May 9, 1933. A. W. POPE, JR 1,907,663

INTERNAL COMBUSTION ENGINE

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Fig. 1.

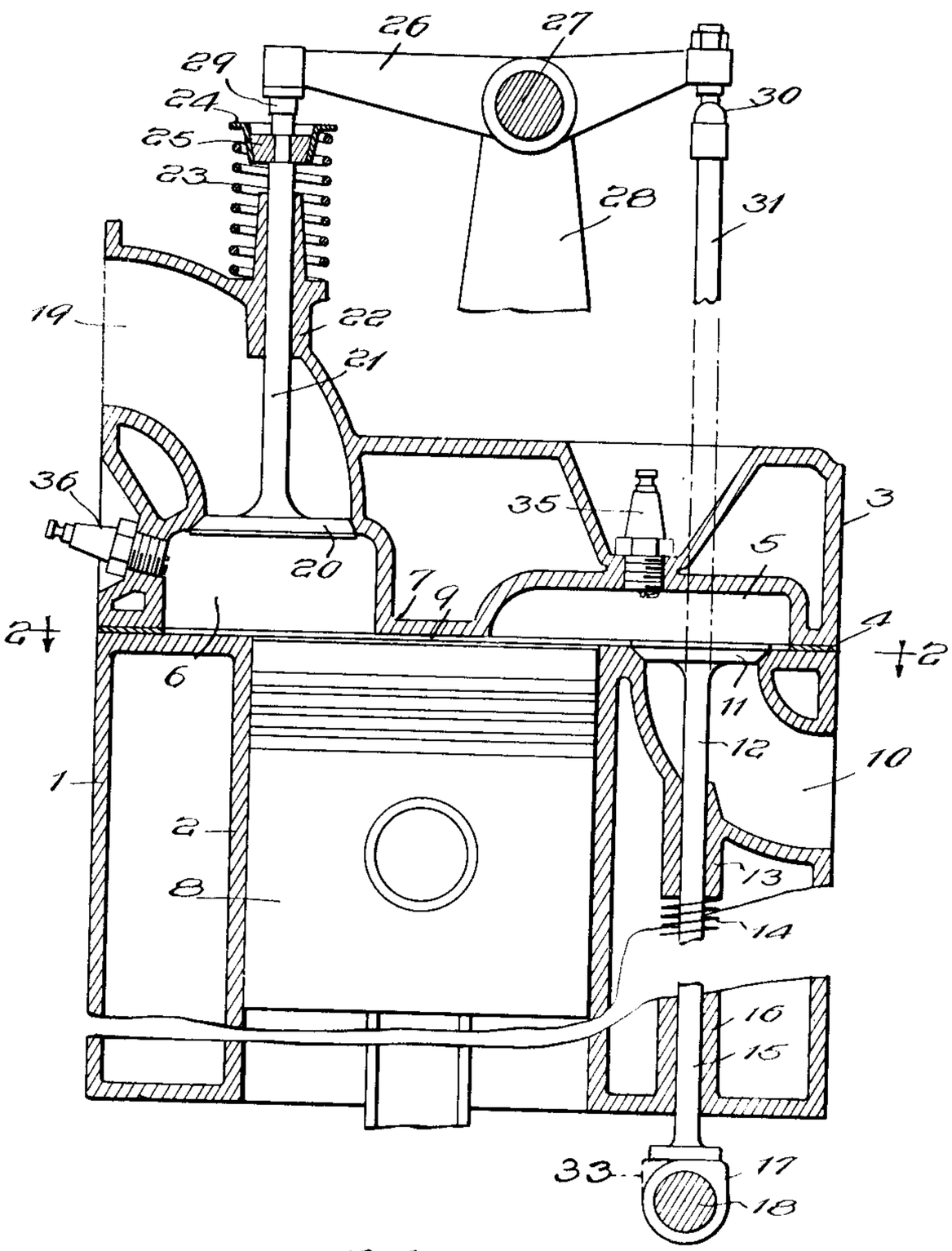

Fig. 2.

