(No Model.) 3 Sheets—Sheet 1.

C. W. BALDWIN.

GAS ENGINE.

No. 407,320. Patented July 23, 1889.

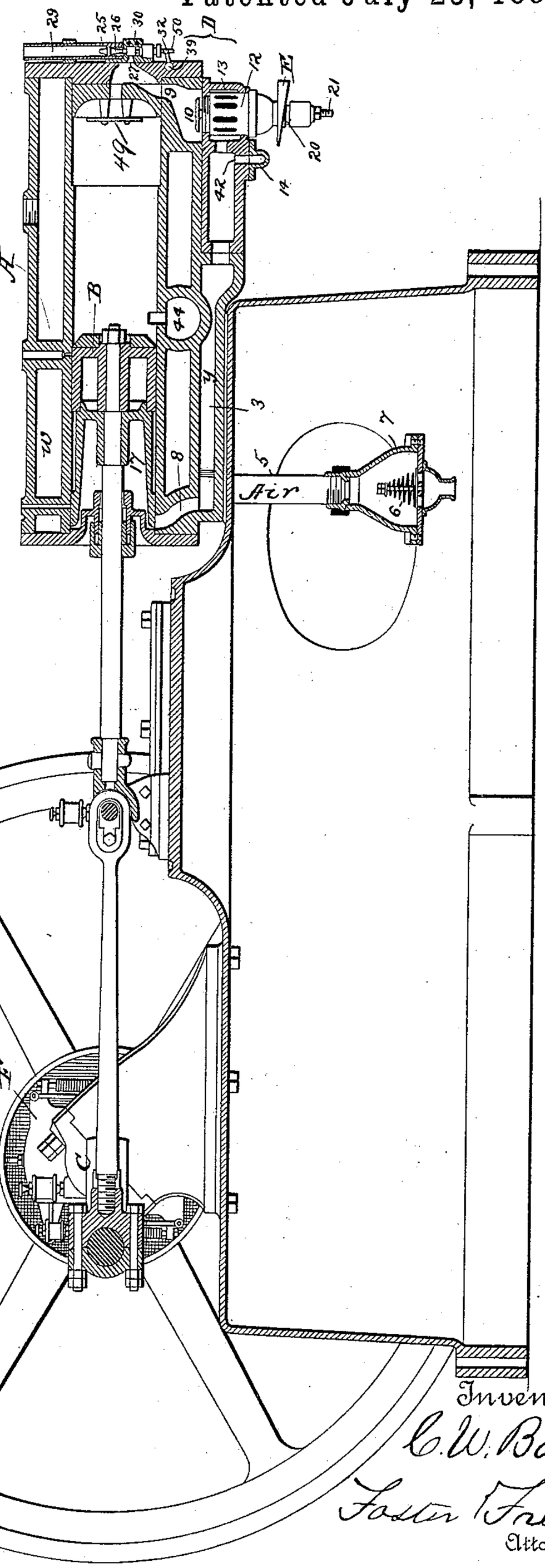

Fig. 1.

