

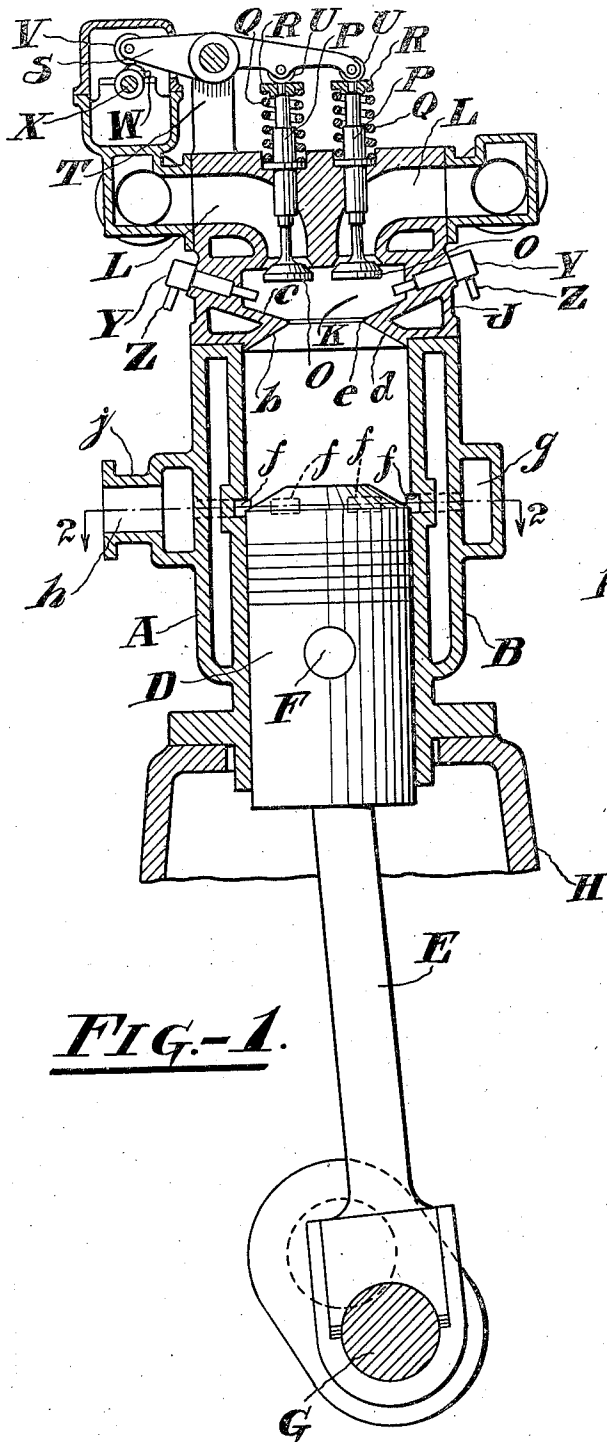
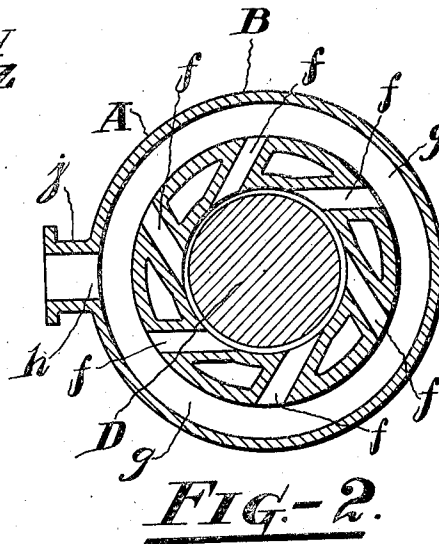
May 19, 1931.

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1,805,670

INTERNAL COMBUSTION ENGINE

Filed Nov. 1, 1929



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INTERNAL COMBUSTION ENGINE

Application filed November 1, 1929. Serial No. 404,097.

This invention relates to internal combustion engines, and more particularly to two-stroke cycle engine of the type in which the fuel charge is forcibly injected into the combustion chamber and is ignited by the compression created by the piston or pistons of the engine.

One object of the invention is to obtain a maximum power yield from the fuel charge.

Another object is to assure a condition of extreme turbulence within the combustion chamber during the fuel injection period so that the fuel may be thoroughly disintegrated and diffused in the combustion chamber.

Other objects will be in part obvious and in part pointed out hereinafter.

In the drawings accompanying the following specification and forming a part thereof and in which similar reference characters refer to similar parts,

Figure 1 is a sectional elevation of a portion of an engine having the invention applied thereto, and

Figure 2 is a transverse view taken through Figure 1 on the line 2—2 looking in the direction indicated by the arrows.

