

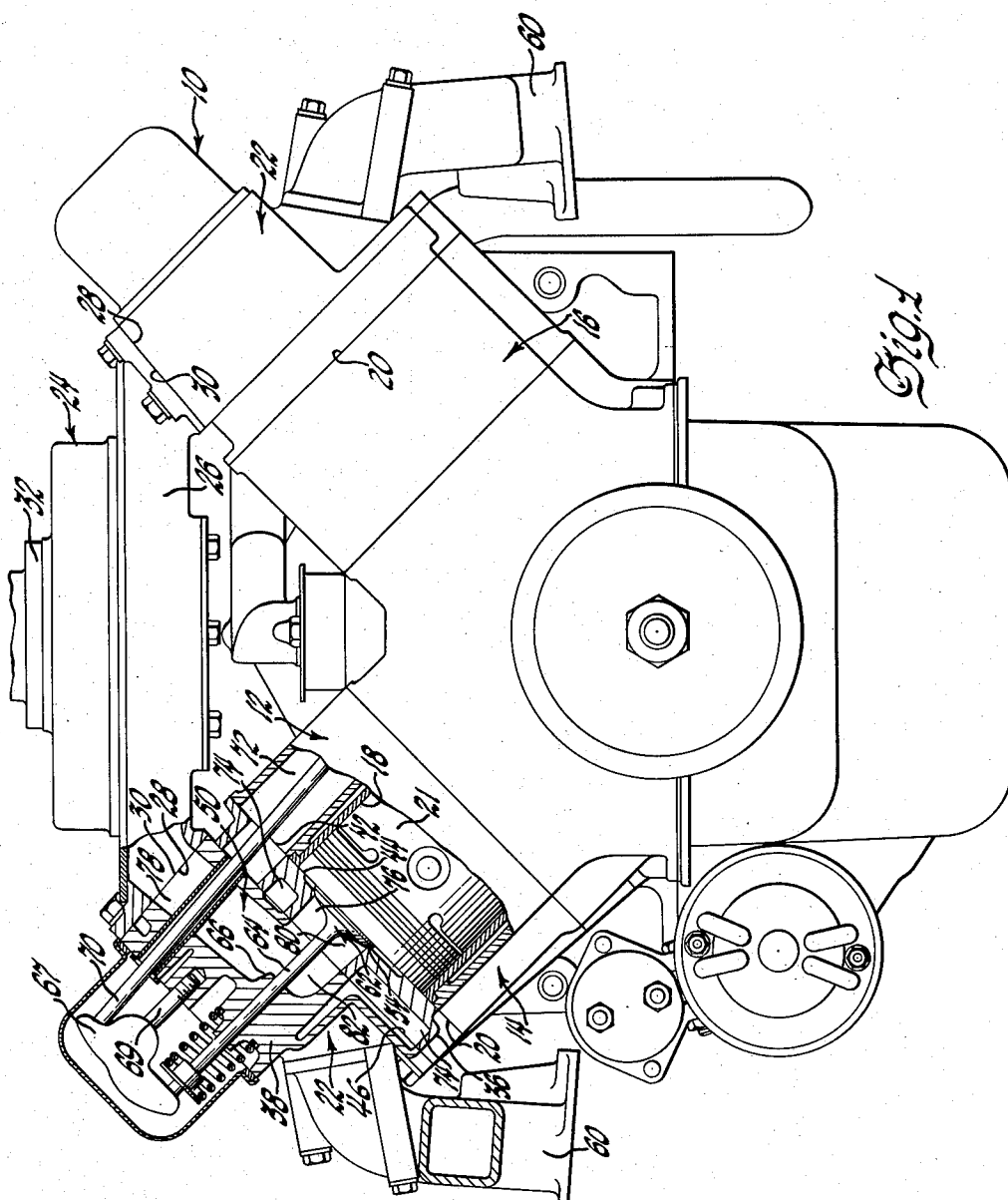
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D. F. CARIS
ENGINE

