

Oct. 23, 1956

V. BOGHOSSIAN
ENGINE HEAD CONSTRUCTION

2,767,694

Filed May 22, 1953

6 Sheets-Sheet 1

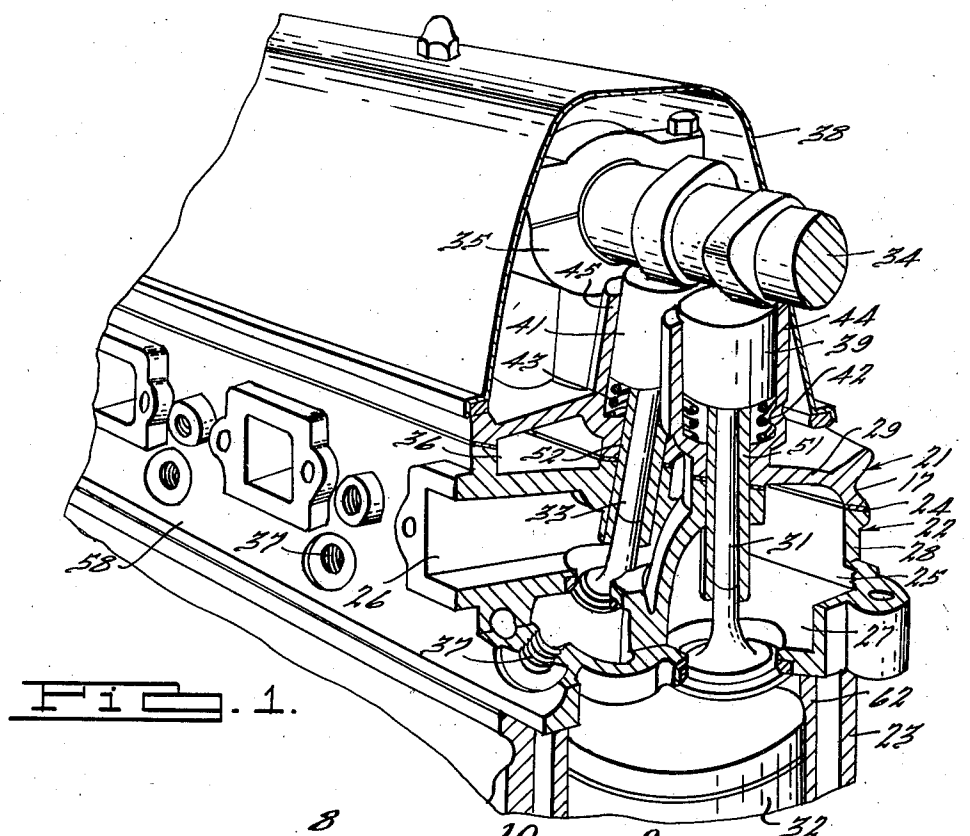


FIG. 1.

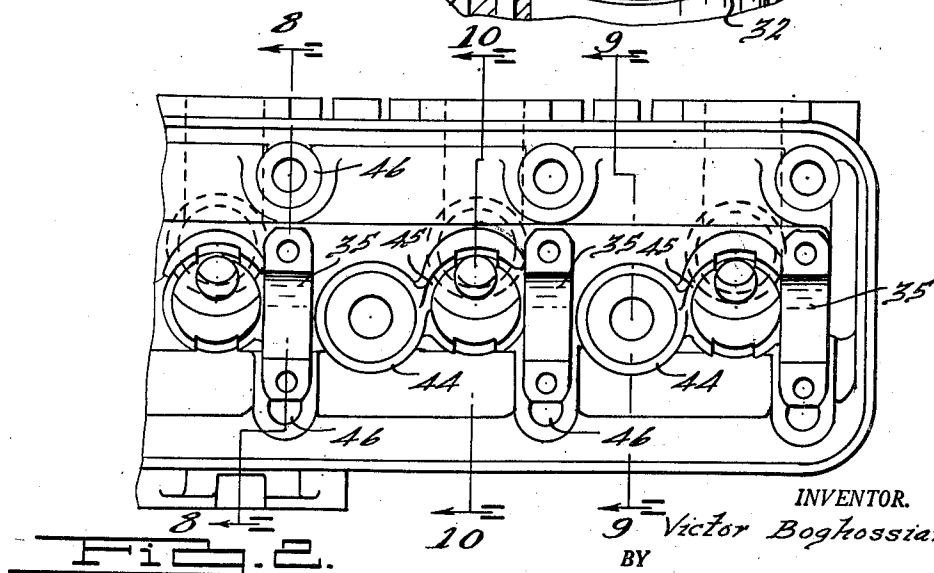


FIG. 2.

