

- [54] **CYLINDER HEAD OF AN AIR-COOLED
INTERNAL COMBUSTION ENGINE**

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- [51] Int. Cl. F01p 9/04

- [58] **Field of Search**..... 123/41.57, 41.73

- ## [56] References Cited

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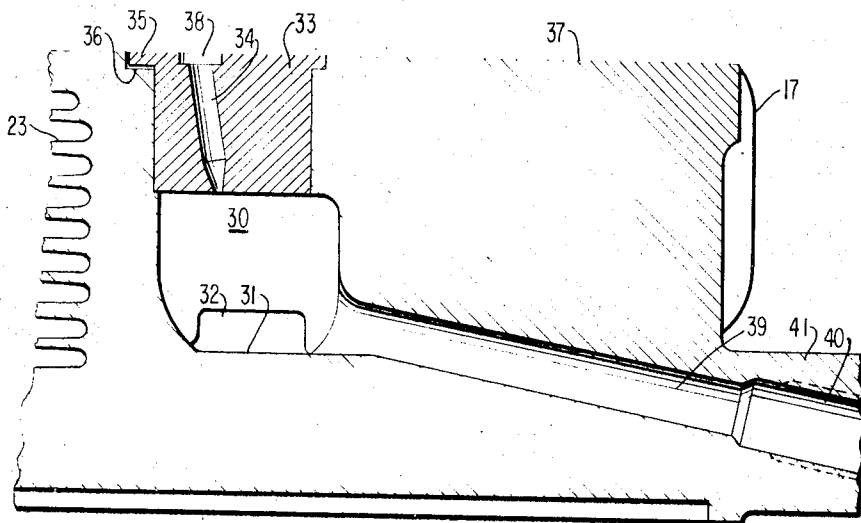
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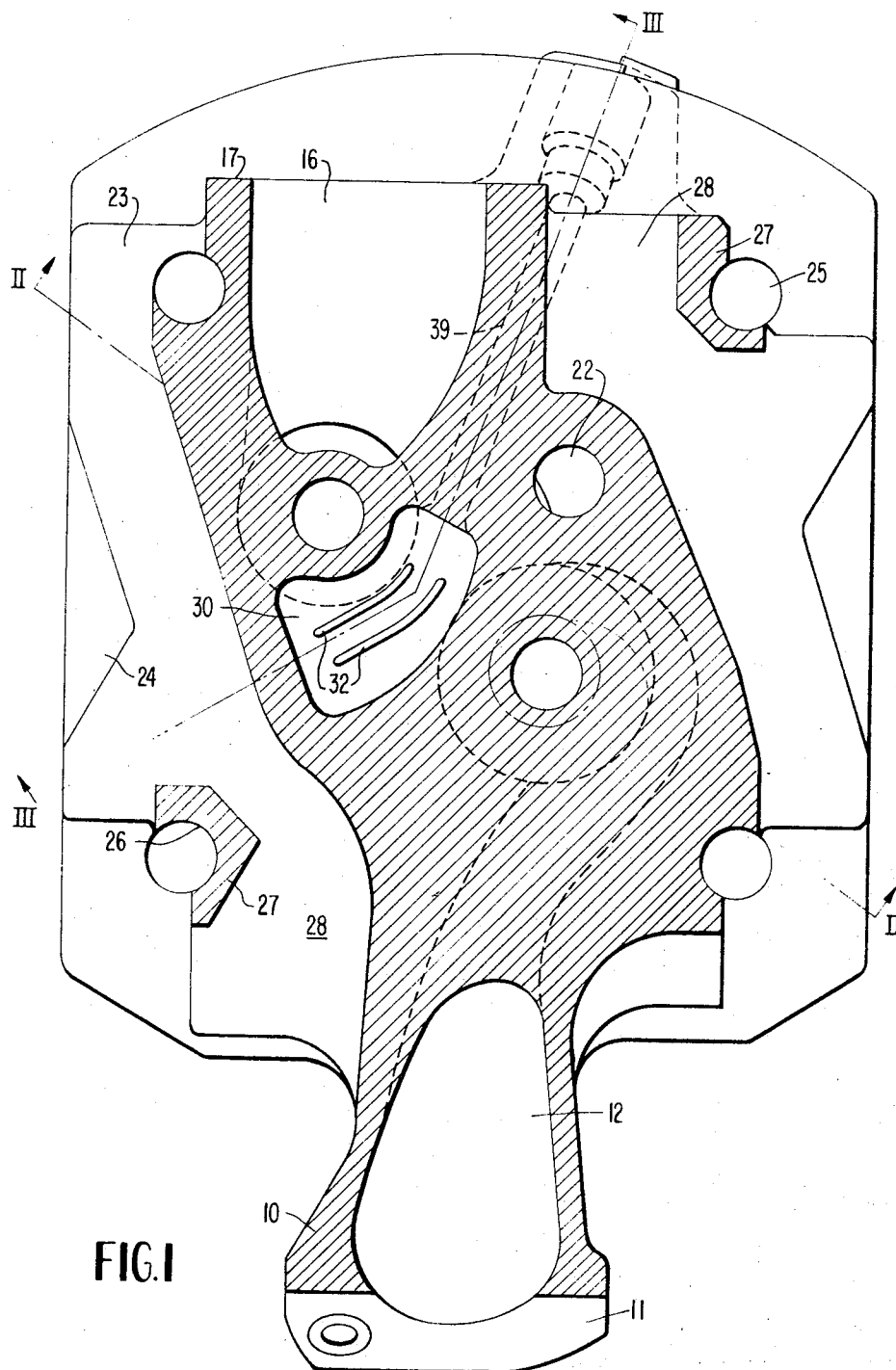
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[57] **ABSTRACT**

