United States Patent

[11] 3,547,086

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[21] Appl. No. **779,128**
[22] Filed **Nov. 26, 1968**
[45] Patented **Dec. 15, 1970**

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[32] Priority **Nov. 29, 1967**
[33] **Austria**
[31] **No. 10800/67**

[54] **CYLINDER HEAD FOR INTERNAL COMBUSTION ENGINES**
5 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **123/41.77,** 123/41.73, 123/41.76, 123/41.79, 123/41.85
[51] **Int. Cl.** **F01p 3/14,** F01p 3/02, F01p 1/06
[50] **Field of Search** 123/41.85; 123/41.82; 123/41.77; 123/41.79; 123/41.77; 123/41.76; 123/41.73; 123/41.31

[56] **References Cited**

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Primary Examiner—Mark M. Newman
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ABSTRACT: A cylinder head for water-cooled and valve controlled internal combustion engines having two water chambers for each cylinder unit separated from each other by a partition and communicating with each other.

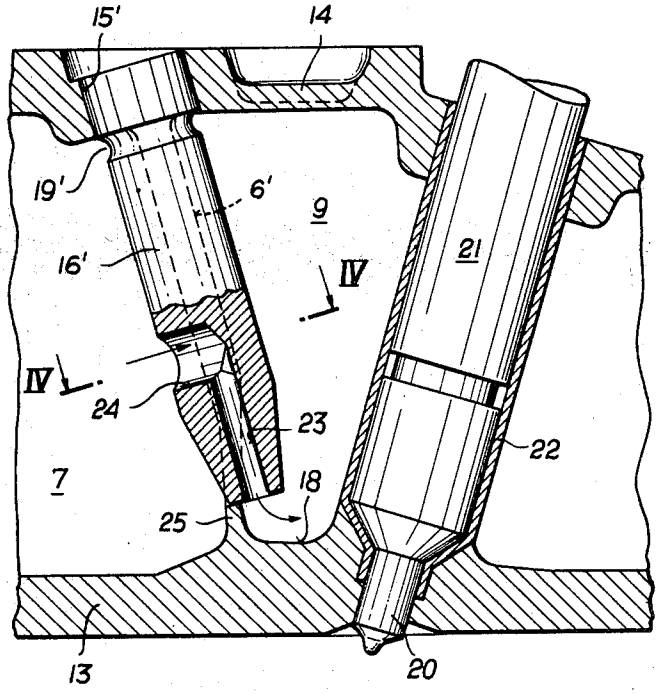

FIG. 1

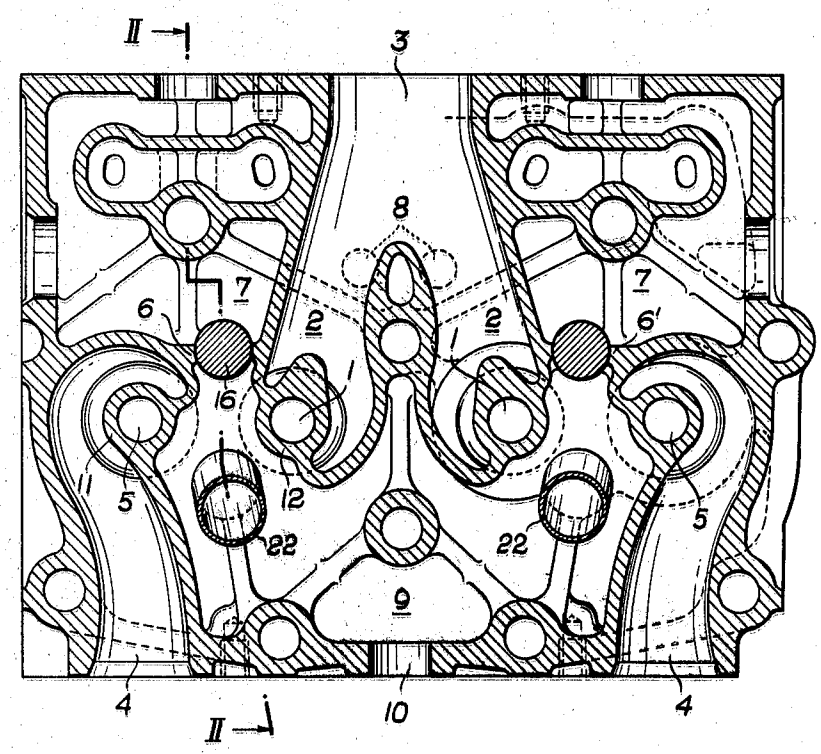

FIG. 2

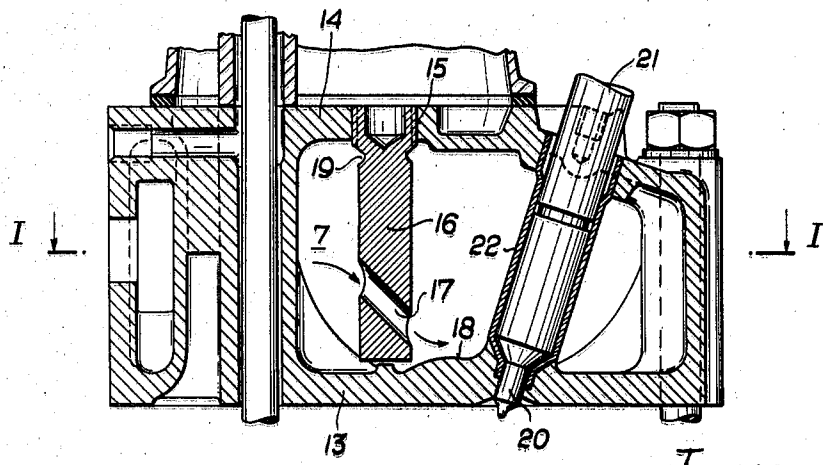

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FIG.3

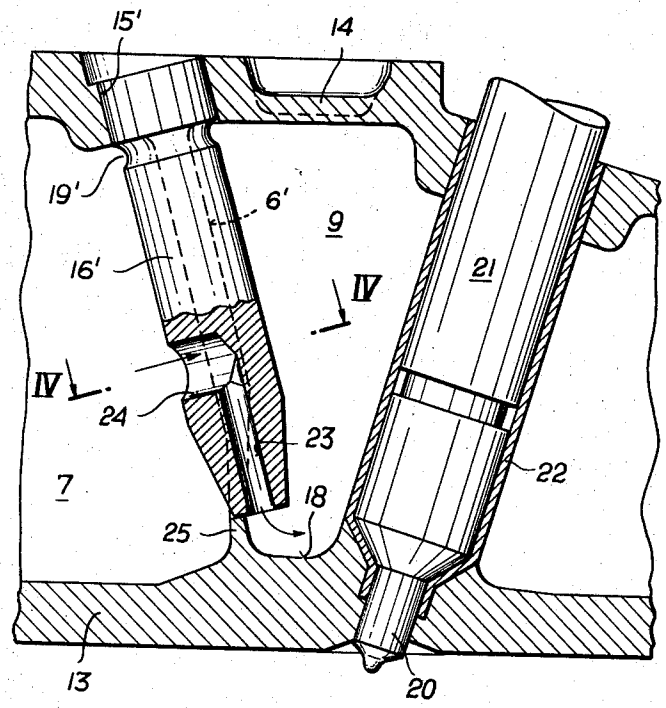

FIG.4

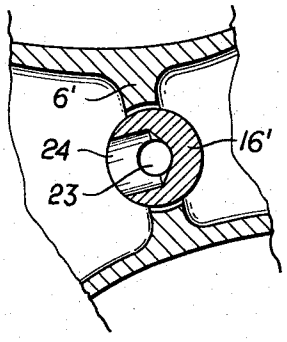

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FIG.7

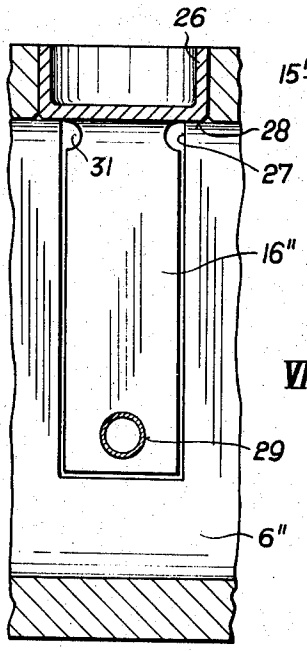


FIG.5

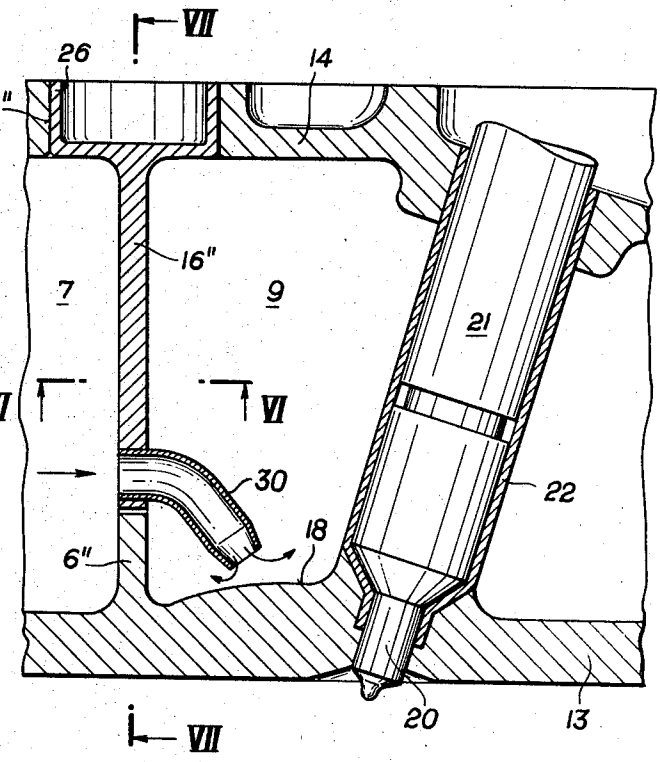
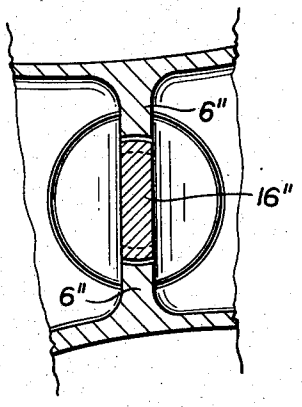


FIG.6



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CYLINDER HEAD FOR INTERNAL COMBUSTION ENGINES

This invention relates to a cylinder head of a water-cooled, valve-controlled internal combustion engine comprising two cooling-water chambers for each cylinder unit, separated from each other by a partition, and communicating with each other via a nozzlelike port at least approximately traversed by the entire cooling-water stream and directed towards that portion of the cylinder head bottom which defines the valve web as viewed in the direction of flow.

