J. F. BUTLER & H. F. McCRAY.

GAS ENGINE.

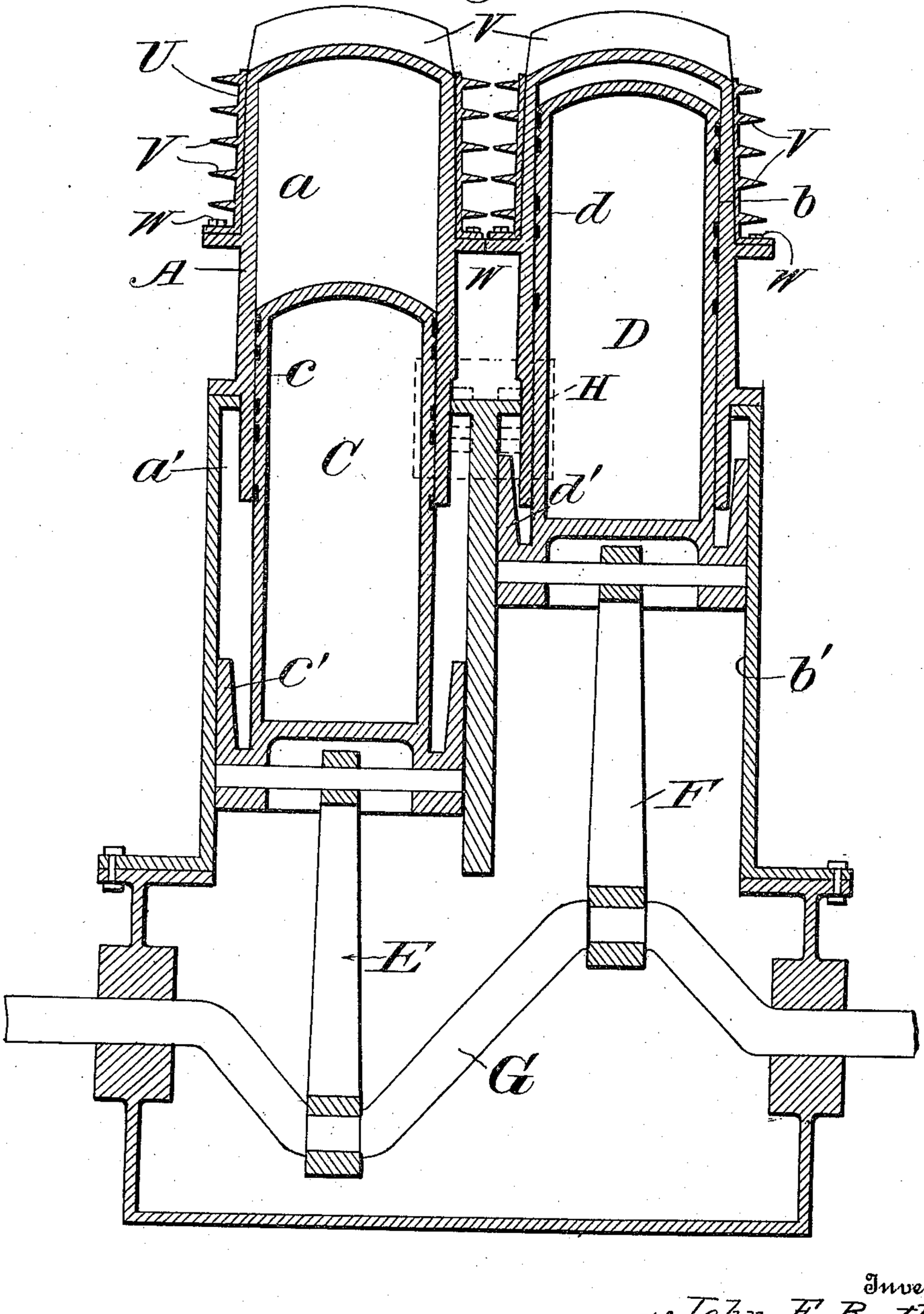
APPLICATION FILED FEB. 16, 1914.

