(No Model.) 3 Sheets—Sheet 1.

C. W. BALDWIN.

GAS ENGINE.

No. 407,321. Patented July 23, 1889.

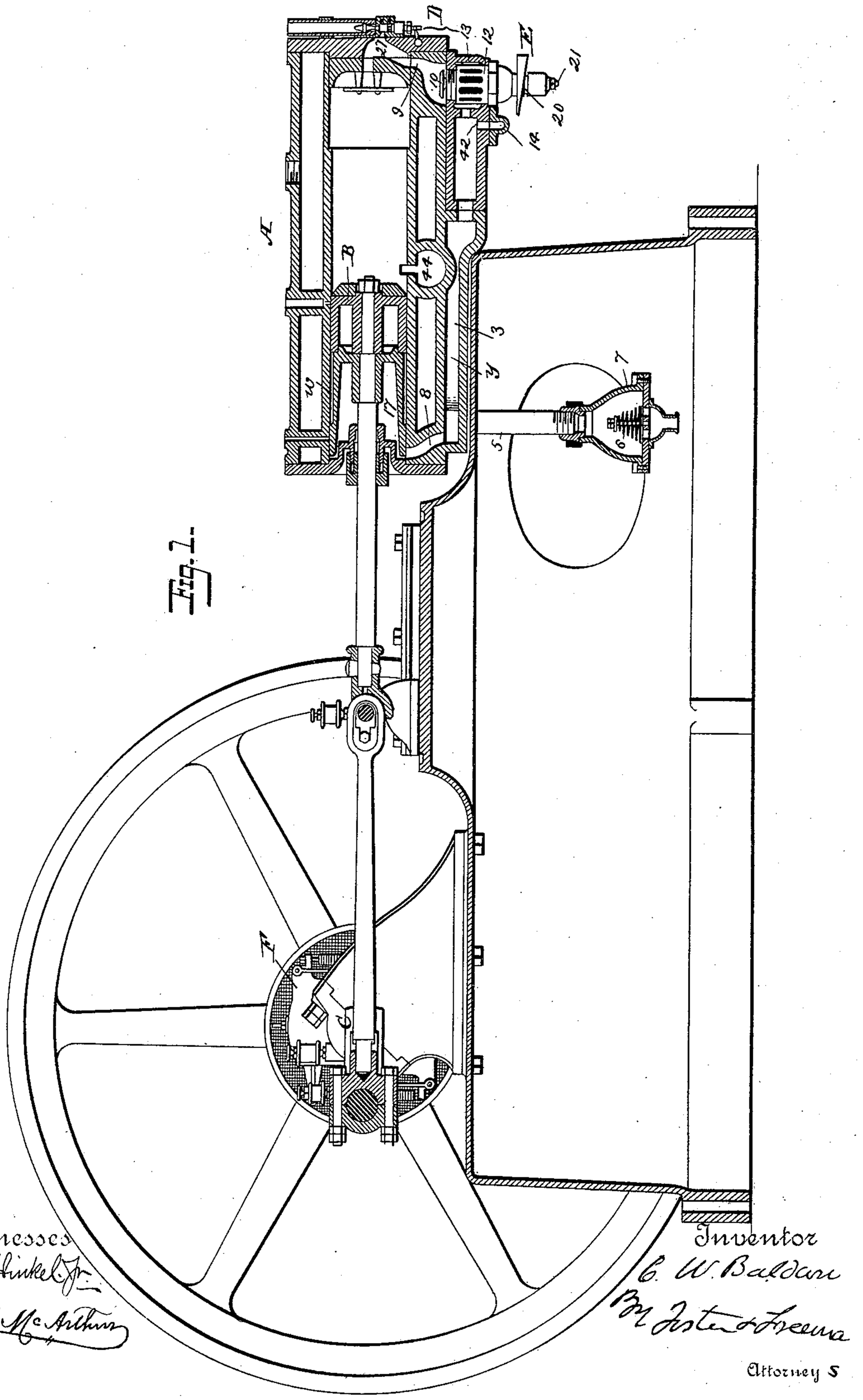


Fig. 1.