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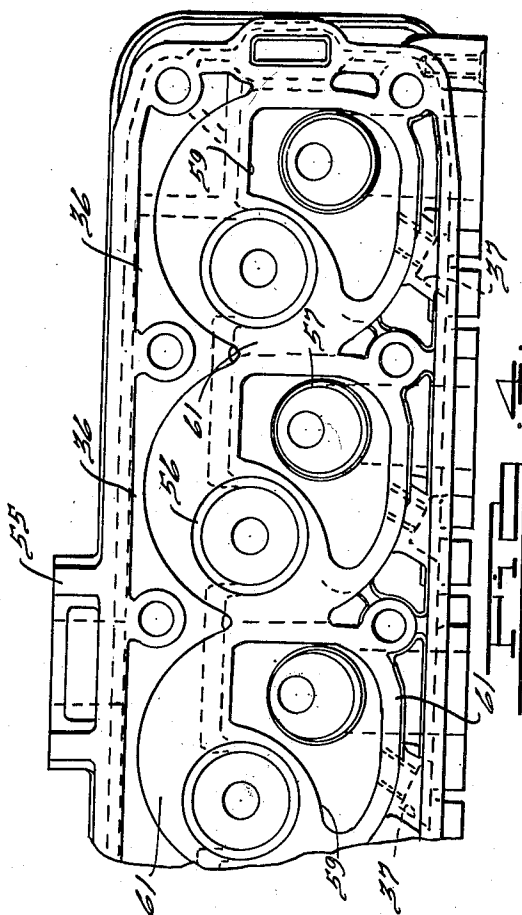
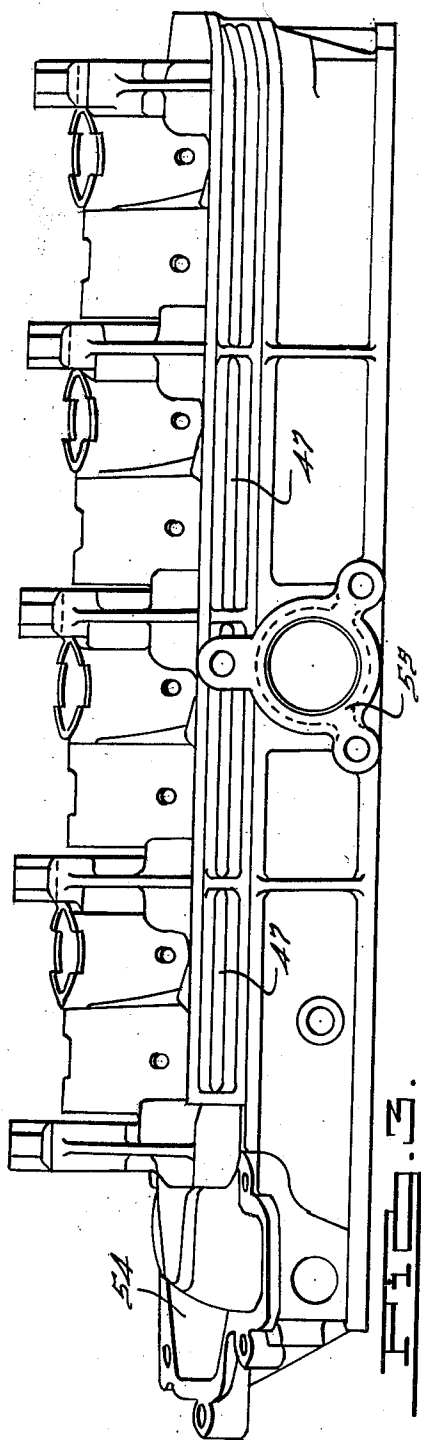
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6 Sheets-Sheet 2



