

No. 642,434.

Patented Jan. 30, 1900.

J. W. EISENHUTH.  
AIR AND GAS ENGINE.

(Application filed June 15, 1899.)

(No Model.)

Fig. 2.

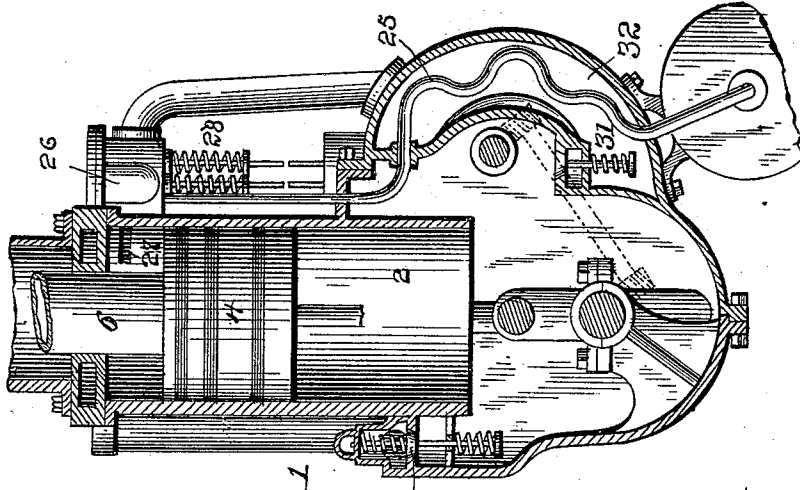


Fig. 1.

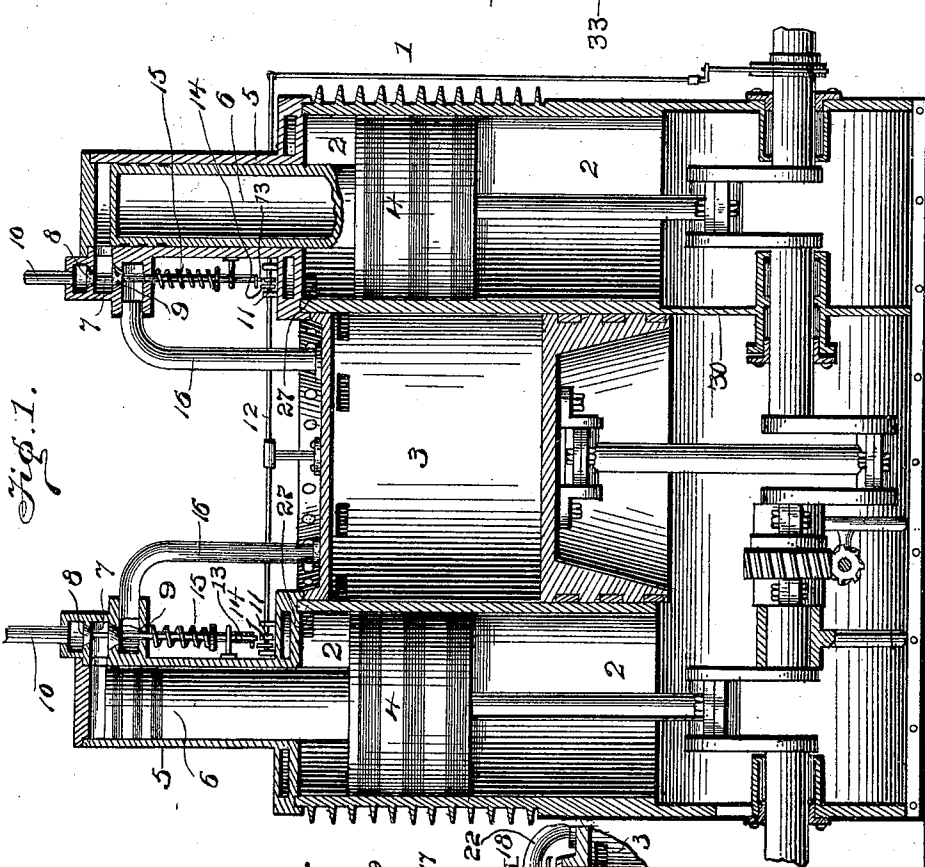
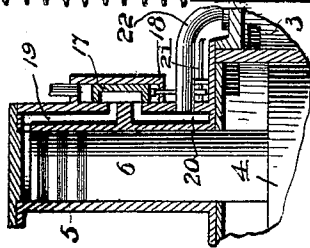


Fig. 3.



