Dec. 14, 1954 C. C. CHRONIC ET AL 2,696,808

TURBULENCE CHAMBER FOR INTERNAL-COMBUSTION ENGINES

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FIG. 1

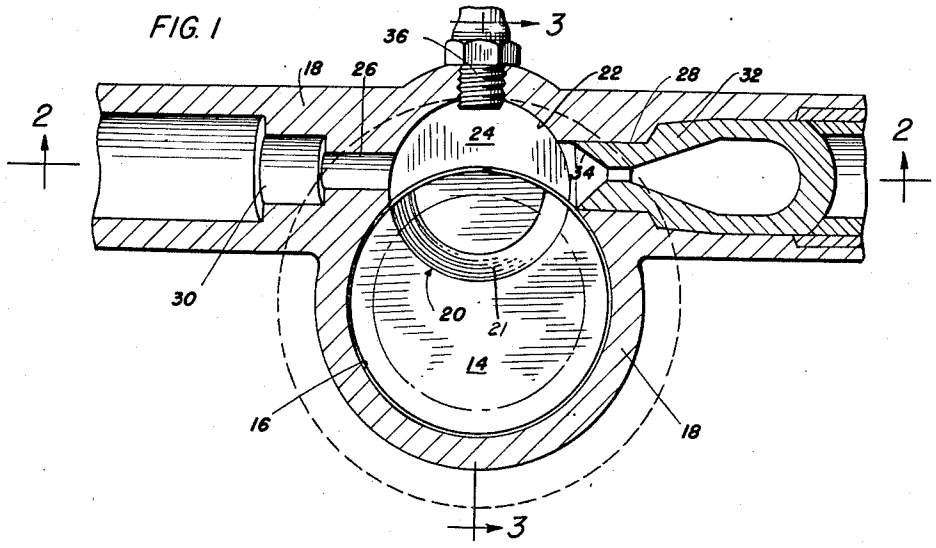


FIG. 2

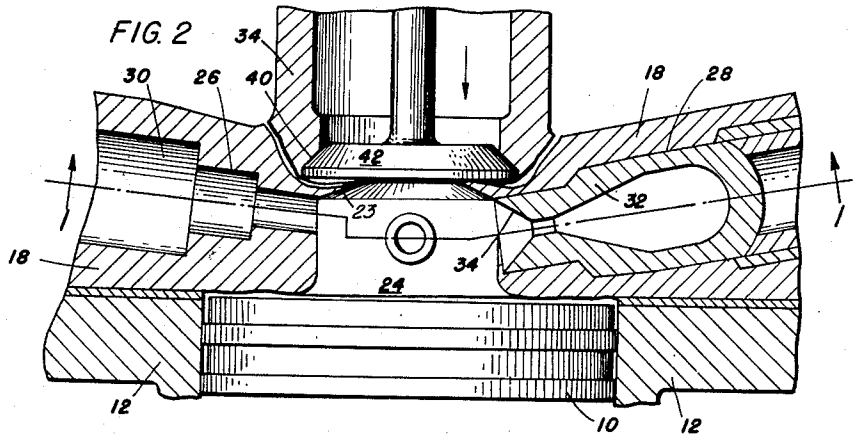
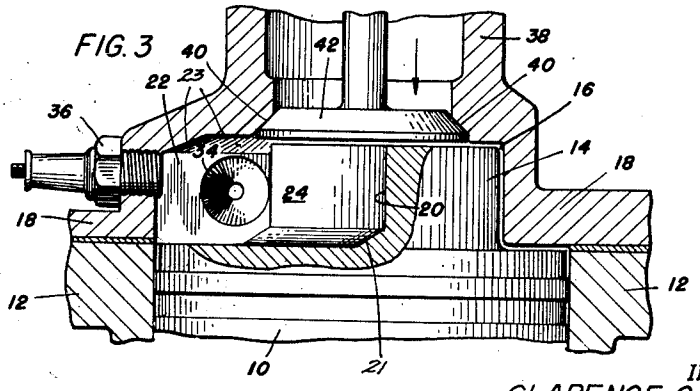


FIG. 3



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TURBULENCE CHAMBER FOR INTERNAL-COMBUSTION ENGINES

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7 Claims. (Cl. 123—32)

This invention relates in general to any internal combustion engine, but it is more particularly described as a chamber of this kind for two cycle engines and for diesel engines.

