No. 894,568. PATENTED JULY 28, 1908.

F. C. AVERY.

GAS ENGINE.

APPLICATION FILED SEPT. 27, 1907.

2 SHEETS—SHEET 1.

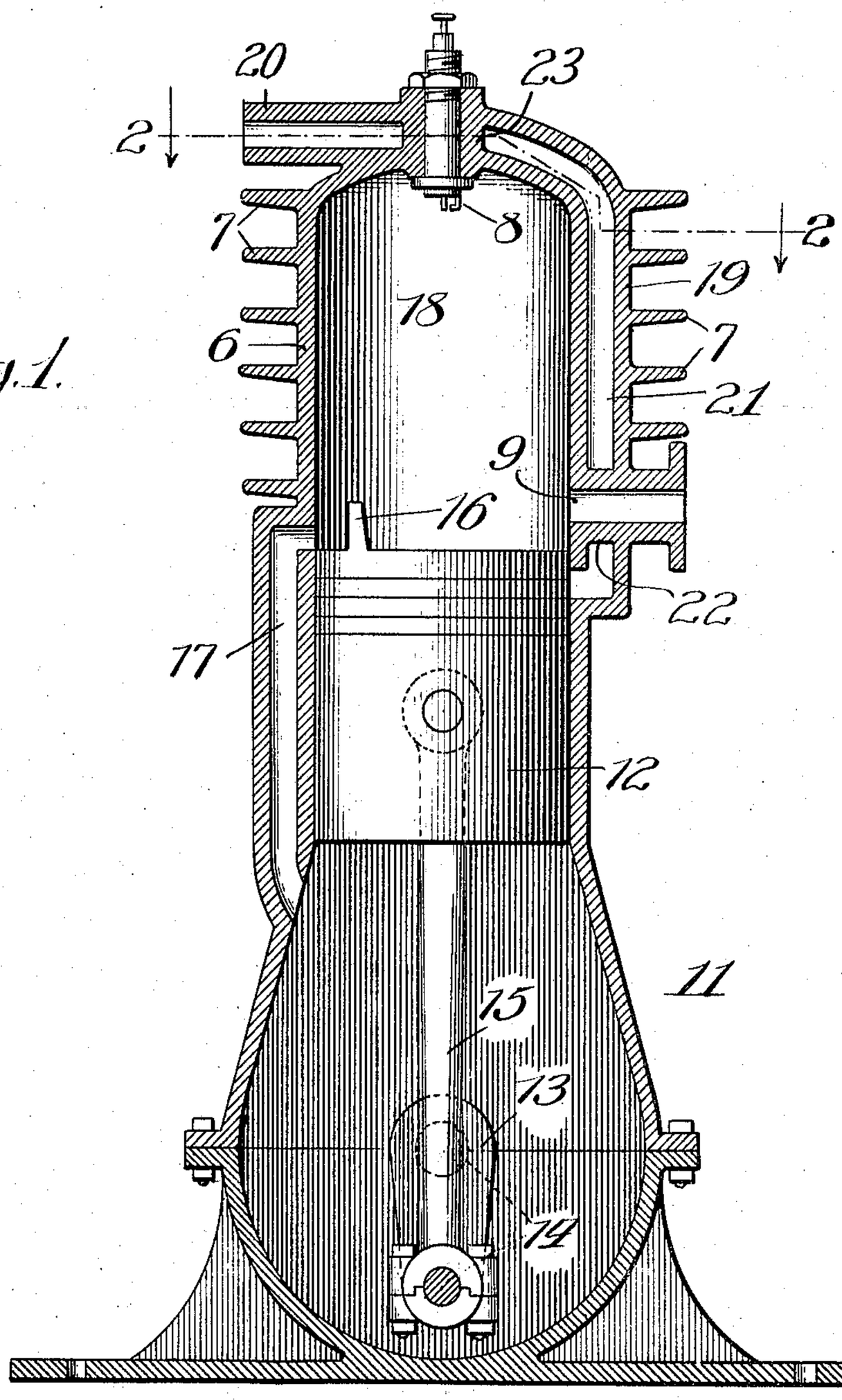

Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 2.

