C. A. BENNETT.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED MAY 23, 1908.

960,254.

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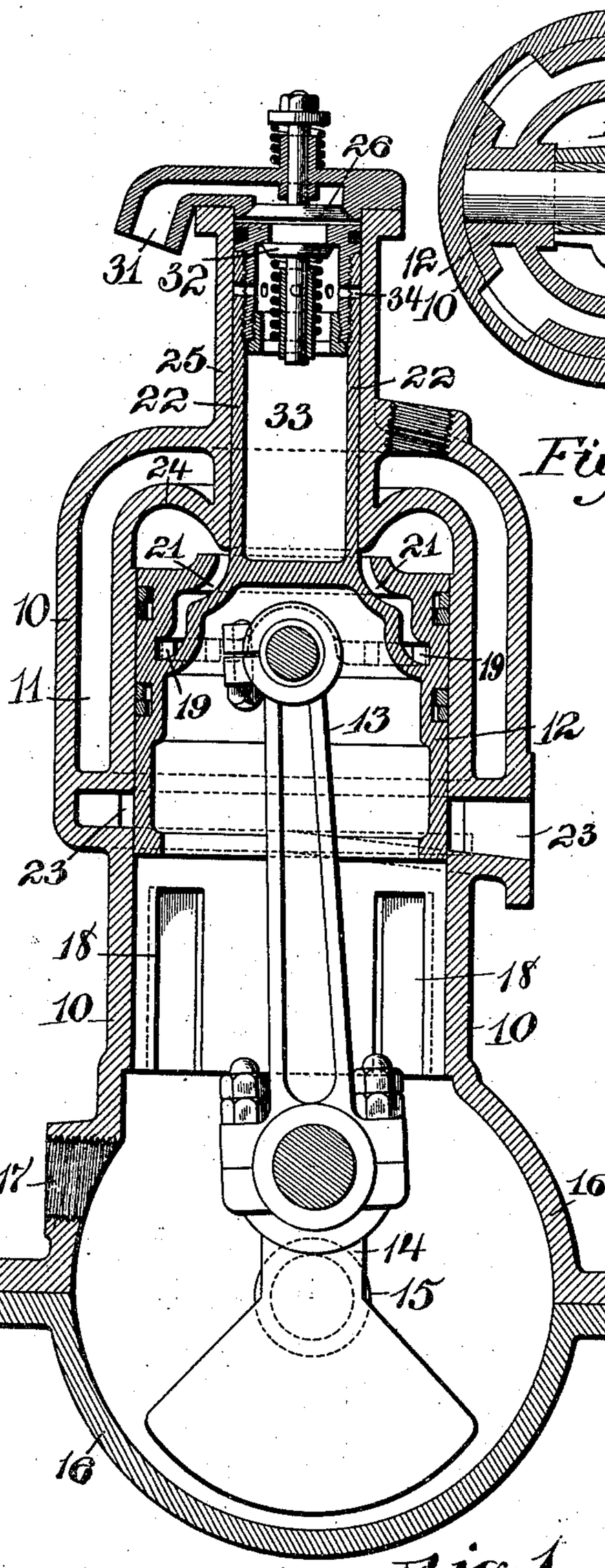

Fig. 1.

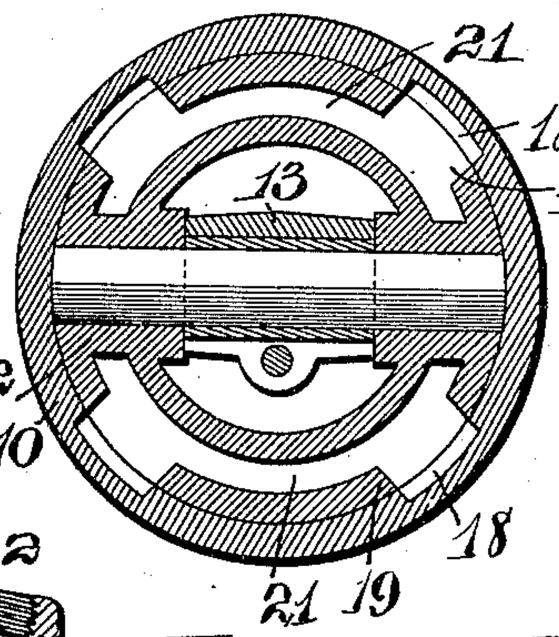

Fig. 3.