A cylinder head of an air-cooled internal combustion engine with additional oil cooling for those places subjected to maximum thermal loads, in which cooling surfaces are arranged on the inside of the cylinder head within a hollow space and an injection nozzle extends into the hollow space to inject cooling oil against the cooling surfaces while a discharge channel is connected with the hollow space.

14 Claims, 3 Drawing Figures





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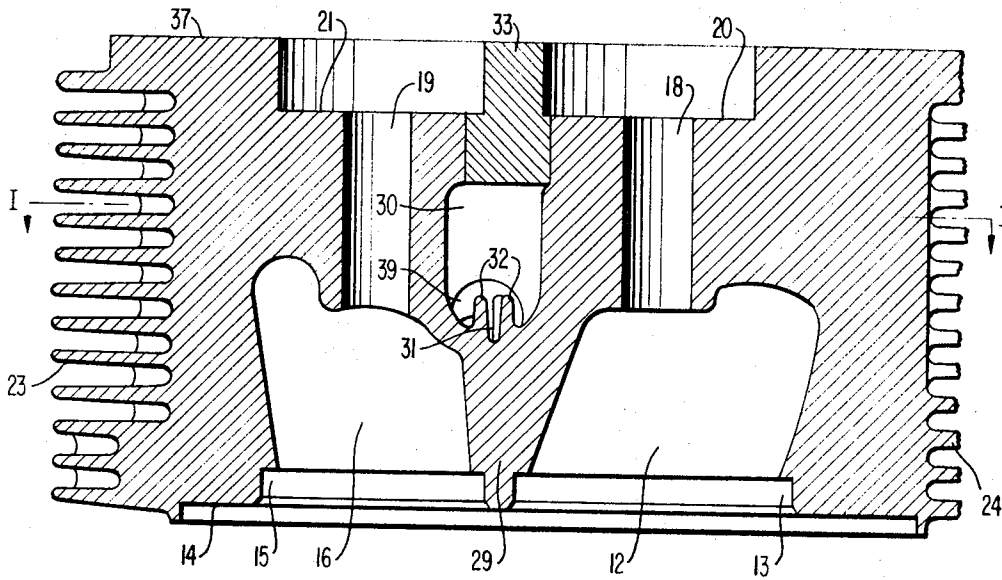


