(No Model.) 2 Sheets—Sheet 1.

L. H. NASH.

IGNITOR FOR GAS ENGINES.

No. 386,215. Patented July 17, 1888.

Fig. 1.

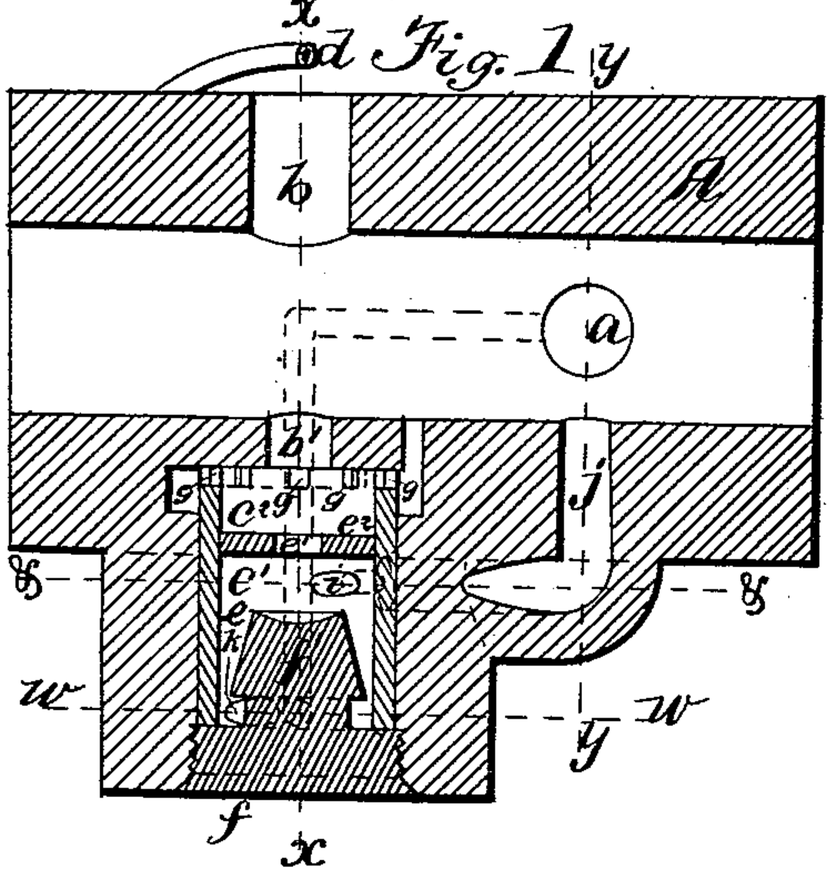


Fig. 2.

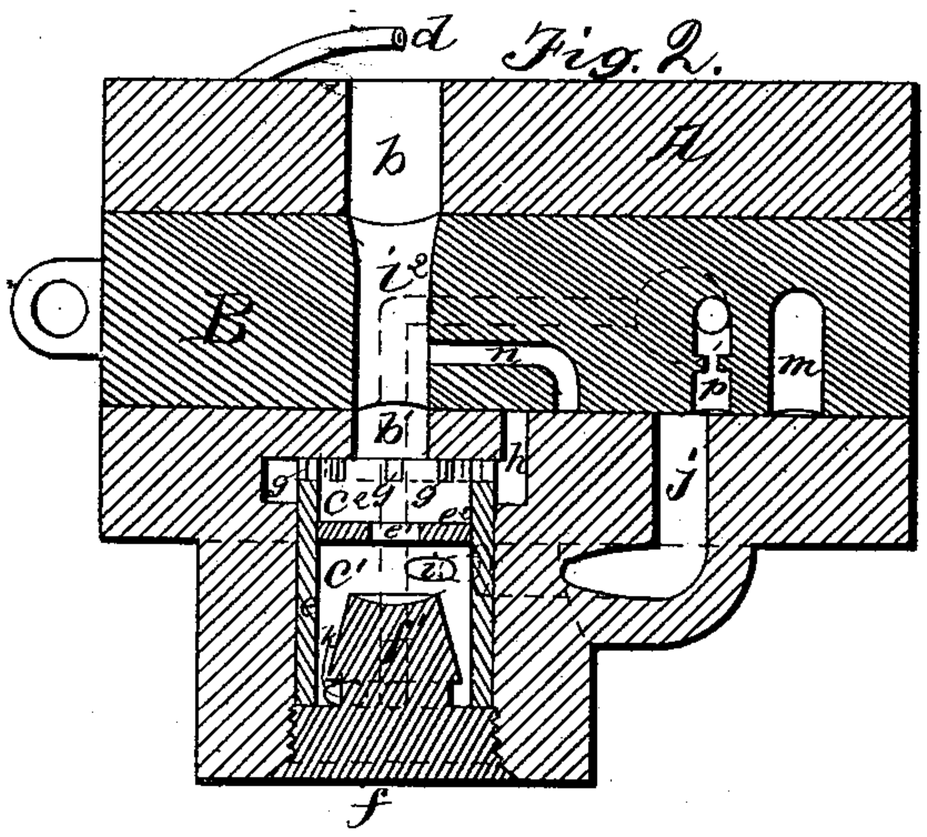


Fig. 3.