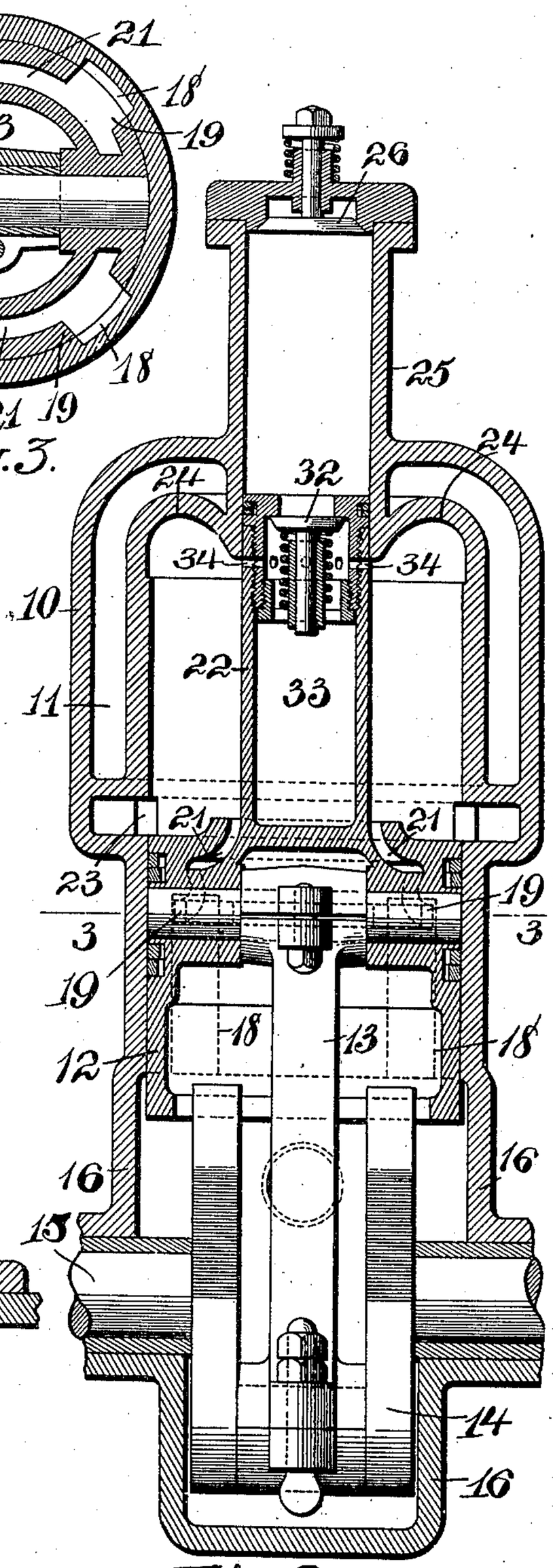

Fig. 2.

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INTERNAL-COMBUSTION ENGINE.

960,254. Specification of Letters Patent. Patented June 7, 1910.

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To all whom it may concern:

Be it known that I, CHARLES A. BENNETT, a citizen of the United States, residing at Dover, in the county of Morris and State of New Jersey, have invented certain new and useful Improvements in Internal-Combustion Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to figures of reference marked thereon, which form a part of this specification.

This invention relates to an internal combustion engine that is designed to have a cylinder and a piston therein, a closed crank-case, a means for compressing pure air in the crank-case on the working stroke of the engine, the same stroke also acting to draw a vapor of the fuel into a vaporizing chamber on the cylinder. The end of this stroke opens the exhaust of the cylinder and also opens ports to admit air alongside a plunger working in the vaporizing chamber and the cylinder, and this air insures the "scavenging" or clarifying of the cylinder by driving out the exploded gas, and if any of this inrushing air passes out with the exhaust, air only and not mixture is lost.

