(No Model.) 3 Sheets—Sheet 1.

L. H. NASH.

IGNITOR FOR GAS ENGINES.

No. 386,213. Patented July 17, 1888.

Fig. 1

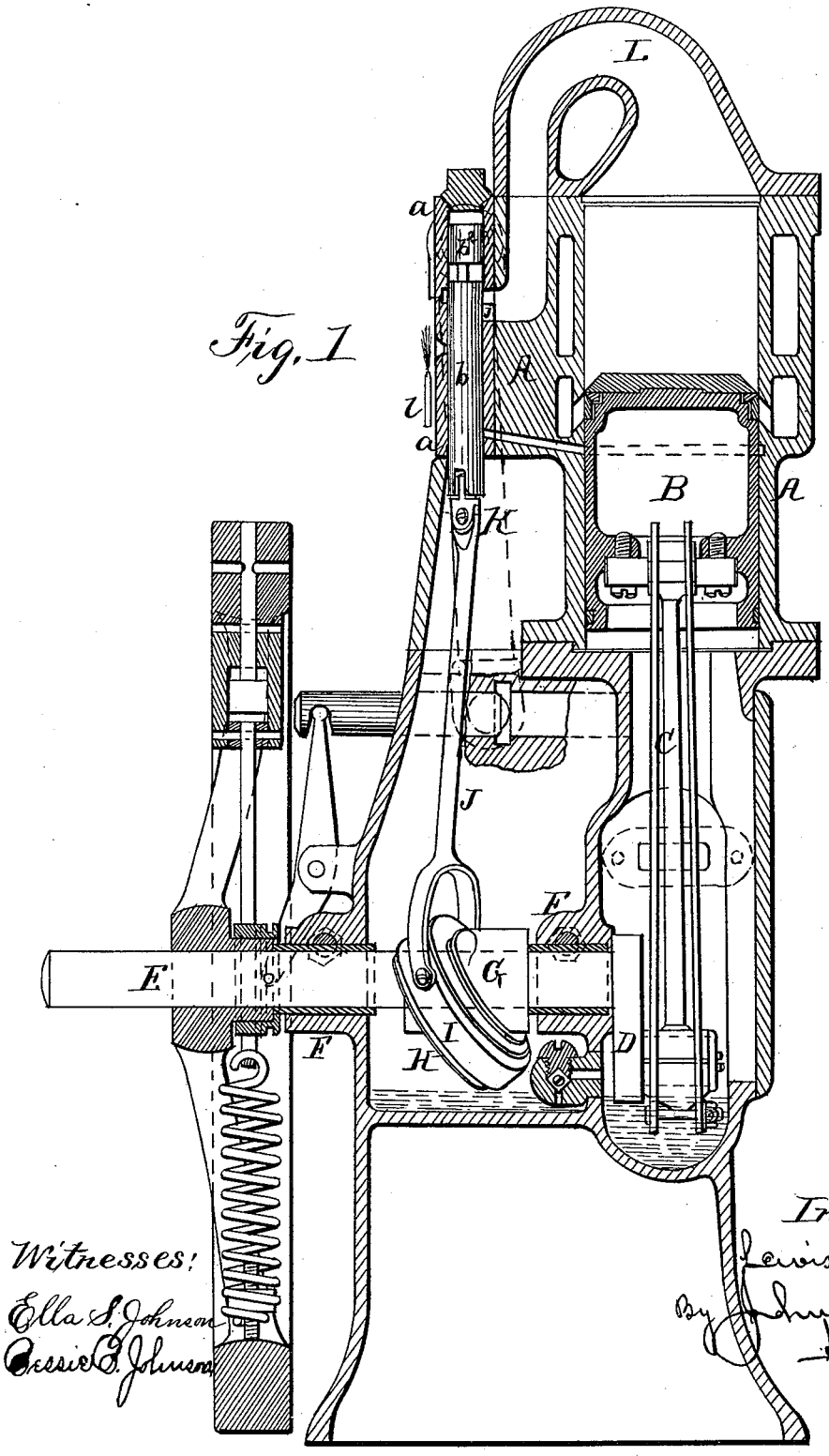

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Fig. 2.

