

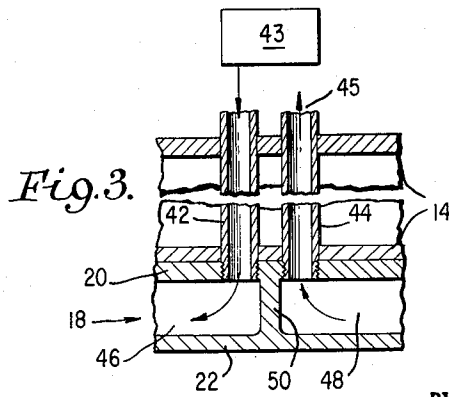
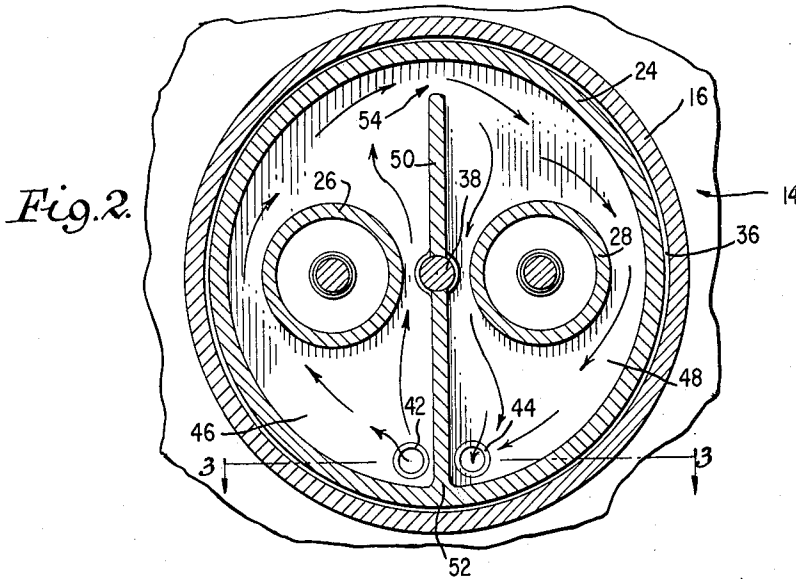
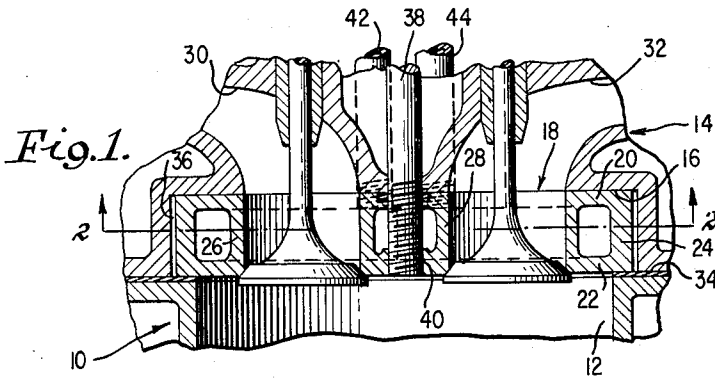
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INTERNAL COMBUSTION ENGINE COOLING SYSTEM

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INTERNAL COMBUSTION ENGINE COOLING SYSTEM

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This invention relates to improvements in internal combustion engines and is concerned more particularly with novel means for more efficiently cooling certain areas of the combustion chambers thereof.

In internal combustion engines, particularly in heavy duty engines, whether mobile or stationary, the problem of cooling critical areas of the combustion chamber is especially troublesome. Even with efficient cooling, cracks and fissures may be expected in those regions where thermal stresses are most highly concentrated, as for example, at or near any area of substantial section change and/or subjected to substantial temperature change. Therefore, cracks usually occur at or near valve seat areas, at or near spark plug bosses, adjacent fuel injection nozzle bosses, and the like. Such failures have been largely obviated by providing, in the critical area of the combustion chamber, insert means which is fabricated of material superior to the material from which the engine is fabricated but whose use throughout the engine would be prohibitive in cost. However, even when such inserts are hollow and utilize internal cooling from the conventional water jacket of the associated engine, insufficient cooling effect may be obtained under certain conditions of usage such as in a large stationary installation, in supercharged engines and the like. Moreover, internally cooled hollow inserts are prone to clogging and loss of efficiency due to corrosion, rusting and sediment deposition when cooled in conjunction with engine cooling water.

It is, therefore, the primary object in connection with this invention to provide an improved insert and cooling system therefor which obviates the above noted defects.