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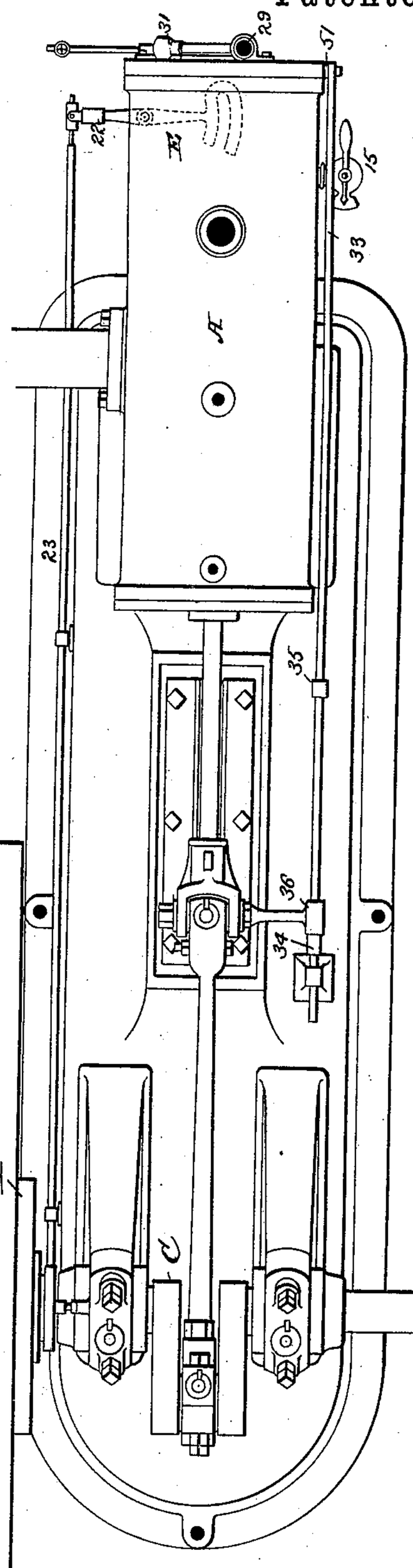

Fig. 2.

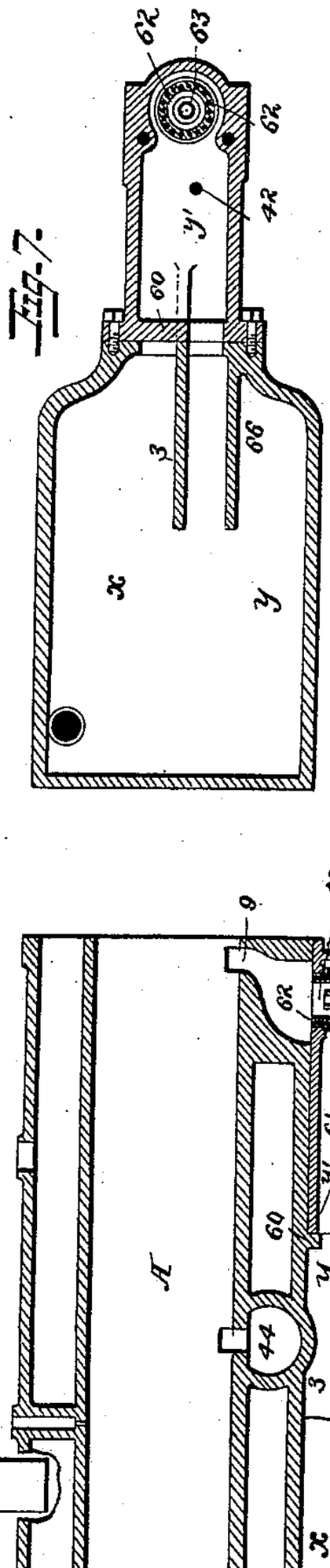

Fig. 7.

Fig. 8.