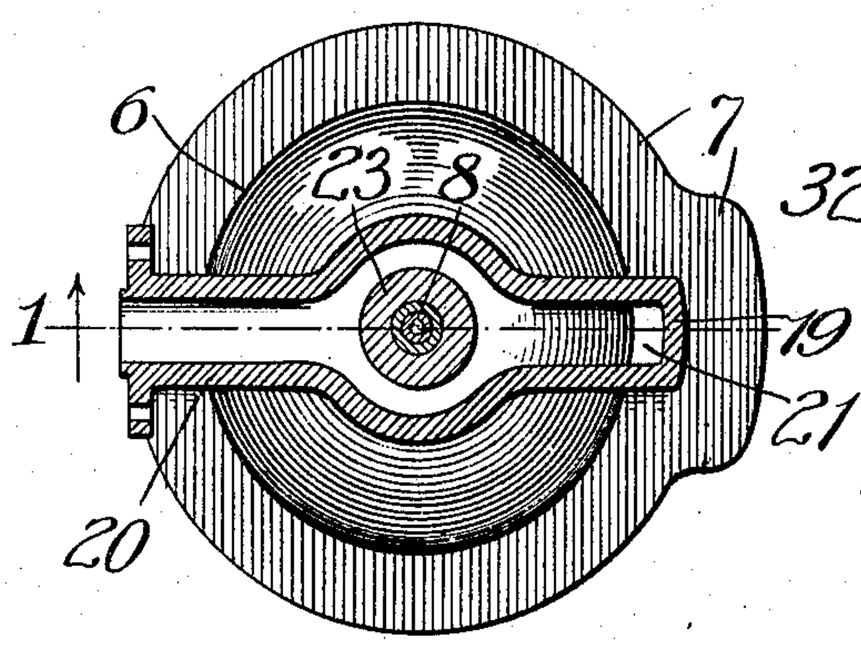


Fig. 5.

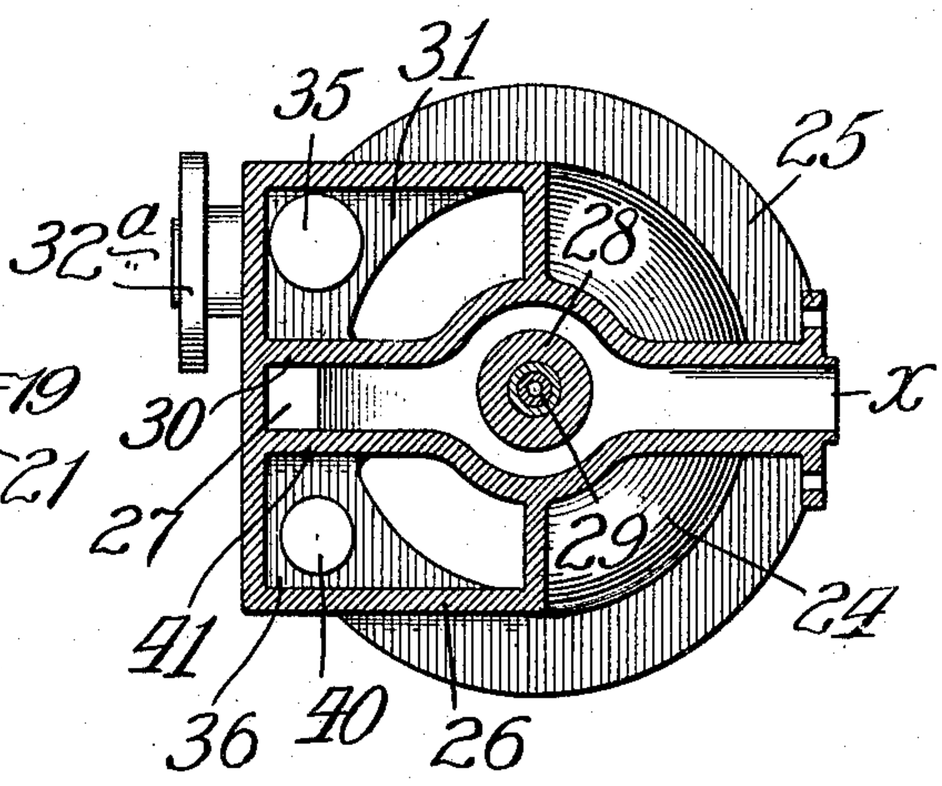


Fig. 3.

