(No Model.)

2 Sheets—Sheet 1.

C. W. PINKNEY.

GAS ENGINE.

No. 505,327. Patented Sept. 19, 1893.

Fig. 1.

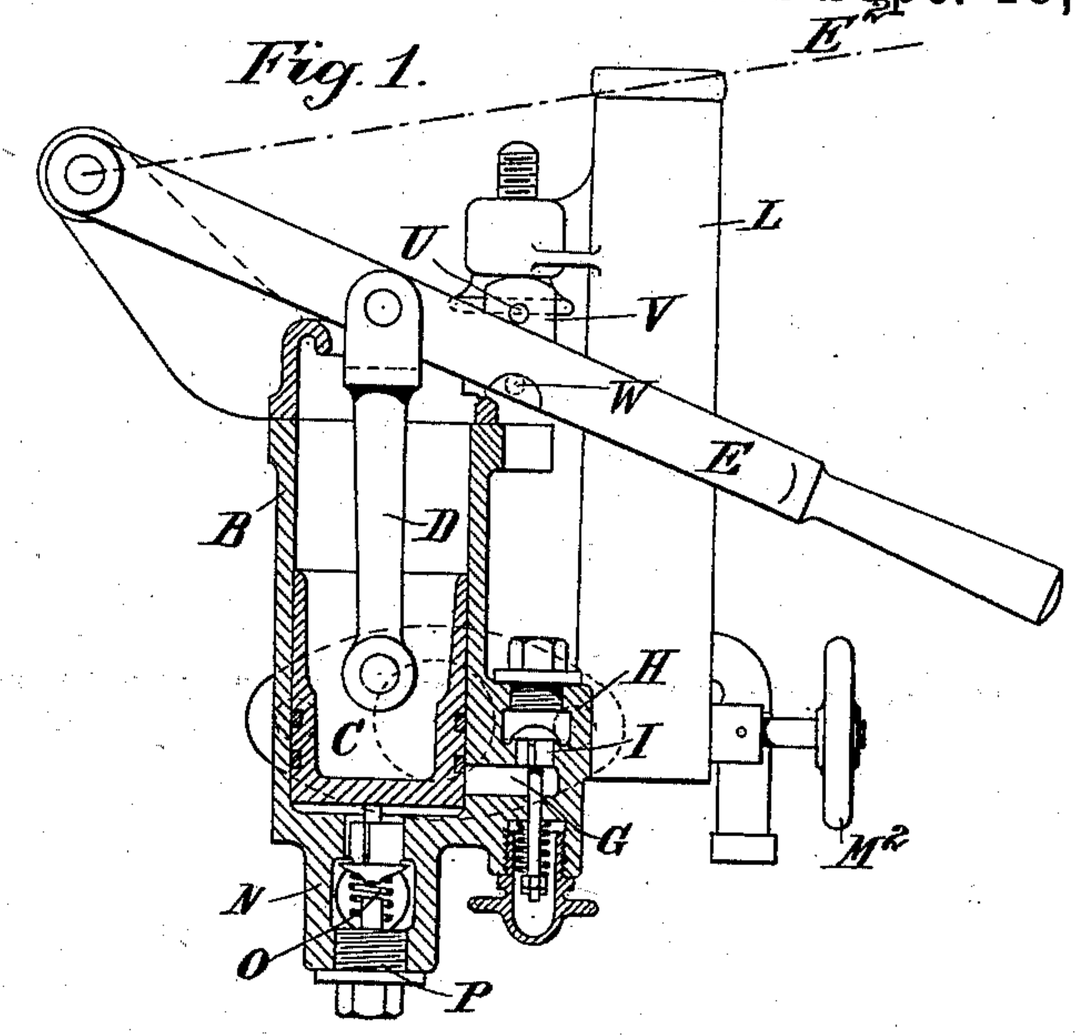


Fig. 2.