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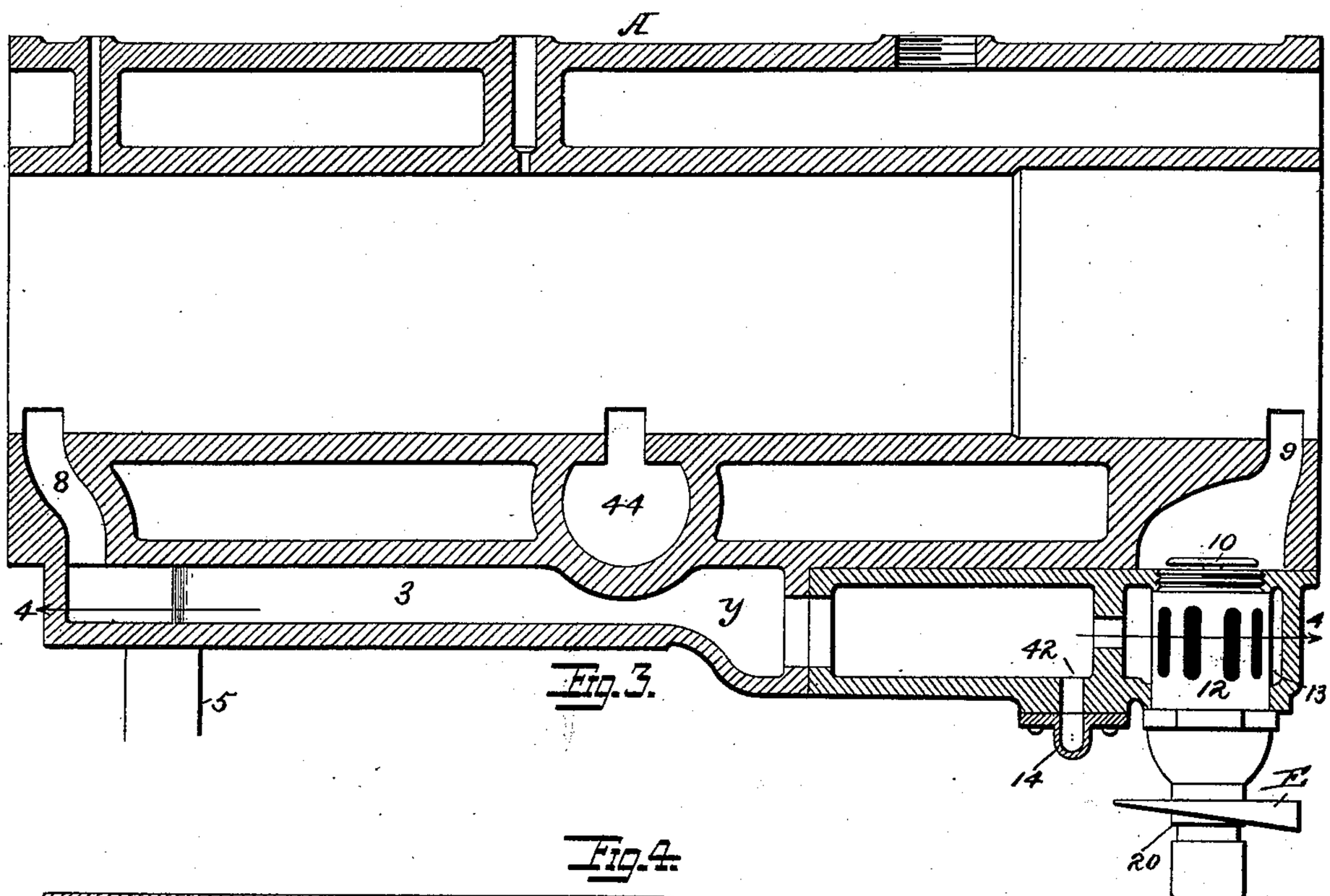

Fig. 3.

Fig. 4.

Fig. 5.

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UNITED STATES PATENT OFFICE.

CYRUS W. BALDWIN, OF YONKERS, NEW YORK, ASSIGNOR TO WILLIAM E. HALE, OF CHICAGO, ILLINOIS.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 407,320, dated July 23, 1889.

Application filed July 23, 1888. Serial No. 280,735. (No model.)

To all whom it may concern:

Be it known that I, CYRUS W. BALDWIN, a citizen of the United States, residing at Yonkers, Westchester county, New York, have invented certain new and useful Improvements in Gas-Engines, of which the following is a specification.

My invention relates to gas-engines in which the piston is operated by the explosions of a mixture of air and gas introduced in successive charges; and my invention consists in constructing the engine as fully set forth hereinafter, and illustrated in the accompanying drawings, in which—

Figure 1 is a longitudinal sectional elevation of a gas-engine constructed in accordance with my invention. Fig. 2 is plan view; Fig. 3, a longitudinal section of the cylinder; Fig. 4, a sectional plan on the line 4 4, Fig. 3; Fig. 5, a section on the line 5 5, Fig. 4; Fig. 6, a longitudinal section through the cylinder, showing a modification; Fig. 7, a sectional plan on the line 7 7, Fig. 6.

