

Nov. 8, 1955

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2,722,922

PREVENTION OF CRACKS IN CYLINDER HEADS

Filed Nov. 10, 1954

2 Sheets-Sheet 1

FIG. 1

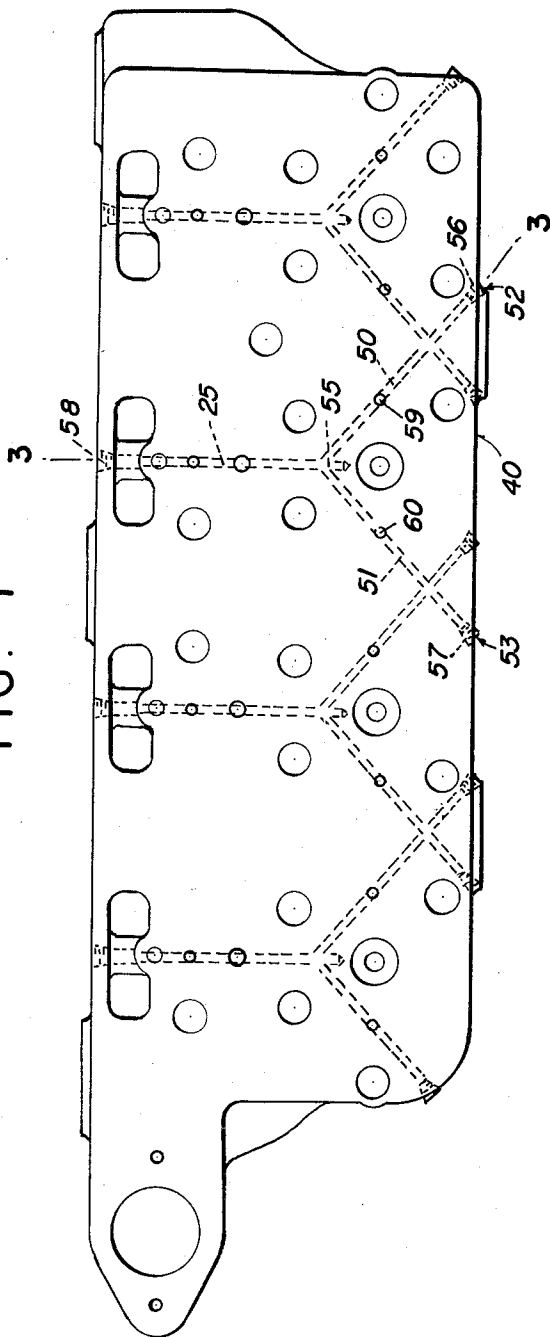
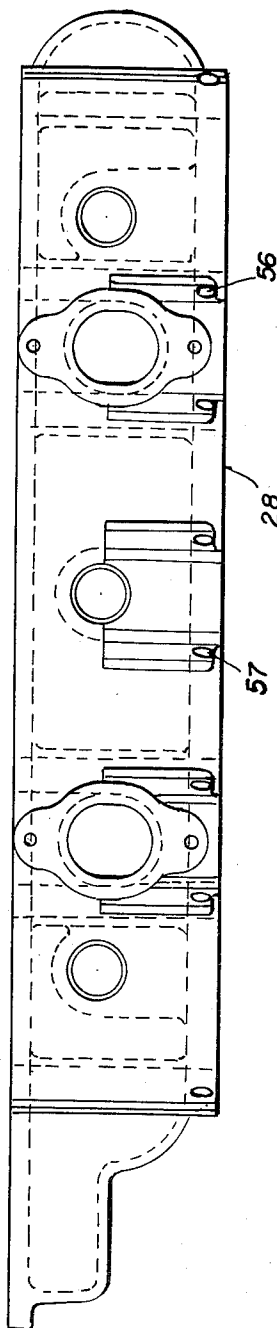