Specifically, it is an object of this invention to provide cooling means for the critical areas of combustion chambers in which a hollow insert is used in conjunction with coolant supply means which is wholly independent of the normal cooling system for the engine.

It is a further object of this invention to provide an insert and cooling system therefor having simplicity of design, economy of construction and efficiency in operation.

The novel features that are considered characteristic of the invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of a specific embodiment when read in connection with the accompanying drawings, wherein like reference characters indicate like parts throughout the several figures and in which:

FIGURE 1 is a cross sectional view taken vertically through a portion of an internal combustion engine, showing the insert and coolant supply means according to the present invention;

FIGURE 2 is a cross sectional view taken along the plane of section line 2—2 in FIGURE 1, showing the interior construction of the insert, and

FIGURE 3 is a fragmentary cross sectional view taken along the plane of section line 3—3 in FIGURE 2 including a diagrammatic illustration of an external coolant supply, showing the fashion in which the coolant inducting and exhaust means are operative to cause coolant flow within the insert.

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Referring now specifically to the drawing, with particular reference to FIGURE 1, typical internal combustion engine structure is fragmentarily shown as including an engine block 10 which is provided with a cylinder 12 and is surmounted by a removably secured head 14. It is to be understood, of course, that aside from the novel insert and cooling system, therefore, as hereinafter described, the engine itself is of conventional construction and operation and, depending upon the type of engine, is provided with the usual ignition system for igniting a combustible charge in the combustion chamber which is constituted by the upper portion of the cylinder 12.

In accordance with the present invention, the bottom surface of the cylinder head 14 which normally forms one wall of the combustion chamber within the cylinder 12 is provided with a recess 16 which receives an insert 18 that is exposed to the intense thermal stresses to which the bottom wall of the cylinder head normally is subjected. The insert 18 itself is hollow, having upper and lower walls 20 and 22 and a cylindrical peripheral or side wall 24, and is provided with port walls 26 and 28 forming extensions for the usual exhaust and intake ports 30 and 32 in the cylinder head. Additional port walls, not shown, may be provided in the insert to accommodate a spark plug or injector nozzle assembly depending upon the type of engine, or one of these elements may be accommodated in the block 10, as the case may be.

It is preferred that the insert 18 be of such dimensions as to overlap, peripherally, the area surrounding the cylinder 12, as shown, so that the marginal edge of the insert seats upon the usual head gasket 34. In this fashion, the normal means for securing the cylinder head to the block will also serve to secure the insert 18 in place. However, in order to properly center the insert within the recess 16, which is enlarged to provide radial clearance 36 between the peripheral wall 24 of the insert 18 and the peripheral wall of the recess 16 to accommodate thermal expansion of the insert, a further fastening element 38 which may be in the form of a stud or bolt passing through the cylinder head 14 and threadedly engaged in a tapped bore 40, conveniently located centrally of the insert.

It is a particular feature of this invention to provide individual inlet and outlet means for introducing coolant into and exhausting the same from the interior of the hollow insert 18. In the particular form of the invention as shown, such means may be in the form of a pair of ducts or tubes 42 and 44 which pass through and are sealed from the interior of the cylinder head 14, and are threaded at their lower ends for engagement in tapped bores through the upper wall 20 of the insert to communicate with the interior thereof. In this fashion, both ducts lead directly to the interior of the insert and, it will be understood, they are individually connected to an external coolant supply source 43 and exhaust 45.

As best shown in FIGURE 2, the interior of the insert preferably is divided into two interior chambers 46 and 48 by a vertical partition wall 50 which extends diametrically from a point of junction 52 with the peripheral side wall 24 of the insert to a point slightly spaced from the diametrically opposite side of said side walls so as to leave an open channel 54 between the two interior chambers 46 and 48. Preferably, the combustion exhaust passage wall 26 traverses, and the coolant inlet 42 opens into the chamber 46 so as to obtain maximum cooling of those portions subject to the greatest heat, and the combustion gas inlet wall 28 may traverse, and coolant exhaust 44 may communicate with, the chamber 48.

The basic concept of the present invention resides in the provision of means for circulating a fluid coolant

through the insert other than the coolant in the engine water jacket which usually is water and which tends to promote rust and carry sediment that settles in and clogs the passages in communication with the insert and thus inhibits circulatory flow and heat transfer. The coolant may comprise compressed air, or other gas, non-rusting liquid coolants, refrigerants of the gas-liquid type, or combinations of gas and liquid coolants. Moreover, the coolant may flow through an open system, as shown in FIGURE 3 wherein the coolant supply 43 may be a source of compressed air, for example, and the exhaust 45 discharge to atmosphere, or it may be a closed circulatory system with the exhaust 45 connected with and discharging to the source 43 which may constitute a condenser or radiator.