An important object of the invention is to form a turbulence chamber by combining the adjacent surfaces of the piston head and the cylinder head when the piston is at the upper or outer end of its stroke.

A further object of the invention is to provide a turbulence chamber having opposite inclined deflecting surfaces in conjunction with a fuel nozzle and an energy cell.

Still a further object of the invention is to provide an internal combustion engine with a turbulence chamber made up of spaces in the cylinder and piston head in close relation to a valve which partially closes the turbulence chamber.

Still a further object of the invention is to provide an arrangement of an inlet valve substantially at right angles to the path of fuel across a chamber into an energy cell where the chamber is substantially formed by the valve, a portion of the cylinder head and a portion of the piston head.

Still a further object of the invention is to provide an improved construction and arrangement for internal combustion engines in which an inlet valve is located in a cylinder head in close relation to the outermost position of the piston head to conjointly form a combustion chamber which is easily cooled by the flow of air through the valve.

Other objects of the invention will appear in the specification and will be apparent from the accompanying drawing in which,

Fig. 1 is a sectional plan view of an engine head and mounting taken on the line 1—1 of Fig. 2 in accordance with this invention;

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1; and

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 1.

This construction is particularly adapted for use in two cycle engines with either an inlet or an exhaust valve in the head and may also be used for Diesel engines, although it may have a more general use wherever applicable.

Referring more particularly to the drawings, a piston 10 is movable in a cylinder 12 and the outer end of the piston head comprises a projection 14 fitting closely in a recess 16 having a portion thereof conforming to a projecting portion of the head.

At one side of the projection 14 of the piston head is a recess 20 shown to be circular and cooperating with a recess 22 in the cylinder head to form a turbulence chamber 24 preferably circular in form and eccentric to the cylinder, a portion of which is thus made up by the recess 20 in the top of the piston and by the recess 22 in the adjacent portion of the cylinder head. Nearly half of the chamber is made from the recessed reduction of the piston head and the remainder is made up of the recess 22 in the cylinder head. These proportions may be changed, if desired, but the approximate proportions are preferable for providing substantially diametric bores 26 and 28 at opposite sides of the chamber 24 for receiving a fuel injection nozzle 30 and an energy cell 32 respectively therein. These bores 26 and 28 are preferably inclined from the outer end inwardly and downwardly toward the piston as shown more clearly in Fig. 2 and the energy cell has a beveled inlet 34 which is substantially in line with the access of the bore 26 so that the fuel from the nozzle 30 will be directed under pressure across the chamber 24

and into the beveled inlet of the energy cell 32. The energy cell being inclined downwardly will not direct its discharge into the bore 26, but rather below the bore in the turbulence chamber 24. By having the bores 26 and 28 slightly offset from the center of the chamber as shown in Fig. 1 and inclined into the chamber as shown in Fig. 2, a mixture of the gases in the turbulence chamber is insured which is further increased by the movement of the piston projection therein.

In the outer wall of the cylinder head, a glow or firing plug 36 is inserted into one side of the chamber 24, particularly for starting, and also for running purposes if desired.

At the outer side of the cylinder head is a housing 38 and a beveled valve seat 40 for receiving an inwardly opening valve 42 close to the outer end of the piston projection 14 and partially overlying the turbulence chamber 24 to close it. A slight opening of this valve will admit air or gas to the chamber 24 and closing the valve will close the chamber when the piston is at the upper or outer end of its travel. This valve may be an inlet or an exhaust valve, but preferably it is an air inlet valve when used in a two cycle engine having the air inlet at the head thereof, thus controlling and reducing the temperature at the head of the engine.

