P. DANIEL.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED FEB. 4, 1909.

957,657. Patented May 10, 1910.

Fig. 2.

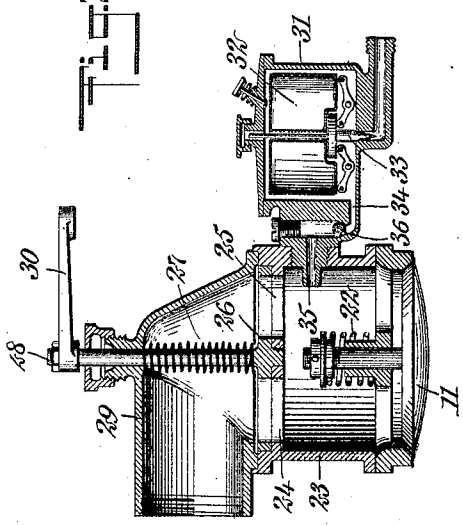
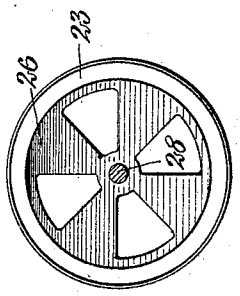


Fig. 3.



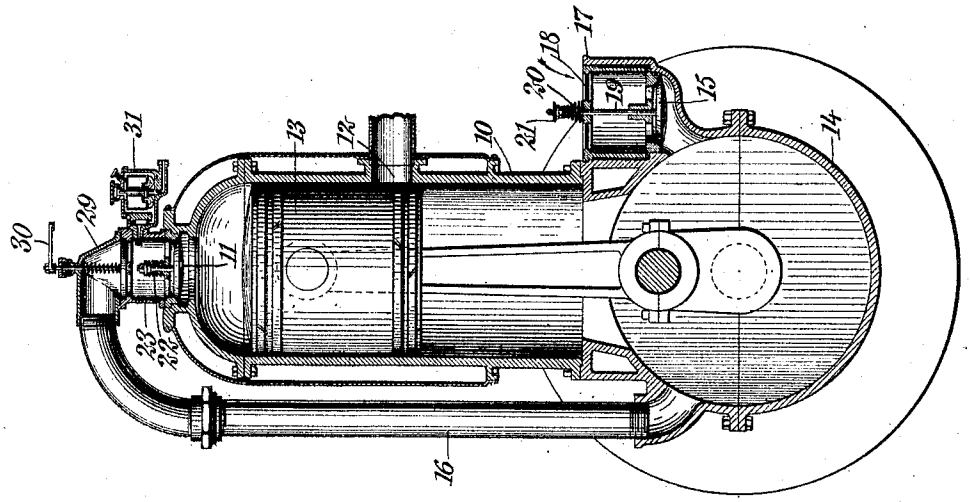


Fig. 1.

WITNESSES

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INTERNAL-COMBUSTION ENGINE.

957,657. Specification of Letters Patent. Patented May 10, 1910.

Application filed February 4, 1909. Serial No. 476,004.

To all whom it may concern:

Be it known that I, PAUL DANIEL, a citizen of the Republic of France, and a resident of the city of New York, Richmond Valley, borough of Richmond, in the county of Richmond and State of New York, have invented a new and Improved Internal-Combustion Engine, of which the following is a full, clear, and exact description.

This invention relates to certain improvements in two-cycle internal combustion engines, and relates more particularly to the means employed for supplying the fuel to form the explosive mixture, and for automatically controlling the amount of fuel admitted.

In my previous Patent No. 877834, granted January 28, 1908, I disclose a two-cycle engine in which air is compressed in the crank case and delivered through a conduit to the inlet valve of the engine, said inlet valve being disposed at the opposite end of the cylinder from the crank case. In this engine I positively inject a quantity of liquid into the conduit adjacent the outer surface of the valve, so that when the valve is opened and the air rushes into the cylinder, it will carry the fuel along therewith and become thoroughly mixed with said fuel in the cylinder prior to and during the compression stroke. In my present invention I eliminate the means for positively forcing in the fuel and rely upon the partial vacuum in the crank case during the compression of the charge in the cylinder, to not only draw air into the crank case but also to draw in the fuel. I provide means for automatically varying the vacuum pressure, so as to vary the quantity of fuel drawn in. To do this, I control the air inlet valve rather than directly controlling the fuel.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures, and in which—

Figure 1 is a longitudinal section through an engine constructed in accordance with my invention; Fig. 2 is a section on an enlarged scale showing the liquid inlet and the mixing chamber; and Fig. 3 is a top plan view of the throttle valve.

In the specific form illustrated, I employ a cylinder 10 having a spring-pressed inlet valve 11 at its outer end and having an exhaust port 12 intermediate its ends and controlled by the piston 13. At the end of the cylinder opposite to the inlet valve is a crank case 14 which serves as the compression chamber for the air. The air is taken into the crank case past the spring-pressed valve 15 and is delivered through a conduit 16 to the inlet valve 11 of the cylinder. The details of construction of these parts constitute no portion of the present invention, except so far as hereinafter indicated.

