 16. Figure 1 is intended to be illustrative only of a method embodying the invention of casting a cylinder block for an inline engine or one row of cylinders in a cylinder block for a V-type engine. Since Figure 1 illustrates a poured assembly, the cylinder walls 18 and the outer walls 20 of the cylinder block 21 are also shown in cross-section.

25 It will be noted that the otherwise cylindrical cylinder cores 14 have flat external surfaces 22 on opposite sides thereof. The cylinder openings 24 in the water jacket core 16 receiving the cylinder cores have similar cooperating flat internal surfaces 26. In this manner, cylinder walls 18 of uniform or substantially uniform thickness and having flat portions 28 may be cast. The flat portions 28 occur not only between cylinders, but adjacent the end portions 30 of the outer wall 20 of the cylinder block defining the cooling fluid chamber 32.

35 By the above casting method, the axes 34 of the cylinders may be more closely spaced with respect to one another and to the end wall 30, and still the thicknesses of the portions 36 of the water jacket core between cylinder openings 24 and the portion 38 at the end thereof may be maintained sufficient to prevent their damage in ordinary handling. Also, the thickness of the cylinder walls 18 may be maintained sufficient and uniform to avoid well-known casting difficulties.

45 Figure 2 illustrates the method of completing the cylinder block cast by the method shown by Figure 1. The method includes the machining out of the internal flat surfaces 40 formed by the flat surfaces 22 of the cylinder cores 14 and represented by the broken lines in Figure 2. For this purpose, the cylinder may be machined to the broken line shown by Figure 1. This machining operation, of course, reduces the finished cylinder wall thicknesses at 42, but the thickness at 42 is sufficient for the operation of the engine.

55 While only one end of a block is shown, it is to be understood that the remaining portion of the block, for purposes of illustrating the invention, is substantially the same as the portion shown. The particular number of cylinders is of course not critical; nor is the particular configuration of the outer walls of the block.

60 It is apparent that the proposed method of casting results in a shorter cylinder block having more closely spaced cylinders. Furthermore, the result is accomplished without the above mentioned foundry problems.

Although it has been stated that the invention relates to the casting of cylinder blocks, it is pointed out that certain features of the invention may be adapted to other methods of making cylinder blocks or other articles. Also, the invention is adapted for the casting or otherwise forming of similar articles other than cylinder blocks.

70 What is claimed is:

1. A cylinder block having connected side walls and end walls defining a closed space adapted to receive cool-

ing fluid for said block, a row of cylinders spaced from each other and extending through said closed space, the end cylinders in said row of cylinders being spaced from said end walls and all of said cylinders being spaced from said side walls, the walls of each of said cylinders having a substantially circular cross-section except at the portions thereof opposite adjacent cylinders and said end walls, said excepted portions being flattened.

2. A cylinder block having a continuous wall defining a closed space adapted to receive cooling fluid for said block, a row of cylinders spaced from each other and extending through said closed space, the end cylinders in said row of cylinders being spaced from said end walls and all of said cylinders being spaced from said side walls, the walls of each of said cylinders having a substantially circular cross-section except at the portions thereof opposite adjacent cylinders, said excepted portions being flattened.

3. In a cylinder block, spaced side walls and end walls joining said side walls, said walls defining an enclosed space adapted to contain cooling fluid, at least two cylinders disposed within said enclosed space and spaced apart from said side and end walls, said cylinders having walls of substantially uniform thickness, said cylinder walls having flattened portions adjacent said end walls and between said cylinders along the portions thereof disposed in said enclosed space, the remainder of said cylinder walls within said enclosed space being of substantially circular cross-section.

4. In a cylinder block, spaced side walls and end walls joining said side walls, said walls defining an enclosed space adapted to contain cooling fluid, at least one cylinder disposed within said enclosed space and spaced apart from said side and end walls, said cylinder having a wall of substantially uniform thickness, said cylinder wall having flattened portions adjacent said end walls along the portions thereof disposed in said enclosed space, the remainder of said cylinder wall within said enclosed space being of substantially circular cross-section.

