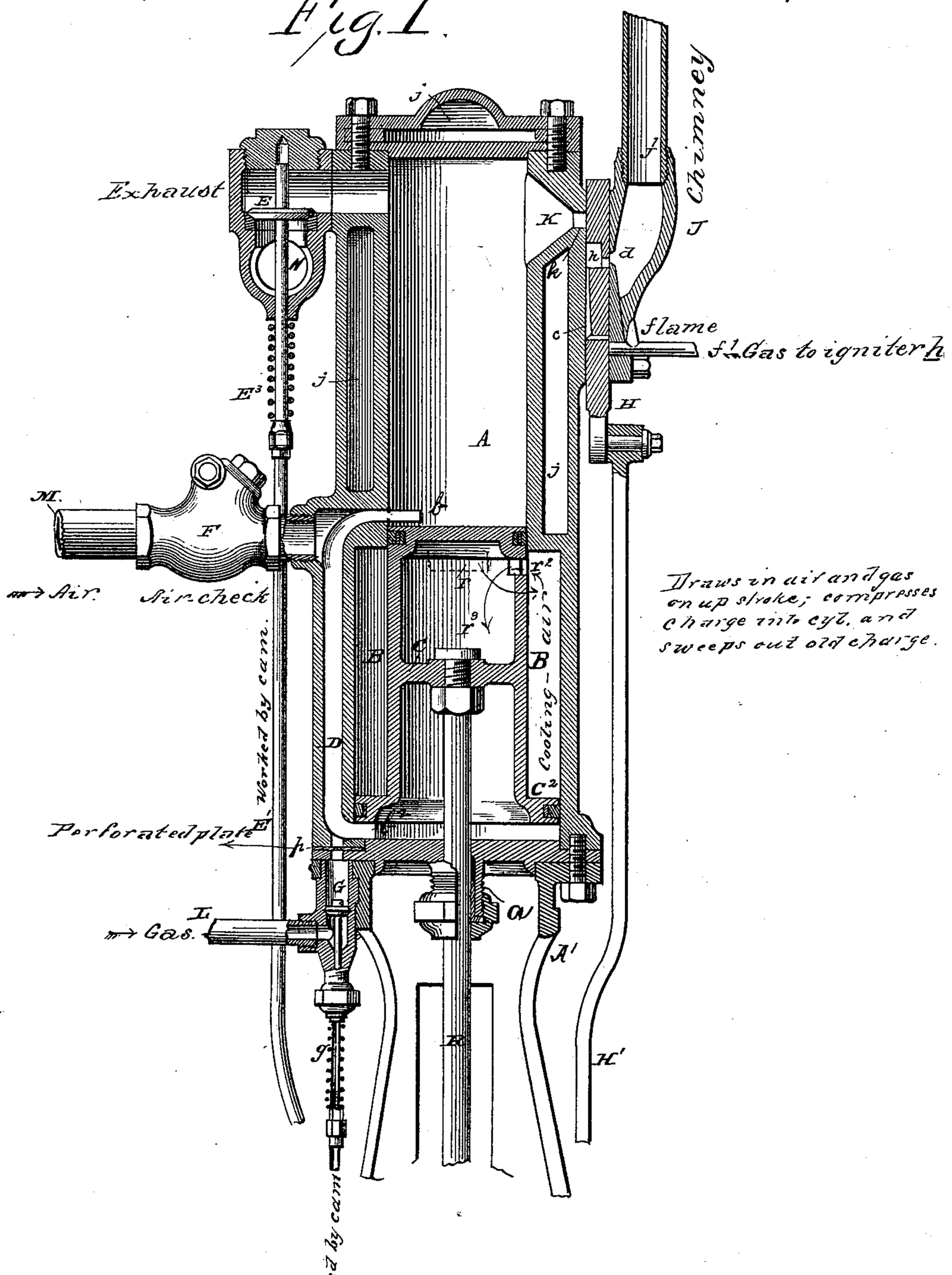
(No Model.) 3 Sheets—Sheet 1.

C. SHELBURNE.

GAS ENGINE.

No. 332,447. Patented Dec. 15, 1885.

Fig. 1.



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(No Model.)