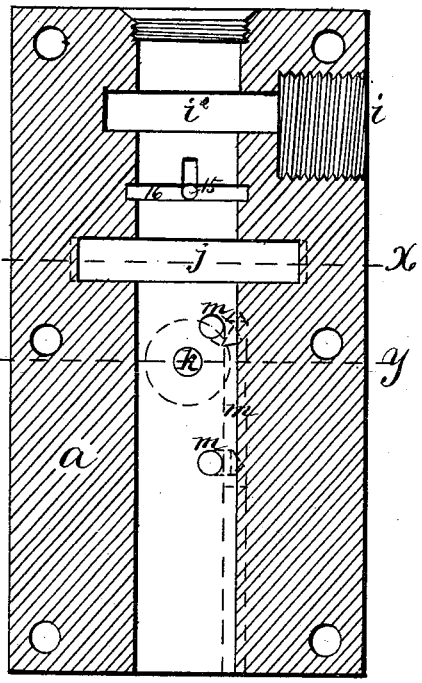


Fig. 3.

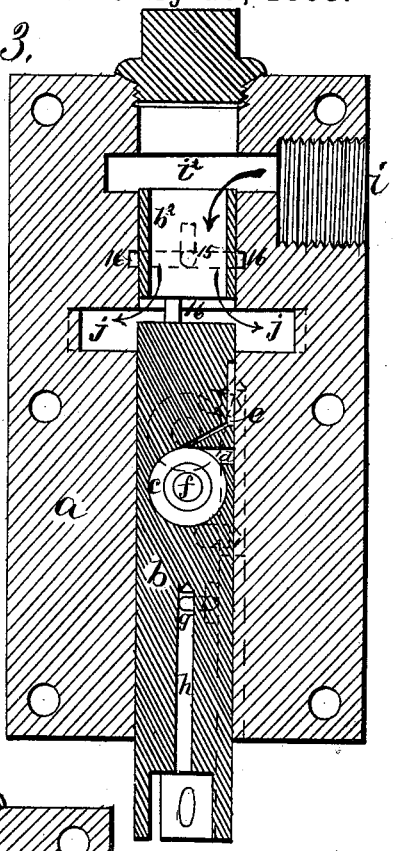


Fig. 5.

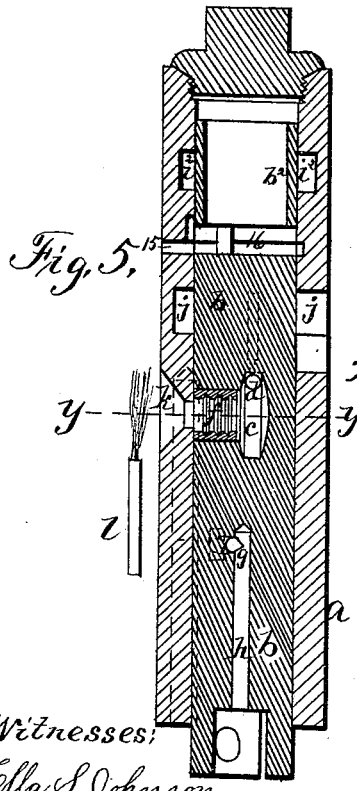
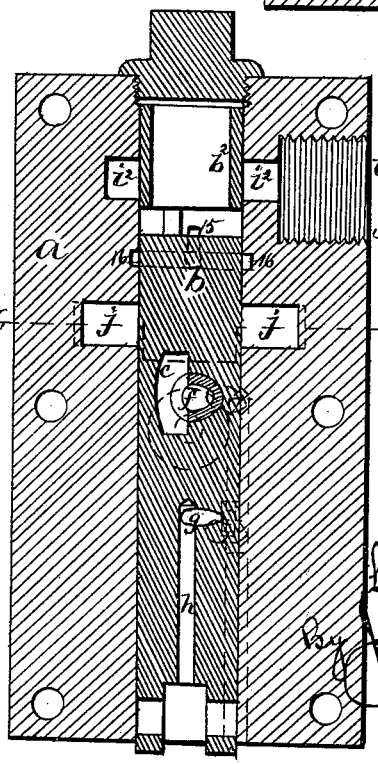


Fig. 4.