At the finish of the power stroke of the piston and its plunger, the engine operates to inject the vapor in the vaporizing chamber to the air confined in the cylinder, and on its return movement compressing the air and vapor in anticipation of ignition of the mixture. The charge is then exploded in the usual way and the operation above described is repeated. I prefer to pass the rich vapor from the vaporizing chamber into a fuel chamber formed inside the plunger, and automatically injecting the vapor from this fuel chamber into the cylinder at the end of the power stroke of the piston.

The invention is illustrated in the accompanying drawing, in which,—

Figure 1 is a vertical section of my improved engine with the piston at the firing position. Fig. 2 is a view at right angles to Fig. 1 with the piston in its transfer position when the air from the crank-case supplants the exploded gas in the cylinder. Fig. 3 is a section on line 3, 3, in Fig. 2.

In my construction I provide a cylinder 10 surrounded by the customary water-jacket 11 and having a piston 12 which has a connecting rod 13 operating a crank 14 of a suitable shaft 15 which is worked in a closed crank-case 16. When the piston moves "outward" or away from the crank-case on its return stroke, it draws in free, clear air through the inlet 17 which is connected to a suitable suction valve usual in this class of engine and not illustrated herein. When the piston travels along the cylinder on its working stroke, it compresses the free air in the crank-case. The cylinder has a series of passages 18 extending part way up its bore from the crank-case, and the piston has a series of ports 19 which are in a line with the passages 18, and when the piston has compressed this free air and is near its limit of movement, the ports 19 come in communication with the passages 18 and the free air enters the annular passage 21 and is passed into the cylinder in the form of a ring, and being cool, it serves to cool the plunger 22 which is to be hereinafter described.

The free air serves to eject all burned gases from the cylinder through the exhaust ports 23 and also clean the cylinder, and at the same time the cylinder walls. The free air passes up the sides of the plunger 22, cooling it, and then is deflected back toward the exhaust ports by the annular concave or grooved portion 24 which surrounds the plunger and insures the "scavenging" of the inner walls of the cylinder. It will be noted here that the air going into the cylinder is free air and has not become mixed, up to its time of entry into the cylinder, with any fuel or fuel vapor.

When the piston moves on its power stroke it carries with it the plunger 22, which is hollow. This plunger slides in a vaporizing chamber 25 on the end of the cylinder 10 and opening directly therein, and on this stroke acts to draw an over-rich mixture or vapor into the vaporizing chamber 25 through a valve 26 which is usually a suction valve, but any kind of valve adapted for the purpose, such as a mechanically operated valve, can be used.

When the plunger is forced by the piston on its return stroke a puppet or check valve 32 is opened by reason of the pressure in the vaporizing chamber, since the valve 26 is forced shut on this stroke of the plunger. The check valve 32 regulates the admission

of fuel from the vaporizing chamber into the fuel chamber 33 which is formed inside the plunger and receives and holds vapor as fuel. It will thus be seen that when the plunger is on its return stroke, the fuel chamber 33 becomes filled with fuel, and on the power stroke the valve 32 is held shut, but the valve 26 is opened by suction and the vaporizing chamber receives another filling. On or near the limit of the power stroke ports 34, in the periphery of the plunger 22, are opened, and the fuel from the fuel chamber 33 is injected into the air of the cylinder and forms the explosive charge. Attention is called to the fact that free air, in which there is no fuel gas or vapor, is admitted to the cylinder immediately after the discharge is open, and while it cleans out all vestige of the exploded gas it also has the advantage of having no regulation except a check valve of some sort, and the pressure of air fed to the cylinder will be constant, and any varying of the gas in the charge is done through the pipe 31 which feeds the vaporizing chamber and can be accomplished by any suitable carbureter or mixing valve. The sequence of the exhaust, the admission of free air and then the injection of fuel to the cylinder, when the piston is at the end of its power stroke, permit no fuel to escape through the exhaust in an unexploded condition.