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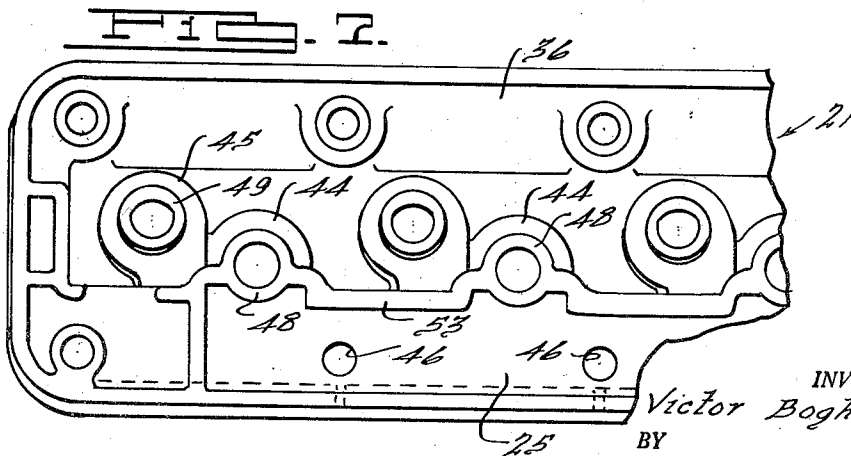
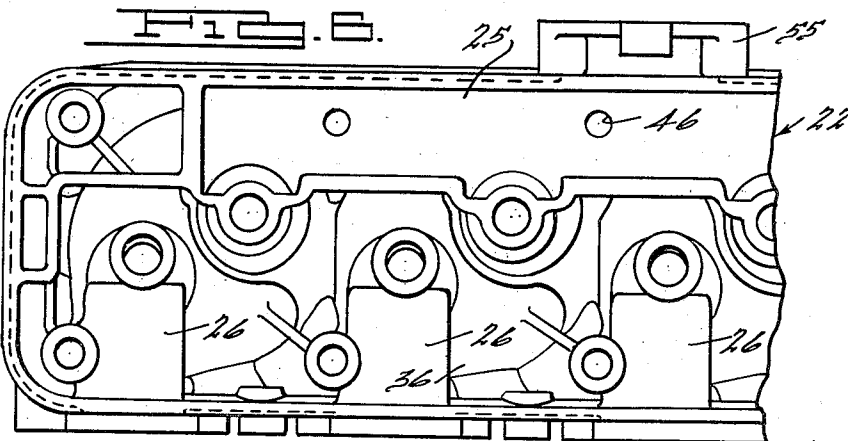
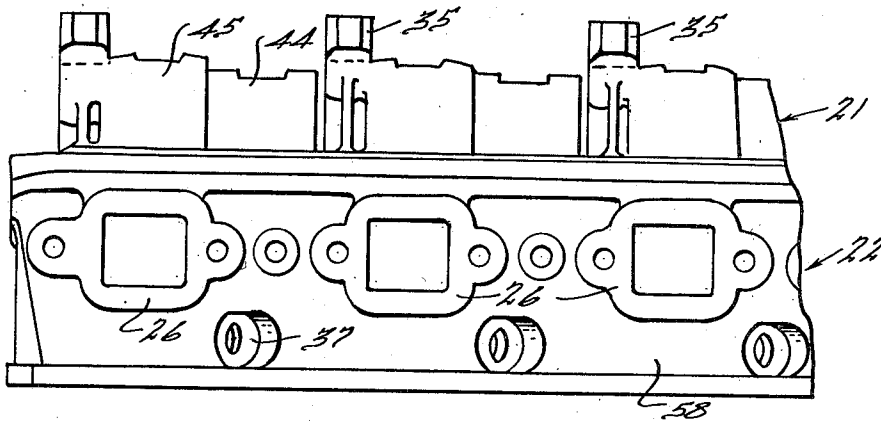
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ENGINE HEAD CONSTRUCTION

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FIG. 5.