WITNESSES

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# UNITED STATES PATENT OFFICE.

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## AIR AND GAS ENGINE.

SPECIFICATION forming part of Letters Patent No. 642,434, dated January 30, 1900.

Application filed June 15, 1899, Serial No. 720,724. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN W. EISENHUTH, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Air and Gas Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to air and gas engines, and particularly to that class of gas-engines which are known as "compound" gas-engines.

It consists in an engine having high and low pressure cylinders adapted to be operated by an explosive compound, air-cylinders arranged in tandem with the gas-cylinders, and means for admitting compressed air to the said cylinders for assisting in the operation of the gas-engine.

It also consists in certain other novel constructions, combinations, and arrangements of parts, as will be hereinafter fully described and claimed.

In the accompanying drawings, Figure 1 represents a vertical longitudinal section through an engine constructed in accordance with my invention. Fig. 2 represents a vertical transverse section through one of the high-pressure cylinders of the same, and Fig. 3 represents a detail sectional view illustrating a different manner of operating one of the air-cylinder valves.

The portion of my improved engine which is adapted to be operated by an explosive mixture is the same as that described and claimed by me in another application, filed June 14, 1899, Serial No. 720,593.

1 in the drawings represents a gas-engine; 2 2, high - pressure cylinders, and 3 a low-pressure cylinder.

The explosive mixture is admitted into the cylinders 2 2 for operating the pistons 4 4, mounted therein, and suitable valves and ports controlling the said admission of the explosive compound and the conveying of the exhausted gases into the low - pressure cylinder 3 are used, as described in the application above referred to.

As illustrated in the drawings, the explosive gas mixture is introduced into the high-pressure cylinders through branch piping, as 25, which lead to valve-casings, as at 26 26. Suitable valves are located in these casings and control the admission of the explosive mixtures through the said casings into each of the high-pressure cylinders. The passages controlled by the valves are also provided with ports, as 27, which lead from each of the said passages into the low-pressure cylinder. Suitable valves, as 28, control the exhaust from the high-pressure cylinders into the said low-pressure cylinder.

The upper ends of the cylinders 2 are provided with extension-cylinders 5 5, which are adapted to receive extension-pistons, as 6 6, carried by the pistons 4 4. The pistons 6 6 are considerably smaller than the pistons 4 and are preferably made integral therewith. The upper end of each extension-cylinder 5 is provided with a valve-chamber, as 7, which is provided with an air-inlet valve 8 and an exhaust-outlet valve 9. Compressed air or other expansive agency is admitted to the valve-chamber 7 through a suitable pipe, as at 10. The stem of the valve 8 extends downwardly outside the valve-casing 7 and is adapted at its lower end to engage a cam, as 11, secured to a shaft 12, the construction being such that when the cam 11 is revolved in conjunction with the other mechanism of the engine the valve 8 will be raised at the proper time to admit air-pressure into the upper end of the cylinder 5. The exhaust-outlet valve 9 is provided with a hollow stem, as 13, which surrounds the stem of the valve 8 and is adapted to engage at its lower end a second cam 14, arranged upon the shaft 12. The valve 9 is normally held upon its seat by means of a spring, as 15, surrounding its standard and engaging a collar formed thereon. The cam 14 is so timed with respect to the operation of the engine as to raise the valve 9 when it is desired to permit the escape of the exhaust from the cylinder 5. The exhaust is conducted from the valve-chamber 7 into the low - pressure cylinder 3 by means of an exhaust - pipe 16, so that the exhaust of the air may be further utilized for assisting in the operation of the low-

pressure piston in the said cylinder. It will be noted that the shaft 12 extends from one cylinder to the other and is adapted to operate the valves of both cylinders 5 at the proper time.