2,963,015

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3 Sheets-Sheet 1



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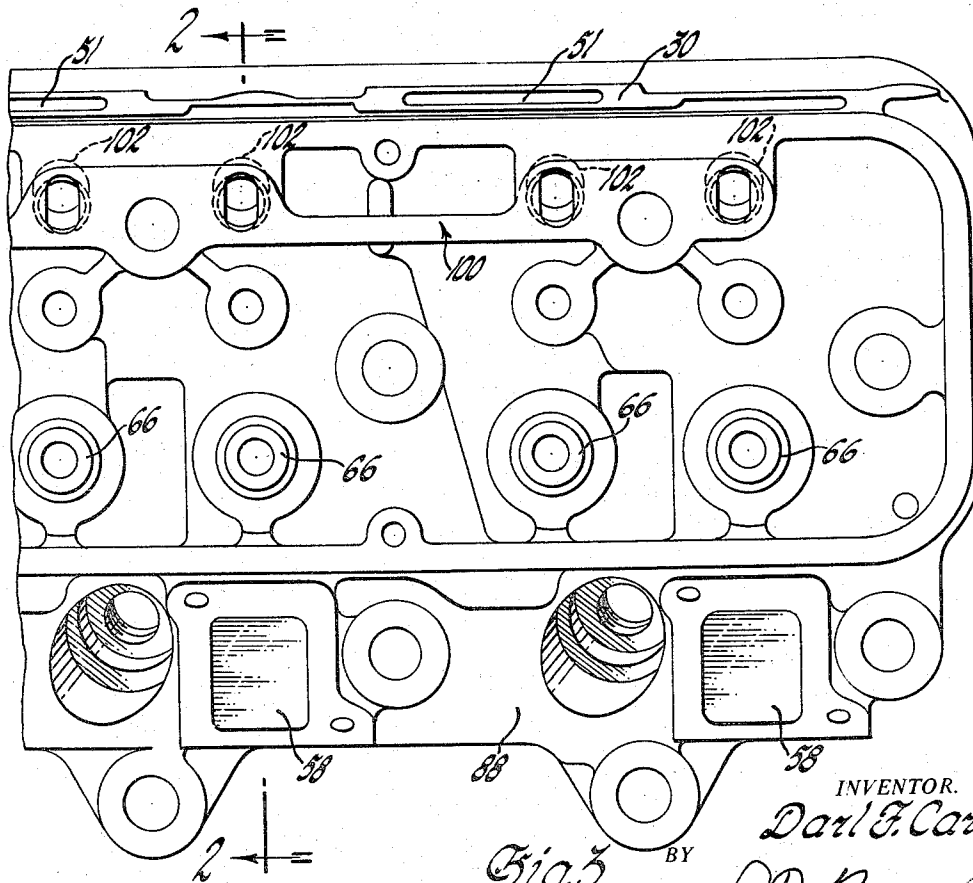