FIG. 2

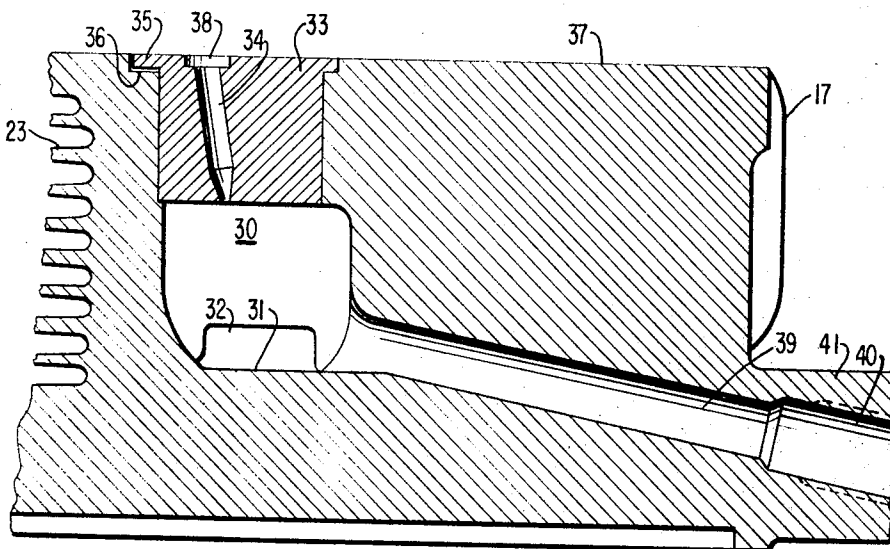


FIG. 3

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CYLINDER HEAD OF AN AIR-COOLED INTERNAL COMBUSTION ENGINE

BACKGROUND OF THE INVENTION

The present invention relates to a cylinder head of an air-cooled internal combustion engine with additional oil cooling of those places in particular subjected to thermal loads.

With such a type of cylinder head, a groove for pressure oil is machined into the seating surface thereof in order not to permit the occurrence of temperature peaks within this area. Untight places and leakages as a result of surface warping and distortion at the cylinder head flange are to be avoided thereby.

SUMMARY OF THE INVENTION

In contradistinction thereto, the present invention aims at achieving, especially with high performance engines, as uniform as possible a temperature distribution by an intensive oil cooling acting from the inside of the cylinder head. Thermal stresses in the entire cylinder head are to be reduced thereby. This takes place according to the present invention in that cooling surfaces are arranged on the inside of the cylinder head which are surrounded by a hollow space into which projects an injection nozzle directed against the cooling surfaces and to which is connected a discharge channel.

A particularly efficacious heat removal is achieved according to the present invention in that the cooling surfaces are constructed as cooling ribs which start from a part of the hollow space heated most strongly.

Accordingly, it is an object of the present invention to provide a cylinder head for an air-cooled internal combustion engine which avoids by simple means the aforementioned shortcomings and drawbacks encountered in the prior art.

Another object of the present invention resides in a cylinder head of an air-cooled internal combustion engine provided with an additional oil cooling system which achieves as uniform as possible a temperature distribution in the cylinder head.

A further object of the present invention resides in a cylinder head of an air-cooled internal combustion engine in which thermal stresses are reduced within the entire cylinder head.

Still a further object of the present invention resides in a cylinder head for an air-cooled internal combustion engine provided with an additional oil cooling that is particularly effective.

These and further objects, features, and advantages of the present invention will become more obvious from the following description when taken in connection with the accompanying drawing which shows, for purposes of illustration only, one embodiment in accordance with the present invention, and wherein:

FIG. 1 is a horizontal cross-sectional view through the cylinder head of an air-cooled Diesel internal combustion engine taken along line I—I of FIG. 2;

FIG. 2 is a vertical cross-sectional view taken along line II—II of FIG. 1; and

FIG. 3 is a vertical cross-sectional view taken along line III—III of FIG. 1.