In conventional cylinder heads of this type more effective cooling is to be achieved for the valve web which is subject to a considerable thermal stress, by directing the cooling-water stream at great speed through the nozzlelike port. These measures have been prompted by the frequent occurrence of heat cracks in the cylinder head bottom in the area of the valve web. With multicylinder internal combustion engines, however, the available cooling-water stream is required to be uniformly distributed over the cooling-water chambers of the cylinder head associated with individual cylinders, in order to achieve uniform cooling conditions for all cylinders. This in turn, requires the provision of exactly identical passage cross sections for the nozzlelike ports. However, this requirement is extremely difficult to meet in actual practice. This applies in particular to such types of cylinder heads where the port has been recessed in the cylinder head casting and will not permit of subsequent machining.

In one of the conventional types of cylinder heads a vertical partition is arranged between the two cooling-water chambers, extending as close to the valve web, where in conjunction with the remaining partitions of the cylinder head it defines the said port. In yet another conventional cylinder head the partition extends approximately in parallel relation to the bottom of the cylinder head, the nozzlelike port being located above the valve web. The two last-mentioned types are not easy to manufacture because of the difficulty of appropriately designing the water core and of cleansing the valve web area. Furthermore, it is not possible with these types of cylinder heads to obtain ports of equal size for multicylinder internal combustion engines because of misplaced castings.

In other known types of cylinder heads the cooling-water is caused to pass via a small pipe from an inlet in the cylinder head close to the valve web. In that case, installation and alignment of the said pipe inside the cooling-water chamber which is not accessible from outside, is beset with considerable difficulties.