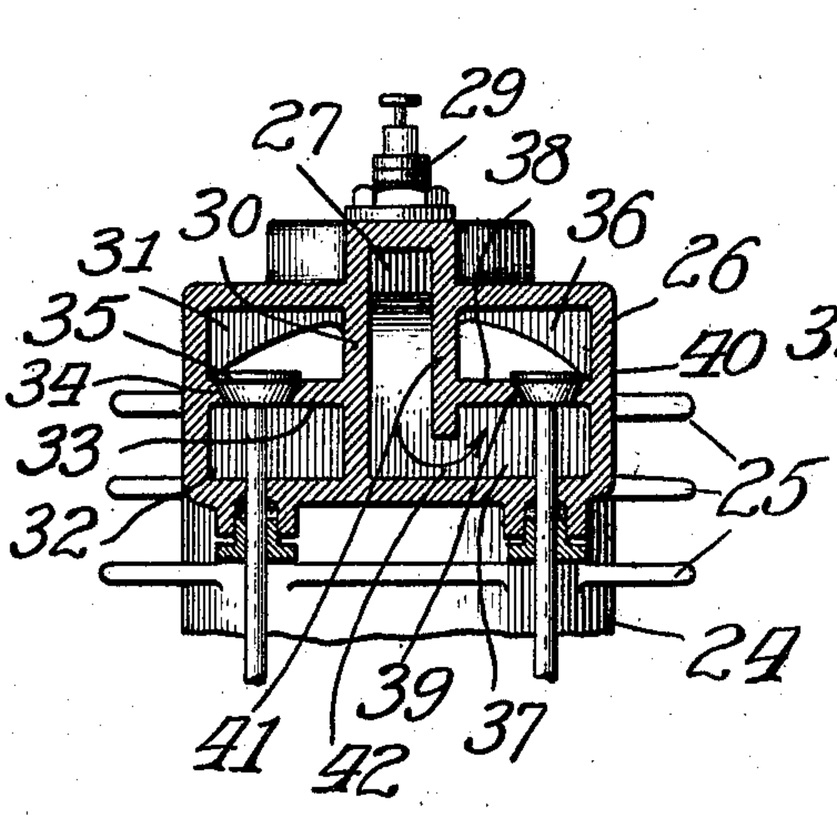
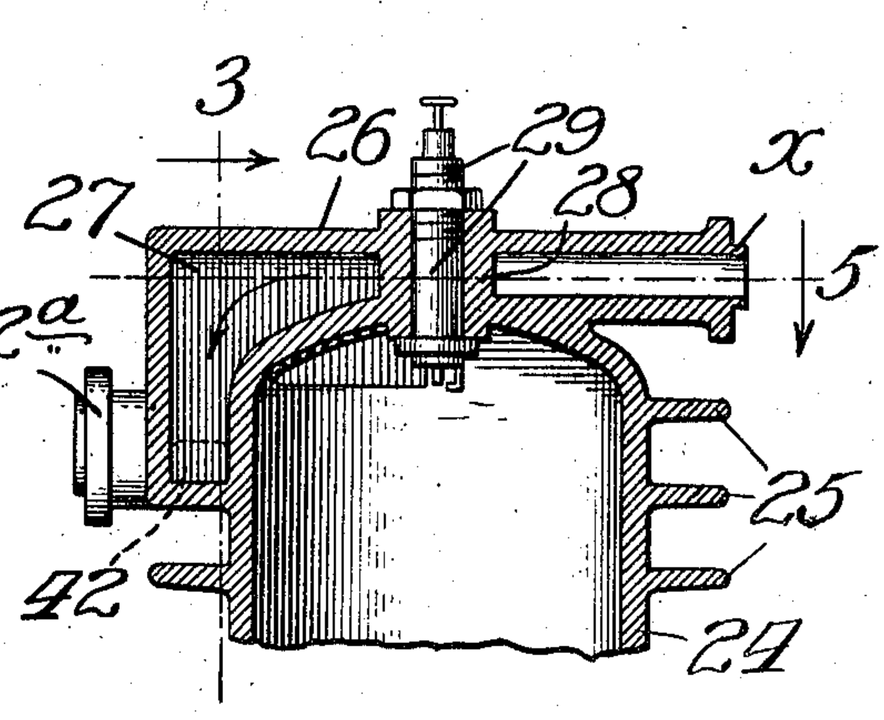


Fig. 4.



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Chas. L. Gaylord.
John Enders.

Inventor:
Frederick C. Avery,
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UNITED STATES PATENT OFFICE.

FREDERICK C. AVERY, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF TO WILLIAM R. DONALDSON, OF CHICAGO, ILLINOIS.

GAS-ENGINE.

No. 894,568. Specification of Letters Patent. Patented July 28, 1908.

Application filed September 27, 1907. Serial No. 394,866.