Witnesses
Jno. J. Hinkel, Jr.
H. S. McArthur

Inventor
C. W. Baldwin
By Foster & Freeman
Attorneys

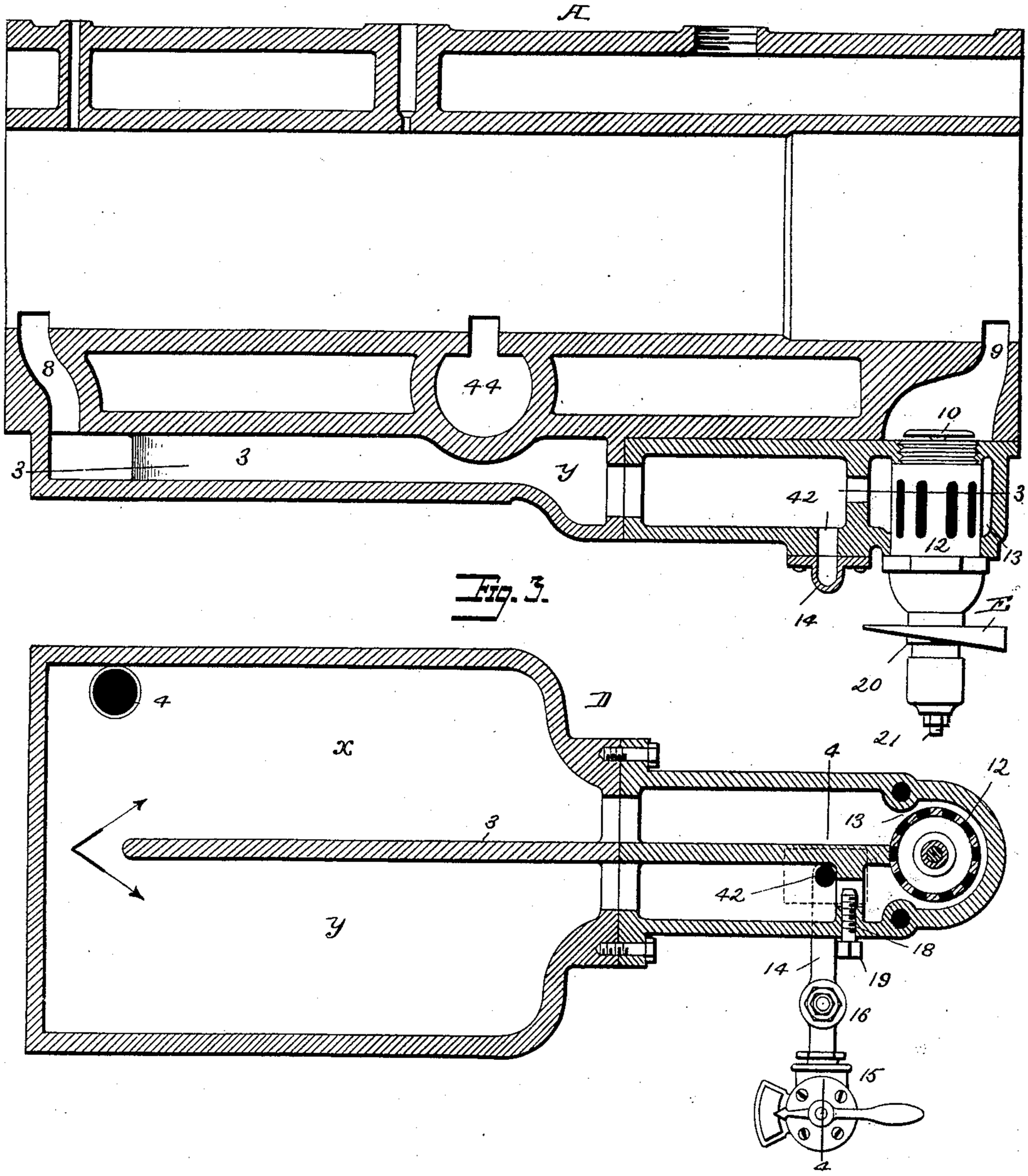
(No Model.) 3 Sheets—Sheet 2.

C. W. BALDWIN.

GAS ENGINE.

No. 407,321. Patented July 23, 1889.

Fig. 2.



Witnesses
Jno. G. Hinkel Jr.
H. S. McArthur

Inventor
C. W. Baldwin
By Foster & Freeman
Attorney s

(No Model.) 3 Sheets—Sheet 3.

C. W. BALDWIN.

GAS ENGINE.

No. 407,321. Patented July 23, 1889.

Fig. 4.