3 Sheets—Sheet 2.

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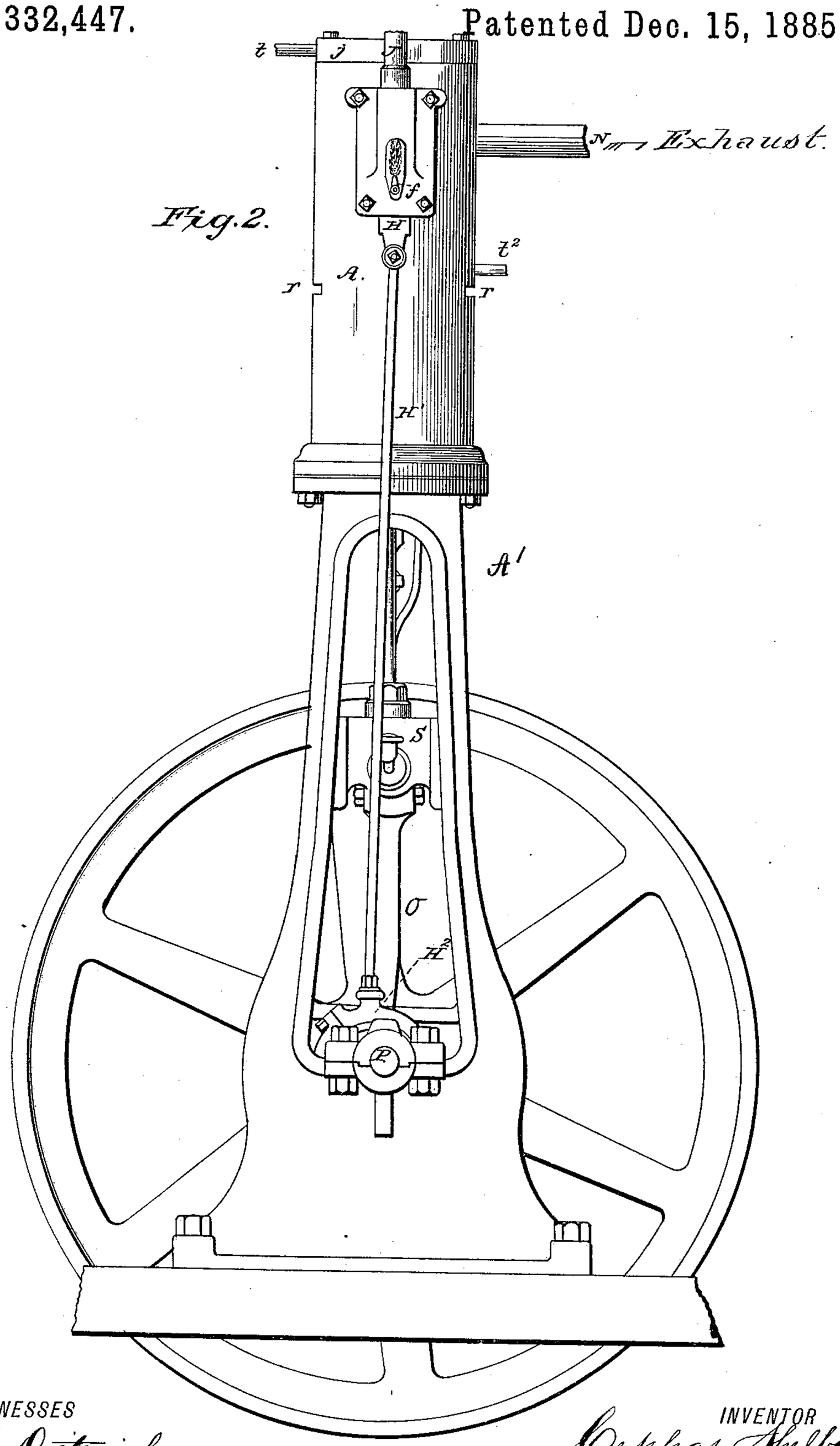
Fig. 2.



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(No Model.) 3 Sheets—Sheet 3.