To induce a thorough mixture of the gases in the turbulence chamber, the upper wall of the recess 22 in the cylinder head which forms one portion of the turbulence chamber 24 has a beveled fillet or projection 23, and the opposite bottom wall of the recess 20 of the piston projection 14 has a corresponding inward projection or fillet 21, the surfaces of these projections 23 and 21 being substantially parallel but diagonally opposite to cause a deflection in the rapid movement of the gases into the turbulence chamber, the effect of which causes a rolling action of the gases instead of a continuous circular type of motion. This is further increased because of the location of the fuel injection nozzle 30 at one side of the turbulence chamber and the energy cell 32 at the opposite side of the chamber.

In operation as a two cycle engine, the downward movement of the piston uncovers an exhaust port for discharging the products of combustion in a well known manner and as the piston moves upwardly, the valve 42 is closed and the contents of the cylinder are compressed in the turbulence chamber 24 causing a thorough mixture of the gases. At or near the end of the stroke, fuel in injected under pressure from the nozzle 30, some of the fuel being directed into the energy cell 32. The combustible mixture is then ignited by pressure in a diesel type engine or, if desired, the mixture may be ignited for starting by the igniting plug 36 or the engine may be operated continuously by a spark plug at this location. The energy cell has the effect of delaying the burning of fuel and increasing the time of pressure applied to the piston.

In this operation of the engine, maximum turbulence is obtained in the chamber 24 because of the different factors; the chamber itself is enlarged and contracted by the movement of the piston in the cylinder; the gases are constantly in movement either due to the movement of the piston or due to the admission of air through the inlet valve 42; the gases are subject to an opposite rocking or rolling action within the chamber 24 due to the opposite inclined beveled surfaces 21 and 23 in the cylinder head and piston projection respectively; and also the agitation of the mixture in the turbulence chamber in its contracted form is materially affected by the injection of the fuel at one side of the center of the chamber and inclined downwardly thereinto and by the delay action of the energy cell which returns ignited fuel into the chamber also at an angle into the chamber and slightly off center therein.

With this thorough mixture of the comburent gases and of the products of combustion, an intimate mixture and complete combustion is afforded, resulting in increased engine power and increased engine efficiency. This construction may be applied generally to internal combustion engines, but the present arrangement is particularly adapted for two cycle engines of the type having an air inlet in the cylinder head, and of the Diesel type.

While we have thus described a particular form of the

invention in some detail, it should be regarded by way of example and illustration rather than as a limitation or restriction of the invention as various changes in the construction, combination and arrangement of the parts may be made without departing from the spirit and scope of the invention.

We claim:

1. An internal combustion engine, comprising a piston having a projection, a cylinder in which the piston is movable, a cylinder head having a recess into which the projection extends at the end of the piston stroke, the projection and the adjacent wall of the cylinder head having complementary recesses which together form a substantially cylindrical turbulence chamber at the end of the cylinder overlapping one side edge of the projection and eccentric to the cylinder but with its axis parallel to that of the cylinder, a fuel inlet at one side of the turbulence chamber, and an energy cell at the opposite side of the turbulence chamber to receive fuel from the opposite fuel inlet.

2. In an internal combustion engine, a piston having a projection at its outer end, a cylinder in which the piston is movable, a cylinder head having a recess into which the projection extends when the piston is at the outer end of its stroke, the projection and the adjacent wall of the cylinder head having complementary recesses forming a substantially cylindrical chamber with flat ends overlapping one edge of the projection and eccentric to the cylinder but with its axis parallel to that of the cylinder, a fuel inlet at one side of the chamber, and an energy cell at the opposite side of the chamber to receive fuel from the fuel inlet, the inlet and the energy cell being substantially diametric to each other but in a line at one side of the cylinder and close to the center line of the chamber.