Referring now to the drawing wherein like reference numerals are used throughout the various views to designate like parts, and more particularly to FIG. 1, an inlet connection 10 with a connecting flange 11 for the

suction pipe (not shown) of the Diesel internal combustion engine is disposed at one lateral wall of the cylinder head. The inlet channel 12 leads from the connecting flange 11 in a spiral to the inlet valve opening 13 (FIG. 2) in the bottom 14 of the cylinder head. The exhaust channel 16 (FIGS. 1 and 2) starting from the exhaust valve opening 15 disposed adjacent the inlet opening 13 leads to the connecting flange 17 for the exhaust gas pipe. Bores 18 and 19 (FIG. 2) serve for the accommodation of the valve guide means and counter-sunk parts 20 and 21 serve as abutments for the springs of the inlet and exhaust valves. A further bore 22 (FIG. 1) leading to the cylinder head bottom 14 is provided for the fuel injection nozzle of conventional construction. Cooling ribs 23 and 24 at the lateral walls extend relatively far into the inside of the cylinder head. In part, the cooling ribs 23 form cooling air channels 28 together with the cylinder head sections 27 adjoining the passage bores 25 and apertures 26 for the cylinder head bolts.

A hollow space 30 (FIG. 2) is arranged above the web 29 between the inlet channel 12 and the exhaust channel 16. Cooling ribs 32 (FIGS. 2 and 3) start from the bottom 31 of the hollow space 30. The hollow space 30 is closed at the top by a plug 33. An injection nozzle 34 for cooling oil is machined into the plug 33 whose axis is obliquely directed against the cooling ribs 32 in the hollow space 30. The installed position of the plug 33 corresponding to the desired jet direction is achieved by the shoulder 35 which engages into a corresponding aperture 36 in the top side 37 of the cylinder head. A cylindrical counter-sunk portion 38 at the beginning of the injection nozzle 34 serves for the connection of the supply line for the cooling oil. A downwardly inclined discharge channel 39 leads from the bottom 31 of the hollow space 30 to a pipe connection 41 provided with internal threads 40 for the return line.

The cooling oil circulatory system of the cylinder head is connected in parallel with the lubricating oil circulatory system of the internal combustion engine.

A separate supply pump and a further oil cooler can be economized thereby. The supply line (not shown) branching off from the lubricating oil circulatory system leads to the injection nozzle 34 in the plug 33 of the cylinder head. The cooling oil jet discharged from the injection nozzle 34 into the hollow space 30 impinges primarily against the ribs 32 starting from the bottom 31 and cools the same. The flowing-off cooling oil collects at the bottom 31 and flows off into the discharge channel 39 through the cooling ribs 32 constructed simultaneously as guide ribs whereby it further absorbs heat from the hot cylinder head parts. From the discharge channel 39, the cooling oil flows into a return line (not shown) threaded into the internal thread 40 of the connection 41 through which the cooling oil is then returned to the lubricating oil circulatory system.

The hollow space 30 is so arranged that the strong cooling oil jet constantly discharged from the injection nozzle 34 is directed exactly against the section of the cylinder head subjected to maximum thermal stresses; namely, against the web 29 which is heated both by the combustion space as well as by the exhaust channel 16. The cooling effect is further enhanced in that the hollow space 30 is curved, within a cylinder head cross-plane, concavely toward the exhaust channel 16 and thereby reaches over its entire extent close to the wall

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of the exhaust channel 16. The cooling ribs 23 are extended up to one of the walls surrounding the hollow space 30. The heat removal is thereby additionally assisted within this area, and the temperature of the oil present in the hollow space 30 is reduced.