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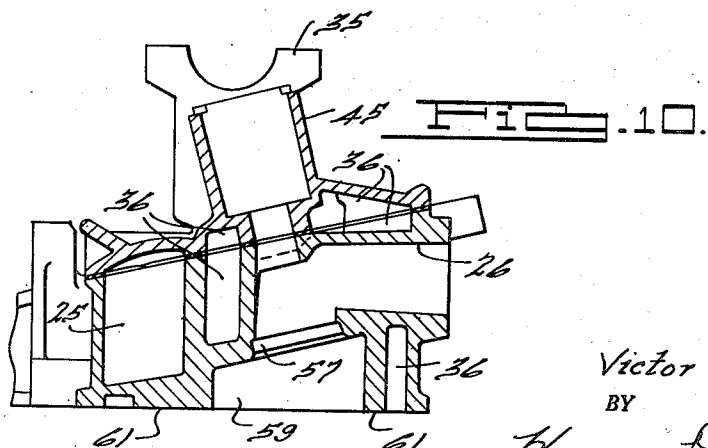
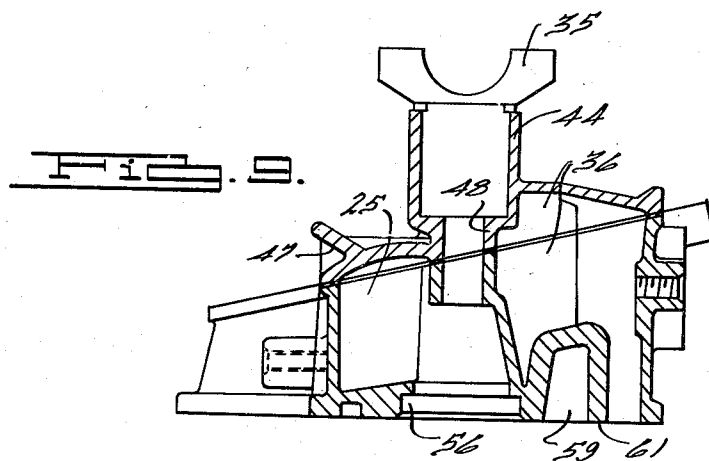
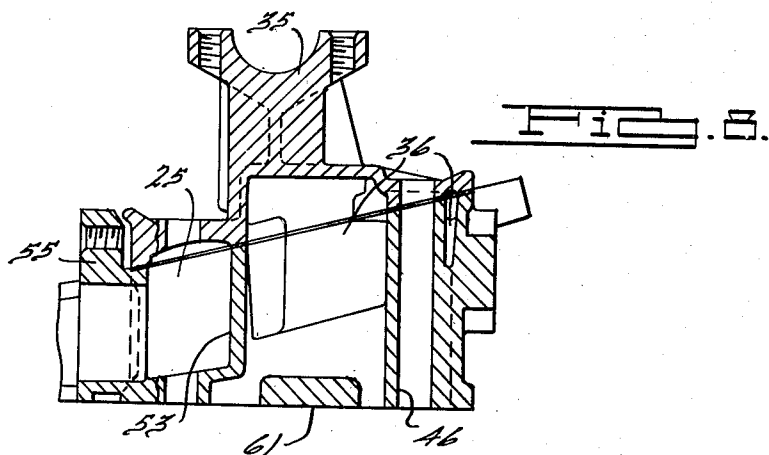
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ENGINE HEAD CONSTRUCTION