In regard to the use of compressed air, it will be noted that in some large power plants, a multicylinder arrangement is used wherein one cylinder operates only as a starting cylinder and as an air compressor for building a supply of compressed starting air. With such an arrangement, the starting air tank may be used for ancillary purposes and likewise may be used as the source 43 of coolant. It is not uncommon for such systems to employ a starting air tank pressure in the order of 200 p.s.i., thereby providing an ample supply of compressed air for cooling the insert. With a high pressure source of compressed air, the sudden expansion of the same as the air is introduced into the relatively large inlet chamber 46, achieves a high degree of cooling effect and efficiency hitherto unobtainable by the conventional use of water as a coolant. Thus, the present invention is particularly invaluable in conjunction with power plants in which combustion chamber cooling is abnormally troublesome.

Similarly, the insert system as described may be used in supercharged engines in which combustion chamber temperatures and pressures are normally much higher than those in un aspirated engines. Moreover, the system in accord with this invention, due to its independence of normal coolant systems employed for the engine, may readily utilize any suitable coolant medium. For example, an admixture of air and water in the form of "fog" may be used, in which case, the latent heat of vaporization of the water content may be used to effect a substantial degree of cooling. That is to say, in contrast to normal water jacket cooling of an engine wherein vaporization is to be avoided, the insert and the external coolant supply system may easily take advantage of the cooling effect achieved by vaporization since the formation of steam pockets is avoided by the internal forced flow through the insert.

Likewise, other coolants may be introduced in liquid form into the insert to advantageously employ the cooling effect of vaporization, with or without the use of air as a carrier therefor.

Although a certain specific embodiment of the invention has been shown and described, it is obvious that many modifications thereof are possible. The invention, therefore, is not to be restricted except insofar as is necessitated by the prior art and by the spirit of the appended claims.

What is claimed is:

1. In an internal combustion engine, a cylinder block provided with a cylinder bore, a cylinder head attached to said block over said bore, said head being recessed in an area thereof over said bore, and an insert removably mounted in said recess, said insert being hollow and having inlet and outlet means connected thereto leading externally of said cylinder head for connection to an external coolant supply system, said head having intake and exhaust valve ports leading to said insert, said insert

having passages therethrough effecting continuation of said valve ports, said insert having divider means therein providing communicating chambers individually containing the insert walls forming said passages, said inlet and outlet means communicating respectively with said chambers, said exhaust passage wall traversing and said coolant inlet means being in communication with the same chamber within said insert.

2. An insert to be removably mounted over a critical area of an engine combustion chamber, said insert comprising a hollow body and having coolant inlet and outlet openings, said insert having valve port passages therethrough and divider means therein providing communicating chambers individually containing the valve port passage walls, said coolant inlet and outlet openings communicating respectively with said chambers, said exhaust port passage wall traversing and the coolant inlet opening being in communication with the same chamber within said insert.

3. In an internal combustion engine having an engine block provided with a cylinder bore and having a cylinder head closing an end of such bore,

an insert attached to said head and forming at least a portion of the combustion chamber surface thereof, said insert including spaced upper and lower wall means joined by continuous side wall means to define a hollow interior for the insert, a pair of valve port walls extending between said upper and lower wall means, partition wall means extending between said upper and lower wall means dividing the interior of said insert into a pair of chambers, and said insert having a coolant inlet opening communicating with one of said chambers and a coolant outlet opening communicating with the other of said chambers, said partition wall means having one end portion closely spaced from said side wall means to provide a restricted channel communicating said two chambers and one opposite end portion joined to said side wall means,

said inlet openings communicating with said one chamber and said outlet opening communicating with said other chamber and each being disposed remote from said channel adjacent said opposite end portion of said partition wall means,

one of said valve port walls being disposed in said one chamber between the coolant opening therein and said channel, and the other valve port wall being disposed in said other chamber between the coolant opening therein and said channel and each valve port wall being spaced both from said partition wall means and said side wall means so that coolant flowing between said inlet and outlet openings is constrained to divide and pass around said one valve port wall, through said channel, and thence to divide and pass around said other valve port wall.

4. In an internal combustion engine as defined in claim 3 wherein compressed air is used as the coolant.

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