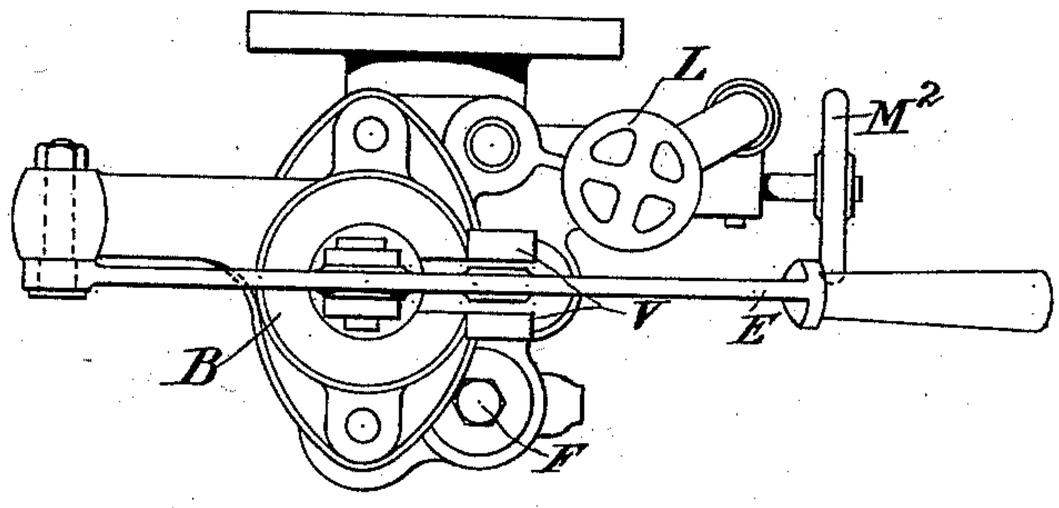
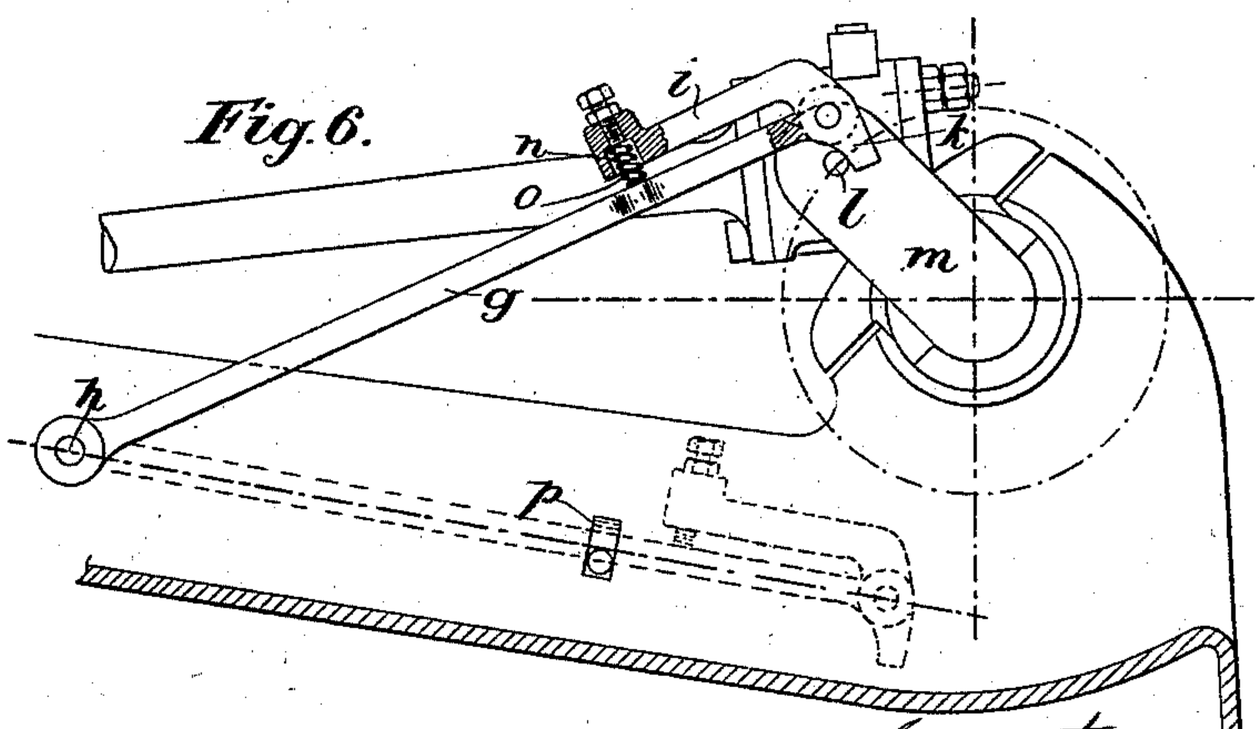


Fig. 6.



Attest:
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(No Model.)

2 Sheets—Sheet 2.

C. W. PINKNEY.

GAS ENGINE.