5. A method of making a cylinder block, comprising forming spaced cylinder walls of substantially uniform thickness and circular cross-section except for flattened internal and external surfaces along certain of the same sides thereof and subsequently machining out the internal flattened surfaces to provide spaced completely cylindrical cylinder bores.

6. A method of making an object having spaced cylindrical openings therethrough, comprising forming spaced cylindrical walls of substantially uniform thickness and circular cross-section except for flattened internal and external surfaces along certain of the same sides thereof and subsequently removing the internal flattened surfaces to provide spaced completely cylindrical passages.

7. A method of casting a cylinder block, comprising supporting spaced cylinder cores having opposed flattened external surfaces within the cylinder openings of a water jacket core having opposed correspondingly flattened internal surfaces in said cylinder openings in a manner so that said cylinder cores are spaced from said water jacket core and filling said space with metal.

8. A method of casting an object having spaced passages, comprising supporting spaced cylindrical first cores having opposed flattened external surfaces within cylindrical openings of a second core having opposed correspondingly flattened internal surfaces in said cylindrical openings in a manner so that said first cores are spaced from said second core and filling said space with metal.

9. A method of manufacturing a cylinder block, comprising supporting spaced cylinder cores having opposed flattened external surfaces within the cylinder openings of a water jacket core having opposed correspondingly

flattened internal surfaces in said cylinder openings in a manner so that said cylinder cores are spaced from said water jacket core, filling said space with metal, removing said cores and machining the internal surfaces of the cylinder walls to remove the flattened internal surfaces formed thereon by said flattened external surfaces on said cylinder cores.

10. A method of manufacturing an object having spaced passages, comprising supporting spaced cylindrical first cores having opposed flattened external surfaces within cylindrical openings of a second core having opposed correspondingly flattened internal surfaces in said cylindrical openings in a manner so that said first cores are spaced from said second core, filling said space with metal, removing said cores and machining the internal surfaces of the cylindrical walls to remove the flattened internal surfaces formed thereon by said flattened external surfaces on said first cores.

11. An engine block, comprising a space defined by spaced side walls and spaced end walls joining said side walls, a row of separate cylinder walls within said space and spaced apart from said side and end walls, said cylinder walls each having a cylindrical internal surface and a substantially cylindrical external surface except at portions between said cylinder walls and between said cylinder walls and said end walls, said excepted portions being flattened with a resultant reduction in cylinder wall thickness.

12. A hollow object, comprising a space defined by a continuous wall, a row of separate cylindrical walls within said space and spaced from said continuous wall, said cylindrical walls each having a cylindrical internal surface and a substantially cylindrical external surface except at portions therebetween and between said cylindrical walls and said continuous wall, said excepted portions being flattened with a resultant reduction in wall thickness.

13. The method of manufacturing a cylinder block which includes forming a water jacket core to include cylinder core passages provided therein having opposed flattened surfaces, forming cylinder core members having opposed flattened external surfaces, disposing said cylinder core members within said water jacket cylinder core passages in spaced relation to the walls thereof, arranging the flattened surfaces of said cores in respective parallel spaced relation, filling the space between said cores with metal to provide cylinders of substantially uniform thickness having opposed flattened sides, and removing said cores.

14. The method of manufacturing cylinder blocks which includes forming a water jacket core to include cylinder core passages provided therein having opposed flattened surfaces, forming cylinder core members having opposed flattened external surfaces, disposing said cylinder core members within said water jacket cylinder core passages in spaced relation to the walls thereof, arranging the flattened surfaces of said cores in respective parallel spaced relation, filling the space between said cores with metal to provide cylinders of substantially uniform thickness having opposed flattened sides, and removing the flattened surfaces providing internally of said cylinders by said flattened sides to form a substantially cylindrical opening therein.

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