1,166,577.

Patented Jan. 4, 1916.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses

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2 SHEETS—SHEET 2.

Fig. 2.

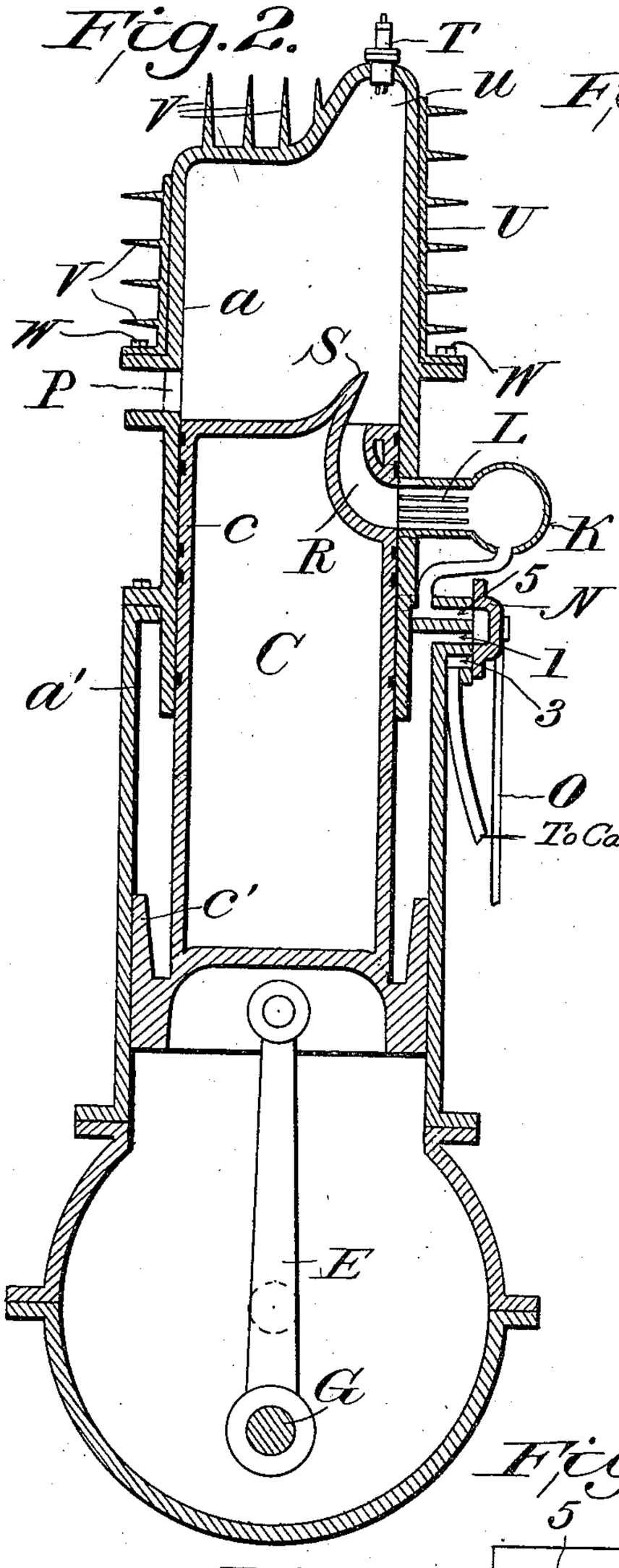


Fig. 3.