The cylinder A is supported upon the bed, and the piston B is connected by the piston-rod and connecting-rod with the crank of a shaft C. A hollow casing D below the cylinder is divided by a partition 3 into two chambers *x* and *y*, communicating near their forward end, the chamber *x* communicating with an air-inlet port 4, to which leads a pipe 5, having a valve-casing 7 and inlet-valve 6 at the outer end, and a port 8 leads from the chamber *x* to the forward end of the cylinder.

At the rear end of the cylinder is a port 9, passage to which is closed and opened by a valve 10 above a valve-casing 12, which communicates with the chamber *x* through a passage 13, Figs. 3 and 4, with which passage also communicates the rear end of the chamber *y*. Gas is admitted to the rear end of the chamber *y* through a port 42 and gas-pipe 14, provided with a cock 15 and check-valve 16.

The cylinder A is provided with an exhaust-port 44 at the lower side near the center, and the extension 17 of the piston is of such a length as to cover this port when the piston is at the end of its rearward movement, and an annular space *w* around the piston permits any gases leaking round the piston to escape to the exhaust instead of finding their way to the forward end of the cylinder.

The cylinder is provided with a suitable ignitor at the rear end, as will be hereinafter more fully described. When the piston moves to the rear, the air will be drawn into the forward or pump end of the cylinder through the casing 7, pipe 5, and ports 4 and 8, and a smaller quantity of gas (determined by the position of the cock 15) will be drawn by the same action of the piston into the rear end of the chamber *y*. As the piston moves forward, the air will be expelled from the pump end of the cylinder into the chambers *x* and *y*, the greater portion passing along the chamber *x* and passage 13 to the valve-casing 12, and a smaller portion carrying with it the gas from the chamber *y* into the casing 12, and from the latter the mixed air and gas, now forming an explosive mixture, passes through the port 9 into the rear end of the cylinder, where it is exploded as the piston reaches its rear position. By thus drawing in regular but separated quantities of air and gas and keeping them separated until the charge is needed, and then thoroughly mixing them on their way to the cylinder, premature explosions, liable to result when a mixture is stored for any time, are absolutely prevented. Different arrangements of chambers may be employed, into which the air and gas are drawn separately and from which they are expelled and brought together on their way to the cylinder, all by the action of the piston B without intervening valves.

To further regulate the quantity of gas, there may be a restricted opening or passage 18 and valve 19, regulating it, so as to determine the volume of the non-explosive mixture of air and gas that passes from the chamber *y* to the casing 12. As the gas is drawn into the chamber *y*, on the rearward movement of the piston, it has time, before being forced into the cylinder, to mix with a portion of air, but in such great relative proportions that the explosive mixture is not produced until an additional volume of air is combined therewith on the passage to the cylinder. The gas, however, is never drawn forward past the end of the partition into the chamber *x*. After the

explosion takes place the piston is moved forward and finally uncovers the exhaust, when the spent gases will escape, and the pressure in the cylinder will be so reduced that the gases from the casing D will lift the valve 10 and allow a new charge to enter the cylinder, after which the piston will move back and compress this charge, and the same will then be exploded and again move forward the piston, as before.