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6 Sheets-Sheet 4



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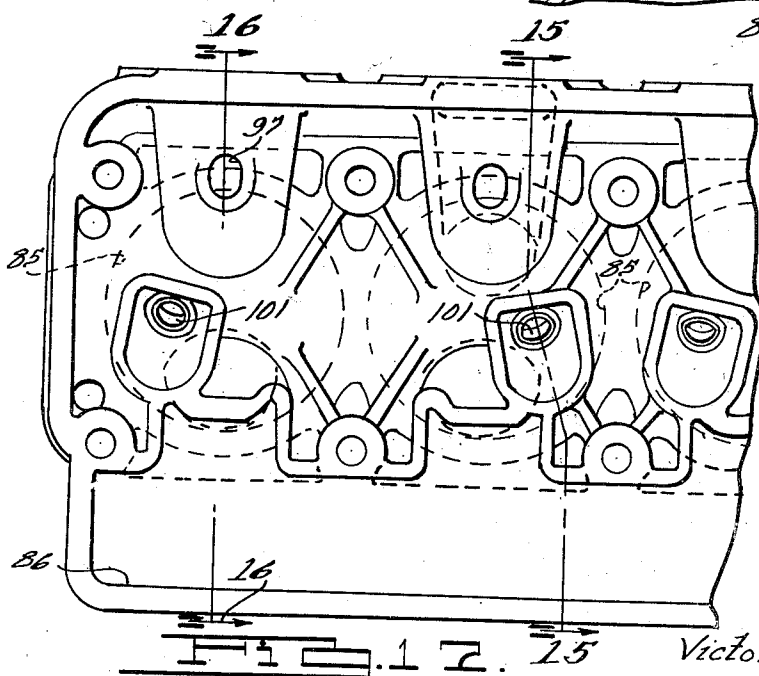
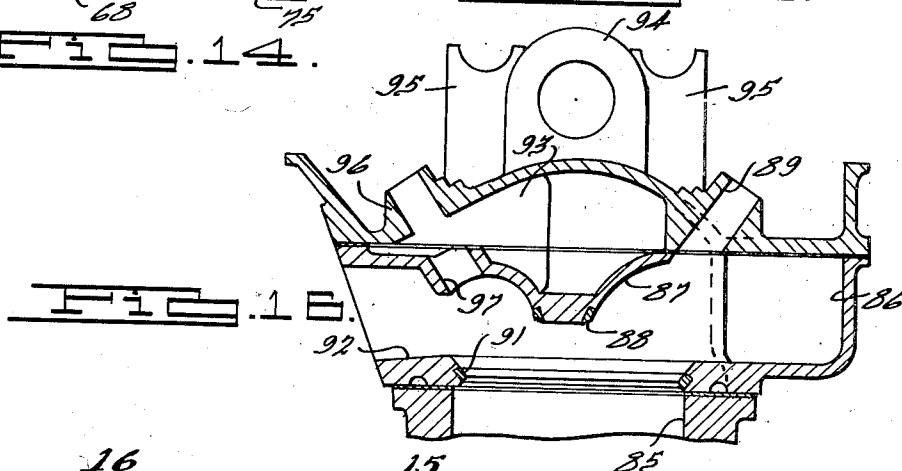
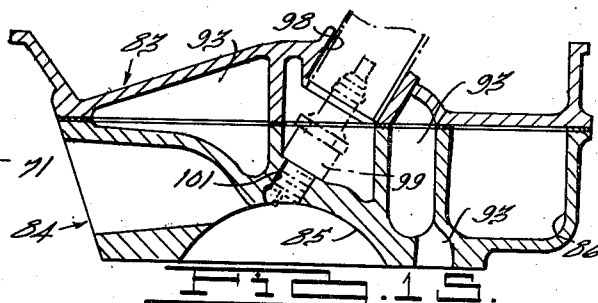
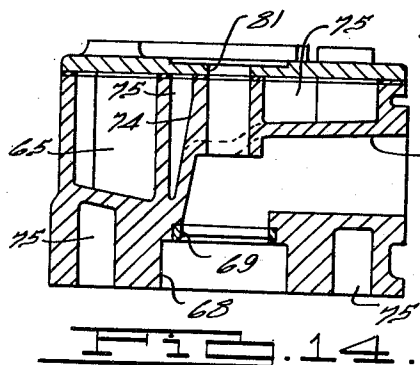
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6 Sheets-Sheet 6



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ENGINE HEAD CONSTRUCTION

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Application May 22, 1953, Serial No. 356,734

3 Claims. (Cl. 123—41.77)

This invention relates to internal combustion engines, and more particularly to the construction of heads for such engines which are adapted for low cost mass production techniques.

It is an object of the invention to provide an improved cylinder head construction which is adapted for fabrication in two parts, and in which the walls, ports and passages are so arranged that the head can be constructed using conventional die casting techniques or by green sand molds without the use of coring.

It is another object to provide an improved engine head of the above nature, in which the intake and exhaust ports are so arranged that the cores which form them can be withdrawn from the work without the need for retractable cores or similar parts.

It is a further object to provide an improved engine head construction of the above nature, in which one section of the head is formed as a structural member to bear the stresses produced during operation of the engine, so that it is not necessary to connect the other head member integrally with the first member.

It is also an object to provide an engine head construction having the above characteristics, in which the water jacket may be formed by overlapping engagement of the upper and lower cores which are removed vertically from the work.

It is another object to provide, in one form of the invention, an engine head construction of the above nature which is especially adapted for cam-shaft-in-head engines.

It is a further object to provide, in another form of the invention, an engine head construction of the above character suitable for valve-in-head engines with the cam shaft in the conventional location.

It is also an object, in still another form of the invention, to provide an engine head construction of the above nature for use with engines having hemispherical combustion chambers.

Other objects, features, and advantages of the present invention will become apparent from the subsequent description, taken in conjunction with the accompanying drawings.

In the drawings:

Figure 1 is a perspective view in cross-section of one form of the engine head construction of this invention adapted for use with cam shaft-in-head type engines, showing the valves and cam shafts assembled in the head;

Figure 2 is a fragmentary top view of the upper section of the engine head shown in Figure 1 with the cover, cam and valves removed;

Figure 3 is a side elevational view of the engine head, showing the cam shaft drive enclosure and the intake manifold connection;

Figure 4 is a fragmentary bottom plan view of the lower section of the head, showing the shape of the cylinder chambers and the water jackets;

Figure 5 is a fragmentary rear elevational view of the head showing the exhaust connections;

Figure 6 is a fragmentary top plan view of the lower section of the head showing the relation of the water jacket and the ports;

