No. 844,040. PATENTED FEB. 12, 1907.

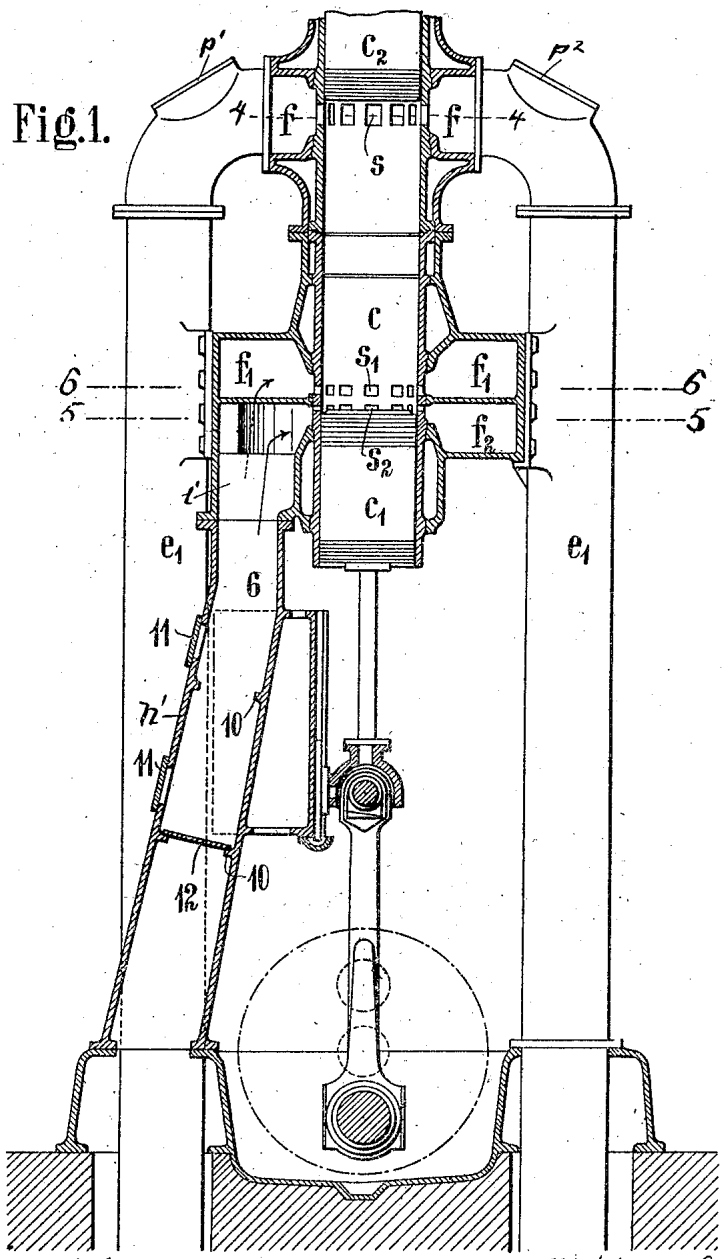
W. VON OECHELHAEUSER.

VERTICAL GAS ENGINE.

APPLICATION FILED FEB. 1, 1906.

