Aug. 9, 1932. G. M. BICKNELL 1,870,397

COMBUSTION CHAMBER FOR INTERNAL COMBUSTION ENGINES

Filed July 12, 1929 2 Sheets-Sheet 1

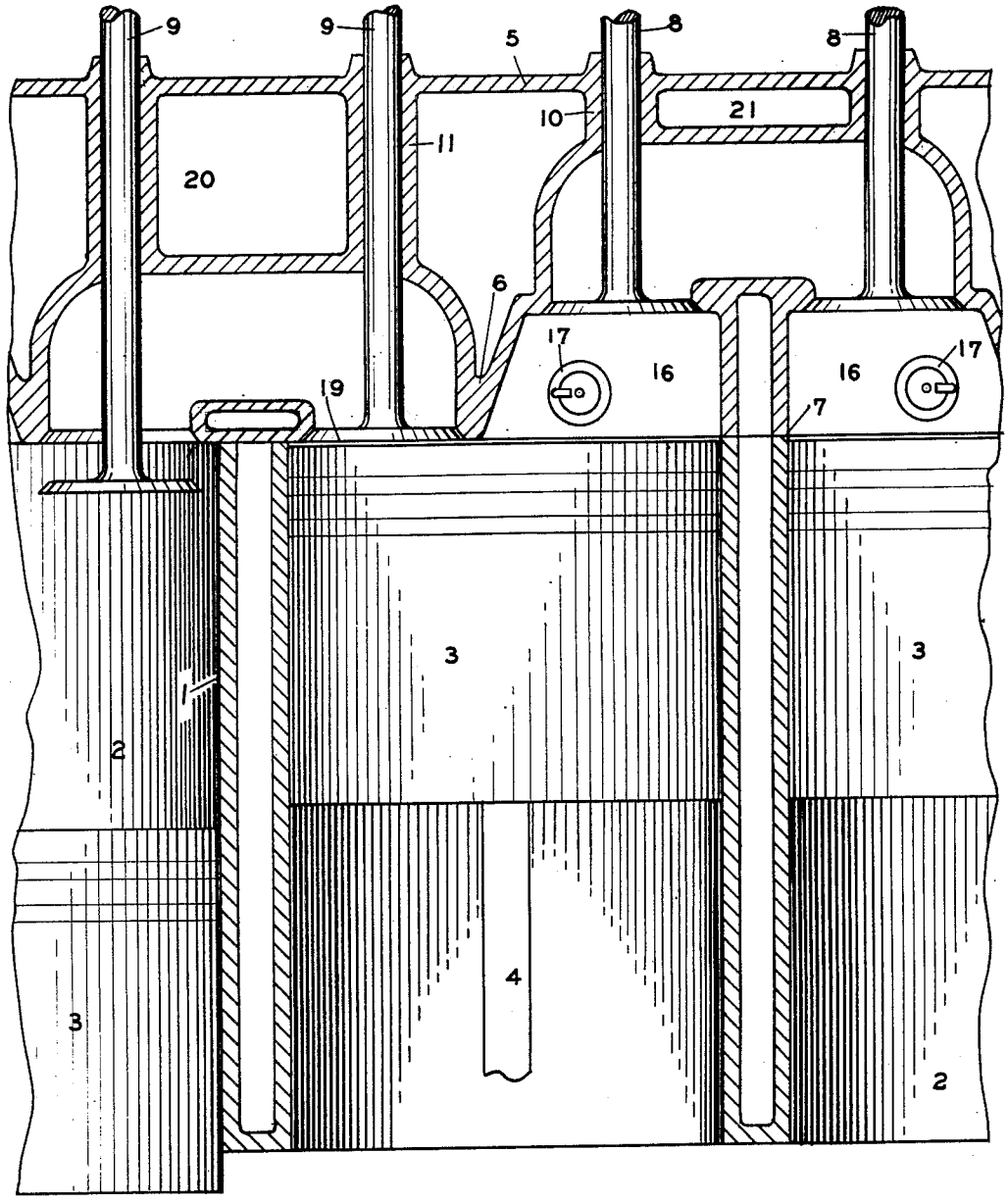


Fig 1

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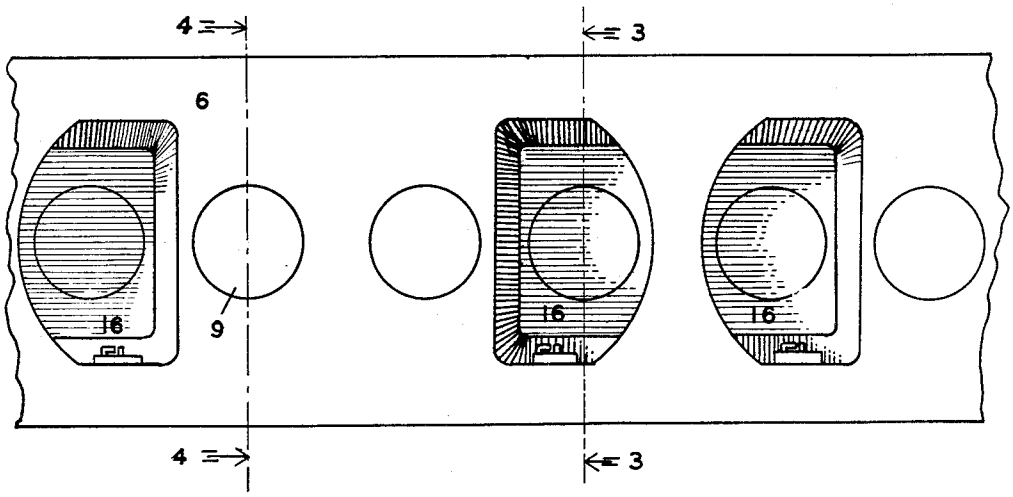


FIG. 2

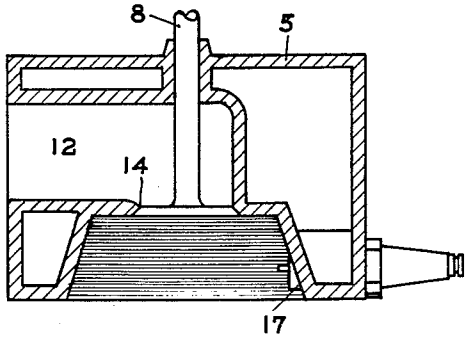


FIG. 3

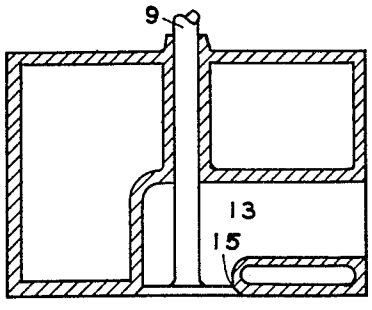


FIG. 4

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UNITED STATES PATENT OFFICE

GEORGE M. BICKNELL, OF ST. LOUIS, MISSOURI

COMBUSTION CHAMBER FOR INTERNAL COMBUSTION ENGINES

Application filed July 12, 1929. Serial No. 377,645.

This invention relates to internal combustion engines, and particularly to the provision of a combustion chamber of an improved design; the invention also relates to valve cooling arrangement for such engines. The invention is especially adapted to four-cycle internal combustion engines of the overhead valve type, though not necessarily limited to such structure.

Heretofore, difficulty has been experienced in engines of this nature due to pre-ignition and detonation of the fuel charge. I have found that this difficulty can be remedied to a great extent by concentrating the main volume of the fuel charge at the time of combustion in a part of the combustion chamber which is comparatively cool.

Exhaust valves of the usual poppet type have practically their whole surface exposed directly to the flame during the exhaust cycle, and since the only paths of escape for the heat are through the seat and stem of the valve, the heads of these valves sometimes become unduly hot or even incandescent, resulting in deterioration of the metal and pre-ignition and detonation of the charge—that is to say, the center of the exhaust valve head becomes heated to such a temperature that the charge would become ignited by contact with it before the desired point for ignition had been reached in the cycle.