FIG. 4



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FIG. 2

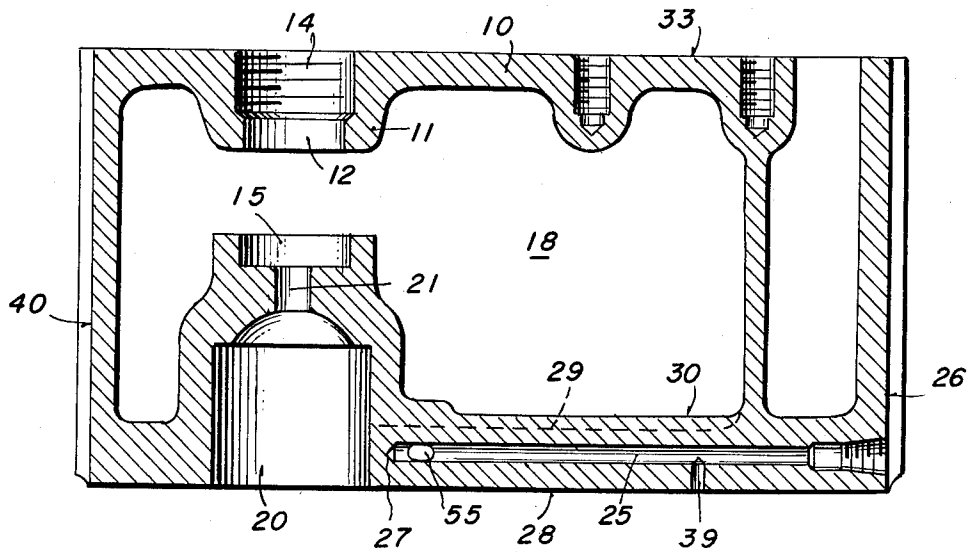
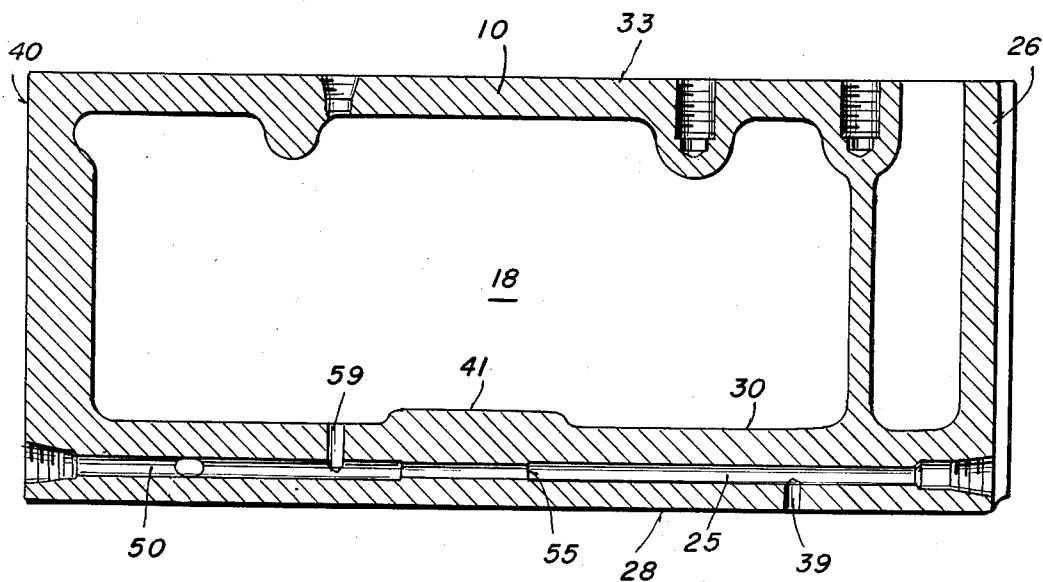


FIG. 3



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PREVENTION OF CRACKS IN CYLINDER HEADS

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Application November 10, 1954, Serial No. 467,965

3 Claims. (Cl. 123—41.74)

This invention relates to internal combustion engines of the type having rather narrow metal bridges extending between the thick sections of a cylinder head, which are required because of the high pressure usual in such engines particularly those of the diesel type. The principal object of the present invention is to retard the cumulative crack-forming effect of the alternate expansion and contraction of these bridges as they are compressed lengthwise during the warm-up periods and are placed in tension in the cooling off periods by the surrounding masses of the relatively thick sections which they connect.

A further object of the invention is to provide for the passage of water not only through the metal between the proximate valve seat inserts of a cylinder head but also between the combustion chamber of a valve in head Diesel engine and each of the two adjacent valve seat inserts, this being particularly advantageous in engines having the larger size bores as the tendency of this metal to form cracks constantly growing in length and depth, seems to increase at a geometrical rate with increase of diameter as the bore diameter exceeds about $3\frac{1}{2}$ ". By equalizing the temperature in these three bridging members, distortion of the valve seat inserts is also lessened to a degree that permits an appreciable saving in labor costs in the grinding of the valves.

In the drawings:

Figure 1 is a plan view of a portion of a cylinder head;

Figure 2 is a transverse vertical section through a combustion chamber recess;

Figure 3 is a vertical section on line 3—3 of Figure 1;

Figure 4 is a side elevation.