Referring more particularly to the drawings, A designates generally an internal combustion engine shown for simplicity of illustration as having only one cylinder B wherein is disposed a piston D to which is pivotally connected one end of a connecting rod E as by means of a wrist pin F. The opposite end of the connecting rod E may be operatively connected in any well known manner to a crank shaft G which may be suitably journaled in a bed plate or base H which also acts as a support for the cylinder B.

The cylinder B is provided with a head J wherein is formed a combustion chamber K and an exhaust passage or passages L which lead from the combustion chamber to the atmosphere to convey the products of combustion from the combustion chamber.

The exhaust passages L are controlled by the usual exhaust valves O which are disposed slidably in valve guides P seated in the head J. The exhaust valves O are provided with the usual springs Q which act against spring seats R secured to

the stems of the valves O for closing the said valves.

Any suitable means may be provided for unseating the exhaust valves O in timed relation with the movement of the piston D. The means illustrated for this purpose comprises a rocker arm S mounted pivotally on a bearing standard T carried by the head J and overlying the stems of the valves O. In the portion of the rocker arm S which overlies the stems of the valves O are disposed rollers U which are adapted to be pressed against the valve stems for unseating the valves O. Similarly in the opposite end of the rocker arm S is a cam roller V adapted to bear against a cam W carried by a cam shaft X and whereby the rocker arm S is oscillated for controlling the movement of the exhaust valves O.

The engine A is illustrated as being of the solid injection type and in order to introduce the fuel into the combustion chamber K in this form the head J is provided with a pair of fuel injection or spray nozzles Y. The spray nozzles are preferably disposed on opposite sides of the combustion chamber K and are connected with a suitable source of fuel supply (not shown) through pipes Z.

Within the head J is a lateral wall b having converging surfaces c and d, the surface d being adjacent the end of the cylinder and the surface c forming a side for the combustion chamber K. A restricted opening e in the wall b affords communication between the combustion chamber K and the cylinder B.

In accordance with the present invention, means are provided for introducing a jet or jets of pressure fluid, such as compressed air, into the cylinder both for expelling the products of combustion from the cylinder and also to inject therein the air required to form a suitable explosive mixture. To this end the cylinder is provided with a passage or passages f so located in the wall of the cylinder that they will be uncovered by the top of the piston as the piston nears bottom center of its stroke.

The passages f open with their outer ends into an annular passage g which surrounds

the cylinder A and which may be in communication with a suitable source of pressure fluid supply through a passage *h* and a connection *j* in the cylinder B.

In order to assure a whirling motion of the pressure fluid in the cylinder, the passages *f* are preferably arranged tangentially in the wall of the cylinder B so that the pressure fluid will flow into the cylinder at an angle to the radii of the cylinder. In this way a whirling sheet or body of pressure fluid may be formed in the cylinder and which, by its whirling movement, will assure an adequate scavenging effect therein to completely expel the exhaust gases from the cylinder and from the combustion chamber.

The operation of the device is as follows: Let it be assumed that the piston D is moving downwardly on its power stroke. When the piston nears the lowermost limiting position in the cylinder and prior to the uncovering of the ports *f* the exhaust valves O will be opened and the exhaust gases will escape through the exhaust passages L and the pressure in the cylinder will drop before the piston uncovers the ports *f*. When the ports *f* are uncovered pressure fluid will flow into the cylinder and, whirling upwardly, will rid the cylinder and the combustion chamber of all exhaust gases by forcing such gas through the exhaust passages L. The piston D will then continue downwardly to the lowermost limit of its travel and shortly after reversal of the movement of the piston the cam shaft X will rotate into a position to permit the exhaust valves O to close.

This movement of the exhaust valves takes place while the ports *f* are still partly uncovered by the piston so that the cylinder and the combustion chamber K may be fully charged with pressure fluid to a pressure substantially equal in value to that existing in the annular passage *g*.

As the piston D proceeds on its rising stroke, the pressure fluid compressed thereby will continue its whirling motion and, in passing from the cylinder into the combustion chamber, such pressure fluid will be caused to whirl in decreasing spirals by the surface *d* and will then pass through the restricted opening *e* into the combustion chamber.

The pressure fluid will continue its whirling motion through the restricted opening *e* and will flow to the end wall of the combustion chamber K whereby its direction of flow is reversed so that it will flow outwardly in all directions along the end wall of the combustion chamber and thence down along the side walls of the combustion chamber. In this way is obtained both a whirling and tumbling turbulence of the air in the combustion chamber at the time the spray nozzles act to inject the fuel into the combustion chamber.

With the air in the combustion chamber in a state of extreme turbulence the fuel injected into the combustion chamber will be disintegrated into finely divided or atomized particles which will readily commingle with the air in the combustion chamber thus assuring a homogeneous mixture of atomized fuel and air and consequently efficient combustion irrespective of external atmospheric conditions or the altitude at which the engine may be operated.