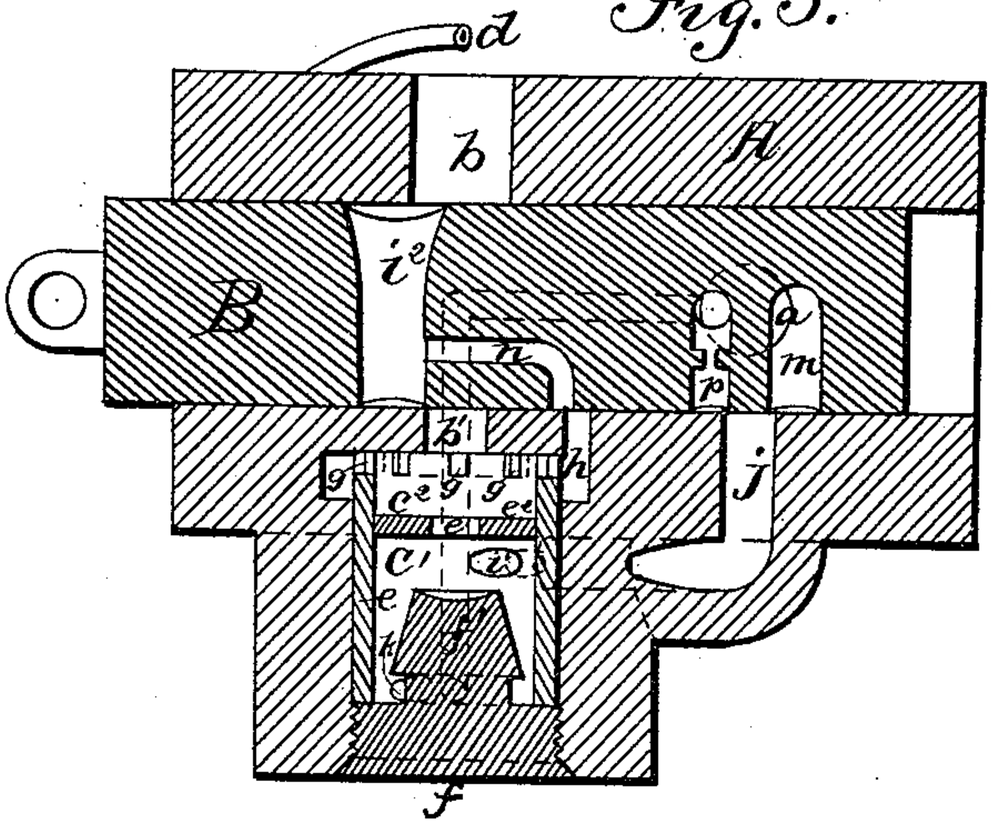


Fig. 4.

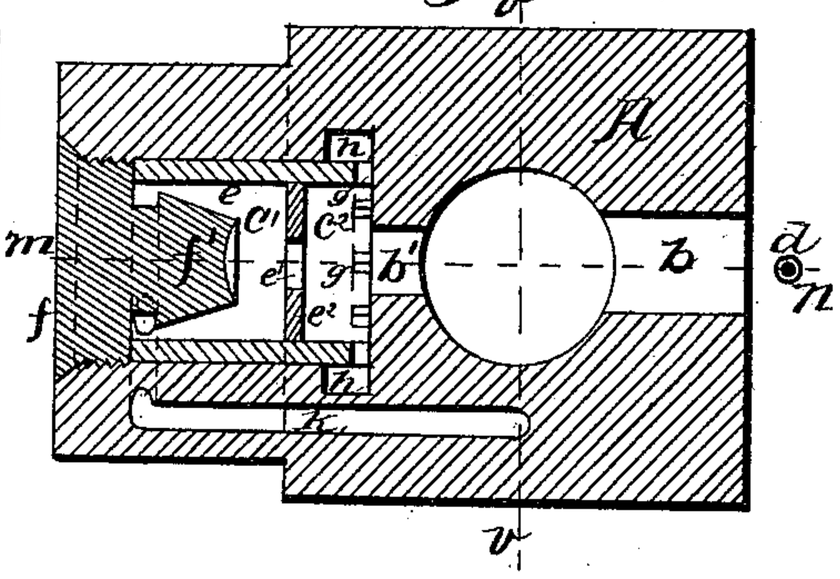


Fig. 5.