To all whom it may concern:

Be it known that I, FREDERICK C. AVERY, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Gas-Engines, of which the following is a specification.

My object is to provide an improvement in engines of this type, by which they may be effectually maintained in cooled condition for continuous running, and another object is to provide an improvement by which the fuel for the engine is heated and thereby rarefied, preliminary to its introduction into the explosion-chamber by the heat generated in the operation of the engine.

My invention, generally stated, consists in subjecting the explosive-mixture, as it passes from the carbureter into the cylinder-inlet, to heat from the cylinder of the engine, whereby heat is extracted from the engine and taken up by the explosive-mixture, with the result of producing a cooling effect on the engine and at the same time becoming heated and thereby rarefied.

As I have devised my improvement for use more especially in connection with air-cooled engines, I have illustrated it in the drawings in this connection, in which—

Figure 1 is a view in vertical sectional elevation of an engine of the two-cycle type embodying my invention; Fig. 2 is a section taken at the irregular line 2 on Fig. 1 and viewed in the direction of the arrow; Fig. 3 is a vertical sectional elevation of a four-cycle gas-engine embodying my invention, the section being taken at the line 3 on Fig. 4 and viewed in the direction of the arrow; Fig. 4 is a vertical sectional elevation of the same; and Fig. 5 is a section taken at the line 5 on Fig. 4 and viewed in the direction of the arrow.

The engine illustrated in Figs. 1 and 2, as to its general features of construction, is of the ordinary two-cycle type comprising a cylinder 6 provided with a series of annular cooling-ribs 7 and containing a sparking-plug 8, an exhaust 9 and an inlet-opening 10, a crank-case 11 and a piston 12 connected with the crank 13 on a shaft 14 by a rod 15 and having a deflector 16 on its upper end, for the usual purpose, a by-pass 17 connecting the crank-case 11 with the explosion-chamber 18 of the cylinder. The wall of the cylinder is preferably provided with a rib 19 formed integrally with it, and extending from below the exhaust longitudinally of the cylinder beyond the spark-plug 8, where it terminates in an extension 20, to which extension the carbureter (not shown) may be attached. This rib is cored to provide a passage 21 extending longitudinally of the cylinder 6 and leading from the inlet 9 around the boss 22 of the exhaust on its opposite sides and around the boss 23 of the spark-plug 8, in a similar manner, and through the extension 20.

The operation of the engine is the same as that of the ordinary two-cycle type, the explosive mixture being sucked into the chamber 18 through the inlet 10 each time the piston moves to retracted position, and the exhaust opening to discharge the spent gases and the by-pass being uncovered to allow fresh fuel to be introduced into the cylinder with each outward movement of the piston.

It is well understood that the hottest parts of the engine are those adjacent to the spark-plug and exhaust, and that the hottest side of the cylinder is that extending from the plug to the exhaust. Thus, the fuel mixture in passing in contact with the hottest portions of the engine is caused to absorb a large amount of heat at the points where it is most desired that heat be eliminated, and consequently cooling of the engine results. The heating of the explosive mixture in its travel from the carbureter to the inlet serves to cause its constituents to become very thoroughly commingled and the whole rarefied, with the result of producing a mixture which is caused to be substantially completely consumed while in the chamber 18. Thus, the engine is rendered highly efficient.

To maintain the engine in properly cooled condition it is not necessary that the gases pass around both the plug and exhaust and along the cylinder wall, as described of the construction shown, though this construction is desirable, very effective results being obtained by causing the gases to traverse a portion of the wall of the spark-plug, a wall of the cylinder at a point where the cooling influence will be exerted against the spark-plug, or first, while in cool condition, along the wall of the cylinder adjacent to the plug,

or across the hottest end of the cylinder, or across the end of the cylinder and around the exhaust.

The four-cycle engine illustrated in Figs. 3, 4 and 5 comprises a cylinder 24 provided with annular cooling-ribs 25, and adapted to receive the usual piston (not shown). The upper end of the cylinder is formed with a head 26 provided with a conduit 27 extending transversely of the upper end of the cylinder and through which conduit the boss 28 of the spark-plug 29 extends, the end *x* of the conduit being the end at which the carbureter (not shown) is to be applied. In the head at one side of the conduit 27 and separated therefrom by a wall 30 are an upper chamber 31 and a lower chamber 32 separated from each other by a partition 33 having an opening 34 controlled by a valve 35 seating therein. The upper chamber 31 opens into the interior of the cylinder and serves to receive the spent gases from the cylinder, from which chamber they escape to the atmosphere when the valve is unseated in the usual manner through an outlet 32^a in the lower chamber 32. On the opposite side of the conduit 27 are an upper chamber 36 and a lower chamber 37, likewise separated from each other by a partition 38 provided with an opening 39 controlled by a valve 40 seating in it. These chambers are separated from the conduit by a wall 41 having an opening 42 opposite to the lower chamber to afford communication of the conduit with chamber 37.