It is also known to those skilled in the art that difficulty has been experienced in cooling the exhaust valves sufficiently without at the same time over-cooling the inlet valve. It is the custom in constructing engines of this type to form the cylinder head integral with the water jacket and to make the combined head and jacket of a generally rectangular shape. It is desirable to have a greater volume of cooling water adjacent the exhaust valve and its guide than that adjacent the inlet valve. In previous constructions, it has been difficult to obtain this arrangement and still keep the desired rectangular shape for the cylinder head, owing to the valve heads being located substantially in the same plane.

It is an object of this invention to produce a combustion chamber for internal combustion engines in which the main part of the volume will be concentrated in a part of the chamber which is comparatively cool—in other words, to concentrate the volume of the combustion chamber adjacent the coolest parts of its walls. It will be understood, of course, that the walls of the chamber include the heads of the inlet and exhaust valves as well as the top of the piston.

It is a further object of this invention to produce an internal combustion engine of a valve-in-head type having greater volume of cooling fluid adjacent the exhaust valve then that adjacent the intake valve.

It is a further object of this invention to produce an anti-detonating cylinder head of simplified construction for valve-in-head inlets.

It is a further object of this invention to produce a cylinder head for internal combustion engines in which substantially all of the combustible change will be confined in a comparatively cool part of the combustion chamber at the instant combustion begins.

Other objects of the invention will appear from the following specification and the accompanying drawings, referring to which:

Figure 1 is a sectional elevation of an internal combustion engine taken along the line 1—1 of Figure 2 looking in the direction of the arrows.

Figure 2 is an inverted plan view of the cylinder head of the engine shown in Figure 1, the head being that portion above the ends of the cylinder shown in Figure 1.