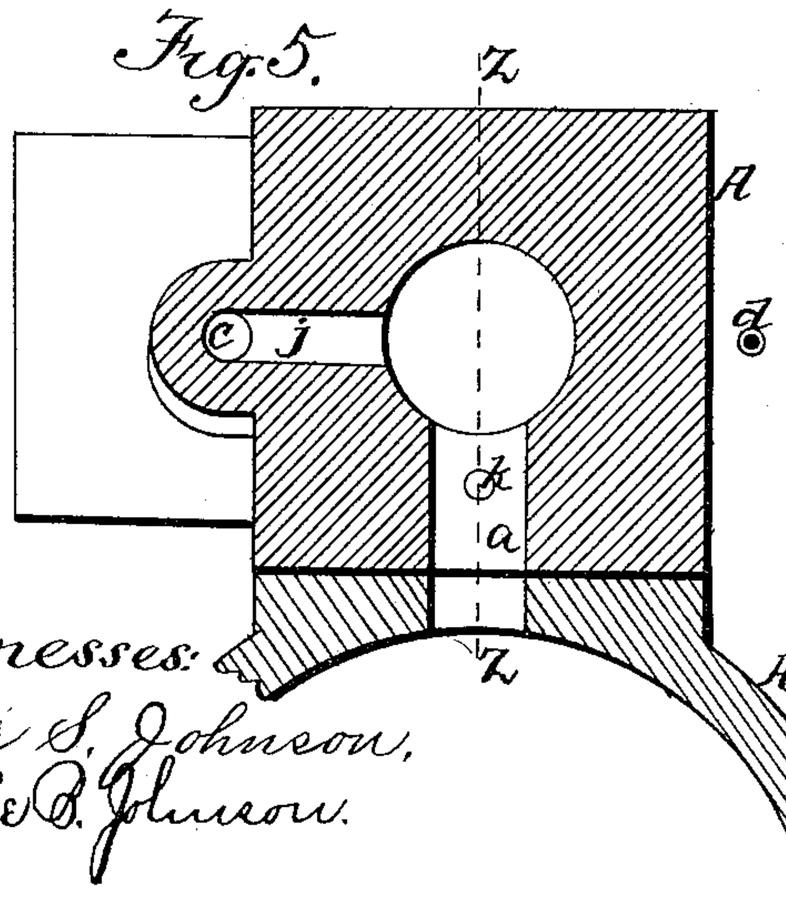
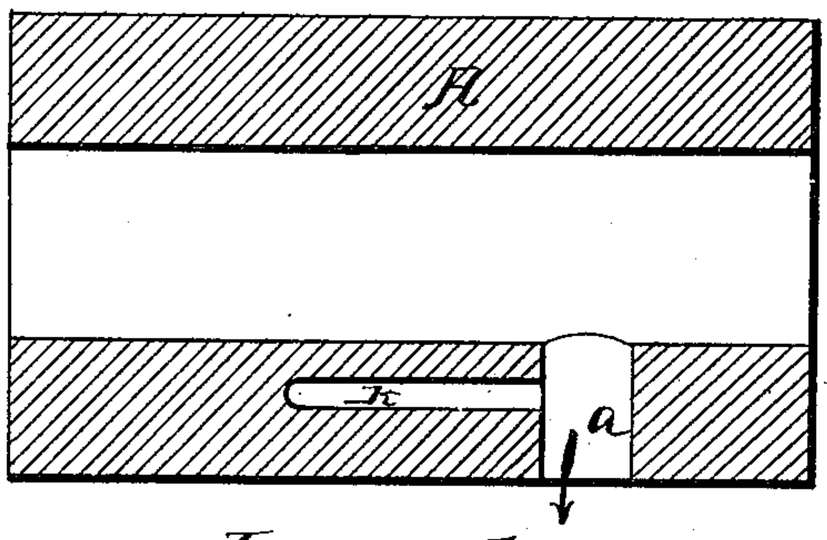


Fig. 6.



Witnesses:
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Inventor:-
Lewis Hallock Nash,
by Johnson & Johnson,
Attys.

(No Model.) 2 Sheets—Sheet 2.

L. H. NASH.

IGNITOR FOR GAS ENGINES.