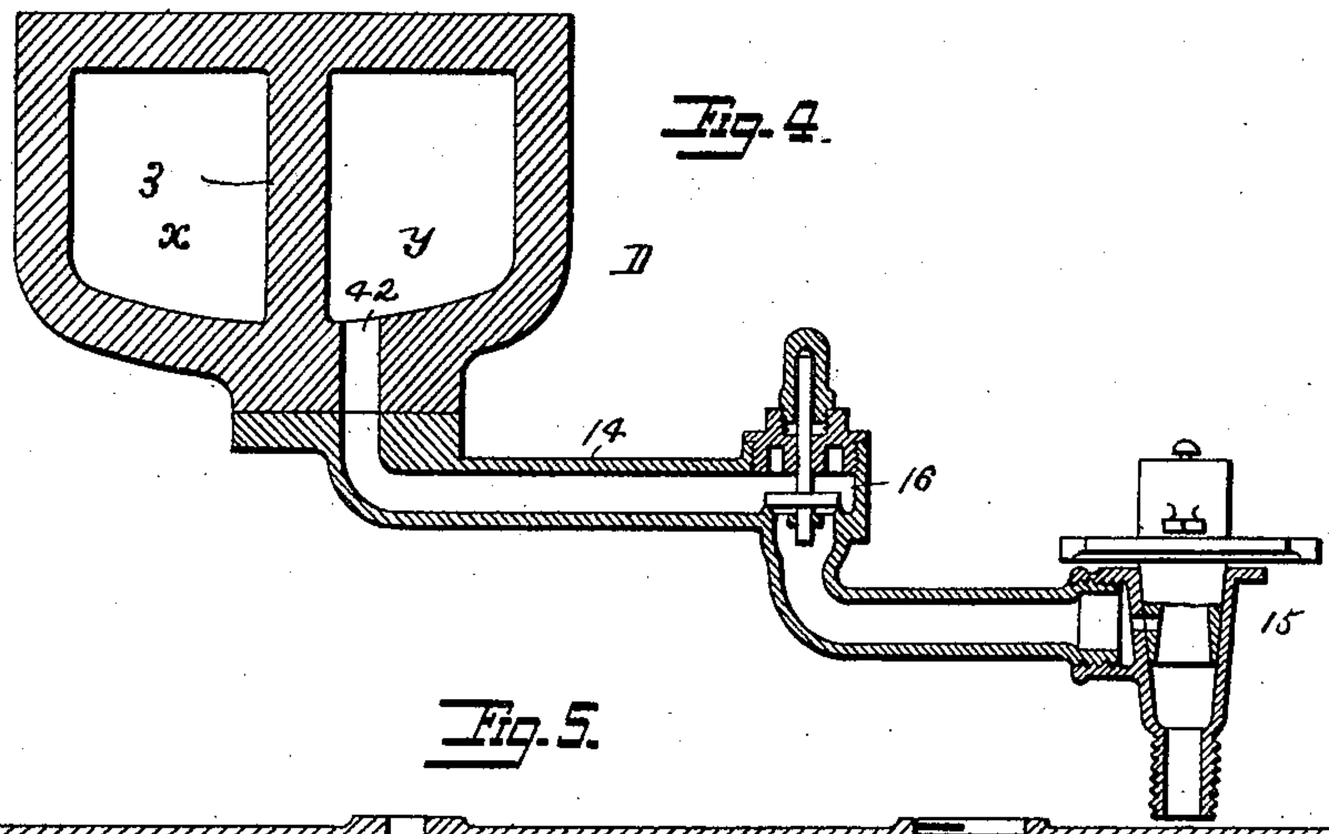


Fig. 5.