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(No Model.) 3 Sheets—Sheet 3.

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Fig. 6.

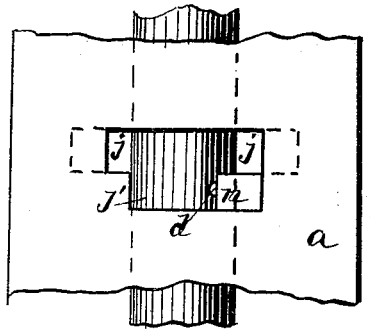


Fig. 6

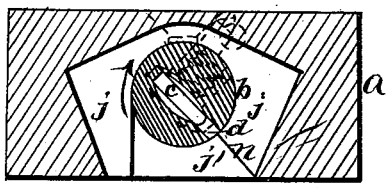


Fig. 7

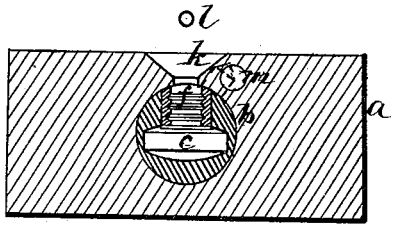


Fig. 8.

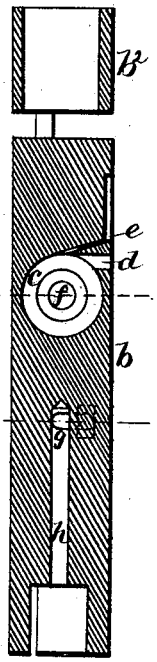


Fig. 9.

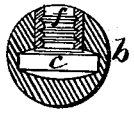


Fig. 10.

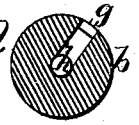


Fig. 11

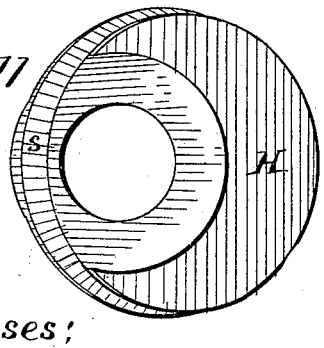
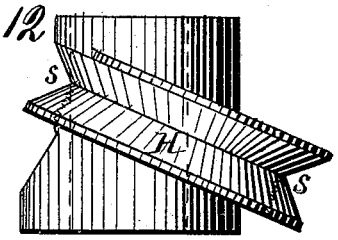


Fig. 12.



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UNITED STATES PATENT OFFICE.

LEWIS HALLOCK NASH, OF BROOKLYN, ASSIGNOR TO THE NATIONAL METER COMPANY, OF NEW YORK, N. Y.

IGNITOR FOR GAS-ENGINES.

SPECIFICATION forming part of Letters Patent No. 386,213, dated July 17, 1888.

Application filed October 6, 1886. Renewed July 14, 1887. Serial No. 244,259. (No model.)

To all whom it may concern:

Be it known that I, LEWIS HALLOCK NASH, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented new and useful Improvements in Ignitors for Gas-Engines, of which the following is a specification.

In a patent granted to me February 17, 1885, numbered 312,499, for ignitors for gas-engines, I have shown, described, and claimed an igniting device in which a combustible mixture is admitted into a circular ignition-chamber in a whirling jet, which is ignited by an external light-jet through a port at the circumference of said chamber, the communication with the exterior lighter-jet being controlled by a valve. A port centrally located in said chamber is also operated by said valve to control the communication with the charge in the power-cylinder to effect its ignition.

In an application for a patent for improvements in ignitors for gas-engines filed by me January 20, 1886, under Serial No. 189,186, I have shown, described, and claimed, among other things, an ignition-chamber provided with a jet-supply passage conveying the gases in a whirl within said chamber, and having an ignition-port formed at one side of the ignition-chamber to direct the inflowing gases in a whirling movement within said chamber, and have shown and described in such application a construction capable of carrying out my said improvement, in which the ignition-chamber is formed in a slide-valve.