No. 505,327. Patented Sept. 19, 1893.

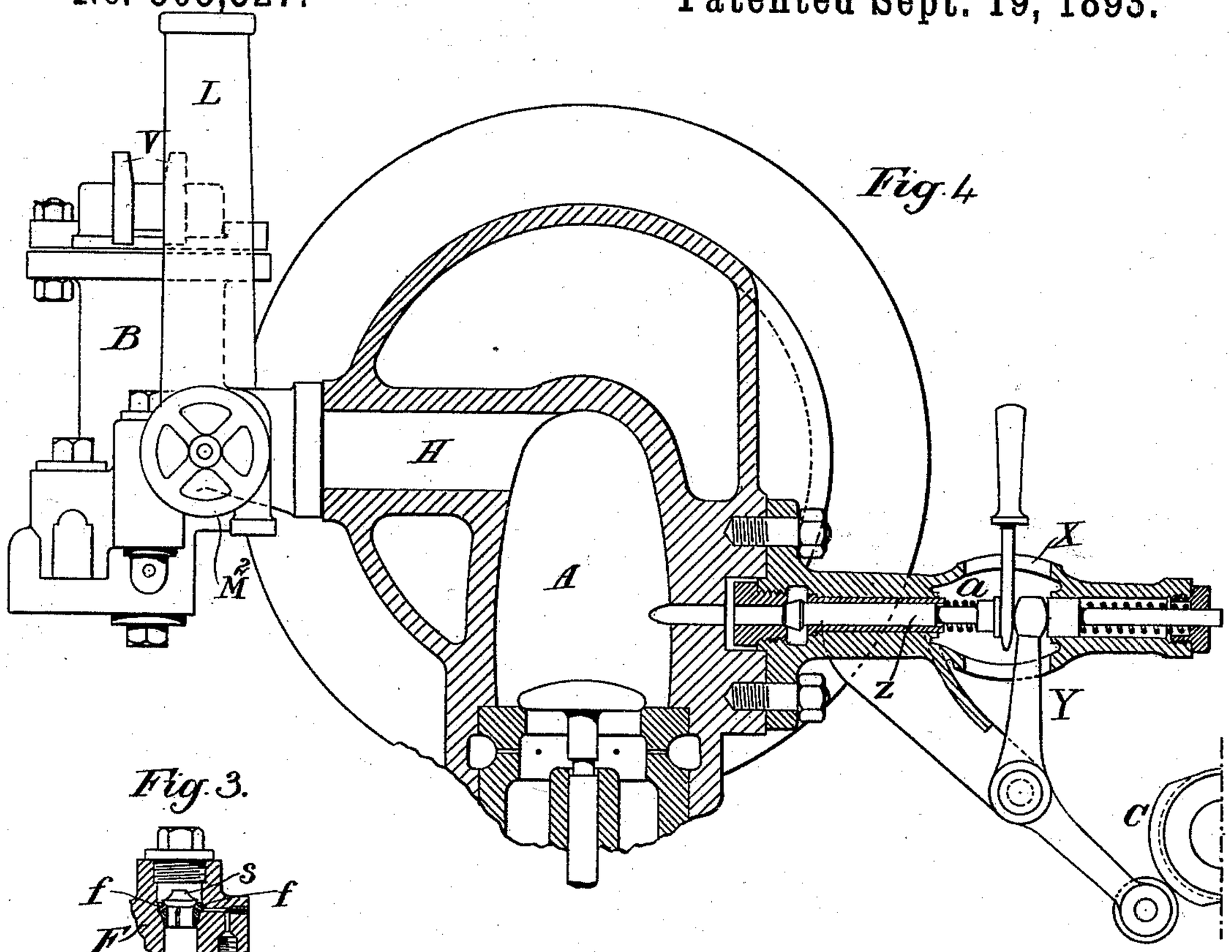
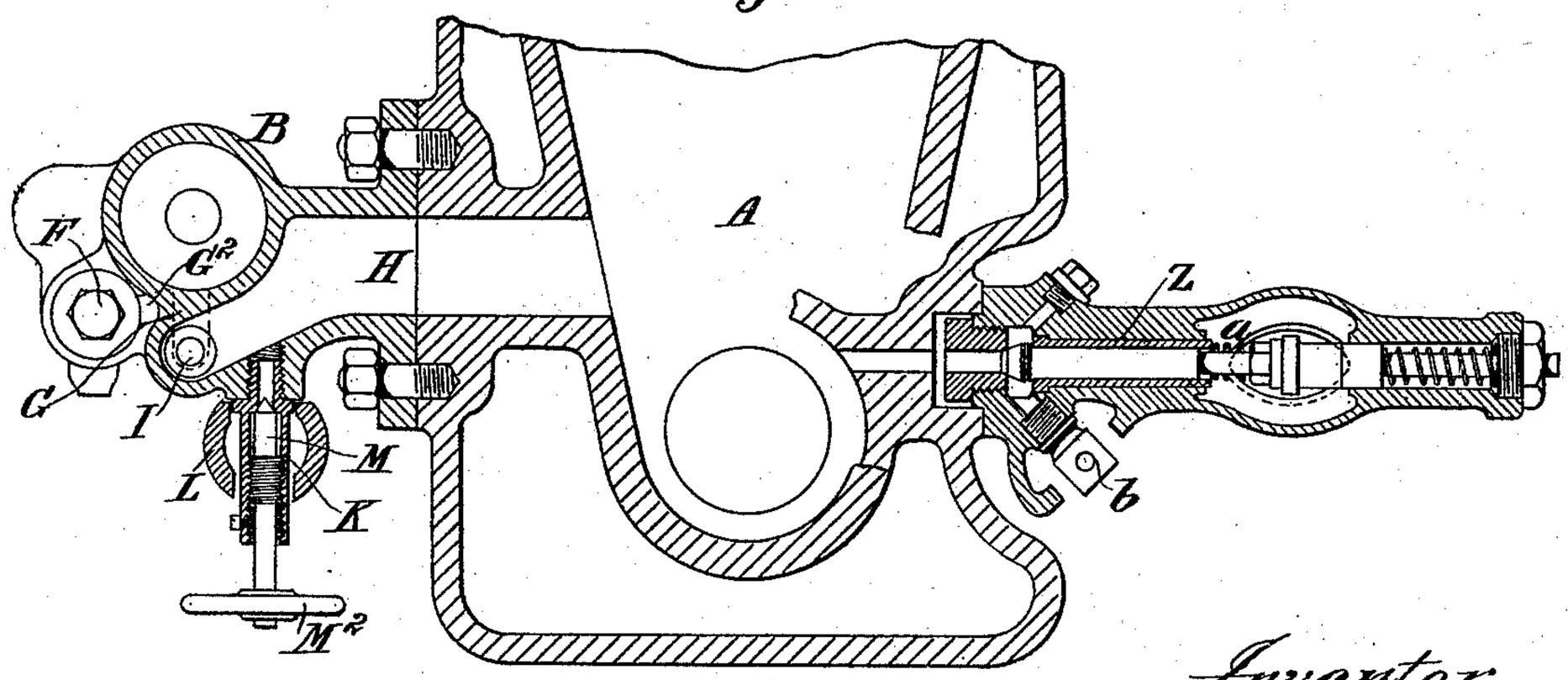