3 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

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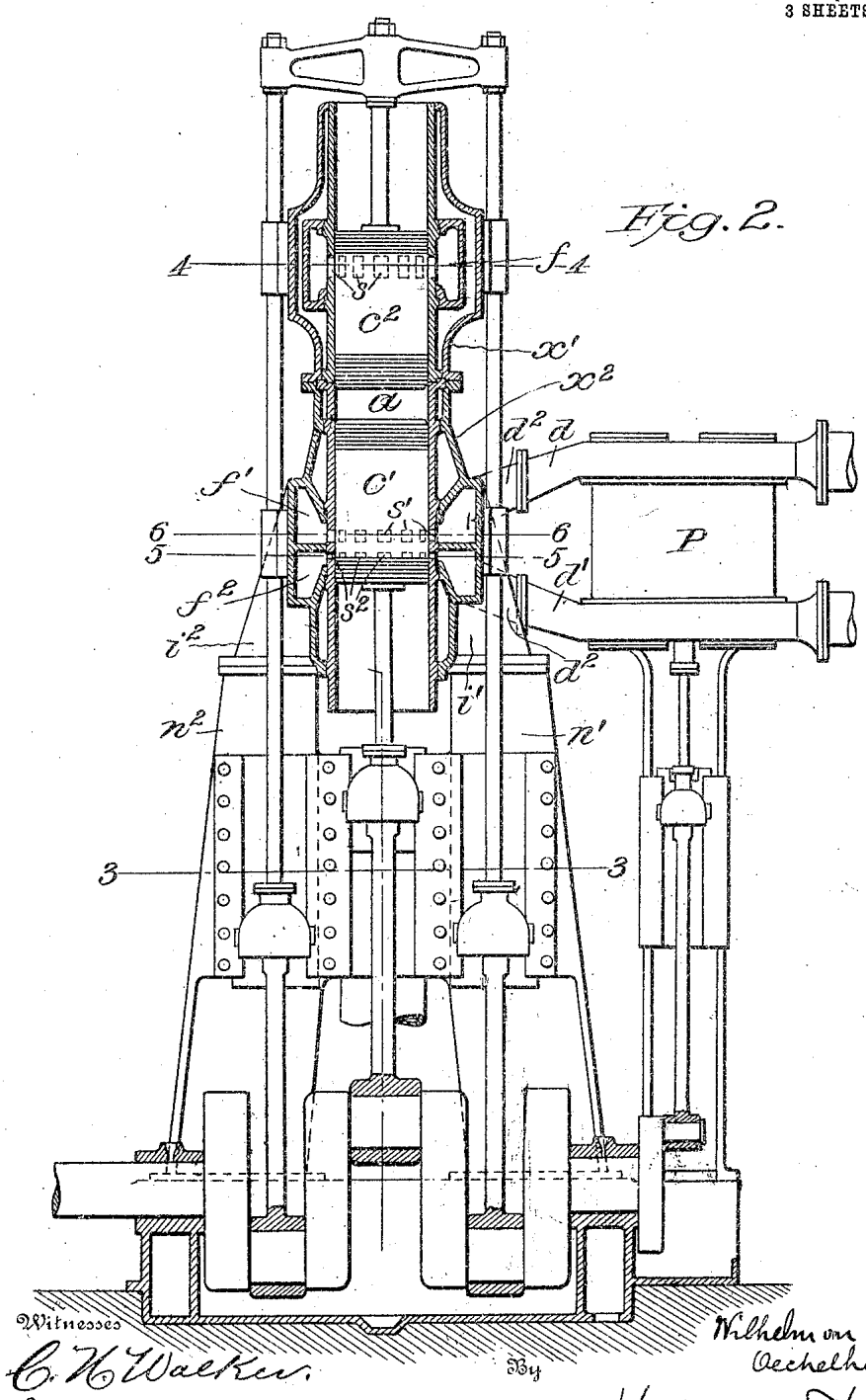
3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

Fig. 3.

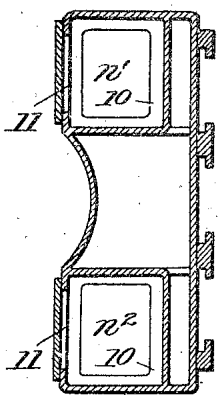


Fig. 7.

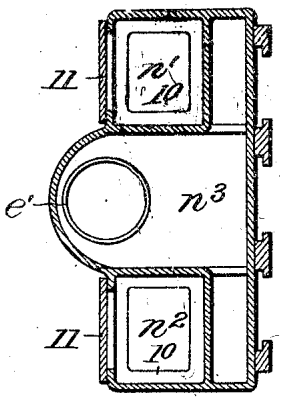


Fig. 4.

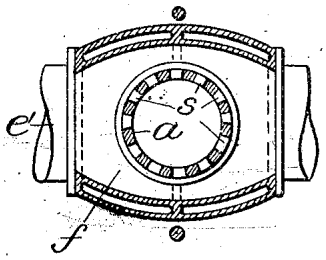


Fig. 8.