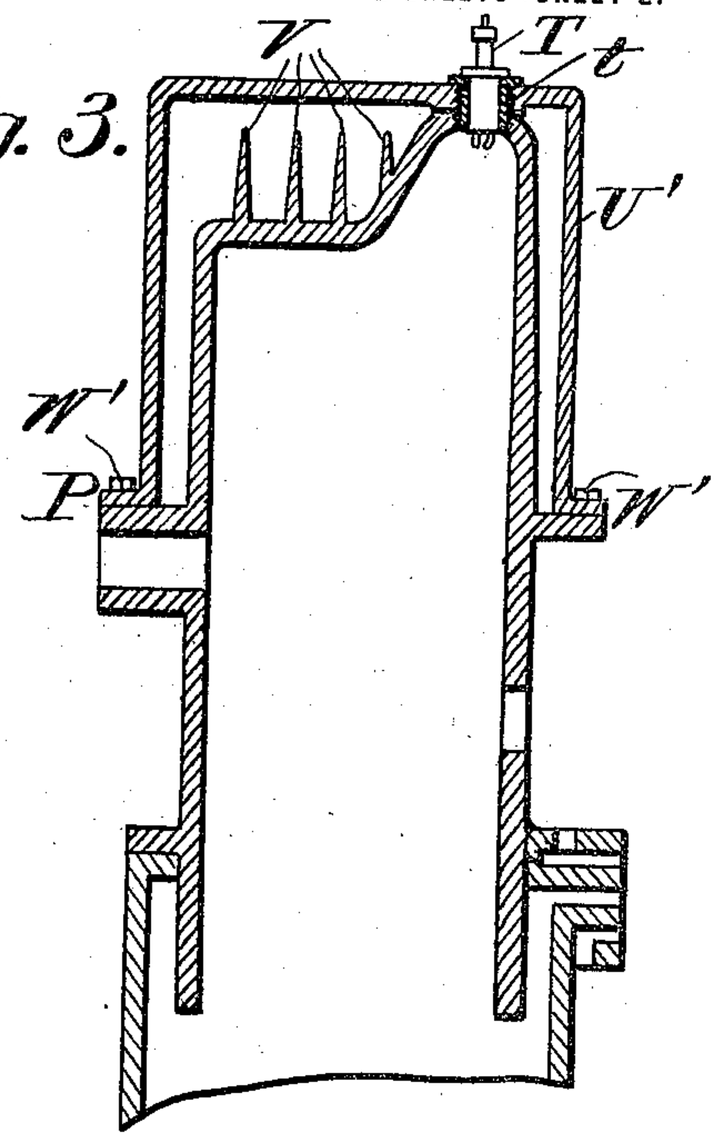


Fig. 5.

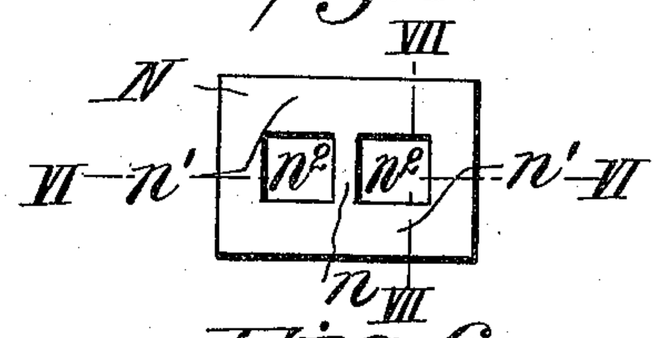


Fig. 6.

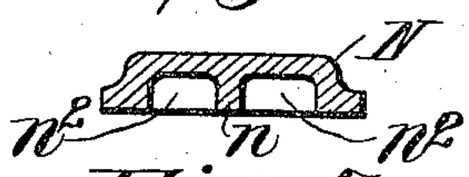


Fig. 7.