No. 386,215. Patented July 17, 1888.

Fig. 7.

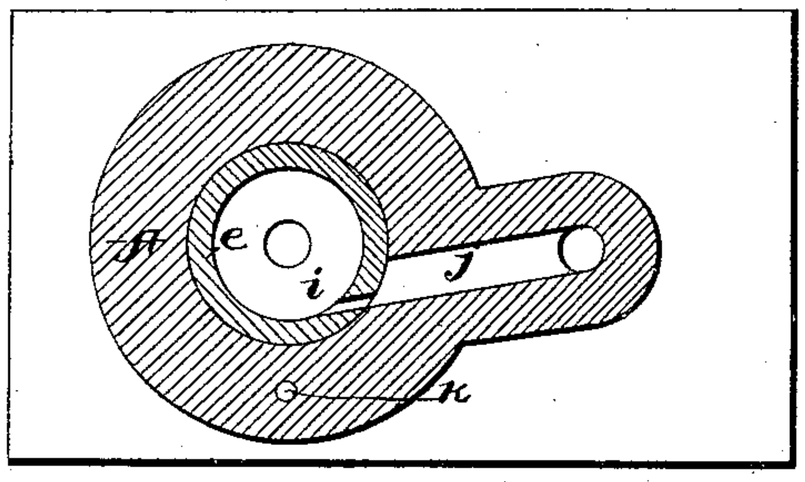


Fig. 8.

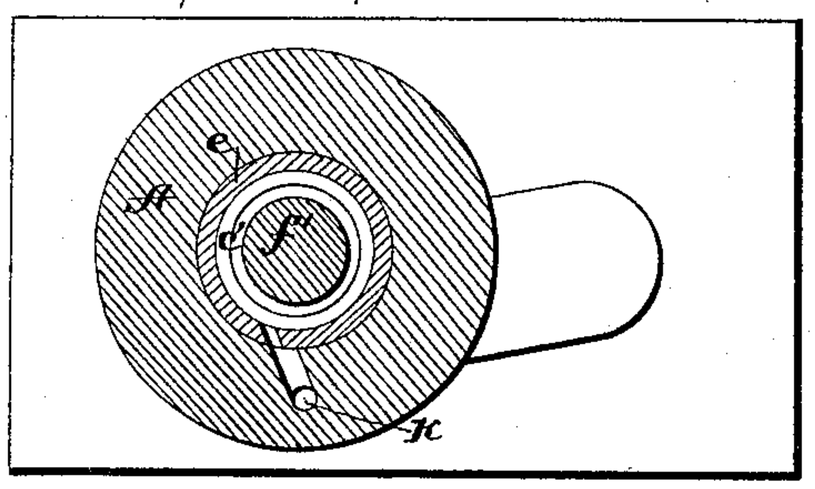


Fig. 10.

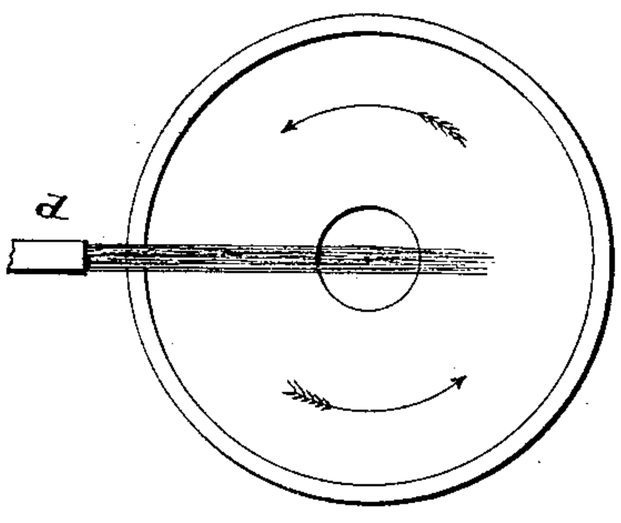
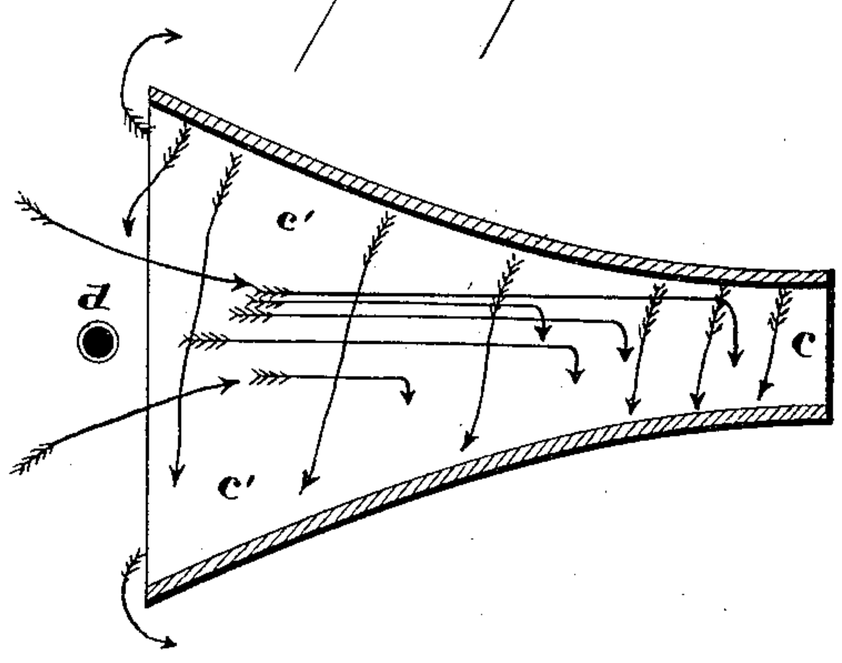