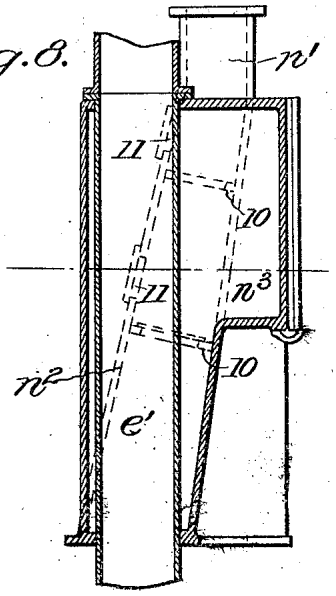


Fig. 6.

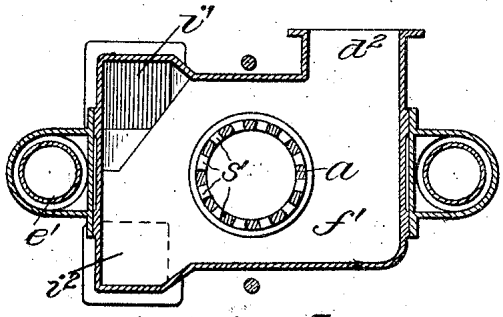
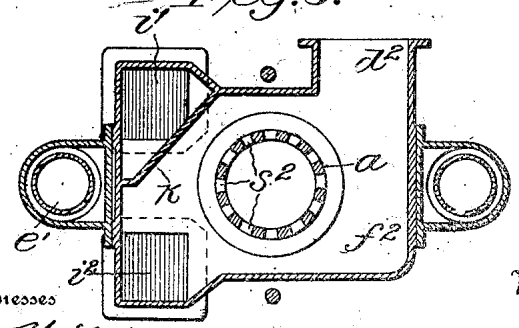


Fig. 5.



Witnesses

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UNITED STATES PATENT OFFICE.

WILHELM VON OECHELHAEUSER, OF DESSAU, GERMANY.

VERTICAL GAS-ENGINE.

No. 844,040. Specification of Letters Patent. Patented Feb. 12, 1907.

Application filed February 1, 1906. Serial No. 299,006.

To all whom it may concern:

Be it known that I, WILHELM VON OECHELHAEUSER, a subject of the King of Prussia, residing at Dessau, Anhalt, Germany, have invented Improvements in Vertical Gas-Engines, of which the following is a specification.

This invention relates to the improvements in two-cycle gas-engines of the construction shown in my prior patents, 508,833, dated November 14, 1893, and 596,613, dated January 4, 1898, but more especially to the vertical type of same.

This invention is not merely an improvement upon known inventions and constructions in the line of gas-engines, but by combining such improvements with newly-invented features overcomes the recognized difficulties of the vertical type of gas-engines and at the same time increases the efficiency of the engine, as will be more fully hereinafter explained.

In the improved engine two pistons move in opposite directions in a single working cylinder in such a way that toward the end of the expansion stroke the exhaust-ports and the inlet-ports for the gas and air are controlled by the pistons. First the one piston opens the exhaust-ports to allow the escape of the gases of combustion into the atmosphere. Then the other piston opens the air-inlet ports to allow the entry of fresh air to displace the gases of combustion in the cylinder and then opens the inlet-ports for the gas. The entering gas now forms with the entering air the proper explosive mixture. On the return stroke of the pistons the ports are closed in the reverse manner, the mixture compressed, and at the proper point of the piston-stroke the charge is ignited. The working cycle thus completed is then repeated.

The foregoing-described method of operation shows that the successive exhaust of the gases of combustion, the displacement by fresh air, and the following mixing of gas and air take place while the cylinder-space between the pistons is in communication with the atmosphere. In order to avoid any loss of gas, the displacement of the various gases must take place in a most uniform manner and is properly accomplished by the well-known arrangement of the ports in slot form around the entire circumference of the cylinder. However, the fact that the gas and air supply pipes, as well as the exhaust-pipe, in all known constructions of similar gas-engines in each case are connected to corresponding chambers around the ports at one side only makes it evident that the displacement of the various gases cannot take place in such a uniform manner as is desirable for the perfect operation of the engine. Besides, the unavoidably long channels for gas and air peculiar to their construction form receptacles which not only retard the movement of the gas into the working parts, but also cause a one-sided entrance and exit of the gases, which prevents that uniform displacement of the gases so necessary for the proper operation of this type of engine. Furthermore, the time lost by such retarded movement of the gases necessarily reduces the efficiency of the engine.