In applications for patents filed by me of even dates herewith, under Serial Nos. 215,419 and 215,420, I have described and claimed, among other things, certain improvements in igniting the charge of a gas-engine in which the ignition is effected by a novel method, in which a portion of the charge flows into the ignition-chamber in one direction and the igniting-flame passes in a contrary direction through the inflow as the current ceases, whereby the communication is effected with the power-cylinder without endangering the extinguishment of the lighter-jet, and in which applications I have shown, described, and claimed an igniter of novel construction for carrying my said invention into effect.

My present improvement is more particularly directed to improvements upon the hereinbefore-referred-to ignitor in which the ignition-chamber is formed within a slide-valve. Provision is made for preventing in any suitable structure the leakage from the supply-valve fouling the supply for the engine, which provision also prevents the back passage of the flame from the combustion-chamber to the supply-reservoir.

My improvement embraces matters of construction, of combinations, and of operation in an igniter-valve, which I will now describe in connection with the accompanying drawings, in which—

Figure 1 represents in vertical central section a gas-engine having my compound operating ignitor-valve, showing its relation to the power-cylinder and to the engine-shaft. Fig. 2 shows a longitudinal central section of the valve-case, showing the ports and passages therein. Fig. 3 is a similar view showing the valve in the position to admit the charge, and Fig. 4 a similar view showing the valve in the position to ignite the charge. Fig. 5 shows a similar view taken at right angles to Fig. 4, showing the valve in the position it occupies when the flame is communicated from the external lighter to the ignition-chamber. Fig. 6 is a cross-section taken on the line $x\ x$ of Fig. 4, and Fig. 6^a shows the form of the inlet supply-opening, and Fig. 7 is a similar section taken on the line $y\ y$ of Fig. 5. The valve is shown in Figs. 8, 9, and 10 in longitudinal and in cross-sections, Fig. 9 being taken through the ignition-chamber, and Fig. 10 being taken through a port of the valve. Figs. 11 and 12 show views of the oblique eccentric.

The valve-case a has a cylindrical longitudinal valve-chamber, within which is fitted a cylindrical valve, b, within the interior body of which is formed the ignition-chamber c, having a tangential ignition-port, d, a tangential supply-port, e, and a central ignition-port, f, opening at right angles to the tangential ports, as seen in Figs. 8 and 9. The ignition-chamber is of circular form, and its ignition-port f has a bushing to give the required size to such port. A lateral port, g, opens at the side of the valve and communicates with a central longitudinal passage, h, which opens at the lower end of the valve.

The supply-passage *i* is formed at one end of the case and opens into the valve-chamber, while the engine supply-port *j* opens at the side and terminates in an annular chamber which surrounds the valve. Below the supply-port *j* the ignition-port *k* is formed, so as to communicate the flame from an external lighter-jet, *l*, to the ignition-chamber in the operation of the valve. An inclosed passage, *m*, is formed in the wall of the case and opens into the valve-chamber at two points, as seen in Figs. 2 and 7, which forms an escape for the gases from the ignition-chamber while the ignition-port for the combustion-chamber is opening. The upper end of the valve-chamber is closed by a plug.

The supply-port *j* has the inlet-opening formed with a lower enlarged part, *j'*, Figs. 6 and 6ª, in such manner as to form an angular wall projection, *n*, within the said port, into which enlarged part *j'* the ignition-port *d* of the valve opens at the point when the valve is turning in its seat to ignite the charge, and passes the edge of said projection, as seen in Fig. 6ª.

However tight the supply-valve of a gas-engine is made to work, its joint-forming contact will wear so as to permit leakage from back-pressure and foul the charge so as to seriously interfere with the operation of the engine. I provide a perfect remedy against this difficulty, so that, however badly the valve may leak, the waste gases cannot be forced back into the supply. Such provision I have shown in a plug-valve; but it may be used in any form of valve. This provision consists in providing the valve-case with a separate valve-controlled port, i^2, opening into the fuel-supply passage *i*, and a separate valve-controlled port, *j*, communicating with the combustion-chamber, and between these ports there is an escape-port, 15, which separates the joint-forming bearings of the two case-ports and is open to the outer air, as seen in Fig. 5. Such case-ports are shown as surrounding the valve, and the intermediate escape-port, 15, opens to the air through the valve-case and also incloses the valve. The valve has two separated bearing-faces, one controlling each of the said ports, and a division-space, 16, Figs. 3 and 8, is formed between said bearing-faces, into which the leaking from the valve-bearings may escape, and thus avoid all possible chance of being forced into the supply-passages, because in such position of the valve both the supply-ports are closed by the valve, as in Fig. 4, and any gases that leak by the bearing-surfaces will pass into and away through the escape-port.