Referring first to Figure 2, the cylinder head casting has a top wall 10 from which extends downwardly a boss 11 having a circular hole 12 to fit the body of an injector which engages the threads 14 so that the injector snugly fits the holes 12 and 15 and thus prevents water from the spaces 17 and 18 entering this area. The large recess 20, coaxial with threads 14 and the holes 12, 15 and 21, receives the usual combustion chamber insert. A bore 25 is drilled from the flat side face 26 of the casting to a point such as 27 fairly close to the recess 20 and slightly farther from the face 28 which engages the engine block than from the usual bottom or flow 29 of the water space. A small ridge 30 is provided above the drilled bore 25 to provide sufficient metal directly above the bore.

In previous practice a hole was drilled through the upper face 33 of the casting so as to make a vertical bore in the bridge 35 between the intake and exhaust recesses 37 and 38 respectively, water being admitted to the bore 25 through a short bore 39 drilled through the bottom face 28 of the casting. This was perfectly satisfactory for engines having smaller bores and has proved highly advantageous for engines of this size but when we come to engines having bores of about $4\frac{1}{4}$ " it becomes necessary to provide for temperature equalization between the combustion chamber recess 20 and each of the two proximate valve recesses 27 and 28 for all loads above 1800

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as well as for overloads at that figure. For a slightly larger bore, say $4\frac{1}{2}$ ", unless there is thermal control in the bridges on both sides of the combustion chamber recess, there will be danger of the formation of cumulative cracks at speeds exceeding 1600.

It is believed that cracks are formed in absence of the bores of the present invention by reason of the rapid rise in temperature of the narrow bridges during the warm-up period this being particularly true during cold weather. The massive portions of the casting heat up very slowly whereas the small narrow bridges heat rapidly being at the hottest part in the entire casting and consequently all three of the bridges tend to expand lengthwise quite quickly and long before the other portions of the casting have come up to operating temperature.

The cracking is minimized by warming the engine up slowly and being sure that the heat is fairly uniformly distributed before a heavy load is applied. Equally obviously, it is very difficult to teach the ordinary operator to take this much care with the engine. Tendency to crack is increased greatly by high speeds and heavy loads. Almost exactly the same trouble is encountered when the engine is stopped. The cylinder head cools down slowly especially in the thicker portions and since the three bridges are both narrow and short and are surrounded by masses of iron of much greater strength because of their sizes, the tendency to crack or to increase cracks already formed is greatly increased.

By joining the bore 25 by additional passageways drilled from the side face 40 opposite the face 26 and locating these additional bores substantially at right angles to each other and about in the center of the bridges 40 and 41 and with direct communication above at some convenient point with the water space in the head directly above the additional bores, the desired temperature control is obtained.

As a typical example: bores 50 and 51 are drilled from points 52 and 53 in the face 40 so that the axes of the three bores 25, 50 and 51 all lie in the same horizontal plane, assuming the bottom face 28 to be horizontal. These bores are continued until they intersect at point 55 with bore 25. The critical areas may then be maintained at such a temperature as to minimize the formation of cracks caused by the alternate compression and tension in the metal. All three of the bores are closed at their entry ends by plugs 56, 57 and 58. The vertical short bores 59 and 60 lead vertically down from the water space in the head to the slanting bores well beyond any critical point. There is thus built up a slight pressure differential between the engine block (not shown) and the cylinder head which pressure aids in overcoming the friction of the three long drilled passages.

In operation, water from the engine block (not shown) enters through the vertical short passage 39, travels along bore 25 which is the stem of a Y and on reaching point 55 branches evenly into bores 50 and 51 discharging from each through the short vertical bores 59 and 60 to the main water space in the head. By carrying heat from the three narrow bridges between the combustion chamber and the valve inserts and between the inserts during the warm-up period and by delaying the cooling of these bridges during the cooling off period, the formation of thermal cracks is minimized if not prevented.

What I claim is:

1. A cylinder head casting having therein recesses for a combustion chamber, an exhaust valve and an inlet valve, with bridges of metal extending in Y formation between the three recesses and joining the bottom wall of the casting, characterized by communicating passageways parallel to the bottom face of the casting and extending through the three bridges, and a bore leading to the passageways from the bottom face of the casting and

exit bores leading from the connected passageways to the water space in the casting, whereby water will circulate through the three connected passageways and provide thermal control for the bridges.

2. The casting of claim 1 in which one of the passageways extends from one side face of the casting and two of the passageways extend from the opposite side face of the casting, the three passageways meeting at a point roughly equidistant from the axes of the three recesses.

3. The casting of claim 2 in which the three bores pass roughly equidistant from the axes of the three recesses.

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