Fig. 9.



WITNESSES.

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Alley, Scott.

INVENTOR.

Lewis Hallock Nash.

By Johnson & Johnson

his Attorneys

UNITED STATES PATENT OFFICE.

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IGNITOR FOR GAS-ENGINES.

SPECIFICATION forming part of Letters Patent No. 386,215, dated July 17, 1888.

Application filed October 5, 1886. Renewed July 14, 1887. Serial No. 244,261. (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, No. 312,499, for improvements in 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 lighter-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 make communication with the charge in the power-cylinder to effect its ignition.

In my present improvement I also use an ignition-chamber which has a passage supplying it with a whirling jet, and also ports communicating alternately with an exterior ignition-jet and with the cylinder-charge controlled by a valve; and it is in connection with such whirling-jet chamber that I have so improved the operation of the passages communicating with the ignition-chamber as to cause an instantaneous flash of the flame through said ignition passages and ports when opened by the said valve, and at the same time to prevent the opening and closing of the said ports from interfering with the action of the flame in the ignition-chamber.

My present improvement is directed to a construction of the ignitor whereby gas is caused to burn with a steady flame within a chamber and to employ this flame to alternately ignite the cylinder-charge and to be ignited by an external permanent burner.

My present improvement is based upon and is the result of a long series of experiments by which the peculiar properties of the combustion of gases of various kinds under pressure have been determined and applied.

My invention, among other things, embraces an ignitor for effecting the ignition of the charge in the power-cylinder by causing the gases to flow through an ignition-passage with a tangential spiral whirling motion in a manner to create a reverse central current in said ignition-passage to transmit the flame.

My invention embraces an ignitor for igniting the charge in the power-cylinder in which the whirling motion of the escaping gases causes an inwardly-flowing central current through the center of the same passage at the same time, and it is by means of this centrally-flowing current that the flame from the external lighter-jet is instantly transmitted to the ignition-chamber.

My invention embraces an ignitor in which the flowing currents are changed from a whirl to a converging cone, while at the same time maintaining the whirling motion of the gases in the ignition-chamber and producing a steady flame.

In the accompanying drawings I have shown my improved ignitor device, which, it will be understood, can be used with any gas-engine for carrying out my invention, and which I will now proceed to describe preparatory to a specific designation of the matters and things which I claim as new for igniting a combustible charge in a gas-engine.

In the drawings, Figure 1 represents a central longitudinal section of the ignitor-case, taken on the line *m n* of Fig. 4, the valve being removed. Figs. 2 and 3 show similar views with the valve in different positions. Fig. 4 is a cross-section of the valve-case, taken on the line *x x* of Fig. 1. Fig. 5 is a similar section taken on the line *y y* of Fig. 1, showing the combustion-chamber in communication with the valve-chamber. Fig. 6 is a longitudinal central section of the valve-case, taken on the line *z z* of Fig. 5. Fig. 7 shows a section of the valve-case taken on the line & & of Fig. 1, and Fig. 8 is a section of the valve-case taken on the line *w w* of Fig. 1. Figs. 9 and 10 represent flame and jet passages, illustrating the action of the gases when issuing from a passage with a whirling motion.

The formation, shape, and location of the ignition-chamber are not limited to any special construction; and it may be either formed in the valve or in the case, or in a depression of

the joint-forming face of either, the essential feature being that it is so formed that when the gases arrive at the external jet-orifice, *b*, they will flow in such a quiet manner as to be easily lighted by said jet.