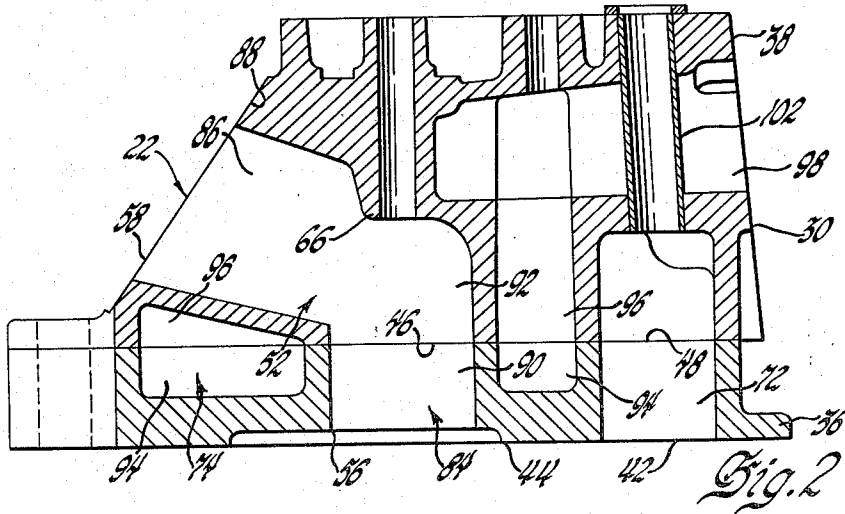
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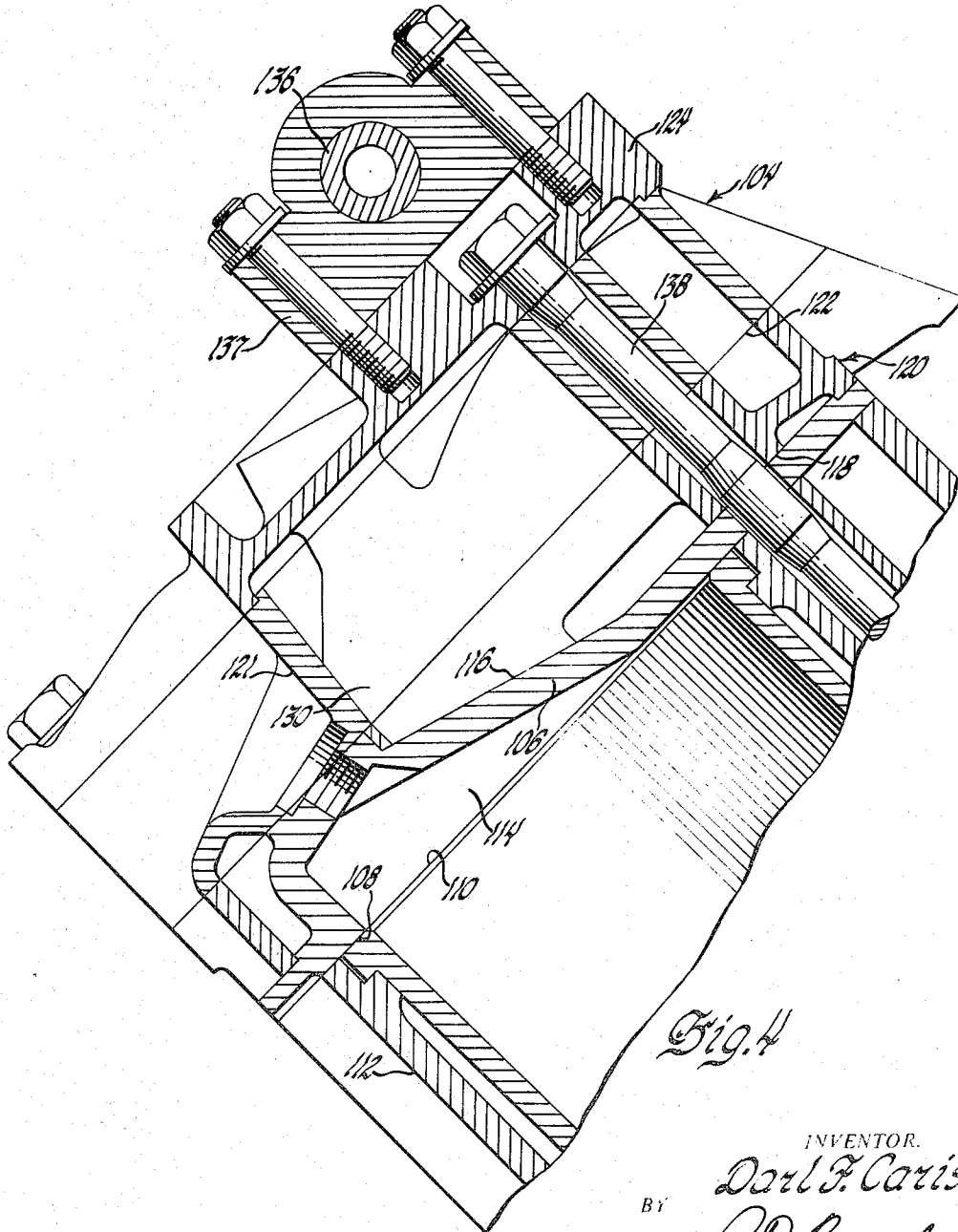