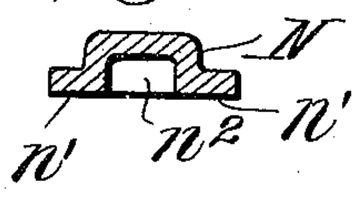
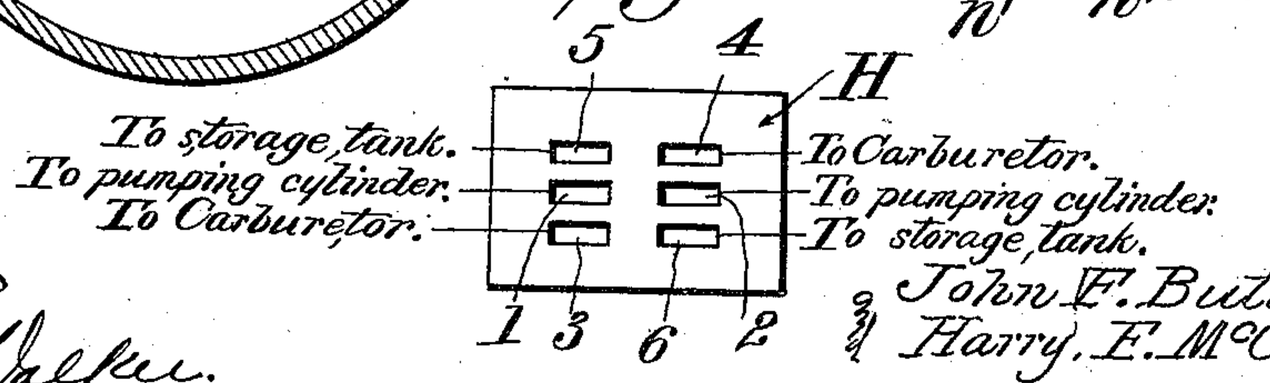


Fig. 4.



Witnesses

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UNITED STATES PATENT OFFICE.

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GAS-ENGINE.

1,166,577. Specification of Letters Patent. Patented Jan. 4, 1916.

Application filed February 16, 1914. Serial No. 818,948.

To all whom it may concern:

Be it known that we, JOHN F. BUTLER and HARRY F. McCRAY, citizens of the United States, residing at Reno, county of Washoe, State of Nevada, have invented certain new and useful Improvements in Gas-Engines, of which the following is a full, clear, and exact specification.

Our invention relates to explosion or internal combustion engines of the two-cycle type in which an explosion occurs every time the piston starts upon its forward stroke as distinguished, for instance, from engines of the four-cycle variety where the arrangements for the scavenging of the exhaust gases and the introduction and compression of a new charge require explosions of lesser frequency.

One object of our present invention is to simplify the mechanism for supplying the charges to a two-cylinder engine by the use of a storage tank for the mixed gases, and a common slide valve for placing the pumping section of one of the cylinders in communication with the carbureter while the pumping section of the other cylinder is in communication with said storage tank, the latter being in direct communication with the interiors of the combustion section of both cylinders when the pistons open their respective ports.

Further objects will become apparent as the description proceeds.

The invention will be first hereinafter described in connection with the accompanying drawings, which constitute a part of this specification, and then more specifically pointed out in the claim at the end of the description.

In the accompanying drawings, wherein the same reference characters are used to indicate corresponding parts throughout the several views: Figure 1 is a vertical sectional view of a two-cylinder engine constructed in accordance with our invention, one of the pistons being illustrated as at the end of its forward or down stroke, and the other piston as at the end of its return or up stroke, and the slotted seat for the single or common valve being indicated in broken lines in the position it would occupy in a front elevation; Fig. 2 is a vertical section taken from front to rear through one of the cylinders, the storage tank, the valve, the pipe leading from the carbureter, and the ports leading from the valve to the pumping section of the cylinder and the storage tank and from the storage tank to the combustion section of the cylinder; Fig. 3 is a broken sectional view of the upper part of one cylinder similar to that shown in Fig. 2 except that it is provided with a water cooled jacket instead of an air cooled jacket as illustrated in Figs. 1 and 2; Fig. 4 is a diagrammatic view of the valve seat; Fig. 5 is an inner face view of the valve drawn to the same scale, and Figs. 6 and 7 are sections of the valve taken on the lines VI—VI and VII—VII, respectively, of Fig. 5.