By forcing the pressure fluid through the restricted opening in the manner described, such pressure fluid will rise therethrough in the form of a whirling or spiral column. When the course of the pressure fluid is reversed by the end wall of the combustion chamber a portion of the air will flow along the walls of the combustion chamber, and thus rearwardly of the outlet opening of the spray nozzles. In this way the entire air charge will be put in motion and the fuel charge will be completely distributed throughout a rapidly moving body of air and in consequence little if any fuel will be deposited on the wall of the combustion chamber.

I claim:

1. In a two-cycle internal combustion engine, the combination of a cylinder and a head therefor, a combustion chamber in the head, means for injecting fuel from the sides to the center of the combustion chamber, an exhaust valve for the combustion chamber, a passage in the wall of the cylinder to direct pressure fluid into the cylinder along a line off-set from the longitudinal axis of the cylinder to cause a spiral motion of such pressure fluid in the cylinder, said passage being controlled by the piston, and a lateral wall projecting from the head having a restricted opening between the cylinder and the combustion chamber and through which the pressure fluid whirls in decreasing spirals into the combustion chamber and impinges against the end wall thereof to spread outwardly and reverse the course of the pressure fluid, thereby effecting both a whirling and a tumbling turbulence in the combustion chamber for diffusing the fuel injected from the sides of the chamber.

2. In a two-cycle internal combustion engine, the combination of a cylinder and a head therefor having a combustion chamber, a piston in the cylinder, a plurality of pressure fluid inlet passages in the wall of the cylinder arranged at an angle to the radii of the cylinder and at a point to be uncovered by the piston as said piston nears its lowermost position, means for injecting fuel from the sides to the center of the combustion chamber, a lateral wall projecting from the head having a restricted opening between the combustion chamber and the cylinder and through which the pressure fluid whirls

in decreasing spirals and impinges against the end wall of the combustion chamber during the rising stroke of the piston to spread outwardly and reverse the course of the pressure fluid, thereby effecting both a whirling and tumbling turbulence for diffusing the fuel injected from the sides of the chamber, an exhaust valve in the combustion chamber, and means for opening the exhaust valve prior to the opening of the said passages and to close said exhaust valve during the admission of pressure fluid through the passages into the cylinder.

3. In a two-cycle internal combustion engine, the combination of a cylinder and a head therefor having a combustion chamber, a piston in the cylinder, pressure fluid inlet passages in the wall of the cylinder and adapted to be uncovered by the piston as said piston nears its lowermost position, said passages being arranged at an angle to the radii of the cylinder to effect a whirling motion of the pressure fluid flowing into the cylinder, means to inject fuel from the sides to the center of the combustion chamber, a lateral wall projecting from the head having a restricted opening between the cylinder and the combustion chamber and through which pressure fluid whirls against the end wall of the combustion chamber during the rising stroke of the piston to spread outwardly and reverse the course of the pressure fluid, thereby effecting both a whirling and a tumbling turbulence for diffusing the fuel injected from the sides of the chamber, an inclined surface on the lateral wall to direct pressure fluid in gradually decreasing spirals from the cylinder to the opening, an exhaust valve in the combustion chamber, and means for opening the exhaust valve prior to the opening of the said passages and to close said exhaust valve prior to closing of said passages by the piston.

4. In a two cycle internal combustion engine, the combination of a cylinder and a head therefor, a combustion chamber in the head, means for injecting fuel from the sides to the center of the combustion chamber, an exhaust valve in the combustion chamber, a passage in the wall of the cylinder positioned at a point to be uncovered by the piston as said piston nears its lowermost position, and a lateral wall projecting from the head having a central restricted opening between the combustion chamber and the cylinder through which pressure fluid enters the combustion chamber and impinges against the end wall thereof to spread outwardly and reverse the course of the pressure fluid, thereby effecting a tumbling turbulence in the combustion chamber for diffusing the fuel injected from the sides of the combustion chamber.

5. In a two cycle internal combustion engine, the combination of a cylinder and a head therefor, a combustion chamber in the head, a plurality of nozzles in the combustion

chamber for injecting fuel from the sides of the combustion chamber to the center thereof, an exhaust valve in the combustion chamber, a lateral wall projecting from the head between the cylinder and the combustion chamber and having converging surfaces on both sides meeting at a central restricted opening, pressure fluid inlet passages in the wall of the cylinder arranged at an angle to the radii of the cylinder and at a point to be uncovered by the piston as said piston nears its lowermost position, said pressure fluid thereby being caused to whirl upwardly in the cylinder during the rising stroke of the piston against the converging surface of the lateral wall and enter the combustion chamber in decreasing spirals through the central restricted opening to impinge against the end wall of the combustion chamber to spread outwardly and reverse the course of said fluid to effect both a whirling and a tumbling turbulence for diffusing the fuel injected from the sides of the chamber.

In testimony whereof I have signed this specification.

RALPH MILLER.