Adjacent the air inlet valve 15 which leads to the crank case, is a short tubular casing 17 closed at its outer end by a sheet of gauze 18, which prevents the passage of dust, dirt, or other foreign bodies to the valve 15 and the interior of the crank case. The valve stem 19 of the valve 15 extends out through the gauze screen 18 and is provided with a spring 20 for normally holding the valve in its closed position. During the compression of the charge within the cylinder there is formed a partial vacuum in the crank case and the difference in pressure between the interior and the exterior of the crank case exceeds the tension of the spring, so that the latter may open and air will be admitted to the crank case. It is evident that the tension of this spring determines the difference in pressure required to open the valve, and, therefore, determines the extent of the vacuum pressure within the crank case during the suction of air thereto. At the outer end of the valve stem I provide a nut 21 engaging with the outer end of the spring 20, so that by tightening or loosening this nut I may increase or diminish the tension of the spring 20 and thus control the vacuum pressure in the crank case.

The inlet valve 11 of the engine cylinder preferably opens inwardly toward the cylinder and is normally held closed by a coil spring 22. Encircling the valve seat and extending outwardly therefrom is a short

cylindrical tube or casing 23, the outer end of which carries a transversely-extending plate 24. The plate is provided with apertures 25 therethrough, and in engagement with the outer surface of the plate is a rotatable valve plate 26 having similar openings which may be brought into registry with the openings in the plate 24. The outer surface of the plate constitutes a valve seat and the valve plate 26 is held against its seat by a coil spring 27 encircling the valve stem 28 of said valve. A hood or dome 29 is secured to the outer end of the tubular casing 23 and to this hood or dome is connected the upper end of the conduit 16 leading from the crank case. The valve plate 26 constitutes a throttle valve and may be rotated manually to control the flow of air through the conduit 16 and the dome 29 to the inlet valve 11. As shown, the outer end of the valve stem 18 carries a short lever 30 for facilitating the rotation of the valve.

The space beneath the throttle valve 26 and above the automatic valve 11 constitutes what may be termed a "mixing chamber" and into this mixing chamber is injected the liquid fuel during the suction of the air into the crank case. For delivering this liquid fuel, I preferably provide a liquid chamber 31, closely adjacent the mixing chamber 23 and having a float 32 and a valve 33 for controlling the admission of liquid fuel to the chamber 31. This float and valve may be of any suitable character desired, and serve merely to maintain a substantially constant level of liquid in the liquid chamber 31. Leading from the lower end of the liquid chamber is a passage 34 terminating in a nozzle 35 disposed within the mixing chamber, and within this passage is a check valve 36 preferably in the form of a ball. The float maintains the liquid in the chamber 31 slightly below the level of the nozzle 35, so that there is always some liquid in the passage 34 ready to be delivered to the mixing chamber. The interior of the float chamber is at the same pressure as the outside atmosphere, as the upper portion of the float chamber is not air-tight. As the piston starts up to compress the explosive mixture within the explosion chamber, a partial vacuum is created in the crank case, as above indicated, and this partial vacuum will, of course, extend up through the conduit 16 and past the throttle valve to the mixing chamber 23. This conduit and mixing chamber may, therefore, be considered as a portion of the compression chamber. As soon as this partial vacuum is formed in the mixing chamber, the liquid fuel is drawn in from the float chamber past the ball valve 36 and through the nozzle 35 into this portion of the compression chamber. The amount of liquid fuel drawn in is of course dependent upon the extent of the vacuum pressure and the vacuum pressure is dependent upon the tension of the spring 20 of the air inlet valve and the resistance to the opening of the latter. I therefore vary the quantity of liquid fuel drawn in and vary the vacuum pressure by controlling the valve 15 which admits the air. As soon as the liquid fuel enters the mixing chamber it falls upon the valve 11 and is vaporized due to the heated condition of the valve. The vaporizing of the liquid fuel tends to cool the valve and to cause the vapors to become mixed with the air in the dome 29 of the upper portion of the conduit 16.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. A two-cycle internal combustion engine having an explosion chamber, a compression chamber, a conduit for delivering compressed air from said compression chamber, to said explosion chamber, an automatic inlet valve for permitting the entrance of air to the compression chamber during the compression of the charge in the explosion chamber, means for varying the resistance to the opening of said valve, an inlet valve for controlling the admission of air from said conduit to said explosion chamber, means for inducting a liquid fuel into said conduit, and means for automatically preventing the return movement of said fuel, the quantity of fuel inducted being dependent upon the resistance to the opening of the first-mentioned valve.

2. A two-cycle internal combustion engine having a cylinder provided with an inlet port, a crank case serving as a compression chamber, a spring-pressed inlet valve for said crank case, a conduit leading from said crank case to said inlet port, the portion of the conduit adjacent said inlet port serving as a mixing chamber, a liquid fuel float chamber adjacent said mixing chamber, a passage leading from said float chamber to said mixing chamber and terminating in a spray nozzle, and a check valve within said passage, the suction of air into said crank case serving to induct fuel into said mixing chamber, and the quantity of the fuel inducted being dependent upon the tension of the spring of the first-mentioned valve.

3. An internal combustion engine having an explosion chamber, a compression chamber, a conduit delivering air to the former from the latter, an inlet valve within said conduit and closely adjacent said explosion chamber, for preventing the return of fluid from said explosion chamber to said conduit, a throttle valve within said conduit and adjacent said inner valve, for control-

ling the quantity of fluid admitted from said conduit to said explosion chamber, and means controllable by a vacuum pressure in the compression chamber and conduit for inducting a fuel into the latter during the admission of uncharged air to said compression chamber.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

PAUL DANIEL

Witnesses:
CLAIR W. FAIRBANK,
JOHN P. DAVIS.