It will be evident that the air and gas chambers, communicating at one end freely with the pump and with each other and both at the other ends with a passage leading to the cylinder, may be differently arranged from those above described without departing from the main features of my invention. Thus in Figs. 6 and 7 the casing D is divided by a transverse vertical partition 60 and between the latter and the rear end by a transverse horizontal platform 61 into two chambers x' y', the chamber x' being below the chamber y' and communicating with air-chamber x, while the upper chamber y' communicates with the chamber y, and the gas inlet or port 42 opens into the chamber y'. The chamber y' communicates with an annular port 62, (or series of ports arranged in a circle,) inclosing the central port 63, which communicates with the air-chamber x', and the valve 10 covers both the air-port and the air and gas port. As the mixture in the chamber y or y' has such a surplus of gas as not to be explosive, the explosive mixture cannot be formed until the valve 10 is raised and the contents of both chambers pass into the passage 9. The mixture of too great an amount of air with the gas in the chamber y or $y\ y'$ may be prevented by contracting the latter toward the rear. One means (shown in Figs. 6 and 7) consists in placing a partition 66 parallel to the partition 3.

To prevent the charge from flowing from the port 9 direct to the exhaust-port, a plate 49 is suspended in the cylinder directly in the line of the inflowing gases. The extent to which the valve 10 rises determines the volume of the charge, and the force of the explosion is in proportion to this volume, and the volumes are varied by the movements of a wedge E, which is interposed between the casing 12 and a nut 20 carried by the valve-stem 21.

The wedge is carried by a lever 22, to which is connected a rod 23, that is moved longitudinally by a governor F, so as to withdraw the wedge and permit the valve 10 to rise farther and increase the charge when the speed of the engine descreases, and to push in the wedge further limit the lift of the valve and decrease the charge when the speed increases.

The governor may be of any suitable character, so as to move back the rod 23 when the speed increases and move it forward when the speed decreases.

The charge may be ignited by an electric spark from a dynamo moved by the engine, or by a flame-ignitor of ordinary construction.

In the drawings I have shown a form of ignitor which need not be here described, as it forms the subject of a separate application for Letters Patent, Serial No. 284,216, filed August 30, 1888.

I do not claim the mode described of supplying charges to the cylinder, as this constitutes the subject of a separate application for Letters Patent, Serial No. 287,623, filed October 9, 1888.

Without limiting myself to the precise construction and arrangement of parts shown, I claim—

1. The combination, with the working-cylinder, inlet-port, and air-pump of a gas-engine, of two chambers communicating with the air-pump and with an air-inlet port, one chamber communicating near its rear end with a gas-supply pipe and both communicating at their rear ends with the passage leading to the cylinder, substantially as set forth.

2. The combination, with the cylinder of a gas-engine having an inlet-port at the rear and air-port at the front, of two chambers communicating with said air-port at the front ends and each communicating independently with the said inlet-port at the rear end, and one of said chambers communicating also with the gas-inlet pipe, substantially as set forth.

3. The combination, with the cylinder, piston, and ports of a gas-engine, of a casing containing two chambers communicating with each other at the front ends, and with an air-inlet port at the front and independently at the rear ends with the charge inlet-port of the cylinder, and a gas-pipe provided with a check-valve communicating with one of said chambers, substantially as set forth.

4. The combination, with the cylinder, piston, and ports of a gas-engine, of a casing provided with a partition partially dividing the casing, an air-inlet port, a gas-inlet port communicating with the casing at one side of the partition, and a communication between the rear ends of the chambers on each side of the casing and the inlet-port of the cylinder, substantially as set forth.

5. The combination, with the pump of a gas-engine, of a casing communicating with the pump and with an air-inlet port at one end partially divided into two communicating chambers, a gas-pipe leading to one of the chambers, a communication between each chamber, and a passage leading to the working-cylinder of the engine, substantially as set forth.

6. The combination, with the cylinder, piston, and ports of a gas-engine, of a casing provided with two chambers side by side, each communicating with the other at one end and at the other with a passage leading to the cylinder, and a gas-pipe connecting with one of the chambers near the end adja-

cent to said passage, substantially as set forth.

7. The combination of the cylinder, casing, passage leading to the cylinder, valve controlling said passage, and partition dividing said casing longitudinally into two chambers communicating at the forward end and each having a communication with the said passage at the rear end, substantially as set forth.

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

CYRUS W. BALDWIN.

Witnesses:
WM. H. SWENY,
JOHN C. HARRIGAN.