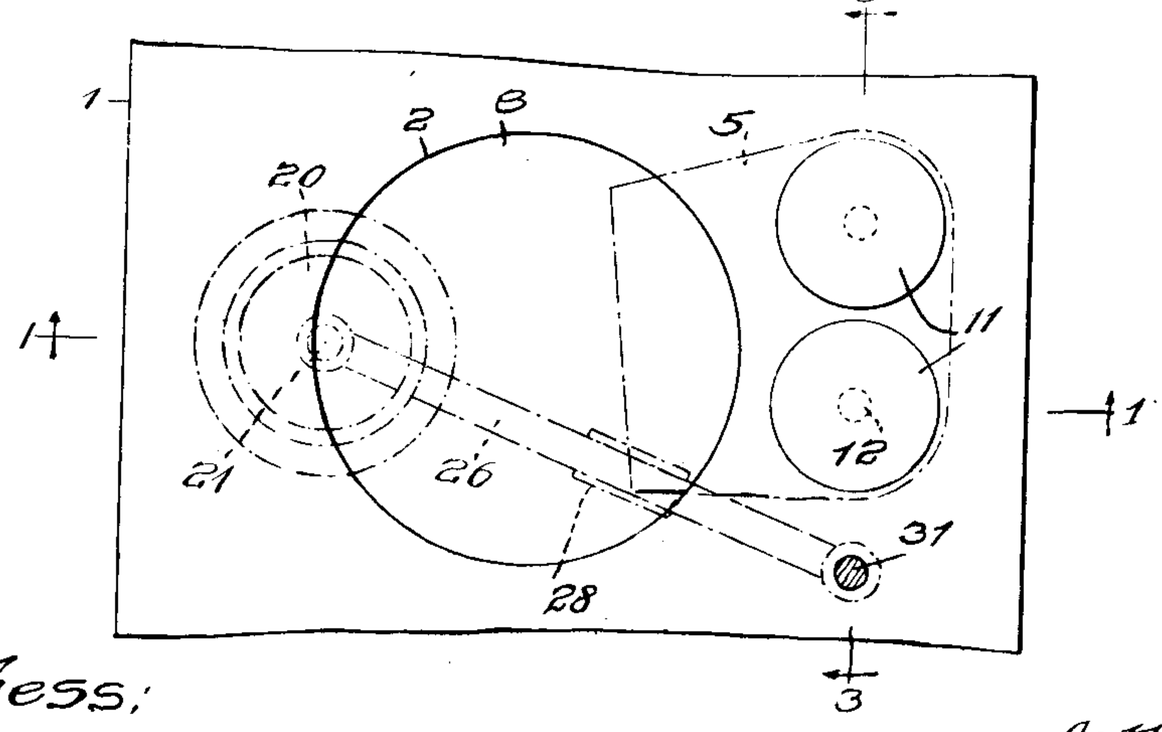

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Fig. 3.