Fig. 4

Fig. 3.

Fig. 5.



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UNITED STATES PATENT OFFICE.

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GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 505,327, dated September 19, 1893.

Application filed February 13, 1893. Serial No. 462,188. (No model.)

To all whom it may concern:

Be it known that I, CHARLES WILLIAM PINKNEY, mechanical engineer, a subject of the Queen of Great Britain and Ireland, residing at 77 Raglan Road, Smethwick, in the county of Stafford, England, have invented certain Improvements in or Connected with Gas-Engines, of which the following is a specification.

My invention relates more especially to large gas engines wherein it is desirable to provide means for starting them by one explosion without the repetition of explosions necessary when the gas and air, forming the explosive charge, is at, or about, atmospheric pressure; but it may be used with gas engines of any size.

According to my invention I place a pump, or equivalent forcing device, in connection with the combustion chamber, by which pump, or like device, I can force a mixture of gas and air into the combustion chamber until there is obtained an explosive charge of a pressure sufficient to enable the explosion of the one charge to effect the starting of the engine (say for instance ten pounds to the square inch above atmospheric pressure) and I provide, in communication with the passage by which the mixture is delivered from the pump to the combustion chamber, or in other suitable place, a passage (which can be controlled by a valve or cock) leading to an ignitor. As there is already air in the combustion chamber I may at first force in a strong mixture of air and gas and just before the explosion is to occur reduce the strength of the mixture being pumped so that it becomes explosive at the time the desired pressure is reached. The explosion then takes place and starts the engine by causing an impulse sufficient for the purpose and thereafter the ordinary supply and ignition arrangements for normal working are brought into action.