5 Instead of using two valves, as 8 and 9, I may, if found desirable, employ a single slide-valve 17, as shown in Fig. 3, which is adapted to slide in the valve-chest 18. Suitable 10 ports, as 19 and 20, connect the valve-chest 18, respectively, with the cylinder 5 and the low-pressure cylinder 3. A cam upon the shaft 21 operates the slide-valve 17 in the usual manner. When the slide-valve 17 is 15 in its lower position, the compressed air or other expansive agency in the valve-chest 18 is admitted through the port 19 into the top of the cylinder 5 and will force the piston 6 20 downwardly. When the valve 17 is lifted, it will close the port 19 to the valve-chest 18 and connect it with a port 20, so that the exhaust may pass through the same and through an exhaust-pipe 22 into the cylinder 3. It will 25 be seen that pistons arranged thus upon the high - pressure cylinders, so as to operate in conjunction therewith and have their exhausts connected with the low-pressure cylinder, may be efficient aids in the operation of a compound gas - engine. The parts are 30 simple in construction and there is no need for packing-glands, the usual packing-rings only being employed upon the pistons 4 and 6 to make them snug in their respective cylinders.

35 The casing connecting the cylinders 2 2 is preferably arranged so as to completely inclose the crank-shaft of the engine. A partition, as 30, is preferably mounted in one end of the casing, so as to form a compartment in the said casing beneath one of the 40 cylinders 2. A valve, as 31, is adapted to open inwardly for admitting the exhaust from an exhaust-chamber 32, which is connected with an exhaust-pipe of the low-pressure cylinder. It will be seen that because of this 45 construction when the piston 4 moves up and down it will pump the exhaust from the chamber 32 into the casing of the engine and will then force the same out through a valve, as 50 33, suitably located in the said casing.

It will be apparent that not only compressed air but other expansive substances may be used in the cylinders 5 to assist in the operation of the gas-engine.

55 It will be observed that an engine construct-

ed in accordance with the present invention is practically a double compound engine. This is so, as will be readily seen, particularly in that it employs two gas-cylinders of high pressure and a low-pressure cylinder for 60 receiving the exhaust thereof and that it employs two air-cylinders of high pressure and also has a low-pressure cylinder into which they exhaust. It will be further observed that I use one large low-pressure cylinder to 65 receive the exhaust both from the high-pressure gas-cylinders and the high-pressure air-cylinders and that the exhaust from the low-pressure cylinder is removed by means of a vacuum-chamber, as above described. 70

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a gas-engine, the combination with a suitable casing, of high-pressure cylinders 75 formed therein, a low - pressure cylinder formed in the said casing between the high-pressure cylinders, pistons moving in the said high-pressure cylinders, reduced cylindrical extensions formed upon the said pistons and 80 extending into reduced extended portions of the cylinders, the said reduced cylindrical portions forming pistons in the said cylinder extensions, valves for admitting compressed air into the cylinder extensions for operating 85 small pistons, means for admitting an explosive mixture into the high-pressure cylinders, and means for introducing the exhaust from both high-pressure cylinders and the compressed-air cylinders into the low-pressure 90 cylinder, substantially as described.

2. In an air and gas engine, the combination of two high-pressure gas-cylinders, a low-pressure cylinder mounted between them, two 95 high-pressure air-cylinders, means for connecting the high-pressure gas-cylinders with the low-pressure cylinder and means for connecting the high-pressure air-cylinders with the said low-pressure cylinder, the construction being such that each of the high-pres- 100 sure gas-cylinders and air-cylinders will exhaust into the said low-pressure cylinder, substantially as described.

In testimony whereof I hereunto affix my signature in presence of two witnesses.

JOHN W. EISENHUTH.

Witnesses:

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C. H. GRAHAM.