Referring to the lighter shown in Figs. 1 to 8, the construction and form are such as I prefer to use. The lighter consists of an inclosing case, A, having a cylindrical chamber, in which a plunger-valve, B, operates. The case has an ignition-port, *a*, which communicates through the valve with the combustion-chamber of the power-cylinder A′, and it has an ignition-chamber, *c′ c²*, formed in its walls, which communicates through case-ports *b b′* and through the valve with the external lighter-jet, *d*. The case-ports *b b′* are placed on opposite sides of the case-chamber and open into it in line with the ignition-chamber *c′ c²*, and the communication between them is made by means of an intermediate ignition-chamber, *c²*. The ignition chamber is formed in one side of the casing, and the external lighter is placed at the other side, and the communication between them is made direct through the valve-port *i²*.

The ignition-chamber is formed of two adjacent communicating spaces, *c′ c²*, within a bushing, *e*, inserted in the case and closed at its outer end by a plug, *f*, which has a conical extension, *f′*, entering the chamber *c²*. A plate, *e²*, within the bushing divides the ignition-chambers and has a central communicating opening. The inner end of the bushing *e* has circumferential holes *g*, which connect the ignition-chamber *c²*, by means of a case-wall passage, *h*, with the valve-chamber. The bushing *e* has a side orifice, *i*, which enters chamber *c′* tangentially and connects the latter, by means of a case-wall passage, *j*, with the valve-chamber at the same side thereof as the wall-passage *h*, so that each ignition-chamber has a separate communication with the valve-chamber. A wall-passage, *k*, also leads from the case-port *a* to the chamber *c′*, entering it tangentially between the projection *f′* and the walls of the bushing, as shown in Figs. 4 and 8. The valve has a cross-port, *i²*, which opens communication between the case-ports *b b′*, a port, *m*, which opens communication between the case-ports *j* and *a*, the port *n*, which operates the case-port *h*, and may also have the port *p* placed between the ports *m n* for making communication between the case-ports *a* and *j*.

The construction which I have described and shown of my preferred plan gives an ignitor-chamber of two communicating spaces, each having two separate and distinct passage-communications with the case-chamber and each having separate and distinct communication with valve-ports.

The function of the conical projection, which I have described as entering the ignition-chamber, and around which the gas enters the latter, is to form a conical enlarging passage for the jet issuing from the passage *k* into the chamber *c′*, and in this particular is identical in its operation with the other forms of enlarging passages, and is for the purpose of retarding the flow of the gas. It is a convenient means for forming an enlarging conical passage in a short space, whereby to effect the retardation of the flow.

The operation of the ignitor has two phases—first, the ignition of the flame in the ignition-chamber *c′* by the external burner, *d*, and, second, the ignition of the charge at the port *a* from the flame in the said chamber. The first phase in the operation is illustrated in Fig. 2, in which the valve is in a position which allows the combustible mixture from the port *a* to pass through the case-wall passage *k* and enter the ignition-chamber *c′* with a tangential whirl, passing through the hole *e′* in the division-plate *e²* into the ignition-chamber *c²*, then out through the ports *b′*, *i²*, and *b* to the lighter jet *d*. The flame then instantly flashes back into the chamber *c′*, wherein it burns with a steady torch-flame. This whirling flame is very permanent and will remain burning under all variations in the velocity of the flow of the gaseous supply. This permanent flame is due to the whirling motion of the gases, whereby the centrifugal force tends to retain them in contact with the chamber-walls. They are therefore retained in the ignition-chamber sufficiently long to be completely ignited, and the products of combustion escape from the center of the flame through the hole in the division-plate *e²* and out through the connecting-passages. An important feature of this whirling movement of the gas-jet consists in the facility which it affords to the flashing of the flame from the external burner, *d*, to the chamber *c′* through the long connecting passage. The flame is not readily communicated through a passage against the flow of the current of the combustible mixture; but the whirling motion of the escaping gases gives the advantage that while there is an outwardly-flowing circumferential current in the connecting-passage there is also an inwardly-flowing central current through the center of the same passage at the same time, and it is by means of this centrally-inflowing current that the flame from the external lighter-jet is instantly transmitted to the ignition-chamber. This operation I will now particularly describe, referring to Figs. 9 and 10, Fig. 9 showing a channel having an outwardly-flowing spiral current, as indicated by the spiral arrows.