Referring especially to gas-engines of the vertical type, it is a well-known fact that the effects of the explosion, movement of masses, reaction of the exhausting gases escaping suddenly and under still a comparatively high pressure are difficult to overcome. The effect of the explosion and of the movement of masses in working parts are overcome by the arrangement of the pistons working in an opposite direction, which balances the force due to the movements of the masses and to the explosion. The unfavorable effect of the exhaust-gases due to the one-sided arrangement of the exhaust-pipe, however, is not overcome in any of the known constructions of gas-engines.

It is the object of this invention to accomplish the following results: quick and uniform removal of the gases of combustion, uniform heating of the bridges between the exhaust outlet-ports in the cylinder-wall, balancing the reaction of the exhaust-gases escaping suddenly and still under high pressure, uniform cooling of the working cylinder and the exhaust-chamber, and the symmetrical arrangement of the exhaust-chamber forming a most favorable manner of supporting, strengthening, and stiffening the various parts of the engine, thereby avoiding all special supports, frames, &c. The means to accomplish these objects, in combination with the proper arrangement and proportioning of the various parts, and the resulting improvements in the general arrangement of the engine, as well as

in the internal working conditions, are embraced in my invention, as more fully specified hereafter.

In the accompanying drawings, Figure 1 represents a vertical section through the working cylinder. Fig. 2 represents a similar section at right angles to Fig. 1 through the working cylinder with a charging-pump. Fig. 3 represents a horizontal section through the frame on line 3 3, Fig. 2. Fig. 4 represents a horizontal section through the exhaust-port on line 4 4, Fig. 1. Fig. 5 represents a horizontal section through the gas-inlet port on line 5 5, Fig. 1. Fig. 6 represents a horizontal section through air-inlet port on line 6 6, Fig. 1. Fig. 7 represents a horizontal section, and Fig. 8 represents a vertical section, through part of an engine-frame in modification.

In the working cylinder *a*, which is open at both ends, two pistons c' and c^2 move in opposite directions and toward the end of the outward and expansion stroke control the outlet and inlet openings in the following order: First, the piston c^2 opens the outlet-ports *s* for the escape of the gases of combustion into the atmosphere. At the moment the exhaust-gases drop to atmospheric pressure the piston c' opens the air-inlet ports s' to admit fresh air for removing gases of combustion and finally opens the gas-inlet ports s^2 to admit the fuel-gas, which, with the air entering through the ports s', forms the explosive mixture. On the return stroke the ports are closed in the reverse order, the inclosed mixture compressed, and at the end of the stroke ignited in the usual manner. A special and important feature of this construction is the immediate connection of the discharge-pipes $d\,d'$ of the charging-pump to the corresponding inlet-pipes $d^2\,d^2$ of the receiving-chambers $f'\,f^2$.

The working cylinder *a* is constructed, preferably, in two parts, joined and fitted into the casings x' and x^2 in the manner indicated, so as to allow for independent movement of the different parts on account of expansion and contraction. The casings, besides forming the cooling-chambers around the cylinder, also contain the receiving-chambers f' for air and f^2 for gas, as well as the exhaust-chamber *f*. The receiving-chambers are arranged around the inlet-ports and provided with means for the immediate connection of the discharge-pipes of the charging-pipes thereto, as above mentioned. The immediate connection of the discharge-spaces of the charging-pumps with the receiving-chambers thus obtained is of great importance, as the pumps discharge with every stroke gas and air direct into the respective receiving-chambers, there to be stored until admitted into the working cylinder through the rings of ports provided in the entire circumference of the cylinder-wall, as heretofore explained.