The chamber 36 opens into the interior of the cylinder, so that when the valve 40 is unseated, in the usual manner, the explosive mixture passes from the carbureter around the boss 28 of the spark-plug, through the conduit 27, in contact with the end-wall of the cylinder and the wall of the exhaust chamber and through the opening 42 to the chamber 37, from which latter chamber it passes to the cylinder, as described. The explosive-mixture is thus caused to traverse the hottest parts of the cylinder, viz: the part adjacent to the spark-plug, that adjacent to the exhaust and that part intermediate the exhaust and spark-plug, with the result of cooling these parts of the engine and at the same time becoming heated, with the advantage heretofore set forth.

By forming the conduit for the explosive mixture in its passage from the carbureter to the inlet of the cylinder as described of the four-cycle engine, the latter may be provided of a form in which the exhaust valve may be disposed on the side opposite to the carbureter, which is of great advantage in automobile engine construction, as it avoids crowding of these parts.

While I have shown and described my invention in connection with air-cooled engines, I do not wish to be understood as limiting it to use in this connection, as it may be used to good advantage, for the purposes hereinbefore stated, in a water-cooled or otherwise cooled gas-engine.

What I claim as new and desire to secure by Letters Patent is—

1. In a gas-engine, the combination with its cylinder containing an inlet-port, an exhaust-port and a spark-plug surrounded by a wall, a piston confined in the cylinder, and a conduit for fuel leading to said inlet and extending in a position to subject the said wall to the cooling influence of the incoming fuel while in relatively cold condition.

2. In a gas-engine, the combination with its cylinder containing an inlet port and exhaust port and a spark-plug surrounded by a wall, a piston confined in the cylinder and a conduit for fuel leading to said inlet and encircling said spark-plug wall, with the inlet to said conduit so positioned as to cause the fuel to contact with said wall while the fuel is in relatively cold condition, for the purpose set forth.

3. In a gas-engine, the combination with its cylinder containing an inlet-port, an exhaust-port and a spark-plug surrounded by a wall, a piston confined in the cylinder, and a conduit for fuel extending along the wall of the cylinder adjacent to the plug and in position to subject the wall surrounding the plug to the cooling influence of the incoming fuel while in relatively cold condition.

4. In a gas-engine, the combination with its cylinder containing an inlet-port, an exhaust-port and a spark-plug at one end of the cylinder surrounded by a wall, a piston confined in the cylinder, and a conduit for fuel leading to said inlet and extending across the end of the cylinder adjacent to the plug in position to subject the wall surrounding the spark-plug to the cooling influence of the incoming fuel while in relatively cold condition.

5. In a gas-engine, the combination with its cylinder containing an inlet-port, an exhaust-port and a spark-plug surrounded by a wall, a piston confined in the cylinder, and a conduit for fuel extending along the wall of the cylinder adjacent to the plug and down one side and around the exhaust to the inlet, for the purpose set forth.

6. In a gas-engine, the combination with its cylinder containing an inlet-port and exhaust-port and a spark plug surrounded by a boss, a piston confined in the cylinder and a conduit for fuel leading to said inlet and encircling said spark-plug boss and in contact with the wall of said exhaust, with the inlet to said conduit in position to cause the fuel to flow past the plug before it contacts with the wall of the exhaust, for the purpose set forth.

7. In a gas-engine, the combination with its cylinder containing an inlet-port, an exhaust-port and a spark-plug surrounded by a wall cast integrally with the cylinder, and a

piston confined in the cylinder, of a conduit for fuel extending around said wall and cast integrally therewith and with the cylinder.

8. In a gas-engine, the combination with its cylinder containing an inlet-port, and exhaust-port and a spark-plug surrounded by a wall, and a piston confined in the cylinder, of a conduit for fuel extending along the wall of the cylinder adjacent to the plug, and thence in position to subject a wall of the exhaust to the cooling influence of the incoming fuel while in relatively cold condition.

FREDERICK C. AVERY.

In presence of—
RALPH SCHAEFER,
L. KIRKLAND.