Having thus described my invention, what I claim is:—

1. An internal combustion engine comprising a cylinder, a piston, a closed crank-case, the crank-case having an air inlet therein, ducts for communicating between the crank-case and the cylinder when the piston finishes its power stroke, a vaporizing chamber on the end of the cylinder, a plunger on the piston and working in the vaporizing chamber, the plunger having a fuel chamber therein and means for causing communication to inject vapor from the fuel chamber to the cylinder only when the piston finishes its power stroke.

2. An internal combustion engine comprising a cylinder, a piston, a closed crank-case, the crank-case having an air inlet therein, ducts for communicating between the crank-case and the cylinder when the piston finishes its power stroke, a vaporizing chamber on the end of the cylinder and opening directly therein, a plunger on the piston and working in the vaporizing chamber and having a fuel chamber therein, and means for causing communication to inject vapor from the fuel chamber to the cylinder only when the piston finishes its power stroke.

3. An internal combustion engine comprising a cylinder a piston and a closed crank-case, the crank-case having an air inlet, a vaporizing chamber on the end of the cylinder opposed to the crank-case, a plunger on the piston and working in the vaporizing chamber, the piston having ports for communicating between the crank-case and the cylinder when the piston finishes its power stroke, an inwardly opening suction valve on the vaporizing chamber for the admission of fuel vapor to the vaporizing chamber, and means for causing communication between the vaporizing chamber and the cylinder.

4. An internal combustion engine comprising a cylinder a piston and a closed crank-case, the crank-case having an air inlet, the crank-case being adapted to receive air devoid of fuel vapor, the piston having ports for passing the free air when compressed from the crank-case to the cylinder, a vaporizing chamber on the cylinder and opening directly therein, a plunger adapted to reciprocate in the vaporizing chamber, the plunger being adapted to contact with the air from the ports in the piston and be cooled thereby, and means for causing communication from the vaporizing chamber to the cylinder.

5. An internal combustion engine comprising a cylinder, a piston, a closed crank-case, the crank-case having an air inlet therein, the cylinder having passages in its inner walls extending part way up from the crank-case, the piston having an annular passage concentric with its center, and having ports adapted to communicate with the passages in the cylinder when the piston finishes its power stroke.

6. An internal combustion engine comprising a cylinder, a piston, a closed crank-case having an air inlet therein, the cylinder having exhaust ports and having air passages extending up from the crank-case toward the exhaust ports, a vaporizing chamber on the cylinder, and a plunger on the piston being adapted to work in the vaporizing chamber, the piston having an annular passage and having ports communicating with the passage and arranged to communicate with the cylinder air passages when the piston finishes its power stroke.

7. An internal combustion engine comprising a cylinder, a piston, a closed crank-case, the crank-case having an air inlet, means for opening communication between the crank-case and the cylinder when the piston is at the limit of its power stroke so as to conduct free air to the cylinder, a vaporizing chamber on the end of the cylinder opposed to the crank-case and opening directly therein, a valve on the vaporizing chamber to prevent the escape of vapor, a plunger on the piston and working in the vaporizing chamber, the plunger having a fuel chamber therein a valve in the fuel chamber adapted to be closed when the valve of the vaporizing chamber is open, and vice versa, and means for opening communication to admit vapor from the fuel chamber

to the cylinder when the cylinder is filled with air.

8. In an internal combustion engine, a cylinder having air passages extending part way from the crank end, a piston, a plunger on the piston, and a chamber on the cylinder to receive the plunger, the piston having an annular passage surrounding the plunger and having ports passing through and adapted to communicate with the air passages of the cylinder.

9. In an internal combustion engine, a cylinder having air passages extending part way from one end, and having exhaust ports near the ends of the air passages, a piston, a plunger on the piston, and a chamber on the cylinder to receive the plunger, the piston having an annular passage adjoining the plunger and having ports to communicate from the passage through the piston to the air passages of the cylinder when the piston uncovers the exhaust ports, the end of the cylinder opposite the exhaust having an annular groove substantially tangential to the plunger and the wall of the cylinder.