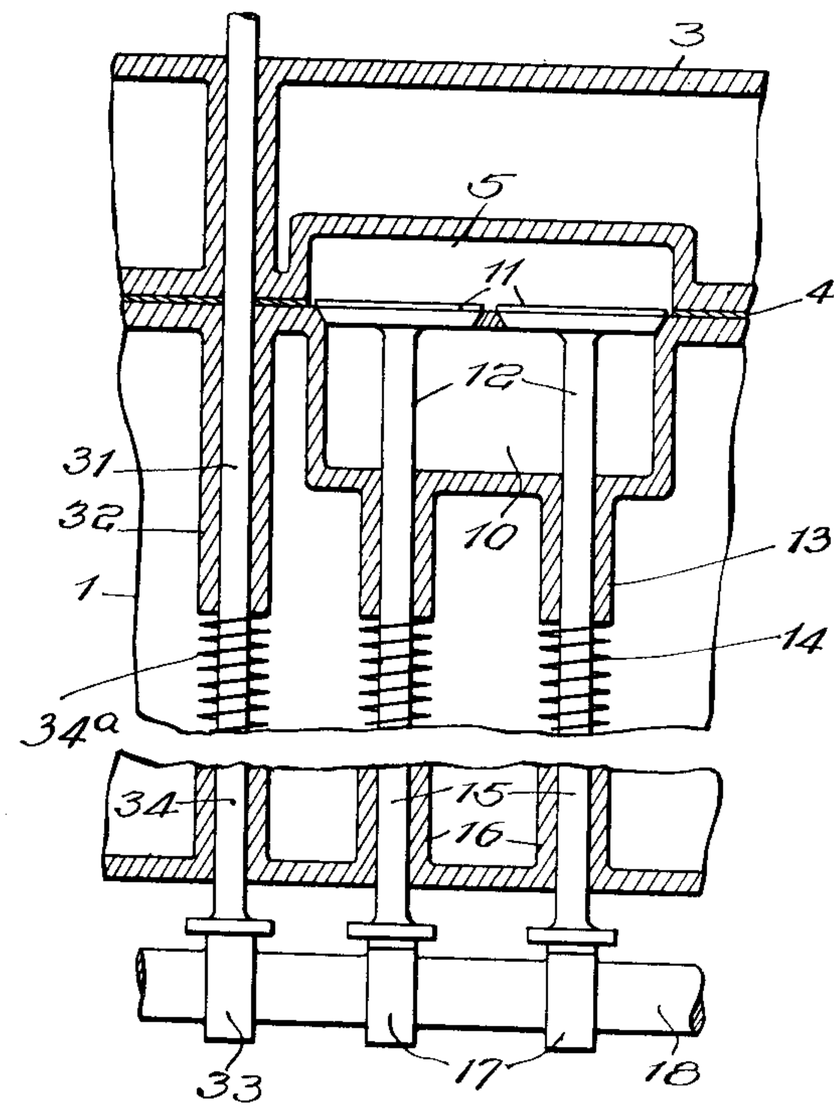
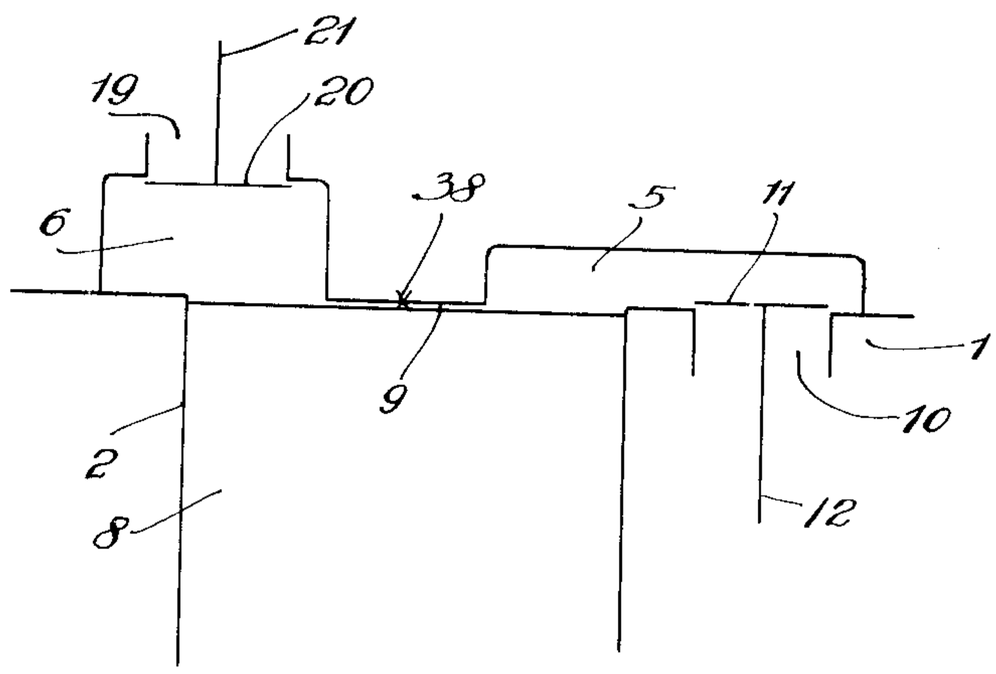


Fig. 4.



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UNITED STATES PATENT OFFICE

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INTERNAL COMBUSTION ENGINE

Application filed December 16, 1929. Serial No. 414,283.

This invention relates to internal combustion engines, and more particularly to engines employing double combustion chambers.

One of the main objects of my invention is to provide an engine of the character stated in which the valves for controlling the fuel mixture inlet and burnt gas outlet passages are so arranged and related as to be operated to advantage from a single cam shaft. A further object is to provide an engine of this type of compact construction and in which flow of the combustible mixture to the cylinder is facilitated. Further objects and advantages of my invention will appear from the detailed description.

In the drawings:

Figure 1 is a vertical sectional view through the head and the cylinder block of an engine constructed in accordance with my invention, taken substantially on line 1—1 of Figure 2, the cylinder block being broken away and parts being shown in elevation;

Figure 2 is a section taken substantially on line 2—2 of Figure 1;

Figure 3 is a section taken substantially on line 3—3 of Figure 2;

Figure 4 is a diagrammatic view illustrating a modified arrangement of the spark ignition means.