A convenient arrangement according to this invention consists of a pump with inlet and discharge valves for drawing in the gaseous mixture and passing it through a passage to the combustion chamber with which passage the ignitor communicates. The inlet for the gas is preferably made through a number of perforations around the seat of the gas and air inlet valve so that the gas and air are properly mixed. The pumping is continued until sufficient of the mixture of gas and air is forced into the combustion chamber to give the requisite pressure to enable the explosion of the one charge to start the engine. If the mixture first pumped in has been a strong mixture the quantity of gas is reduced (by partly closing a cock on the gas supply pipe) toward the end of the pumping to make the mixture in the passage with which the ignitor communicates explosive when the necessary pressure is reached. A relief valve may be provided it being "weighted" so as to open when the necessary pressure is reached and give a signal that such pressure is reached. The gaseous mixture will then be ignited and an explosion will occur of sufficient force to start the engine. When the engine is started the passages from the pump, and to the ignitor if necessary, are closed. The closing of the passage from the pump can be effected by holding the outlet valve to its seat, or a special valve may be provided for the purpose in the passage leading into the combustion chamber. The pump may be either single, or double acting. And in order that my said invention may be fully understood I shall now proceed more particularly to describe the best means with which I am acquainted for carrying it into effect and for that purpose shall refer to the several figures on the annexed drawings the same letters of reference indicating corresponding parts in all the figures. I do not however limit myself to the precise details which I now describe and illustrate.

Figure 1 is a sectional elevation of the pump. Fig. 2 is a plan of the same. Fig. 3 is a sectional view of the gas and air inlet valves detached. Fig. 4 shows the pump in elevation attached to the combustion chamber of the engine the said combustion chamber being shown in section, and Fig. 5 is a horizontal section through the pump, combustion chamber and ignition tube. Fig. 6 shows an arrangement which may be applied to the engine to keep the crank in the most advantageous position for starting.

A is the combustion chamber of the engine, B the pump cylinder and C the pump piston, or plunger, connected by a rod D, to a lever E, by means of which the piston is reciprocated in the cylinder B.

F is a valve through which gas and air are admitted to the pump cylinder.

G is a passage leading from the interior of the pump cylinder B to a passage H communicating with the combustion chamber A.

I is a valve between the passages G and H to prevent the explosive mixture forced into the combustion chamber by the pump from re-entering the pump cylinder.

K is an ignition tube preferably heated by means of a Bunsen burner contained in a chamber or chimney L. The tube K is in communication with the passage H and is provided with a screw valve M opened and closed by means of a hand wheel M^2 for admitting, when required, the explosive mixture from the combustion chamber into the heated tube K to explode the charge to start the engine.

N is a relief valve in the pump cylinder B which valve remains closed until the required pressure is pumped into the combustion chamber but which will open and allow air and gas to escape to relieve any additional pressure and to notify the attendant that the charge in the combustion chamber has been pumped to the necessary pressure. This valve may be weighted to open only at the required pressure by a spring O compressed more or less as required by means of a screwed plug P. To start the engine the piston and crank of the engine are placed in position most suitable for starting, the combustion chamber A being then full of air at atmospheric pressure. The lever E of the pump is then raised from the position shown by full lines in Fig. 1 into the position indicated by the dotted line E^2 thereby raising the piston C in the cylinder B. By the upward movement of the piston C a mixture of gas and air is drawn into the cylinder B the air entering by the passage Q Fig. 3 and the gas entering by the smaller passage R and small orifices *f* in the valve seat the mixture passing by the valve F into the chamber S and thence by the passages G^2 and G into the pump cylinder B, the said gas and air becoming thoroughly mixed in their passage to the said cylinder. The charge of gas and air thus drawn into the cylinder B by the upstroke of the piston C is, by the descent of the said piston, forced through the passage G and past the valve I into the passage H leading to the combustion chamber A, the inlet valve F, resting upon its seat and preventing the mixture of air and gas from passing back therethrough. Another charge of mixed air and gas is then similarly drawn into the pump cylinder and forced into the combustion chamber, this being repeated until the required pressure in the combustion chamber is reached which will be notified by gas and air under any additional pressure escaping past the relief valve into the atmosphere or into the exhaust pipe of the engine. The combustion chamber being thus charged to the required pressure the pumping operation is stopped and the valve M may then be opened by means of the hand wheel M^2 so as to permit of a portion of the explosive mixture from the combustion chamber entering the ignition tube K which has been previously heated by the Bunsen flame in the chamber or chimney L and thereby cause an explosion of the charge in the combustion chamber which will give sufficient impetus to the piston of the engine to start it by imparting motion to the crank and fly wheel and bring into action the ordinary gear for operating the engine. The piston C of the pump B when in its lowest position covers the passage G by which the explosive mixture enters the said cylinder and it also presses on the relief valve N so as to force the said valve from its seat in which position it may be retained by means of a pin U inserted in the upper hole or holes provided in lugs V on the pump cylinder B the said pin being over the top of the lever E so as to prevent the said lever and consequently the piston C from being raised. By thus keeping the relief valve open when the engine is ready to be started, or while the engine is at work, any of the explosive mixture that may leak past the valve I into the passage G will not act on the under side of the piston C, but will fill the said passage G. Should any of the pressure leak past the piston C into the pump cylinder it will escape through the relief valve N into the atmosphere or into the exhaust pipe of the engine. When the pump is in use for charging the combustion chamber the piston C may be prevented from coming into contact with the relief valve N by removing the pin U from the upper hole in the lugs V and inserting it in the lower hole or holes W so that the under side or edge of the lever, when the piston C is making its down stroke, will come against this pin and prevent the piston from moving to its full extent so as to drive the valve N from its seat.