In the construction shown one of the bearing-face sections, b^2, of the valve has a central passage which opens into the division-space 16, whereby to make communication between the two ports when the valve is admitting the charge to the power-cylinder. In this provision it is immaterial whether the escape-passage 15 be formed in the valve-case or in the valve, so long as it separates the joint-forming surfaces of the two supply-ports when they are closed, as shown in Fig. 4.

In the function of the valve to prevent back-pressure from the combustion-chamber fouling the charge the construction by which this is effected serves also the important function of preventing the flame from the combustion-chamber from being communicated back to the supply. In my experiments I used a lifting-valve in the supply-pipe which communicated directly with the combustion-chamber, so that the back-pressure of the gases in the combustion-chamber would act to close said valve. I found that such valve could not be relied upon, however perfect its seating, as the valve would wear out of perfect joint, and that it was also liable to collect foreign matter—such as dirt and flakes of burned oil—which would prevent its tight closing. This caused leakage, fouling the charge, as well as allowing the flame to pass under the valve and ignite the mixture in the supply-reservoir. I found that a sudden explosion of the charge in the combustion-chamber would often transmit the flame under the bearing-face of the lift-valve, however perfect its seating, and that this result would also take place from the rebound of the valve caused by the sudden impact from the explosion. I provide against this serious difficulty in the use of a lift-valve by the use of a sliding valve for controlling the admission of the charge, which can have no such rebound and no uncertain seating, and by the provision of an escape-passage for the flame should it leak by the bearing-surfaces of the valve, because, now supposing the flame to run along the joint-forming faces of the valve from the cylinder-port i^2, the flame would enter the escape passage or port 16 and pass out to the air. It would not pass beyond this escape-port into the supply-passage *j*, because the port i^2 is closed by a portion, b^2, of the valve, and because the pressure carrying the flame would end in the escape-port which separates the two supply-ports. I also found that when the pressure in the combustion-chamber had been reduced by reason of the opening of the exhaust-ports below the pressure in the supply-passage the gases from the latter would rush into the combustion-chamber and become prematurely ignited, and the flame would be transmitted under the valve back into the reservoir. My improvement overcomes this very serious defect by a valve controlled by a positive connection with the engine, and which cannot be opened by the varying pressures of the gas, but which is controlled solely by the connecting mechanism, and is only opened at the proper time.

Referring to Fig. 1, A is the cylinder. B is the piston. C is the piston connecting rod. D is the crank, and E is the crank-shaft, having bearings in the engine-frame at F.

The ignitor-valve is operated from the crank-shaft by an eccentric of peculiar construction, as I shall now describe. Upon the shaft is se-

cured a hub, G, having an eccentric-disk bearing, H, turned with its axis oblique to the axis of the shaft, and having a circumferential V-shaped groove, *s*, (seen in Figs. 11 and 12,) to receive a bearing-ring, I, to which is pivoted the valve-connecting rod J, which has a universal-joint connection, K, with said valve. It is this peculiar eccentric connection that gives the compound movement to the igniter-valve, and this peculiar motion I will now describe. It consists of a forward movement gradually twisting or turning as it advances toward the end of its stroke, at which point it is caused to have a more rapid twisting or turning motion which continues to about the middle of the length of its return-stroke, at which point it begins to twist or turn in the opposite direction and rapidly increases such turning motion at the end of such return-stroke. Then, moving again forward with the same twisting or turning movement until it reaches about the middle of the length of such forward stroke, it begins to reverse its twisting or turning movement and advances, as first stated. The valve, being in the position shown in Figs. 1 and 3, admits the charge into the combustion-chamber L, and, moving forward into the position shown in Fig. 5, brings the ports *f* and *k* into communication, and also opens communication between the valve-port *e* and the port *j'*, so that the charge is admitted into the ignition-chamber *c* in a whirling current and is lighted by the external lighter, *l*. The valve now advances to the position shown in Fig. 4, opening communication between the valve-ports *f* and *g* through the case-wall passage *m*, and also opening the port *d* with the port *j'*, as seen in Fig. 6, at which moment the valve has a motion of rotation as shown by the arrow, opening the port *d* and closing the wall-passage *m*. At this point the flame is communicated through the ports *d* and *j'* to the combustion-chamber, and the valve returns into the position shown in Fig. 3 to admit the succeeding charge.