I have illustrated my invention, by way of example, as applied to an internal combustion engine comprising a cylinder block 1, within which is suitably supported a cylinder 2, and a head 3, secured upon block 1 in a known manner, a gasket 4 being interposed between the head and the block. Head 3 is provided, at its underside, with two combustion chambers 5 and 6, which overlie the cylinder area at opposite sides thereof. This head is also provided with a lower wall 7 extending between the chambers 5 and 6. The underface of this wall is flat or planar and is disposed closely adjacent the upper end of the cylinder area. A piston 8 reciprocates in cylinder 2 and the upper face of this piston, when in the position of greatest compression, is spaced closely adjacent the under face of wall 7 to form therewith a shielded area or space 9.

Two exhaust passages 10 are formed in block 1 at one side of the cylinder, these passages being disposed side by side. Each of these passages 10 is controlled by an exhaust valve 11, the stem 12 of which reciprocates in a valve stem guide 13.

Valve 11 is normally held seated by a valve spring 14 mounted about stem 12 and confined between guide 13 and a valve seat washer (not shown), secured on stem 12 in a known manner. This valve opens upwardly and has the lower end of its stem 12 disposed adjacent the upper end of a tappet 15 operating in a guide member 16 carried by block 1. Tappet 15 is raised by a cam 17 secured on a cam shaft 18 which is driven from the engine in timed relation thereto. The cam shaft and the means for driving the same are well known in the art and need not be illustrated nor described in detail, it being sufficient to note that the cam shaft is driven in a suitable manner and the cam 17 actuates the tappet 15 for opening the valve 11 in proper timed relation to the operation of the engine. The combustion chamber 5 overlies a portion of the cylinder area, as above noted, and also overlies the exhaust passages 10, and the exhaust valves 11 controlling these passages.

Combustion chamber 6 is of cylindrical shape, as will be noted more clearly from Figure 2, and the head 3 is provided with an inlet passage 19, which opens through the roof of chamber 6 concentrically therewith. This passage is controlled by an overhead valve 20, the stem of which, designated 21, is slidably mounted in a guide member 22 conveniently formed integrally with passage 19. Valve 20 is normally held in its raised or seated position by an expansion coil spring 23 mounted about guide member 22 and confined between the same and a spring seat washer 24 suitably secured upon the valve stem 21, as by means of a key 25.

A rocker lever 26 is rockably supported on a member 27 which is supported by a standard 28, suitably secured to head 3. This lever is provided, at one end, with a tappet 29 disposed to contact the upper end of valve stem 21 in the operation of the lever.

At its other end, the lever 26 is suitably connected, as by means of a ball and socket connection 30, to the upper end of a push rod 31 which is slidable through a guide member 32 in head 3 and block 1. Push rod 31 is disposed in the plane of the stems of valves 11, this rod and the valve stems 12 being aligned lengthwise of block 1. A cam 33 is secured on cam shaft 17 and the lower end of rod 31 is disposed in alignment with a tappet 34 slidably mounted in the lower portion of guide 32, this tappet contacting cam 33. Push rod 31 is held in contact with the upper end of tappet 34 by spring 23, through lever 26, though a separate spring 34*a* for urging the push rod 31 downwardly may be provided if desired. Under ordinary conditions, however, spring 23 serves to urge the valve 20 closed and to urge the push rod 31 toward its associated tappet 34. Two spark plugs 35 and 36 are secured in head 3, in a known manner, and are disposed to ignite the fuel charge in the chambers 5 and 6, respectively.

It will be noted that the valve 20, at one side of the cylinder, is an overhead valve and opens downwardly, whereas the valves 11 at the other side of the cylinder open upwardly and are disposed beneath the head 3.

For purposes of description, the valves 11 may be termed underhead valves as distinguished from the overhead valve 20.

It will be noted that all of the valves are operated from a single cam shaft, through suitable operating connections. This is advantageous as simplifying construction. The provision of the overhead valve 20, in addition to facilitating operation of the valves from a single cam shaft, has the additional advantage that such a valve can be located nearer to the center of the cylinder area than can an underhead valve, such as the valve 11, which renders it possible to make the engine narrower than engines of this type in which an overhead valve is not employed. This is desirable as contributing to compactness of construction. Referring more particularly to Figure 2, the combustion chamber 6 is cylindrical, as previously noted, and the passage 19 opens into chamber 6 concentrically therewith. This is advantageous as facilitating flow of the fuel mixture into the cylinder and also has the advantage of providing a more compact combustion chamber than is possible when a side valve is used, that is, when a valve opening into the chamber at the side thereof is employed. This will be clear from Figure 1, in which it will be noted that the chamber 5 is of much greater horizontal area than chamber 6, due to the provision of the valve 11 adjacent the outer portion or side of chamber 5.

A further advantage of the provision of the overhead passage 19 and associated overhead valve 20 is that this engine is particularly well adapted for use with a down-flow manifold, such as are now coming into use.