3. An internal combustion engine, comprising a piston having a projection at its head, a cylinder in which the piston is movable, a cylinder head having a recess to receive the projection, the projection and the recess of the cylinder head together forming a cylindrical turbulence chamber with substantially flat ends at the end of the cylinder and overlapping one edge of the projection but with its axis parallel to that of the cylinder, a fuel nozzle at one side of the chamber and an energy cell at the opposite side of the chamber having a beveled inlet to receive fuel from the nozzle, the fuel nozzle and the energy cell being inclined upwardly relatively to the turbulence chamber and located at one side of the center thereof so that the discharge from the energy cell will be out of line with the fuel nozzle to produce additional turbulence in the chamber.

4. In an internal combustion engine, a piston having a projection at its outer end, a cylinder in which the piston is movable, a cylinder head having a recess to receive the projection of the piston, the projection and the wall of the recess of the cylinder head together forming a substantially cylindrical turbulence chamber with substantially flat ends at the end of the cylinder and overlapping one side edge of the projection but with its axis parallel to that of the cylinder, a fuel inlet at one side of the turbulence chamber, an energy cell at the other side of the turbulence chamber to receive fuel from the inlet, and the energy cell and the fuel inlet being slightly inclined toward the bottom of the chamber and tangential to the edge portion of the projection of the engine cylinder which is in said chamber.

5. An internal combustion chamber, comprising a piston having a projection at its outer end with a partly circular recess at one side, a cylinder in which the piston is movable, a cylinder head for the end of the cylinder having a recess into which the projection extends at the upper end of the stroke of the piston, the wall of the cylinder head adjacent the projection having a partly circular recess complementary to the recess in the projection and together forming a circular turbulence chamber with substantially flat ends at the end and eccentric to the cylinder but with its axis parallel to that of the cylinder, the chamber overlapping one side edge of the projection, a fuel inlet at one side of the chamber, an energy cell at the opposite side of the chamber, and a valve movable in the cylinder head and operative to admit gases to the outer flat end of the chamber and to close the chamber at the outer end thereof.

6. In an internal combustion engine, a piston having a projection at its outer end with a partly circular recess at one side of the projection, a cylinder head at the end of the cylinder having a recessed portion to receive the projection of the piston and having a partly circular extension of the recess in the wall thereof complementing the recess of the projection to form a circular chamber with substantially flat ends at the end of the cylinder and overlapping one side edge of the projection, a fuel inlet at one side of the chamber, an energy cell at the opposite side of the chamber, the inlet and the energy cell being inclined outwardly from the chamber, the energy cell and the fuel inlet being slightly inclined toward the bottom of the chamber and tangential to the edge portion of the projection of the engine cylinder which is in said chamber, and a flat inlet valve at the outer end of the chamber in the cylinder head concentric with the cylinder and piston and partially closing the turbulence chamber at the outer end thereof.

7. In an internal combustion engine, a piston having a projection at its outer end with a circular recess at one side thereof, a cylinder in which the piston is movable, a cylinder head having a recess into which the projection extends when the piston is at the upper end of its stroke, the cylinder head having a recess opposite the recess of the piston, together forming a substantially cylindrical turbulence chamber with substantially flat ends intersected at the bottom by the side of the projection and located at the end of the cylinder and eccentric thereto but with its axis parallel to that of the cylinder, the top of the recess in the cylinder head and the bottom of the recess in the piston projection which form the turbulence chamber having inward opposite inclined beveled projections, the surfaces of which are substantially parallel, a fuel inlet at one side of the chamber, and an energy cell at the opposite side of the chamber to receive fuel from the fuel inlet, the energy cell and the fuel inlet being slightly inclined toward the bottom of the chamber and tangential to the edge portion of the projection of the engine cylinder which is in said chamber, the beveled projections increasing the turbulence therein.

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