In order that the cooling air passages in the cylinder head are not excessively constricted, the hollow space is generally kept as small as possible. Instead of a single larger hollow space, also several smaller hollow spaces may be provided. The injection nozzle may have different shapes corresponding to the strength and configuration of the cooling oil jet. Instead of one injection nozzle, a simple small injection pipe may also be used. It is also possible to enlarge the surfaces directly cooled by the oil by the use of several injection nozzles and/or injection pipes with different jet directions.

Thus, while I have shown and described only one embodiment in accordance with the present invention, it is obvious that the same is not limited thereto, but is susceptible of numerous changes and modifications as known to a person skilled in the art, and I therefore do not wish to be limited to the details shown and described herein but intend to cover all such changes and modifications as are within the scope of those skilled in the art.

I claim:

1. A cylinder head for an air-cooled internal combustion engine with additional oil cooling of only those places which are particularly subjected to thermal loads in order to equalize large temperature differences in the cylinder head, characterized by an oil-cooling system, providing for the continuous flow of cooling oil, which includes wall means forming on the inside of the cylinder head an enclosed hollow space located only in those parts of the cylinder head that are particularly subjected to thermal loads, cooling surface means provided on the inside of said hollow enclosed space, said cooling surface means defining a flow passage with an upstream and a downstream end for the flow of the cooling oil, injection means for injecting cooling oil from the upstream end against the cooling surface means and projecting into the enclosed hollow space, and discharge channel means connected to said enclosed hollow space near the bottom thereof and in the downstream continuation of the flow passage defined by said cooling surface means to enable a continuous orderly and directed flow of the injected oil through said flow passage in heat-exchange relation with said cooling surface means into the discharge channel means to remove the heat from said cooling surface means by the heated continuous oil flow carrying off the heat through the discharge channel means.

2. A cylinder head according to claim 1, wherein the cooling surface means are constructed as cooling ribs that start from the part of the hollow enclosed space

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that is subjected most strongly to thermal loads.

3. A cylinder head according to claim 2, wherein said cooling ribs are constructed as guide ribs which lead the cooling oil to the discharge channel means.

4. A cylinder head according to claim 3, wherein the cylinder head is provided with ribs for the air-cooling extending up to at least one of the wall means surrounding the hollow enclosed space.

5. A cylinder head with inlet and exhaust channels according to claim 4, wherein the hollow enclosed space containing the cooling surface means is arranged above a web disposed between the inlet and outlet channels of the cylinder head.

6. A cylinder head according to claim 5, wherein the injection means and discharge channel means of the cooling oil circulatory system are connected in parallel with a lubricating oil circulatory system of the internal combustion engine.

7. A cylinder head according to claim 1, wherein the cylinder head is provided with ribs for the air-cooling extending up to at least one of the wall means surrounding the hollow enclosed space.

8. A cylinder head with inlet and exhaust channels according to claim 1, wherein the hollow space containing the cooling surface means is arranged only above a web disposed between the inlet and outlet channels of the cylinder head.

9. A cylinder head according to claim 1, wherein the injection means and discharge channel means of the cooling oil circulatory system are connected with a lubricating oil circulatory system of the internal combustion engine.

10. A cylinder head according to claim 7, wherein the cooling surface means are constructed as cooling ribs that start from the part of the hollow space that is subjected most strongly to thermal loads.

11. A cylinder head according to claim 7, wherein the injection means and discharge channel means of the cooling oil circulatory system are connected with a lubricating oil circulatory system of the internal combustion engine.

12. A cylinder head with inlet and exhaust channels according to claim 7, wherein the hollow space containing the cooling surface means is arranged only above a web disposed between the inlet and outlet channels of the cylinder head.

13. A cylinder head according to claim 12, wherein the cooling surface means are constructed as cooling ribs that start from the part of the hollow space that is subjected most strongly to thermal loads.

14. A cylinder head according to claim 1, wherein the cooling surface means are surrounded by the wall means forming said hollow space.

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