The whirling movement of the current causes a rarefaction of the gas in the center of the whirl, which causes a current to flow inwardly, as shown by the central arrows. The instant the flame of the lighter-jet *d* is communicated to the center of this whirling current it flashes along the center of the passage to its inner chamber. The second phase in the operation of the ignitor in igniting the cylinder-

charge is shown in Fig. 3, in which the valve has closed the communication between the chamber c' c^2 and the external lighter-jet and is just opening communication between the ports a and j through the valve-port m, so that the combustible mixture passes through the port and passage j and i into the ignition-chamber c' with a whirling motion and burns therein with a whirling flame. It will continue to burn therein as long as there is a flow of the gases through the orifice i. The instant the flow ceases through said orifice the flame will flash back through it and along the passage j to the valve-port m, if the latter has been opened wide enough to permit the flame to pass through said port-opening. In order to make certain that the said port shall be wide open before the flow of the gas ceases, I provide ports g and h, which lead from chamber c^2 to the valve-port n, which is not closed by the motion of the valve until after the port b' has been closed and the valve-port m is sufficiently opened; hence, after the valve has closed port b' and opened port j, the flow of the gaseous mixture continues through the port i^2 and escapes from chamber c^2 through the wall-ports g and from the passages h, n, and b until the valves close communication therewith, when the flow ceases through the orifice i, and the flame instantly flashes from c', through ports and passages i, j, and m, to the charge in the port a.

Referring now to the ignition-chamber c' c^2 and the wall-passages g, their function is as follows: It is important that the whirling motion of the flame in chamber c' shall not be obstructed or interfered with, and so long as the valve is in the position shown in Fig. 2 the connecting-passages are all concentric and there is nothing to disarrange the whirling motion of the gases; but as the valve closes the port b' and the gases are forced to escape through a small opening with great velocity the direction of the flowing currents near said orifice is entirely changed from that of the whirl to a converging cone. The dividing-plate c^2 is provided in order to separate the conical current from the whirling, and this prevents the latter from overcoming the whirling motion in chamber c'. To still further decrease the injurious effect of the conical currents, I provide circumferential escape-ports g, from which the gases in chamber c^2 can escape. The flow of the gases through the holes g in the side walls does not have any injurious effect upon the whirling motion of the gases in the chamber c'. Referring to the supply-passages k and p, when the ignitor is operating with a combustible mixture highly compressed the mixture will be supplied to the ignition-chamber c' under a great velocity when the valve is in the position shown in Fig. 2; and in order to prevent too much of the mixture from flowing into said chamber I provide a separate source of supply at this time of much smaller capacity than that of the ignition-passage j. This may be done by separate passage, as at k, which has a separate opening into the ignition-chamber c', or it may be by passage p, which opens into the ignition-passage j, formed either in the valve or case. Wherever formed its office is to supply the chamber c' with a limited amount of the gases when the said chamber is in free communication with the external lighter, the ignition-port j being opened when the external lighter-ports, b b', are nearly or quite closed.

The escape-ports g and h may be dispensed with and still the ignitor would operate with fair result; but I prefer to use them because they render the action more certain. I may dispense with the passage k and cause the gases to enter the chamber c' by some other channel, as by a port, p, of the valve through the channel j and orifice i, the flow and operation of the gases being in all cases substantially as herein set forth.

The method herein described of igniting the charge in the power-cylinder of a gas-engine is not claimed herein, as such invention is made the subject of a separate and distinct application for a patent filed by me of even date herewith under Serial No. 244,260, and it is only the invention comprehended in the device and the combinations of elements therein that form the subject-matter of my claims herein.

My invention is not limited to the exact construction and operation of the devices described, but includes the use of equivalent devices and combinations which perform substantially the same functions. Neither is my invention limited to the conjoint or combined use of the elements described, but involves also their use separately, as indicated in the concluding claims.

Other features of invention described or illustrated, but not claimed herein, are made the subject of other pending applications.

I claim—

1. The igniting-chamber arranged to receive its supply and ignite the charge through one and the same port, i, in combination with the valve B, the external lighter, d, and the combustion-chamber, substantially as described.

2. The combination, in an igniting device for a gas-engine, of a circular ignition-chamber, a supply-passage having valved connection with the combustion-chamber of the power-cylinder, entering said ignition-chamber tangentially, and a passage having valved communication with the external lighter, operating substantially as described, for the purpose specified.

3. The combination, in a gas-engine igniting device, of a circular ignition-chamber, one or more tangential supply-passages therefor having valved communication with the combustion-chamber of the power-cylinder, and an ignition-passage opening centrally into said ignition-chamber, having valved communication with an external ignition-burner, oper-

ating substantially as described, for the purpose specified.