Moreover, according to a different conventional design of cylinder heads, all of the cooling-water stream available for each cylinder unit is directed at increased speed via an annular chamber defined by the injection nozzle and a tubular sleeve surrounding the latter, against the bottom of the cylinder head. The injection nozzle is the main beneficiary of the improved cooling conditions obtained by this arrangement.

It is the object of the present invention to avoid the shortcomings of conventional types of cylinder heads and to substantially improve cooling conditions prevailing in the area of the valve webs. According to the invention, the partition of the cylinder head opposite the bottom of the cylinder head presents a bore which extends through the partition inside the cylinder head and wherein an insert including the nozzlelike port is fitted. This design of the cylinder head offers considerable advantages both with regard to manufacture and operation as compared with cylinder heads of conventional design. Furthermore, the casting of the water core is substantially simplified since the two cooling-water chambers communicate with each other through a bore in the partition already provided in the casting. Since the insert is manufactured as a separate element, it is possible for the required direction and cross section of the nozzlelike port to be obtained with great precision and for the inlet of the port to be arranged very close to the valve web. The design according to the invention is also applicable in such cases where the water inlets of the cylinder head are provided in inaccessible locations, such as for example, below the exhaust port. The insert manufacture with a slight oversize as compared with the receiving bore is preferably installed by simple pressing, as a result of which the cooling-water chambers are at the same time sealed off against the outside.