Preferably, the passage 19 is the fuel inlet passage and passages 10 are the burnt gas outlet or exhaust passages. This is not essential, however, and the passages may be reversed, under certain conditions, passage 19 becoming the exhaust passage and the passages 10 the inlet passages. It will be understood, therefore, that passages 10 and 19 have been described as the exhaust and inlet passages, respectively, for purposes of description, and these passages may be reversed, though there are certain advantages in having the passage 19 the inlet passage, as above pointed out. While I have shown one valve controlling passage 19, and two passages and two valves therefore leading to chamber 5, this particular arrangement of valves and passages is not essential. Obviously, the use of either single or multiple valves in either chamber may be resorted to as desired or as conditions require.

The spark means for igniting the fuel charge may be disposed in various ways. In Figure 1 I have shown two plugs, one for each chamber. In the diagrammatic view of Figure 4, I have shown one spark plug 38 disposed to ignite the charge at the center of the shielded area 9. I also contemplate using two or more spark plugs in either one or both of the combustion chambers, when desired or required.

What I claim is:

1. In an internal combustion engine, a cylinder, a piston reciprocating in the cylinder, a head overlying the cylinder and having combustion chambers formed in its under face, said chambers overlying the cylinder area at opposite sides thereof, a passage opening into one of the chambers from below, a valve controlling said passage, a passage in the head and opening through the roof of the other chamber, an overhead valve controlling the passage in the head, a cam shaft, means actuated by the cam shaft for operating the valves in timed relation, and spark means for igniting the fuel charge, said head having a wall overlying the cylinder area between the combustion chambers, the upper face of the piston being closely adjacent the underface of said wall when the piston is in the position of greatest compression.

2. In an internal combustion engine, a cylinder, a piston reciprocating in the cylinder, a head overlying the cylinder and having combustion chambers formed in its under face, said chambers overlying the cylinder area at opposite sides thereof, a passage opening into one of the chambers from below, a valve controlling said passage, a passage in the head and opening through the

roof of the other chamber substantially concentrically therewith, an overhead valve controlling the passage in the head, a cam shaft, means actuated by the cam shaft for operating the valves in timed relation, and spark means for igniting the fuel charge.

3. In an internal combustion engine, a cylinder, a piston reciprocating in the cylinder, a head provided in its under face with combustion chambers overlying the cylinder area at opposite sides thereof, one of said chambers being cylindrical, fuel mixture inlet and burnt gas outlet passages opening into the respective chambers, one of said passages being in the head and opening through the roof of the cylindrical chamber concentrically therewith, an overhead valve controlling the passage opening into the cylindrical chamber, a valve controlling the other passage, means for operating the valves in timed relation, and spark means for igniting the fuel charge.

4. In an internal combustion engine, a cylinder, a piston reciprocating in the cylinder, a head provided in its under face with combustion chambers overlying the cylinder area at opposite sides thereof, one of said chambers being cylindrical, fuel mixture inlet and burnt gas outlet passages opening into the respective chambers, one of said passages being in the head and opening through the roof of the cylindrical chamber concentrically therewith, an overhead valve controlling the passage opening into the cylindrical chamber, a valve controlling the other passage, a cam shaft, means actuated by the cam shaft for operating the valves in timed relation, and spark means for igniting the fuel charge.

5. In an internal combustion engine, a cylinder, a piston reciprocating in the cylinder, a head provided in its under face with combustion chambers overlying the cylinder area at opposite sides thereof, one of said chambers being cylindrical, a fuel mixture inlet passage in the head and opening through the roof of the cylindrical chamber concentrically therewith, an overhead valve controlling said passage, a burnt gas outlet passage opening into the other chamber, a valve controlling the outlet passage, means for operating the valves in timed relation, and spark means for igniting the fuel charge.

6. In an internal combustion engine, a cylinder, a piston reciprocating in the cylinder, a passage at one side of the cylinder, a valve controlling said passage, a cam shaft at said side of the cylinder, a head provided in its under face with combustion chambers overlying the cylinder area at opposite sides thereof, one of the chambers also overlying said passage and the valve therefor, a passage in the head and opening through the roof of the other chamber, an overhead valve controlling the passage in the head, said passages constituting fuel mixture inlet and burnt gas outlet passages, means actuated by the cam shaft for operating the valves in timed relation, and spark means for igniting the fuel charge.

In witness whereof, I hereunto subscribe my name this 11th day of December, 1929.

ARTHUR W. POPE, JR.