Figure 7 is a fragmentary bottom plan view of the upper section of the head showing the enclosing structure for the intake manifold and water jacket;

Figure 8 is a cross-sectional view taken along the line 8—8 of Figure 2 showing the shape of the water jacket at a point between adjacent cylinders;

Figure 9 is a cross-sectional view taken along the line 9—9 of Figure 2 and showing the shape of the water jacket at an intake valve;

Figure 10 is a cross-sectional view taken along the line 10—10 of Figure 2 and showing the shape of the water jacket at an exhaust port;

Figure 11 is a top plan view of a modified form of engine head for use with a valve-in-head engine having a cam shaft in the conventional location;

Figure 12 is a bottom plan view of the engine head of Figure 11 showing the shape of the cylinder chambers;

Figure 13 is a cross-sectional view taken along the line 13—13 of Figure 11 and showing the shape of the water jacket at one of the intake ports;

Figure 14 is a cross-sectional view taken along the line 14—14 of Figure 11 and showing the shape of the water jacket at one of the exhaust ports;

Figure 15 is a cross-sectional view taken along the line 15—15 of Figure 17 and showing a third embodiment of the invention in which the combustion chamber is of hemispherical shape, a spark plug being shown in position in the cylinder;

Figure 16 is a cross-sectional view taken along the line 16—16 of Figure 17 and showing the construction of the intake and exhaust ports; and

Figure 17 is a top plan view of the lower section of the engine head of Figures 15 and 16 showing the shape of the water jacket.

Referring to the embodiment of Figures 1—10, the engine head is shown as being constructed of an upper section generally indicated at 21 and a lower section generally indicated at 22, the head surmounting the cylinder block 23. This cylinder block may be of any conventional construction, and may for example be constructed according to the principles set forth in applicant's copending application Serial No. 219,650, filed April 6, 1951, now Patent No. 2,681,054, issued June 15, 1954, for Construction of Die Cast Cylinder Blocks. As seen in Figure 1, the upper and lower sections are united along an inclined plane, the two sections being joined by any conventional method such as a heat resistant or soft metal gasket 24 or a brazed or soldered joint. Although the parting plane is shown as being of a sloping nature in the illustrated embodiment, it should be understood that the principles of the invention contemplate the use of a horizontal parting plane if desired.

Upper section 21 and lower section 22 are both of such construction that they may be formed by conventional die casting methods, with dies being withdrawable from the top, bottom and sides of the work and without retractable cores being used. The sections may of course also be fabricated by conventional permanent mold methods if desired, in which case no cores would be required. Moreover, the lower section 22 which is secured directly to the cylinder block is of such construction that it acts as a structural member to absorb the stresses developed during engine operation.

The general arrangement of the ports, valves and manifold is perhaps best seen in Figure 1, which shows the engine head as having a longitudinally extending intake manifold 25 at one side thereof and a plurality of trans-

versely extending exhaust ports 26 on the other side of the head. The intake manifold is formed by the floor 27 of section 22 which also serves to form the cylinder chamber heads, the side wall 28 of the lower section and web portion 29 of upper section 21. An intake valve 31 is provided above each piston 32, and an exhaust valve 33 is also provided for each cylinder. These valves have upwardly extending stems which are actuated by a rotary cam shaft 34 carried by bearings 35 on the upper head section 21. A water jacket 36 is also formed in the engine head and surrounds the exhaust ports 26 and intake manifold as well as the cylinder chamber walls. Spark plug openings 37 are provided in the lower section 22, and a cover 38 may be provided for the cam shaft 34.

Figure 2 shows the relative arrangement of the intake valve and exhaust valve guides. As shown in Figure 1, the upper ends of valves 31 and 33 carry cam followers 39 and 41 respectively which are engaged by the cam shaft, and are urged against the cam shaft by springs 42 and 43. The followers and springs are disposed within intake valve guides 44 and exhaust valve guides 45 which are formed as part of the upper head section 21. In the illustrated embodiment the intake valve guides 44 are vertical while the exhaust valve guides 45 are inclined, although it will be understood that other arrangements could be used if desired. The cam shaft bearings 35 are disposed alternately between each pair of intake and exhaust valves as shown in Figure 2, and the upper head section is also provided with a plurality of bolt holes 46 adjacent bearings 35 for securing the head to the engine block. One side of upper head section 21 is also provided with a series of recesses 47 as seen in Figure 3 which serve to produce the proper thicknesses of the section walls.