10. An internal combustion engine comprising a cylinder, a piston, a closed crank-case, means for intermittently admitting air to the cylinder, a vaporizing chamber on the cylinder, a hollow plunger on the piston to reciprocate in the vaporizing chamber and forming a fuel chamber, a valve on the vaporizing chamber to regulate the admission of vapor thereto, a valve on the fuel chamber to regulate the passage of vapor from the vaporizing chamber to the fuel chamber, and ports in the sides of the fuel chamber adapted to be uncovered by the walls of the chamber to admit the vapor to the cylinder from the fuel chamber, when the piston finishes its power stroke.

11. An internal combustion engine comprising a cylinder, a piston, a closed crank case with an air inlet thereto, ducts in the wall of the cylinder for communication between the crank case and power cylinder as the piston finishes its power stroke, a chamber on the end of the piston adapted to receive and hold fuel from a chamber with which it acts on its outward stroke, and means for causing transfer of said fuel from the fuel chamber to the combustion cylinder only after admission of air to the cylinder begins.

12. An internal combustion engine comprising a cylinder, a closed crank case and a piston, the cylinder having on its interior ducts extending part way therein, a cylinder having a chamber on one end thereof, the piston having a plunger to work in the chamber and the piston having ports, the ports having their inlets arranged on the periphery of the piston so as to be placed in line with the ducts in the cylinder when the piston finishes its power stroke, the outlets of the ducts being arranged in a line substantially parallel with the movement of the piston and arranged to inject the air passing therethrough against the plunger to cool the same.

13. An internal combustion engine comprising a cylinder, a piston, a vaporizing chamber on the end of the cylinder, a fuel chamber on the end of the piston and working in the vaporizing chamber, means for passing pure air into the cylinder when the piston finishes its power stroke, means for injecting the compressed fuel from the fuel chamber into the cylinder immediately after the cylinder is filled with air, the return stroke of the piston compressing the air in the vaporizing chamber and causing it to pass into the fuel chamber, and a valve for closing the fuel chamber from the vaporizing chamber on the power stroke of the piston and causing communication between them on the return stroke.

14. An internal combustion engine comprising a cylinder and a piston, a vaporizing chamber on the end of the cylinder, a plunger on the piston and working in the vaporizing chamber, the piston having ports extending from points on the end of the piston adjacent to the plunger and emerging from the sides of the piston, the cylinder having means for injecting pure air into the ports where they emerge from the sides of the piston when the piston finishes its power stroke, an inwardly opening suction valve on the vaporizing chamber, the plunger on the piston having a fuel chamber therein, means for closing the fuel chamber from the vaporizing chamber on the power stroke of the piston, and means for injecting compressed fuel from the fuel chamber into the cylinder immediately after the cylinder is filled with air.

15. An internal combustion engine comprising a cylinder, a piston, a vaporizing chamber on the end of the cylinder and opening directly therein, a hollow plunger on the piston forming a fuel chamber and adapted to operate in the vaporizing chamber, an inlet valve on the vaporizing chamber, an inlet valve on the fuel chamber, and a series of perforations projecting through the walls of the fuel chamber and adapted to be uncovered when the piston finishes its power stroke and to be closed by the walls of the vaporizing chamber when the piston begins its return stroke.

16. An internal combustion engine comprising a cylinder, a piston therein, means for admitting air to the cylinder when the piston finishes its power stroke, a vaporizing chamber on the end of the cylinder and opening directly therein, a fuel chamber in the end of the piston and adapted to reciprocate in the vaporizing chamber, an inlet on the vaporizing chamber, and an inlet to the

fuel chamber from the vaporizing chamber, the fuel chamber having perforations through its walls adapted to be uncovered by passing into the cylinder when the piston finishes its power stroke and adapted to be covered by the walls of the vaporizing chamber when the piston begins its return stroke.

In testimony, that I claim the foregoing, I have hereunto set my hand this 21st day of May 1908.

CHARLES A. BENNETT.

Witnesses:
E. A. PELL,
WM. H. CAMFIELD.