In the operation of a two-cycle gas-engine it is characteristic that charging-pumps press the gas and air into their respective receiving-chambers, and from the latter the compressed gas and air after the opening of the ports by the piston enters the working space of the cylinder. The amount of gas and air entering the cylinder, as well as the proper proportion of the mixture, depends, first, upon the size of its inlet-openings; second, upon the size of the receiving-chamber, and, third, upon the quantity of the gas and air delivered into the receiving-chambers by the pumps. The pressure of the gas and air thus treated in their respective receiving-chambers depends upon the receiving capacity of same. It is now obvious that with a change of the receiving capacity of the chambers the pressure of either gas or air can be varied, and the amount of gas and air entering the cylinder can be regulated so as to obtain the proper and desired proportion of the mixture. The possibility of such regulation is of great importance for all gas-engines where there is a possibility or necessity for using gases of different quality and with different proportions in the mixture. The advantage of this regulation becomes still more pronounced from the fact that the engine may be built according to one standard construction, and yet without any change in the construction can be accommodated to any condition of the operation and quantity of gas used.

The arrangement of the receiving-chambers around the working cylinder allows the same to be utilized as a base for the entire upper part of the engine, as is indicated in the drawings, and at the same time as a convenient and suitable connection between this upper part and the base-frame of the engine by means of the two standards or columns n' and n^2. The columns n' and n^2 are constructed hollow, and the hollow space of the column n^2 is connected direct to the receiving-chamber f^2 by means of the connecting-piece i^2. The hollow space of column n' is connected to receiving-chamber f' by means of connecting-piece i'. The connecting-piece i' occupies part of the receiving-chamber f^2 and separated from the same by the wall *k*, Fig. 5. The hollow spaces in columns n' and n^2 are thus utilized as extensions of the receiving-chambers f' and f^2. Arranged at different heights in the hollow columns n' and n^2 are projections 10, which serve for the reception of plates 12. These plates can be inserted through openings 11, which are formed above the projections 10 in the columns n' and n^2 of the engine, and can be closed by suitable covers. The plates can be secured to the projections—as by screwing,

for example—and may be packed by means of some suitable packing material—such, for example, as cement or the like. This construction and arrangement provide means whereby the size of the hollow extension-chambers can be readily varied by filling with water or the like, so that the engine can be adapted in the simplest and cheapest way to the working conditions, kinds of gas, &c., employed for the time being.

The general construction of the engine-frame and the arrangement of the chambers n' and n^2 therein can be clearly seen from the drawings. The space n^3, inclosed between and around the columns n' and n^2, serves as a cooling-chamber for the guide-surfaces and also as a cooling-jacket for the exhaust-pipe e'. (Shown in Figs. 7 and 8.) The symmetrical arrangement of the exhaust-chamber f around the exhaust-ports s, with two connections to the atmosphere by means of the removable elbows p' and p^2 and the exhaust-pipe e' and e^2, as shown on the drawings, offer a quick and uniform removal of the gases of combustion and uniform heating of the bridges between the exhaust outlet-ports in the cylinder-wall.

I claim as my invention—

1. The combination in a gas-engine, of a supporting-frame, a working cylinder having exhaust-ports, a piston in said cylinder controlling said ports, an additional wall around the cylinder near the exhaust-ports forming an exhaust-chamber, and exhaust-pipes leading from opposite sides of the chamber and forming part of the engine-frame.

2. The combination in a gas-engine, of a supporting-frame, a working cylinder having inlet-ports for gas and air, means in said cylinder controlling said ports, an additional wall around the central part of said cylinder forming an air-receiving and a gas-receiving chamber, and an extension from one of said chambers in the supporting-frame, and means for varying the capacity of said chamber.

3. The combination in a gas-engine, of a supporting-frame, a working cylinder having three rings of ports, oppositely-moving pistons controlling said ports, additional walls around said cylinder forming separate receiving-chambers for air, gas and exhaust, respectively, around said three rings of ports in said cylinder, an extension from said air-chamber in the supporting-frame, and means for varying the capacity of said extension-chamber.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

WILHELM VON OECHELHAEUSER.

Witnesses:

JOHANNES HEIN,

HENRY HASPER.