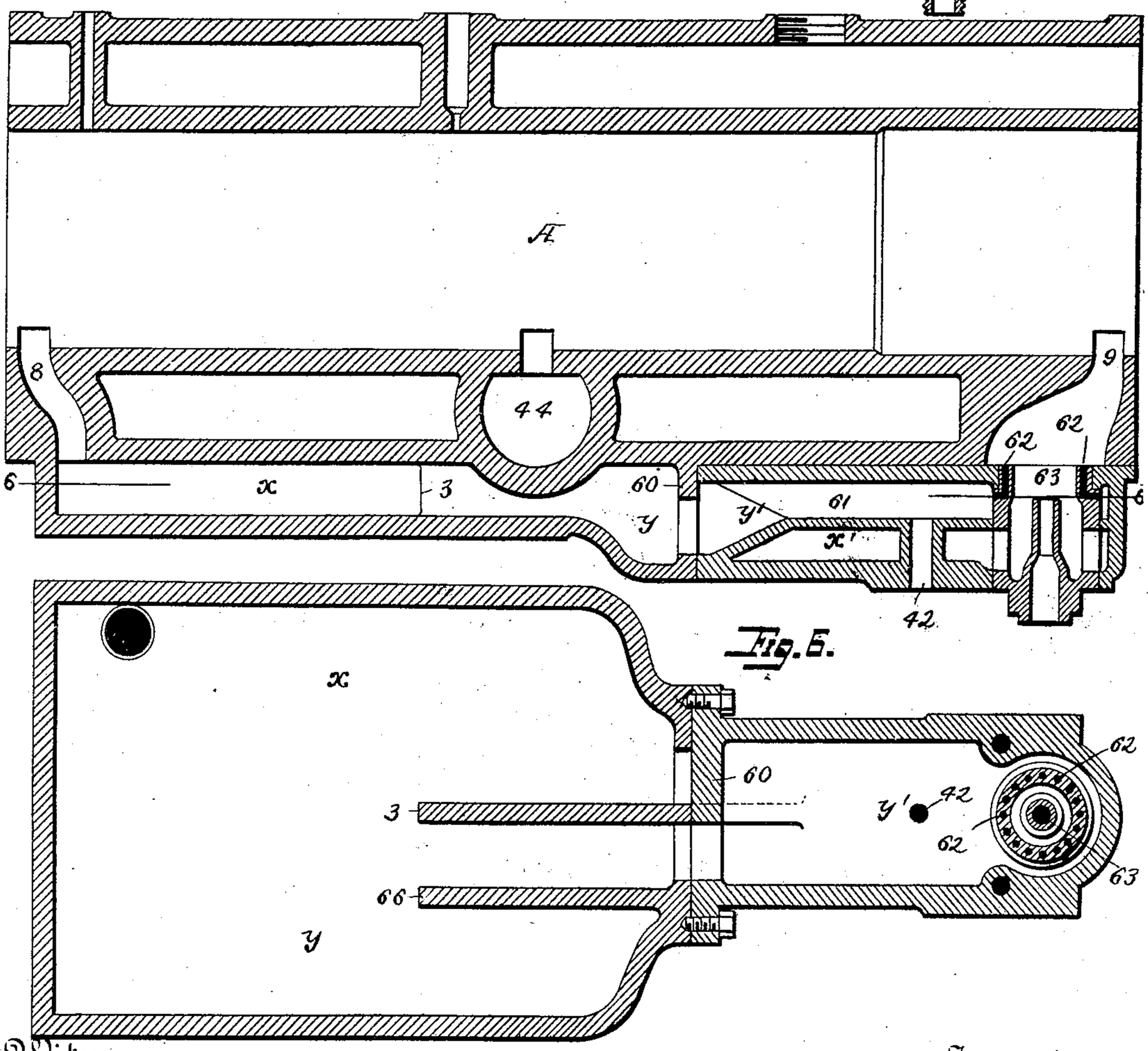


Fig. 6.

Witnesses
Jno. G. Hinkel, Jr.
H. S. McArthur

Inventor
C. W. Baldwin
By Foster & Freeman
Attorney 5

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. 407,321, dated July 23, 1889.

Application filed October 9, 1888. Serial No. 287,623. (No model.)

To all whom it may concern:

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

This invention relates to gas-engines in which the movements of the piston are effected by the rapid explosion of successive charges of explosive mixture; and the invention consists in the method of supplying the charges to the cylinder without previously forming or storing explosive mixture in any other portion of the engine, as fully set forth hereinafter, and as 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, a longitudinal section of the cylinder; Fig. 3, a sectional plan on the line 3 3, Fig. 2; Fig. 4, a section on the line 4 4, Fig. 3; Fig. 5, a longitudinal section through the cylinder, showing a modification; Fig. 6, a sectional plan on the line 6 6, Fig. 5.

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 the forward end, the chamber *x* communicating with an air-inlet port 4, to which leads a pipe 5, having a valve-casing 7, and an inlet-valve G 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 *x'* 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, which constitutes, practically, a part of the explosion-chamber.

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 decreases, and to push in the wedge farther, 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.

I do not here claim the construction of the engine shown and described, as the same constitutes the subject of a separate application, Serial No. 280,735.

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

1. The within-described improvement in supplying the cylinder of a gas-engine with charges of explosive mixture, the same consisting in drawing air into two chambers, each independent of the gas-chamber, and gas also into one of them, and in then forcing the contents from said chambers and mixing the same together only after they reach the explosion-chamber, substantially as described.

2. The mode of supplying the cylinder of a gas-engine with charges of explosive mixture, consisting in supplying one chamber with a mixture of air and gas having an excess of gas, supplying another chamber with air, forcing the contents from both chambers and bringing them together in the explosion-chamber of the engine, substantially as described.

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

CYRUS W. BALDWIN.

Witnesses:
WILLIAM RILEY,
GRIFFITH JOHN.