Figure 3 is a sectional elevation of the cylinder head shown in Figure 2 taken along the line 3—3 looking in the direction of the arrows.

Figure 4 is a sectional elevation of the cylinder head shown in Figure 2 taken along the line 4—4 of Figure 2 looking in the direction of the arrows.

The reference numeral 1 indicates the cylinder block of an engine. This block is provided with cylinders 2 which are fitted with pistons 3 having connecting rods 4. The pistons and connecting rods operate in a conventional manner well known in the art.

A cylinder head is provided comprising an outer wall 5 and an inner wall 6. The head is detachable along the line indicated at 7 and is secured in place with conventional bolts and gaskets (not shown). Each cylinder is provided with a fuel valve 8 and an exhaust valve 9. These valves are mounted in guides 10 and 11, respectively.

The head is provided with inlet ports 12 and an exhaust port 13. These ports have valve seats 14 and 15, respectively, on which are seated the heads of the valves. The wall 6, which is adjacent the ends of the cylinders 2, is substantially flat with the exception of the pockets 16. These pockets form the compression chamber for the cylinders, the pistons traversing substantially the full length of the cylinder so that when they are in their upward position, there is only a small clearance sufficient for tolerance in manufacturing between the piston and the wall 6.

Conventional spark plugs 17 are provided and these are located in the combustion chamber adjacent the inlet valve so that the inflowing fuel gas must flow directly over the terminals of the spark plugs. The inlet valves in adjacent cylinders are located on opposite sides of the center so that there will be two exhaust ports adjacent and two inlet ports adjacent to reduce the number of manifold connections. This arrangement is more or less conventional and need not be further described.

The exhaust valve 9 at the left of Figure 1 is shown in open position. It will be noted that this is in the path of the piston 3 in that cylinder. This, however, is not a disadvantage, for the reason that the exhaust valve opens and closes at a time when the piston is not at the upper end of the cylinder. In the usual four-cycle operation, the exhaust valve begins to open when the piston is approaching the lower limit of its travel on the explosion stroke, and it begins to close again during the latter part of the exhaust stroke, being substantially closed by the time the piston has reached the upper limit of its travel. There is a small operating clearance and manufacturing tolerance provided, but the main part of the movement of the exhaust valve head is in the path that is traversed by the piston at other points in the cycle.

It will be understood that the usual valve operating means such as springs, cam shaft, or other conventional apparatus are provided for operating the valve in the proper manner, but this is not shown for the reason that any conventional means may be used for the purpose.

The operation of the device is as follows:

The piston 3 operates in the cylinders 2 in a conventional manner. Fuel is drawn into the cylinder 2 through the inlet port 12 and inlet valve 8 and the combustion chamber 16. The fuel is then compressed in the combustion chamber 16 and exploded by means of the spark plug 17 at a time when the piston 3 is substantially in the position shown in the central cylinder in Figure 1. There is only a thin layer of gas between the head of the exhaust valve and the top of the piston, as indicated at 19. The greatest heat of combustion occurs immediately after the explosion and before the piston has had time to recede to any great extent from its position adjacent the top of the cylinder and the head of the exhaust valve. Thus, it will be seen that the exhaust valve will not be exposed for so long an interval to the heat of combustion as the intake valve and the other parts of the combustion chamber. It will be understood that the inlet valve is cooled by the inflowing fuel gas, and there is no necessity for protecting it from the heat of combustion.

The mounting of the inlet valve in a pocket with the exhaust valve flush with the top of the cylinder permits the formation of the larger water space 20 above the exhaust valve and around the comparatively long exhaust valve guides 11 and a smaller water space 21 above the inlet valve with shorter inlet valve guides 10.

I claim:

1. In an internal combustion engine of the valve-in-head type, a cylinder head of substantial rectangular cross section, said head having inlet and exhaust ports, poppet valves carried by said head and controlling said ports, pockets in said head forming combustion chambers, said inlet valves being mounted in said pockets, and said exhaust valves being mounted flush with the surface of said head.

2. In an internal combustion engine of the valve-in-head type, a cylinder, a cylinder head having a pocket therein, said pocket being of suitable size to form a combustion chamber for the cylinder, said pocket being in unrestricted constant communication with the cylinder and having its largest cross-sectional area in the plane in which it joins the cylinder an exhaust valve carried by said head at a point spaced from said pocket, a spark plug carried by said head and extending into said pocket.

3. In an internal combustion engine, a cylinder, a combustion chamber, a piston operating in said cylinder, inlet and exhaust valves for said combustion chamber, said exhaust

valve being so mounted that the top of the piston in its upward position will be closely adjacent the head of the exhaust valve in its closed position, said combustion chamber having a pocket, the volume of said combustion chamber being disposed chiefly in said pocket, said exhaust valve being mounted at a point spaced from said pocket and said inlet valve being mounted in said pocket.

In testimony whereof, I affix my signature this 10th day of July, 1929.

GEORGE M. BICKNELL.