The underside of upper section 21 cooperates with the lower section 22 to form the water jacket and the intake manifold of the engine. Figure 7 shows the formation of the underside of upper section 21, and it will be seen that intake manifold 25 is formed along one side of the section adjacent intake valve guides 44, several of the bolt holes 46 passing through the intake manifold. Both the intake and exhaust valve guides have portions of reduced cross-section at the underside of upper section 21, these reduced portions being indicated at 48 and 49 respectively. The reduced portions of the valve guides serve to carry valve sleeves 51 and 52 respectively as seen in Figure 1, and are aligned with similar valve guide openings in the lower head section.

The water jacket portion 36 of upper head section 21 varies in cross-sectional configuration along the length of the head, as is best seen in Figures 8, 9 and 10. In the vicinity of each intake valve guide opening the cross-sectional area is continuous, as seen in Figure 9, whereas in the vicinity of each exhaust valve guide opening the cross-sectional area is divided into two portions, as seen in Figure 10. It should be noted that, as seen in Figures 7 to 10, the water jacket is in contact with the inner wall 53 of the intake manifold at all points along the length of the cylinder head.

As indicated previously, the lower head section 22 acts as a structural member and for this purpose is of considerably greater depth than upper section 21. As seen in Figure 3, a cam shaft drive space 54 is cast integrally with the lower head section at one end thereof, this drive space being open at both top and bottom and enclosing the drive means (not shown) for the cam shaft. Centrally located on section 22 is intake manifold connection 55 which is adapted for connection to the carburetor and leads to the intake manifold space 25 as shown in Figure 8. Water jacket 36 surrounds the intake and exhaust ports 56 and 57 respectively and also surrounds the exhaust passages 26 which lead from exhaust ports 57 to the side wall 58 of section 22. It will be noted that the exhaust ports 57 open into combustion chambers 59 formed at the bottom of section 22, these chambers having

the configuration shown in Figure 4. Spark plug openings 37 likewise lead into these combustion chambers 59. It will be observed that, as seen particularly in Figure 10, the chambers 59, exhaust ports 57 and exhaust passages 26 are so arranged that they can be formed by a die withdrawn downwardly and a die withdrawn to the right in Figure 10.

The water jacket 36 is separated from the chamber 59 and the valve ports by boss portions 61 which have a flat surface engageable with the cylinder liners 62 of the engine, the upper ends of these liners engaging the flat surfaces of portions 61, preferably by means of sealing gasket. As seen in Figure 6, water jacket 36 as formed in section 22 surrounds the exhaust passages 26, and as shown in the cross-sectional views (Figures 8, 9 and 10) the formation of the water jacket is such that it can be formed from dies withdrawable upwardly and downwardly. In particular, the water jacket in the vicinity of each exhaust passage 26 has an upper and a lower portion which are separated by the exhaust passage, as shown in Figure 10. Between exhaust passages however, the water jacket is continuous as shown in Figure 9, and would therefore be formed by engagement of the upper and lower dies. Figure 9 further illustrates the method of maintaining walls of substantially constant thickness in the head section, and in particular shows the formation of combustion chamber 59 in the vicinity of the intake valve port 56, the combustion chamber being adjacent water jacket 36.

It will be seen from the above description that both the upper section 21 and the lower section 22 are so shaped as to be capable of fabrication by conventional die casting methods, or by green sand molds without cores, since all the surfaces may be formed by dies withdrawable from the bottom, top and sides of the work. This is made possible by so arranging the intake and exhaust ports and passages, the combustion chamber and the water jacket so that no retractable cores are needed to form these elements of the engine head. Furthermore, the head may be made with two parts, only one of these parts being used to absorb the operational stresses during engine operation.

Figures 11-14 show a second embodiment of the engine head which is adapted for use with engines of the valve-in-head type but with the cam shaft in the conventional location. The head comprises a cover section generally indicated at 63 and a main section generally indicated at 64, these sections having functions similar to the corresponding sections of the first embodiment. As seen in Figures 11 and 12, a four cylinder head is shown although it will be understood that the principles of construction are applicable to other engine sizes. The main section has an intake manifold 65 formed therein with a connection 66 leading from the carburetor, and a plurality of intake ports 67 formed in the lower portion of the main section opening into combustion chambers 68. The main section also has a plurality of exhaust ports 69 leading to exhaust passages 71 which extend to the side of the main section. An exhaust manifold (not shown) may be connected to the side of the main section which is provided with bosses 72 for this purpose. The main section also has formed therein intake valve guides 73 and exhaust valve guides 74, these guides being formed to carry the valve stems in vertical position. The main section also has formed therein a water jacket 75 which surrounds the exhaust passages 71 and is adjacent the intake manifold 65. Bolt hole bosses 76 are also provided at spaced intervals along the sides of the main section. As seen in Figure 12, the bottom of the main section has a flat surface 77 which is so shaped as to seal the combustion chamber 68 from the water jacket 75 by means of its engagement with the cylinder liner (not shown). One end of the main section has formed thereon a water connection 78 for the water jacket. The upper section 63 acts mainly as a cover, and