It will be understood that the ignition-chamber may be used in a valve whose only office is to ignite the charge, while the function of admitting and discharging the gases may be performed by other valves. The case-wall passage *m* is not always necessary, and in quickly-moving valves it may be dispensed with. It will also be understood that a crank having a pin set obliquely to the line of the shaft may be used to drive the valve in cases where the connection can be made at the end of the shaft, giving the same motion as the oblique eccentric.

It will be understood that my invention is not limited to the precise devices or combinations of devices shown and described, since other equivalent structures may be employed without departing from the spirit or scope of my invention.

I claim—

1. An igniting device for gas-engines, provided with an external lighter and a plunger-valve having a circular ignition-chamber, a tangential supply-port, *e*, a tangential ignition-port, *d*, a central ignition-port, *f*, and a lateral port, *g*, in combination with an inclosing-case having the ports *j*, *k*, and *m*, substantially as herein set forth.

2. An igniting device for gas-engines, consisting of an inclosing-case having the ports *j*, *k*, and *m*, a cylindrical plunger-valve having the ports *d*, *e*, *f*, and *g*, a circular ignition-chamber, *c*. means, substantially such as described, whereby said valve is caused to have a compound movement, and an external lighter.

3. An igniting device for gas-engines, consisting of a plunger-valve having a circular ignition-chamber provided with a central ignition-port, *f*, and one or more tangential ports for supplying the said chamber, and a case having a port leading to an external lighter and a port leading to the combustion-chamber, substantially as herein set forth.

4. The combination, with an igniting device for gas engines, of a valve having a compound reciprocating and rotatory movement, and provided with suitable ports and with an ignition-chamber, substantially as described.

5. The valve-case having the annular supply-port i i^2 and the annular supply-port *j*, the ignition-port *k*, and an escape-port, 15, arranged between the said supply-ports, in combination with a plunger-valve of two parts, *b* b^2, having the circular ignition-chamber *c*, its tangential ports *d* and *e*, and a central port, *f*, and means for imparting to said valve a compound reciprocating and turning or twisting movement.

6. The combination, with a plunger-valve having two separate joint-forming faces, of a valve-case having a port, i^2, opening into the fuel-supply passage, a port, *j*, communicating with the combustion-chamber, and an escape-port, 15, opening to the air between the said ports i^2 and *j*, whereby when the latter are closed the division-space of the valve is open to the escape-port, for the purpose described.

7. The combination, with a gas-engine, of a plunger-valve and an inclosing-case therefor, having provision for supplying the charge, for igniting the same, and for preventing the back passage of the flame to the supply-port, substantially as described.

8. The plunger-valve having two joint-forming faces and an intermediate space, 16, the part b^2 of said valve having a central passage opening into the division-space, and the part *b* having a circular ignition-chamber, its tangential ports *d* and *e*, its central port, *f*, and a lateral port, *g*, and a central passage open to the air, in combination with a valve-case having the supply-ports *i*, i^2, and *j*, the ignition-port *k*, and the escape-port 15, and means, substantially such as described, for operating said valve with a compound reciprocating and turning movement, for the purpose stated.

9. The combination, with the power-cylinder of a gas-engine, of a cylindrical plunger-valve having a circular ignition-chamber hav-

ing tangential ports, and a case having supply and ignition ports, and an external lighter, with mechanism for imparting a combined reciprocating and turning or twisting movement to said valve, substantially as herein described.

10. The combination, with a power-cylinder of a gas engine, of a cylindrical plunger-valve provided with an ignition-chamber and a suitable device for causing a whirling jet of combustible mixture within said chamber, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

LEWIS HALLOCK NASH.

Witnesses:

A. E. H. JOHNSON,

BESSIE B. JOHNSON.