Fig. 4

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2,963,015

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The present invention relates to internal combustion engines and more particularly to laminated cylinder head structures therefor.

Heretofore, it has been customary to employ cast iron cylinder heads on internal combustion engines. These heads are normally cast around temporary sand cores with which it is difficult, if not impossible, to cast the various surfaces with sufficient accuracy. As a result, it is frequently necessary to machine the combustion chambers and other portions. Also, cast iron is excessively heavy as well as a relatively poor conductor for dissipating the heat from the burning gases.

In order to overcome the above objections, numerous attempts have been made to devise an economical and practical means for producing cylinder heads of light-weight alloys such as aluminum or magnesium which are comparatively good conductors of heat. However, due to the intricate passages and surfaces in the cylinder head, it has been necessary to cast the structure with expendable sand cores in substantially the same manner as employed in connection with the cast iron cylinder heads or else to weld or solder several pieces together. This is unsatisfactory due to the cost and production problems involved.

It is now proposed to provide a novel means for producing a new cylinder head which is particularly adapted to be die cast. More particularly, the cylinder head comprises at least two members that are adhesively bonded together by any suitable thermal setting plastic material such as an epoxy resin. Each of these members has cavities arranged therein so that when they are bonded together, they will form the various intake and exhaust passages and cooling cavities contained in the cylinder head. The members separate along surfaces arranged with the surfaces of the cavities complementary to the exterior of permanent cores so as to permit full advantage to be taken of the characteristics of the metals.

In the drawings:

Figure 1 is an end view, with a portion thereof being broken away, of an engine employing cylinder heads embodying the present invention.

Figure 2 is a transverse cross-sectional view of a cylinder head employed in the engine of Figure 1.

Figure 3 is a fragmentary plan view showing a portion of the top of the cylinder head.

Figure 4 is a fragmentary cross-sectional view of an engine employing a cylinder head embodying a different form of the present invention.

Referring to the drawings in more detail, although this invention may be embodied in any type of engine 10, it is particularly adapted for use in an internal combustion engine of the so-called V-type such as disclosed and claimed in Serial No. 716,904, filed February 24, 1958.

The present engine 10 includes a cylinder block 12 having a pair of angularly disposed banks 14 and 16 of cylinders 18. The cylinders 18 extend through the block with the outer ends forming openings in the face 20 on top of the cylinder bank 14 or 16 while the inner ends

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open into the crankcase. A piston 21 is reciprocally disposed in each of the cylinders 18 and is operatively interconnected with a rotating crankshaft by a connecting rod of any suitable form.

A laminated cylinder head 22 is secured by bolts to each of the faces 20 on the cylinder block 12 to close the ends of the cylinders 18 and form combustion chambers. An induction system 24 is disposed between the two heads 22 for supplying a combustible mixture of air and fuel for the combustion chambers. This system 24 includes an intake manifold 26 having the opposite sides 28 thereof secured to the inboard sides 30 of the cylinder heads 22. A carburetor 32 is mounted on top of the manifold 26 and a plurality of distribution passages extend through the manifold 26 to ports in the sides thereof for distributing the charge to the combustion chambers.

The cylinder head 22 is a laminated structure which includes a first member 36 and a second or backing member 38. One side of the first member 36 has a plane surface 42 for engaging the face 20 on the cylinder block 12. Portions 44 of this surface 42 close the open ends of the cylinders 18 to thereby form suitable combustion chambers. If desired, the portions 44 may be recessed into the surface to give the combustion chamber any desired shape.

The backing member 38 includes a surface 46 complementary to a second surface 48 on the backside of the first member 36. In addition to being secured together by the bolts securing the heads 22 to the block 12, the members 38 and 36 also may be adhesively bonded. The two surfaces 46 and 48 may be secured together by employing any suitable thermally setting plastic material such as an epoxy or buna-phenolic resin. This material preferably sets up at a comparatively low temperature so that in assembling the structure, it will not be necessary to subject the entire head 22 to temperatures which might adversely affect the characteristics of the metal or cause thermal distortions in the finished head 22.

Separate intake and exhaust passages 50 and 52 are provided for each of the cylinders 18. The intake passages 50 extend transversely of the cylinder head structure 22 so that the outer ends of the passages 50 form intake ports 51 in faces 30 registering with the ports in the sides 28 of the manifold 26, while the inner ends form valve seats 54 opening into the combustion chambers. The inner ends of the exhaust passages 52 form exhaust valve seats 56 communicating with the combustion chambers while the outer ends form exhaust ports 58 for discharging exhaust gases into exhaust manifolds 60 on the opposite sides of the engine 10.

Intake and exhaust valves 62 are provided with the stems 64 thereof disposed in the valve guides 66 and the heads thereof in the valve seats 54 or 56 to thereby control the charging and exhausting of the cylinders 18. Rocker arms 67 are pivotally mounted on top of the backing member 38 so that the ends thereof will bear on the ends of the valve stems 64. The rocker arms 67 may be mounted on a shaft or on the ends of studs 69 press fitted into the backing member 38. The opposite ends of the rocker arms 67 bear on the ends of push rods 70 actuated by a rotating camshaft in the cylinder block 12 for controlling the opening and closing of the valves 62. The push rods 70 extend through clearance spaces 72 in the cylinder heads 22 and cylinder block 12.

A cooling cavity 74 is provided in the cylinder head 22 to contain a suitable coolant to be retained in intimate heat absorbing relation with the combustion chamber, valve seats 54 and 56 and intake and exhaust passages 50 and 52. This cavity 74 is interconnected with the jacket in the cylinder block 12 so that coolant may flow therebetween and maintain a controlled temperature in the working parts of the engine.

Each of the members 36 and 38 of the cylinder heads 22 is arranged to be die cast from a lightweight material such as an alloy of aluminum or magnesium. To facilitate the die casting the intricate passages and cavities are formed to be complementary to non-collapsible cores which may be pulled in straight lines from the cavities. For example, each of the intake passages 50 includes a section 76 around the intake valve seat 54 and a section 78 extending from the end of the first section 76 to the intake port 51. The first section 76 includes a portion 80 that extends completely through the first member 36 and a portion 82 that extends part-way into the backing member 38 to terminate around the valve guide 66. The portion 80 of the passage through the first member 36 is tapered complementary to the exterior of a permanent core which may be an integral part of a mold with which the plane surface 42 and combustion chamber may be formed. If a core is employed, the core may be removed along a straight line substantially normal to the surface 42. In addition, the first section also includes a portion 82 around the valve guide 66. The surface of this portion 82 is tapered to be complementary to the exterior of a permanent core that may be pulled in a straight line normal to the surface 46 of the backing member 38. This core may be an integral part of the mold for the bottom surface on the backing member 38. The second section 78 of the intake passage 50, which extends from the area of valve guide 66 to the port 51, includes a surface complementary to a second permanent core that may be employed to engage the inner end of the first core and to be pulled in a straight line from the inboard side 30 of the cylinder head 22 together with the mold for this side 30.

The exhaust passage 52 is similar to the intake passage 50 and includes a first section 84 around the exhaust valve seat 56 and a second section 86 which extends from the first section 84 to the outboard side 88 of the cylinder head 22. The first section 84 includes a substantially straight portion 90 extending completely through the first member 36. This portion 90 is preferably tapered to allow the core to be pulled in a straight line downwardly from the member 36. It is thus apparent the cores for portions 80 and 90 of the intake and exhaust passages 50 and 52 through the first member 36 may be integral with the mold for the surface 42 of the first member 36. The remaining portion 92 of the first section 84 or the portion in the second member 38 is complementary to the exterior of a permanent core tapered to be pulled in a straight line downwardly from the passage 52. It is thus apparent that these parts of the exhaust cores may be removed on lines parallel to the cores for the corresponding parts of the intake passages 50. Thus these cores may be an integral portion of the mold for the surface 46 of the second member 38.

The cooling cavity 74 comprises a plurality of chambers disposed in heat exchanging relation with the combustion surface and portions of the intake and exhaust passages. These chambers are formed by cavities 94 and 96 that are recessed into the mating surfaces 46 and 48 on the two members 36 and 38 so as to extend in opposite directions from the joint or split line therebetween. The cavities 94 on the back surface 48 of the first member 36 are tapered to permit the use of permanent non-collapsible cores. These cores are preferably pulled in directions substantially normal to the plane of the surface 48 so that they may be an integral part of the mold for the surface. The cavities 96 in the backing member 38 are preferably tapered to permit the cores therefor to be an integral part of the mold for the surface 46 of the backing member 38 and removable in directions parallel to the first sections 76 and 84 of the intake and exhaust passages 50 and 52. An outlet 98 from the cooling jacket 74 may be formed by a core on the mold for the side 30 of the head 22. This core is tapered similar to the cores for

the second sections 78 of the intake passages 50 and intersect the cores for the cavities 96 in the surfaces 46.

The clearance spaces 72 for the push rods 70 may be cored in a manner similar to that for the other passages. However, due to various design considerations, it may be desirable for the axes of these spaces to be oblique to the surfaces of the molds. Accordingly, a harness 100 may be inserted into the mold with tubes 102 disposed in position to be aligned with the clearance spaces 72. Thus the clearance spaces 72 will be continued through the heads 22 by the tubes 102 molded into the heads and secured therein by inter atomic diffusion of the metallic structures of the hermetically united parts.

As an alternative the structure shown in Figure 4 may be employed. This cylinder head 104 is particularly adapted to be employed on an engine similar to that disclosed in Figure 1. The head 104 includes a first member 106 having a plane surface 108 on one side thereof that is adapted to fit onto the face 110 of the cylinder bank 112. This surface 108 includes recessed portions 114 adapted to register with the open ends of the cylinders and form combustion chambers. The opposite or backside of this member 106 includes a surface 116 adapted to have a complementary surface 118 on a first backing member 120 adhesively bonded thereto by a suitable thermally setting plastic. The backing member 120 also includes a second surface 122 adapted to have a second backing member 121 secured thereto. A cover member 124 is adhesively bonded to the second backing member 120. The intake passages, exhaust passages, the cooling cavity 130 and the spaces for the push rods, etc. are formed by registering cavities in the surfaces on these members 106, 120, 121 and 124. Each of these cavities is arranged to be complementary to a core forming an integral portion of the mold for the surface into which the cavity is recessed. By employing more than two members in fabricating the head 104, any desired shape can be given to the passages, etc. while still die casting all of the parts. A rocker arm shaft 136 is mounted on the cover member 124 by a bracket 137 and includes rocker arms having one end thereof bearing on the stems of the valves and the other ends thereof bearing on the push rods. Thus rotation of the camshaft will reciprocate the push rods which, in turn, will open and close the intake and exhaust valves. The cylinder head assembly 104 is secured in position by a plurality of bolts 138 which, preferably, extend through the entire assembly 104 and compress all of the joints together.

What is claimed is:

1. A cylinder head for an internal combustion engine having a cylinder block with a cylinder extending there-through and forming an opening in one side thereof, said cylinder head comprising a pair of members having complementary surfaces on adjacent sides thereof and having inlet and exhaust passages formed therein to communicate with said cylinder, at least one of said passages being formed to extend through said complementary surfaces, one of said pair of members also being formed to provide a face complementary to said one side of said block and being adapted to close said cylinder opening, said complementary surfaces being adhesively bonded and securing said members together and sealing said passages against leakage of fluid to or from said passages, said head also embracing means adapted removably to secure said head to said block with said face engaging said one side of said block and closing said cylinder opening and with said inlet and exhaust passages communicating with said cylinder.
2. A cylinder head for an internal combustion engine having a cylinder block with a cylinder extending there-through and forming an opening in one side thereof, said cylinder head comprising a pair of members having complementary surfaces on adjacent sides thereof and having inlet and exhaust passages formed therein to communicate with said cylinder, at least one of said passages being

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formed to extend through said complementary surfaces, one of said pair of members also being formed to provide a face complementary to said one side of said block and being adapted to close said cylinder opening, said complementary surfaces being adhesively bonded and securing said members together and sealing said passages against leakage of fluid to or from said passages, said head also embracing means in addition to said bonding and securing said members together on said complementary surfaces and adapted removably to secure said head to said block with said face engaging said one side of said block and closing said cylinder opening and with said inlet and exhaust passages communicating with said cylinder.

3. A cylinder head for an internal combustion engine having a cylinder block with a cylinder extending therethrough and forming an opening in one side thereof, said cylinder head comprising a pair of members having complementary surfaces on adjacent sides thereof and having inlet and exhaust passages formed therein to communicate with said cylinder, said passages and said cavities being formed to extend through said complementary surfaces, one of said pair of members also being formed to provide a face complementary to said one side of said block and being adapted to close said cylinder opening, said complementary surfaces being adhesively bonded and securing said members together and sealing said passages and cavities against leakage of fluid to or from said passages and cavities, said head also embracing means adapted removably to secure said head to said block with said face engaging said one side of said block and closing said cylinder opening and with said inlet and exhaust passages communicating with said cylinder.

4. A cylinder head for an internal combustion engine having a cylinder block with a plurality of cylinders extending therethrough and forming openings in one side thereof, said cylinder head comprising a pair of members having complementary surfaces on the adjacent sides thereof and having inlet and exhaust passages formed therein to communicate with said cylinders and having coolant cavities formed therein to cool said cylinders, said passages and said cavities being formed to extend through said complementary surfaces, one of said pair of members also being formed to provide a face complementary to said one side of said block and being adapted to close said cylinder openings, said complementary surfaces being adhesively bonded and securing said members together and sealing said passages and cavities against leakage of fluid to or from said passages and cavities, said head also embracing means adapted removably to secure said head to said block with said face engaging said one side of said block and closing said cylinder openings and with said inlet and exhaust passages communicating with said cylinders.

5. A cylinder head for an internal combustion engine having a cylinder block with a plurality of cylinders extending therethrough and forming openings in one side thereof, said cylinder head comprising a pair of members having complementary surfaces on the adjacent sides thereof and having inlet and exhaust passages formed therein to communicate with said cylinders and having coolant cavities formed therein to cool said cylinders, one of said pair of members also being formed to provide a face complementary to said one side of said block and being adapted to close said cylinder openings, said inlet and exhaust passages being adapted to open into said cylinders through ports in said complementary face and to extend axially outwardly of said cylinders through said one of said pair of members and into the other of said pair of members and thereafter to extend laterally through said other of said pair of members and to terminate in ports in at least one side of said other of said pair of members, said coolant cavities also being formed to extend through said complementary surfaces, said complementary surfaces being adhesively bonded

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and securing said members together and sealing said passages and cavities against leakage of fluid to or from said passages and cavities, said head also embracing means removably securing said head to said block with said face engaging said one side of said block and closing said cylinder openings and with said inlet and exhaust passages communicating with said cylinders.

6. A cylinder head for an internal combustion engine having a cylinder block with a plurality of cylinders extending therethrough and forming openings in one side thereof, said cylinder head comprising a pair of members having complementary surfaces on the adjacent sides thereof and having inlet and exhaust passages formed therein to communicate with said cylinders and having coolant cavities formed therein to cool said cylinders, one of said pair of members also being formed to provide a face complementary to said one side of said block and being adapted to close said cylinder openings, said inlet and exhaust passages being adapted to open into said cylinders through ports in said complementary face and to extend axially outwardly of said cylinders through said one of said pair of members and into the other of said pair of members and thereafter to extend laterally in opposite directions through said other of said pair of members and to terminate in ports in opposite sides of said other of said pair of members, said coolant cavities also being formed to extend through said complementary surfaces, said complementary surfaces being adhesively bonded and securing said members together and sealing said passages and cavities against leakage of fluid to or from said passages and cavities, said head also embracing means removably securing said head to said block with said face engaging said one side of said block and closing said cylinder openings and with said inlet and exhaust passages communicating with said cylinders.

7. A cylinder head for an internal combustion engine having a cylinder block with a cylinder extending therethrough and forming an opening in one side thereof, said cylinder head comprising a pair of members having complementary surfaces on adjacent sides thereof and having inlet and exhaust passages formed therein to communicate with said cylinder, one of said pair of members also being formed to provide a face complementary to said one side of said block and being adapted to close said cylinder opening, inlet and exhaust valve seats in said one of said members at the ends of said passages and adapted to communicate with said cylinder, inlet and exhaust valves controlling said passages and engaging said seats, said valves having stems extending transversely through said members, the other of said members being formed to provide valve guide means engaging said valve stems and supporting said valves in said head, adhesive bonding means securing said members, together and operatively supporting said guides with respect to said seats, and means adapted removably to secure said head to said block with said face engaging said one side of said block and closing said cylinder opening and with said inlet and exhaust passages communicating with said cylinder.

8. A cylinder head for an internal combustion engine having a cylinder block with a cylinder extending therethrough and forming an opening in one side thereof, said cylinder head comprising a pair of members having complementary surfaces on adjacent sides thereof and having inlet and exhaust passages formed therein to communicate with said cylinder, one of said pair of members also being formed to provide a face complementary to said one side of said block and being adapted to close said cylinder openings, inlet and exhaust valves disposed in said head and extending across said complementary surfaces, said valves having the seats thereof formed in one of said members and the guides therefor formed in the other, means adhesively bonding said complementary surface to secure said members together, and means for removably securing said head to said block

with said face engaging said one side of said block and closing said cylinder opening.

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