5

as seen in Figures 11-14 has formed therein openings 79 which are aligned with intake valve guides 73 and openings 81 corresponding with exhaust valve guides 74. The cover section also has bosses 82 for the head attaching bolts.

It will be seen from the above description and the accompanying drawings that, as in the previous embodiment, both the cover section 63 and the main section 64 may be formed by conventional die casting methods or by green sand molds without cores. Referring particularly to the main section, it will be seen that the intake manifold and the intake ports are so arranged that they may be formed by the cooperation of two dies withdrawn from the top and bottom respectively. Similarly, the combustion chamber 68, exhaust ports 69 and exhaust passages 71 may be formed by the cooperation of dies withdrawable from the bottom and side of the work. The water jacket 75 is also of such configuration that it may be formed by dies withdrawable from the top and bottom of the work. In this connection, it should be pointed out that the portions of the water jacket in the vicinity of exhaust passages 71 are made up of upper and lower portions, as seen in Figure 14, and that these portions are connected between the exhaust passages as shown in Figure 13.

Figures 15 to 17 illustrate a third embodiment of the invention in which the engine head is formed with hemispherical combustion chambers and is of the type having a cam shaft mounted on the head. In this embodiment, a cover section generally indicated at 83 and a main section generally indicated at 84 are provided, the latter having formed therein a plurality of hemispherical combustion chambers 85. The main section has cast integrally therewith an intake manifold 86 although it will be understood that the intake manifold could be formed as a separate part attached to the head if desired. Intake passages 87 lead from the intake manifold downwardly and inwardly to intake ports 88, and the cover section 83 has intake valve guides 89 formed thereon. The exhaust valve ports 91 are formed adjacent the intake valve ports and have exhaust passages 92 leading therefrom, these passages being connected with the side of main section 84. The main section also has water jacket 93 formed therein, this water jacket being of such configuration as to be formable by conventional die-casting techniques. For example, as seen in Figure 15, the portion of the water jacket 93 adjacent the intake manifold 86 may be formed by dies withdrawable from the top and bottom of the work. As shown in Figure 16, the water jacket 93 is also adjacent the intake and exhaust passages, and the cover section 83 is somewhat dome-shaped as seen in this figure and forms the upper portion of the water jacket. Cam

6

shaft bearings 94 and pedestals 95 for the rocker arms (not shown) are also cast integrally with cover portion 83. The cover portion further is provided with exhaust valve guides 96 which are aligned with guides 97 in the main section 84. Openings 98 are also formed in the cover section for access to the spark plug, indicated in dot-dash lines at 99, which is mounted in an opening 101 in the main section adjacent combustion chamber 85. It is thus seen that the engine head of Figures 15 to 17 embodies the principles of construction and the advantages pointed out with respect to the previous modifications.

While it will be apparent that the preferred embodiments of the invention herein disclosed are well calculated to fulfill the objects above stated, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope or fair meaning of the subjoined claims.

What is claimed is:

1. In an engine head construction, a main section and a cover section joined on a plane and extending from said plane in opposite directions, bearing means formed integrally with said cover section, intake and exhaust valve guides formed integrally with said cover section and said main section, corresponding valve guides being aligned, intake and exhaust ports formed in said main section, combustion chambers formed in said main section, individual exhaust passages leading from said exhaust ports to one side of said main section, and a water jacket formed between said main and cover sections, said bearing means and valve guides of the cover section having surfaces so formed that dies may be withdrawn therefrom in opposite directions, said combustion chambers, ports, and passages on said main section having surfaces so formed that dies may be withdrawn therefrom outwardly from the top, bottom and sides of the main section.
2. The combination according to claim 1, further provided with an intake manifold formed in said main section, said water jacket surrounding each of said individual exhaust passages and being adjacent said intake manifold.
3. The combination according to claim 1, the axes of said intake valve guides and exhaust valve guides in said cover section being relatively inclined.

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