According to a preferred embodiment of the invention the insert is designed as a cylindrical body with a port extending in oblique relation to the cylinder axis. This design is particularly suitable for serial production.

According to the invention, it is, however, also possible for the bore receiving the insert to be inclined towards the valve web, the insert being formed by a cylindrical body tapered at its inner extremity and presenting an axial blind bore which is open towards the valve web and communicates via a radial inlet hole with the adjacent cooling-water chamber. The advantage offered by this design resides in the fact that no accurate angular alignment is required for the installation of the insert since the blind bore extends at any rate in coaxial relation to the receiving bore of the insert and is thus aligned in the direction of the valve web.

However, it is also possible according to the invention to provide an insert of about the same thickness as the plate presenting the partition which comprises in a transverse bore an insert tube bent in the direction of the valve web. With this design again it is possible to provide for any exit direction and speed of the overflowing cooling-water stream without the least difficulty.

According to a further feature of the invention it is convenient to provide the insert in the proximity of the upper partition of the cylinder head with at least one additional aperture through which the two cooling-water chambers communicate with each other. Through this aperture such steam bubbles as are occasionally produced at the topmost point of the first cooling-water chamber can be evacuated. Similar apertures may be produced in cylindrical inserts for example, by the provision of an annular groove in the shell of the insert.

Further details of the invention will appear from the following description of several embodiments of the invention with reference to the accompanying drawing in which:

FIG. 1 shows a horizontal cross-sectional view of the cylinder head of a two-cylinder internal combustion engine according to the invention on line I–I of FIG. 2,

FIG. 2 is a vertical sectional view of the same cylinder head on line II–II of FIG. 1,

FIG. 3 is a vertical cross-sectional view of another embodiment of the invention as restricted to the area of the cylinder head which is essential for the understanding of the invention,

FIG. 4 is a sectional view taken on line IV–IV of FIG. 3,

FIG. 5 is a sectional view of yet another embodiment of the invention taken on similar lines as FIG. 3,

FIG. 6 a sectional view on line VI–VI of FIG. 5, and

FIG. 7 another sectional view on line VII–VII of FIG. 5.

The embodiment of the invention illustrated in FIGS. 1 and 2 refers to the cylinder head of a water-cooled, valve-controlled two-cylinder internal combustion engine comprising valves arranged in a row. The exhaust passages 2 of the exhaust valves 1 placed side-by-side join in a common exhaust manifold 3. Separate intake passages 4 originating with the opposite side of the cylinder head lead to the intake valves 5.

The isolated water-carrying spaces of the cylinder head are subdivided by means of vertical partitions 6 associated with each cylinder unit into a first cooling-water chamber 7 with inlets 8 located below the exhaust manifold 3 and a second cooling-water chamber 9 with a common discharge bore 10. The vertical partitions 6 are located in front of the narrowing of the water-carrying inner chamber produced by the two valve guides 11 and 12 of each cylinder. In the area of the partitions 6 the upper limiting wall 14 of the cylinder head opposite the bottom 13 of the cylinder head presents a receiving bore 15 extending through the partition 6 as far as the interior of the cylinder head. This perforation terminates close to and above the bottom 13 of the cylinder head. According to the design of the cylinder head shown in the drawing the diameter of the perforation of the partition 6 extending in coaxial relation to

the bore 15 almost equals the whole width of the partition, so that narrow webs only are formed by the same on both sides. Into the bore 15 a cylindrical insert 16 is fitted which extends over the entire width and depth of the perforation of the partition 6. The insert 16 has an opening 17 extending in oblique relation to its longitudinal axis are directed towards the valve web 18 defined by the bottom 13 of the cylinder head between the two valve guides 11 and 12. The insert 16 is furthermore provided with an annular groove 19 near the upper limiting wall 14, which in conjunction with the partition 6 defines two additional apertures through which steam bubbles produced in the water chamber 7 are allowed to escape.