4. The combination, in an igniting device for gas-engines, of a circular ignition-chamber having one or more tangential supply-passages communicating with the combustion-chamber of the power-cylinder, an ignition-passage having valved communication with an external lighter, and an escape-passage for the products of combustion from the ignition-chamber, controlled substantially as described.

5. In an igniting device, the combination of an ignition-chamber formed of joining communicating spaces c' c^2, escape-ports g, and ignition-ports having valved communication with an external lighter-jet and with the combustion-chamber of the power-cylinder, operating substantially as described.

6. In an igniting device for gas-engines, the combination, with an ignition-chamber, of a port having valved communication with an external lighter, a tangential supply-passage arranged to supply said chamber when the external lighter-port is open, and a tangential ignition-passage having valved communication with the combustion chamber of the power-cylinder, operating substantially as described, for the purpose specified.

7. In an ignitor device for gas engines, the combination, with the valve B, having the ports i^2 and m, with a valve case having the ports a o and j k, and an ignition-chamber communicating with said case and valve ports, having a conical projection whereby to form an enlarging passage therein, substantially as described, for the purpose stated.

8. The combination, in an ignitor device for gas-engines, of an external lighter-jet and a valve controlling its communication with the combustion-chamber of the power-cylinder, with an ignition-chamber of two spaces, c' and c^2, having central communication with each other, a tangential communication with said combustion-chamber, and a central communication with said external lighter.

9. In an ignitor device for gas-engines, a circular ignition-chamber divided into two communicating spaces, each having passages communicating with valve-ports, substantially as described.

10. The combination, in an igniting device, of an ignition-chamber formed with a bushing, e, having one or more tangential supply-passages, i and k, a central ignition-port having valved communication with an external lighter, and passage j, having valved communication with the combustion-chamber, for the purpose specified.

11. In an ignitor device for gas-engines, the combination, with the valve B, having the ports i^2, m, n, and p, of a valve-case having the ports a, b, b', j, and h, and a circular ignition-chamber communicating with said case and valve ports, substantially as described, and for the purpose stated.

12. In an ignitor device for gas-engines, the combination, with a valve, B, having ports i^2 and m, of a case having ports a j and b b' and a passage, k, and a circular ignition-chamber communicating with said case-ports, substantially as described, and for the purpose specified.

13. In an ignitor device for a gas-engine, the combination of a valve, B, having ports i^2, m, and p, with a case having ports a, b, b', and j, and an ignition-chamber communicating with said case-ports and operating substantially as described.

14. In an ignitor device for a gas-engine, the combination, with an ignition-chamber having valved communication with an external lighter and with the combustion-chamber, of relief-ports g, h, and n, for continuing the flow of the gas while the valve is closing communication with the external lighter and opening communication with the combustion-chamber, for the purpose specified.

15. In a gas-engine, the combination of an ignition-chamber, a lighting device, a suitable device for causing a current of combustible mixture to flow from the ignition-chamber toward said lighting device, and a suitable device for causing a current to flow simultaneously toward said igniting-chamber, along which the igniting-flame is transmitted, substantially as described.

16. An ignitor device for gas-engines, consisting of an ignition-chamber provided with a passage leading to a lighting device and a passage leading to the power-chamber, combined with a suitable device for causing a current to flow toward said chamber along which the lighting-flame is transmitted, substantially as described.

17. The combination, in a gas-engine, of a power-cylinder, a lighter, an ignitor-chamber, an intermediate chamber and communicating passage, with a suitable device for causing a current of gas to flow through said passage in one direction and suitable device for causing a central current to flow therethrough in opposite direction, substantially as described.

18. In an ignitor device for a gas-engine, the combination of a retarding-passage and a device for causing a whirling jet of combustible mixture within said passage, substantially as described.

19. In combination with a power-cylinder of a gas-engine, an ignition-chamber, a lighting device, a communicating passage between said chamber and lighting device, and a device for causing a current of gas to flow through said passage in one direction and a device for causing a reverse current therein, along which the flame from the lighting device is transmitted, substantially as described.

20. The combination of an ignitor-chamber in valved communication with a power-cylinder of a gas-engine, a charge-supply valve, an ignitor, and an escape-passage in communication with said ignitor-chamber, said power-cylinder and said ignitor-chamber being intermittently in communication, and a device for causing a whirling jet of combustible mixture

within said chamber, substantially as described.

21. In a gas-engine, the combination of an ignition-chamber, an external lighter, and a device for causing a current intermittently to flow from said lighter toward said chamber, along which the lighting-flame is transmitted, substantially as described.

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

LEWIS HALLOCK NASH.

Witnesses:
H. W. BRINCKERHOFF,
WILLIAM C. WESTERVELT.