Instead of using the ignitor tube K for starting the engine as described the ignitor used for the ordinary working of the engine may be employed for the purpose, in which case before the explosive mixture is pumped into the combustion chamber the passage to the ignitor is closed which may be done by forcing a wedge X between the upper end of the lever Y and the valve Z of the ordinary ignitor so as to force the valve tightly onto its seat as shown in Fig. 4. When sufficient pressure has been forced by the pump into the combustion chamber A the wedge X is withdrawn whereupon the valve Z by the pressure in the combustion chamber and the spring *a*, will be removed from its seat and admit of communication between the charge in the combustion chamber and the ordinary ignition tube in the holder *b* to effect the explosion of the compressed charge and start the engine. The

engine will then continue to work in the ordinary manner, *c* being the cam for operating the valve Z through the lever Y. As the ignition tube and passages leading to it may be filled with inert gas, which would interfere with the contact of the explosive mixture with the ignitor, there may be a small passage from the outer end of the ignitor tube which passage may be opened, when the valve Z is released, so as to allow the inert gas to pass out into a chamber, or into the outer air.

In small engines, when the crank of the engine has been placed in the most advantageous position for starting, it is important that means should be provided to prevent it from being moved out of this position by the pressure of the mixture being forced into the combustion chamber and a simple arrangement for this purpose is shown in Fig. 6 in which *g* is an arm or lever centered at *h* to the frame or bed plate of the engine. To the outer or free end of the arm *g* is hinged another lever *i* the front end *k* of which lever is curved, or of hooked form, to engage a stud *l* (projecting from the cheek of the crank *m*) when the said crank is in the most advantageous position for starting. The rear end of the lever *i* has a recess *n* containing a spring *o* which bears on the arm or lever *g*, the said spring being of sufficient strength to keep the end *k* of the lever *i* engaged with the stud *l* on the crank until the explosion takes place. When the charge is exploded the spring *o* yields by the force of the explosion acting on the crank so as to release the said crank, the arm *g* then falling to the position shown by dotted lines. It may be held by a spring clamp *p* by which it is prevented from rising.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. In a gas engine the combination with a passage communicating with the combustion chamber, of a pump or similar device, an inlet valve between the pump and communicating passage for admitting a mixture of air and gas, and a relief valve connected with the pump, operated by excessive pressure therein when the pressure of the mixture in the combustion chamber reaches a certain predetermined limit, substantially as described.

2. The combination with a gas engine of a pump or forcing device for the purpose described, and a relief valve, and a projection on the piston of the forcing device for opening the said valve and means for keeping the said valve open when the engine is to be started or is at work and for preventing the said projection opening the said valve when the pump is forcing in the starting charge substantially as hereinbefore described.

3. In a gas engine the combination with means for forcing a starting charge into the combustion chamber, of the crank arm, and means for holding the latter in the proper position for starting consisting of a rod carrying a spring actuated catch engaging a projection on the crank arm whereby the latter is released upon the explosion of the starting charge, substantially as described.

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

CHARLES WILLIAM PINKNEY.

Witnesses:

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EDWARD J. HODGKINS,

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