Referring more particularly to the drawings, A and B, designate the two cylinders, having combustion sections *a* and *b* and pumping sections *a'* and *b'*, respectively. The pistons C and D have their main cylindrical portions *c* and *d* fitted to slide in the combustion sections *a* and *b* of the cylinders, and said pistons also have enlarged heads *c'* and *d'* fitted to slide in the pumping sections *a'* and *b'* of the cylinders. The pistons are actuated by pitmen E and F connected to oppositely extending cranks of the driving shaft G. Consequently one of the pistons is at the end of its upward stroke when the other one is at the end of its downward stroke, and the force of the explosion which drives the first piston downward will carry the second piston upward.

The lower or pumping sections of both cylinders have ports 1 and 2 in the valve seat H which also has four other ports or slots, two of them, 3 and 4, leading to the carbureter (not shown), and the other two, 5 and 6, leading to the storage tank K, Fig. 2. Said tank communicates with the combustion sections of the cylinders by passages L in which screens or grids of mesh material are placed to divide the gas into small particles as it enters the cylinders in order to insure a proper mixture and ignition. The ports or slots in the valve seat H are arranged in two vertical columns of three each, and three horizontal rows of three each, as illustrated in Figs. 1 and 4. The two middle slots lead to the pumping sections of the cylinders. The upper slot of one column and the lower slot of the other column lead to the storage tank, while the remaining two ports lead to the carbureter.

The valve N is adapted to be reciprocated by means of a cam rod O, and is designed

to close either the two upper or the two lower ports in the valve seat while placing the two lower or upper ports in each column in communication with each other. In other words, when the valve is in its lowered position, as indicated by the dotted lines in Fig. 2, the port 1, Figs. 1 and 4, leading to the pumping section of one cylinder, is in communication with port 3, leading to the carbureter, while port 2 leading to the pumping section of the other cylinder, is in communication with port 6 leading to the storage tank, and the ports 5 and 4 are closed. On the other hand when the valve is in its raised position, as illustrated in solid lines in Fig. 2, ports 3 and 6, Figs. 1 and 4, are closed, while port 1 which leads to the pumping section of the first cylinder, is in communication with port 5 leading to the storage tank, and port 2 which leads to the pumping section of the second cylinder, is in communication with port 4 leading to the carbureter. The valve is formed with a central vertical partition n and upper and lower flanges n', as clearly shown in Figs. 5, 6 and 7, in order to accomplish these results, as will be readily understood, the length of the grooves n^2 in the valve being just sufficient to cover or include two of the three ports in each column at the same time. The result of the construction just described is that in the raised position of the valve, the upward movement of the enlarged head of one of the pistons in the pumping section of its cylinder will force the gas from said pumping section into the storage tank via the port 1, one of the grooves n^2 and port 5, while the simultaneous downward movement of the enlarged head of the other piston in the pumping section of its cylinder will draw gas into said pumping section from the carbureter via port 4, the other groove n^2 of the valve, and port 2, the ports 3 and 6 being closed by the lower flange n' of the valve. In the lowered position of the valve, its upper flange n' closes the ports 5 and 4, and the upper movement of the enlarged head of the second piston in the pumping section of its cylinder will force the gas from said pumping section into the storage tank via the port 2, second groove n^2 in the valve, and port 6, while the simultaneous downward movement of the enlarged head of the first piston in the pumping section of its cylinder will draw in another supply of gas from the carbureter into said pumping section via the port 3, first groove n^2 in the valve, and port 1. Thus gas or fuel is always being drawn into the pumping section of one cylinder while the gas previously drawn into the pumping section of the other cylinder is being forced into the storage tank.

The combustion section of each cylinder is provided with an exhaust port P on a level with the top of the piston when the latter is in its lowest position. The supply port or passage L in each cylinder is arranged on a lower level than these exhaust ports. The main piston head in each cylinder is formed with a delivery passage R opening in the top thereof and also in the side adjacent the supply port L. This side opening of the passage R is adapted to register with said supply port L when the piston is in its lowest position, that is, at the end of its working stroke, as shown in Fig. 2. The top opening of the passage R is arranged near the point on the wall of the cylinder which is diametrically opposite the exhaust port P, and said opening is shielded behind an upward projection or lug S on the top of the piston. The side of the lug adjacent the opening of the passage R is inclined upwardly and away from the exhaust port, whereas the side of said lug facing the exhaust port is inclined downwardly and toward the same. By reason of this peculiar formation of the top of the piston and arrangement of the delivery passage therein, the charge on entering the cylinder is prevented from mixing with the exhaust gases which are guided to their exit by the sloping or inclined side of the lug S facing it. Moreover, the nozzle shape of the delivery passage R forms a pocket or cup which holds the rich mixture and carries it directly to the top of the cylinder which is provided with a peaked projection u shaped to correspond to the formation of the top of the piston and has the spark plug T fitted in the uppermost portion or peak directly over the lug S. Hence the richest part of the combustible mixture is carried right into proximity to the spark plug where upon ignition it will develop the most power.

The combustion section of each cylinder is inclosed by a removable hood or jacket which may be air cooled or water cooled as preferred. As illustrated in Figs. 1 and 2, the hood U is adapted to be air cooled and is provided with volutes or fins V around its sides only. This hood is made of aluminum or other metal suitable for radiating the heat. This hood is open at the top and slides over the cast iron cylinder which is tapered from bottom to top, thus insuring a perfect joint and also allowing the hood to be easily removed. The volutes V on the top of the cast iron cylinder are integral thereof, and are therefore not removable. This hood is bolted to the top cylinder by bolts W, which may be readily removed for taking off the hood when occasion arises or when the water hood is to be substituted.

In Fig. 3 we have illustrated a form of water cooled hood or jacket U′, made of similar material as hood U in Figs. 1 and 2,

and removably secured in place by bolts W'. This hood is also retained by the threaded bushing *t* in which the spark plug T is fitted. The walls of this hood are vertical and spaced a suitable distance from the cast iron cylinder, allowing for a free circulation of water. The water also circulates around the volutes or fins on top of the cylinder.

It will be observed that the hoods, either for air or water cooling purposes are interchangeable and can be transferred in a few moments by simply loosening their securing means, and that these hoods are made of aluminum or other metal that radiates heat to advantage. Furthermore, it will be noted that the upper or working pistons travel their entire length in the top sections of the cylinders while the lower or pumping pistons travel their entire length in the lower sections of the cylinders, and that there are no joints in either sections where leaks can occur.

The engine may be operated with any description of gas which may be formed in an auxiliary attachment. Inasmuch as there are no puppet valves, the engine is noiseless, the single slide valve being operated by an eccentric from the crank shaft. Moreover, as the engine does not compress in the crank case, overheating and leakage are avoided.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent of the United States is:

In an internal combustion engine, the combination with two cylinders, each having a pumping section and a combustion section, of pistons to work in the cylinders, a storage tank for the mixed fuel having ports leading to the combustion sections of the two cylinders, a valve seat having six ports arranged in parallel rows and columns, the two middle ports leading to the pumping sections of the cylinders, two of the other ports leading to the storage tank, and the remaining two ports leading to a source of fuel supply, one of the ports leading to the fuel supply and one of the ports leading to the storage tank being arranged at either side of the middle row of ports leading to the pumping sections of the cylinders, and one of the ports leading to the storage tank being arranged in each column, a valve having two grooves each adapted to cover two of the three ports in each column, said valve also having flanges for closing the end ports in each column when the other ports in the valve seat are covered by the grooves, and means for sliding said valve on the seat whereby the source of fuel supply may be placed in communication with the pumping section of one cylinder while the pumping section of the other cylinder is placed in communication with the storage tank.

In testimony whereof we have signed our names to this specification in the presence of two attesting witnesses:

JOHN F. BUTLER.
HARRY F. McCRAY.

Witnesses:
GEORGE SPRINGMEYER,
E. I. PARKER.