Each of the two nozzle-holders 21 comprising the injection nozzles 20 extend through the cylinder head in a nozzle-holder protection tube 22 arranged in oblique relation to the cylinder axis and stayed in the bottom 13 of the cylinder head in the immediate proximity of the valve web 18. This design provides highly favorable cooling conditions for such areas of the cylinder head as are subject to a particularly heavy thermal stress, in such a manner that both cylinder units benefit equally from same. The cooling water entering the first cooling water chamber 7 from the water jacket of the cylinder block (not shown in the drawing) through two inlets 8 flows at great speed over into the second cooling-water chamber 9 through the openings 17 of the two inserts 16, impinging in a sharply focused jet directly upon the two valve webs 18, so that these are most intensively cooled. The cooling-water then flows towards the nozzle-holder protection tubes 22 adjoining the valve webs 18 as a result of which the injection nozzles 20 are also cooled effectively. The heated cooling-water then passes through the outlet 10 into the cooling-water circulating system (not shown in the drawing).

The cylinder head as illustrated in FIGS. 3 and 4 of the drawing differs from the embodiment of the invention hereabove described essentially in that the bore 15' comprising the insert extends in an oblique relation to the valve web 18 and that the partition 6' is inclined in its upper portion at the same angle as is the bore 15'. The insert 16' is designed as a cylindrical body with a tapered inner end and presents an axial blind bore 23 which is open towards the valve web 18 and communicates through a radial bore 24 with the first cooling-water chamber 7. The lower portion 25 of the partition 6 extends approximately in perpendicular relation to the bottom 13 of the cylinder head, so that the outlet of the blind bore 23 is exposed in the direction of the valve web 18. For the passage of steam bubbles from the cooling-water chamber 7 into the adjacent cooling-water chamber 9 the insert 16' is also provided with an annular groove 19' located close to the upper limiting wall 14 of the cylinder head.

The cylinder head shown in FIGS. 5 through 7 comprises an insert 16'' designed as a plate of approximately the same thickness as the partition 6''. At its upper end the insert 16'' has a hollow cylindrical lug 26 tightly fitted in the receiving bore 15'' of the upper limiting wall 14 of the cylinder head. The perforation 27 of the partition 6'' extending in coaxial relation to the bore 15 is of a smaller diameter than the bore 15'' so that shoulders 28 are produced on the partition 6'' which serve as axial stops for the hollow cylindrical lug 26.

In the proximity of its inner end the plate-shaped insert 16'' presents a transverse bore 29 into which an insert tube 30 curved in the direction of the valve web 18 is pressed. For the evacuation of steam bubbles from the cooling-water chamber 7 two opposing notches 31 are provided at the transition between the plate-shaped portion of the insert 16'' and the hollow cylindrical lug 26.

I claim:

1. A cylinder head of a water-cooled, valve-controlled internal combustion engine, comprising a lower limiting wall defining the bottom of the cylinder head, an upper limiting wall opposite the said bottom of the cylinder head and sidewalls extending from the bottom of the cylinder head as far as the upper limiting wall, the said walls enclosing the water-carrying interior of the cylinder head, each cylinder unit comprising a partition extending from the upper limiting wall of the cylinder head to the bottom of the cylinder head and terminating close to the portion of the cylinder-head bottom forming a valve web between the valves of each cylinder unit, the said partitions subdividing the water-carrying interior into two separate cooling chambers, furthermore one bore each extending through the upper limiting wall of the cylinder head and continuing inside the cylinder head close to the bottom of the cylinder head and defining a perforation of the said partition and on insert arranged in the said bore so as to provide an external sealing means, a nozzlelike opening in the said insert directed towards the said valve web and traversed by approximately the entire cooling-water stream allocated to each cylinder unit.

2. A cylinder head according to claim 1, wherein the said insert is designed as a cylindrical body having an opening which is inclined in relation to the axis of the cylinder.

3. A cylinder head according to claim 1, wherein the said bore includes the axis of the said insert which is inclined in relation to the cylinder axis and directed towards the valve web, the said insert being designed as a cylindrical body with a tapered inner end, having an axial blind bore open towards the valve web, a radial inlet bore open towards the adjacent cooling-water chamber and terminating in the said blind bore.

4. A cylinder head according to claim 1, wherein the said insert is defined by a plate of about the same thickness as the said partition, a transverse bore in the said plate, an insert tube arranged in the said transverse bore, the axis of the insert tube being curved in a downward direction towards the valve web.

5. A cylinder head according to claim 1, wherein an additional bore is recessed in the said insert in the proximity of the upper limiting-wall of the cylinder head, the said additional opening serving as a means of communication between the two cooling-water chambers, and having a substantially smaller cross section than the entire nozzle-shaped opening of the insert.

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3547086 Dated 12/15/70

Inventor(s) Othmar Skatsche and Gerhard Feichtinger

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Title Page, second line, under "Inventors" substitute

--Austria-- for "Switzerland".

Signed and sealed this 1st day of June 1971.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents