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L. M. TAYLOR

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CYLINDER HEAD CONSTRUCTION FOR ENGINES

Original Filed April 8, 1941

Fig. 1.

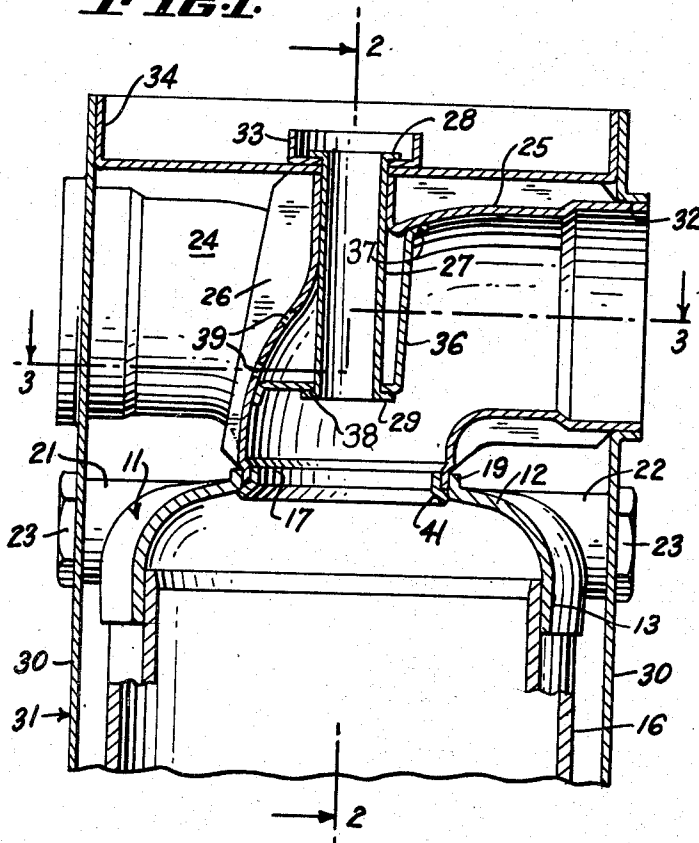


Fig. 2.

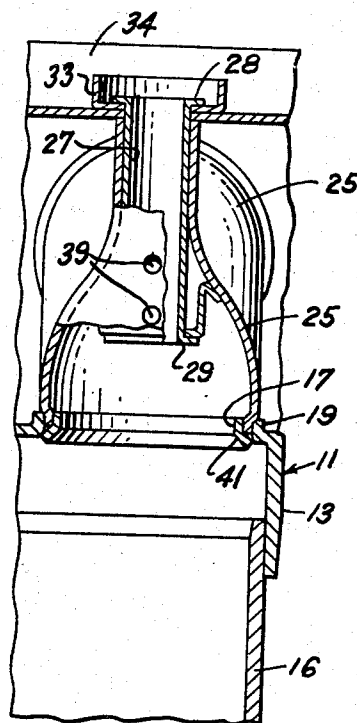


Fig. 3.

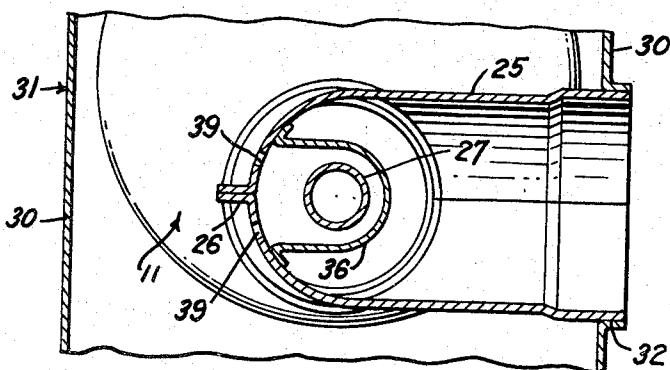
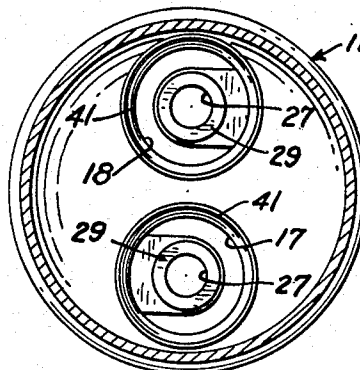


Fig. 4.



INVENTOR.
LLOYD M. TAYLOR
BY *Abington L. White*
ATTORNEY.

UNITED STATES PATENT OFFICE

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CYLINDER HEAD CONSTRUCTION FOR ENGINES

Lloyd M. Taylor, San Leandro, Calif., assignor,
by direct and mesne assignments, to Taylor
Engines, Inc., Oakland, Calif., a corporation of
Nevada

Original application April 8, 1941, Serial No.
387,410. Divided and this application January
6, 1942, Serial No. 425,776

6 Claims. (Cl. 123—173)

The invention, in general, relates to fabricated internal combustion engines embodying sheet material, and more particularly relates to an improved cylinder head construction for the individual cylinders of such an engine to afford effective heat dissipation.

The present application is a division of my co-pending application, Serial No. 387,410, filed April 8, 1941, and entitled Fabricated internal combustion engine.

As a general rule, practically all internal combustion engines heretofore constructed have included a unitary or integral cylinder head block comprising a metal casting. Due to inherent casting problems, nearly all of such castings are of uneven thickness all around the combustion chamber of the cylinder with the result that localized heating of the head in numerous places occurs and, as a consequence, the head becomes warped and often cracks because of these hot spots. In addition, these castings are so produced as to provide a mass of solid material between valve ports which causes the development of internal stresses retarding the flow of heat or, in other words, inhibits effective heat dissipation. Moreover, due to the lack of heat radiation away from the valves and spark plugs and combustion chamber, engines embodying cast metal blocks for the cylinder head are limited as to the compression ratios under which they may be effectively operated.

A primary object of the present invention is to provide an improved cylinder head construction fabricated of sheet material of even thickness throughout and affording maximum dissipation of heat away from the valves, the spark plugs, valve ports and valve guides.

Another object of my invention is to provide a cylinder head for an internal combustion engine which affords operation of the engine at higher compression ratios and improved efficiency.

A still further object of the invention is to provide a cylinder head construction of the indicated nature for the cylinders of an internal combustion engine which reduces to a minimum the likelihood of cracking of the head and entirely eliminates hot spots as well as eliminates the creation of undue internal stresses.

Another object of my present invention is to provide an improved cylinder head construction of the aforementioned character for internal combustion engines which is relatively light in weight and relatively easy and inexpensive to manufacture.

A still further object of my invention is to provide a cylinder head construction for the individual cylinders of an internal combustion engine which enables the cooling medium employed in the engine to be brought nearer to working parts in the combustion chamber and thus to enhance the dissipation of heat therefrom.

The foregoing and other objects are attained in a preferred embodiment of my invention which is illustrated in the accompanying drawings. While a preferred embodiment is shown, it is to be understood that I am not to be limited to the precise embodiment shown, nor to the precise arrangement of the several parts thereof, as my invention, as defined in the appended claims, can be embodied in a plurality and variety of forms.

Referring to the drawing:

Figure 1 is an elevational view, partly in section, of a preferred embodiment of my invention.

Figure 2 is a view of the preferred embodiment shown in Figure 1 and taken on the line 2—2 thereof.

Figure 3 is another view of the preferred embodiment and taken on the line 3—3 of Figure 1.

Figure 4 is a bottom plan view in part section of the preferred embodiment of the invention with the side spark plug bosses removed.

In its preferred form, the cylinder head construction of my invention for application to the individual cylinders of an internal combustion engine preferably comprises a cap member of sheet material having a relatively deep, depending flange for uniting the cap member to the top of a cylinder; said cap member having a plurality of spaced valve ports therein for permitting a combustible charge and discharge gases to enter and leave the cylinder, a relatively high flange bounding each of said valve ports and providing appreciable welding surfaces, a pair of elbows of sheet material united to said flanges and communicating with said valve ports; said elbows each having a plurality of small holes therein, valve guides carried by each elbow in axial alignment with said valve ports and extending within each elbow, a cooling medium jacket surrounding that portion of each valve guide within each elbow; each of said cooling medium jackets being united to the inner surface of each said elbow and communicating with the main cooling medium jacket of the engine, and a valve seat fitted and united to each said elbow at said valve ports.

In accordance with my invention, I provide a cap member 11 which is preferably stamped from

sheet material to afford uniform even thickness of material throughout the entire cap member, and which preferably assumes an inverted cup-like shape, as particularly illustrated in Figure 1 of the drawing. The cap member includes a top 12 and a relatively deep, depending flange 13, the latter defining a relatively large opening for passing or receiving a cylinder sleeve 16 of an engine and affording an appreciable welding surface for permanently uniting the cap member 11 and the sleeve 16 together which preferably is carried out by copper brazing in a hydrogen-copper brazing furnace as fully described in my co-pending application, Serial No. 427,018, filed January 16, 1942, and entitled "Method of uniting fabricated structures." The top 12 of cap member 11 is so formed as to provide therein a pair of spaced valve ports 17 and 18, as clearly shown in Figure 4 of the drawing; each valve port preferably being so formed in top 12 of the cap member as to provide a pair of spaced, upstanding relatively high flanges 19 and 20 affording appreciable welding surfaces. In addition to valve ports 17 and 18, the cap member 11 is so formed as to provide a pair of internally threaded apertured bosses 21 and 22 therein at diametrically opposite sides of the flange 13 for passing and supporting suitable spark plug bushings 23 which serve to receive and to hold spark plugs, not shown, in proper alignment within the cylinder sleeve 16.

The improved cylinder head construction of my invention also preferably includes a pair of oppositely directed elbows 24 and 25 which serve as conduits for intake and exhaust gases and which establish communication between the intake and exhaust manifolds of the engine, not shown, and the interior of each engine cylinder 16. Elbows 24 and 25 preferably are each formed of two complementary half-sections stamped from a suitable thin, light weight metal, and are welded together to define a web 26 at the welded juncture of the two half-sections, such web 26 providing increased strength at such joints. Elbows 24 and 25 are preferably united by means of welding or brazing to the upstanding flanges 19 and 20, respectively, that bound the valve ports 17 and 18, the height of these flanges affording appreciable and sufficient welding surfaces for effecting an appreciably strong bond between such elements. Since the valve ports 17 and 18 are spaced apart one from the other, it is clear that no solid mass of material bridges or connects these elbows 24 and 25 and that they are similarly spaced apart. Hence, there are no localized hot spots and heat is rapidly and effectively dissipated from around these elbows and joints. Each of the elbows 24 and 25 conveniently is so formed as to provide valve guides 27 thereon, such valve guides being so arranged and disposed on the elbows as to be in axial alignment with corresponding valve ports with which the elbow is associated, and such valve guides, as shown, extend an appreciable distance within the elbows, as clearly shown in Figures 1 and 2 of the drawing. It may be observed here that each valve guide 27 preferably is formed with flanges 28 and 29 thereon at the top and bottom thereof so that each valve guide is, in effect, a hollow rivet serving not only as a guide for the valve stems but also as a means for rigidly and firmly holding together certain of the parts to enhance the brazing operations. Moreover, elbows 24 and 25 are each provided with an external bead adjacent its inlet end

which serve as abutments for the sides 30 of a main cooling medium jacket 31 of the engine, the inlet ends of such elbows being fitted to and extending through suitable openings 32 formed in the sides 30 of such cooling medium jacket for receiving intake and exhaust manifolds, not shown.

As particularly illustrated in Figures 1 and 2 of the drawing, there is provided at the top of each valve guide 27 a cup-like member 33 which seats on a top closure plate 34, such cup-like member having a bottom provided with a suitable sized opening for passing the valve guide. As shown, the top closure plate 34 preferably is united by means of welding to the upper portion of the main cooling medium jacket 31 and this closure plate similarly is provided with openings for passing the valve guides 27. It will be observed that the upper flanges 28 of the valve guides 27 bear upon the inner surface of the cup-like member of valve spring receptacle 33 and firmly hold these members 33 under compression and in proper alignment seated upon the closure plate 34. To insure rigidity, I preferably unite the flanges 28 of the valve guides directly to the valve spring receptacles 33 by means of welding.

In accordance with my invention, and in order to afford rapid and effective dissipation of heat from around the valve guides 27, I preferably provide in my improved cylinder head construction an auxiliary cooling medium jacket 36 within each elbow 24 and 25 and encircling each valve guide. To this end, I unite flanged ends 37 and 38 of such auxiliary cooling medium jackets 36 to the inner surface of each elbow, as clearly shown in Figure 1 of the drawing, and construct each of such auxiliary cooling medium jackets 36 of such size and dimensions as to surround the valve guides in spaced relationship thereto. The bottoms of these cooling medium jackets 36 are formed, of course, with openings for passing the valve guides 27 and to insure rigidity between these parts I preferably clamp the lower flanges 29 of the valve guides against the outer surfaces of the bottoms of the cooling medium jackets 36. With the upper flanges 28 of the valve guides bearing upon the inner surface of the valve spring receptacles 33 and the lower flanges 29 of the valve guides 27 bearing upon the outer surfaces of the bottoms of the auxiliary cooling medium jackets 36, these several parts are firmly held together under compression for enabling an increased bond to be effected therebetween in the brazing operations. In order to establish communication between the auxiliary cooling medium jackets 36 and the main cooling medium jacket 31 of the engine, each of the elbows 24 and 25 is provided with a series of holes 39 extending therethrough, thus affording a constant circulation of the cooling medium all around the valve guides 27.

In addition to the foregoing elements, the improved cylinder head construction of the present invention includes a valve seat 41 for each of the valve ports 17 and 18 that are formed in the top 12 of each cap member 11; the valve seats 41 preferably being faced with a relatively hard metal, such as stellite or k-monell metal or the like, in order effectively to withstand impacts. Each valve seat 41 is press-fitted into the inner end of each elbow 24 and 25 and, in addition, is permanently welded thereto by means of copper brazing to insure a tight joint and an effective bond therebetween; the seats 41, of course,

being formed complementary to the shape of the valve head, not shown, that may be used. Since these valve seats 41 are not merely press-fitted or screwed into position, as is the case in present types of valve seats of internal combustion engines which results in a bond that retards heat dissipation rather than aiding the same, but seats 41 are both press-fitted and welded into position, I have thus provided a bond between valve seats and cylinder head conduits that effectively enhances heat radiation from the valves to the cooling medium. It may also be especially observed that due to the stamping of the cylinder head cap member 11 and the elbows 24 and 25 from relatively thin sheet material, there is provided a relatively thin joint of uniform, even thickness at all valve ports affording rapid heat conveyance to the cooling medium which entirely surrounds these parts.

In experimental tests of an internal combustion engine fabricated of a plurality of separately mounted, in-line cylinders and embodying a cylinder head construction as hereinabove described, the engine operated efficiently under much higher temperature conditions than it is possible to operate conventional engines embodying cast metal cylinder heads enclosing all cylinders. Moreover, upon cooling of the engine so tested, no cracking of the cylinders occurred. The increased rapidity of heat dissipation from the combustion chambers and working parts, all as afforded by the heat flow characteristics of an internal combustion engine embodying my improved cylinder head construction as above described, enables higher compression ratios to be utilized. The pressed steel construction, or stampings from light weight metal, of the cylinder head parts affords uniform thickness of material throughout and eliminates all likelihood of warpage that so frequently occurs in cast metal heads of prior engine construction due to the uneven thickness of material resulting from the casting of such heads. Moreover, all hot spots or localized heating are overcome and the improved head construction facilitates rather than retards heat flow from all valves to the cooling medium with a consequent rapid dissipation of the heat that is normally produced in the combustion chamber and around valves. Further, this improvement in cylinder head construction affords the welding or uniting into the valve ports of a much harder valve seat than is possible with prior cylinder head constructions.

It is to be understood that the appended claims are to be accorded a range of equivalents commensurate in scope with the advance made over the prior art.

I claim:

1. A cylinder head construction for attachment to each cylinder of a plurality of separately mounted cylinders of an internal combustion engine, said head construction comprising a cap member fabricated of relatively thin sheet material of uniform thickness and including a top and a relatively deep, depending flange to which a cylinder sleeve may be fastened; said flange defining a relatively large opening for establishing communication between the cylinder and the cylinder head, said top having a pair of spaced valve ports therein, upstanding, relatively high flanges bounding each of said valve ports, gas intake and exhaust elbows united to said valve ports, valve guides on said elbows axially aligned with said valve ports; each of said valve guides including a flange on its lower end, and auxil-

iary cooling medium jackets within each said elbow and surrounding each said valve guide; each of said cooling medium jackets including an apertured bottom for passing a valve guide and to which said flange of said valve guide is welded.

2. A cylinder head construction for attachment to each cylinder of a plurality of separately mounted cylinders of an internal combustion engine, said head construction comprising a cap member including a top having a plurality of spaced valve ports therein, and a relatively deep, depending flange for uniting said cap member to a cylinder sleeve, relatively high flanges bounding each of said valve ports and providing appreciable welding surfaces, gas intake and exhaust elbows united directly to said flanges, valve guides on each said elbow in axial alignment with said valve ports; each of said valve guides including a flange on its lower end, an auxiliary cooling medium jacket within each said elbow and encircling each said valve guide; each of said cooling medium jackets including an apertured bottom for passing a valve guide and to which said valve guide flange is welded, and a valve seat faced with a relatively hard metal united to the inner end of each said elbow at each of said valve ports.

3. A cylinder head construction for attachment to the individual cylinders of an internal combustion engine, said head construction comprising a cap member of relatively thin sheet material of uniform thickness including a top having a pair of spaced valve ports therein and a deep, depending flange defining a large opening for passing a cylinder sleeve and serving to unite the head to the cylinder, gas intake and exhaust elbows united to said top and communicating with said valve ports, a valve guide on each said elbow and disposed in alignment with the valve port with which said elbow communicates; each of said valve guides having flanged ends, a valve spring receptacle on the top of each said valve guide and retained thereon by one of the flanged ends of said valve guide, and a cooling medium jacket in each said elbow and encircling the valve guide on said elbow; said cooling medium jacket being held firmly against the bottom of said valve guide by the other flanged end thereof.

4. A cylinder head construction for attachment to the individual cylinders of an internal combustion engine, said head construction comprising a cap member having a pair of spaced valve ports therein and a depending flange for attaching said cap member to the top of a cylinder sleeve, a pair of elbows united directly to said cap member and communicating with said valve ports for permitting ingress and egress of gases to and from said cylinder sleeve; each of said elbows being fabricated of complementary half-sections of relatively thin sheet material of uniform thickness united together to define hollow conduits, a valve guide formed on each of said elbows and extending within the same, and an auxiliary cooling medium jacket of relatively thin material of uniform thickness encircling each of said valve guides within each said elbow.

5. A cylinder head construction for attachment to the individual cylinders of an internal combustion engine; said head construction comprising a cap member having a pair of spaced valve ports therein and including a depending flange for uniting said cap member to the top of a cylinder sleeve, a pair of elbows united di-

rectly to said cap member and communicating with said valve ports for permitting ingress and egress of gases to and from the cylinder sleeve; each of said elbows having a plurality of holes therethrough and being fabricated of complementary half-sections of relatively thin sheet material of uniform thickness united together to define hollow conduits, a valve guide formed on each of said elbows and extending within the same; each of said valve guides including a flange on its lower end, and an auxiliary cooling medium jacket surrounding each valve guide within an elbow and communicating with a main cooling medium jacket of the engine through said holes in said elbows; each of said cooling medium jackets surrounding said valve guides including an apertured bottom for passing the valve guide and to which said valve guide flange is welded.

6. A cylinder head construction for engines, said head comprising a top having a pair of spaced valve ports therein, a pair of elbows united directly to said top and communicating with said ports; each of said elbows having a plurality of holes therethrough for passing a cooling medium, a valve guide formed on each of said elbows and extending within the same; each of said valve guides including a flange on its lower end, and an auxiliary cooling medium jacket within each of said elbows and surrounding each valve guide; each of said cooling medium jackets communicating with the main cooling medium jacket of the engine through said holes in said elbows and including an apertured bottom for passing the valve guides and to which the flanged lower ends of the valve guides are welded.

LLOYD M. TAYLOR.