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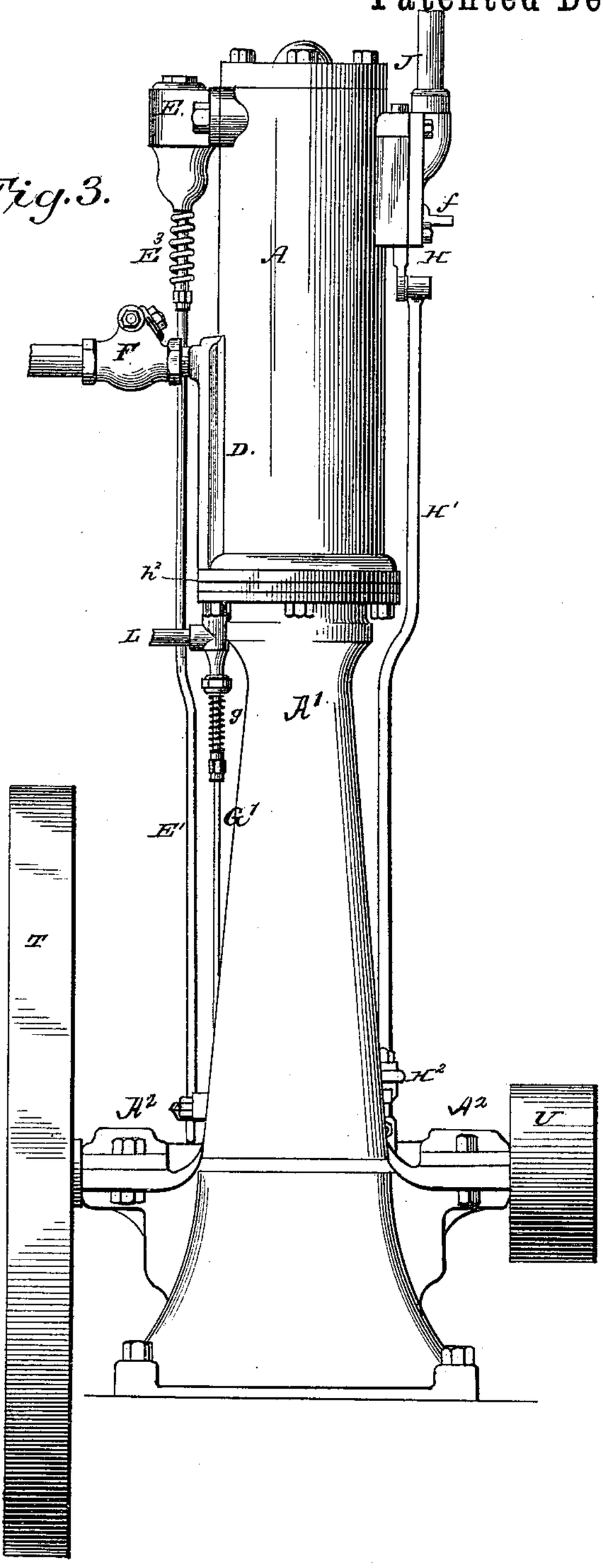
Fig. 3.



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UNITED STATES PATENT OFFICE.

CEPHAS SHELBURNE, OF RICHMOND, VIRGINIA.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 332,447, dated December 15, 1885.

Application filed April 6, 1385. Serial No. 161,312. (No model.)

To all whom it may concern:

Be it known that I, CEPHAS SHELBURNE, a citizen of the United States, residing at Richmond, in the county of Henrico and State of Virginia, have invented a new and useful Improvement in Gas-Engines, of which the following is a specification, reference being had to the accompanying drawings.

My improvement relates to that class of gas-engines in which the combustible mixture of gas or vapor and air for forming the motive power is fired while under compression; and it has for its object to greatly simplify the gas-engine and render its operation more reliable and efficient by providing a combination-cylinder—by which I mean a power and preparation or displacement cylinders combined in one—which shall perform all the functions of preparing and mixing the combustible mixture to be exploded, forcing out the burned or used gases from the previous explosion, of allowing the charge to be compressed, and then fired in such a manner as to produce an explosion at every outstroke of the piston. These objects I attain by mechanism herein specified, and illustrated in the accompanying drawings, in which—

Figure 1 is an enlarged vertical section of the cylinder. Fig. 2 is a side elevation of the engine. Fig. 3 is a front elevation of the same.

Referring to the drawings, which represent an engine of the upright pattern, the cylinder A is bolted upright upon a cast-iron frame, A′, which rises above bearings A^2, which support the crank-shaft P. The piston C is connected by a rod, R, which passes through a stuffing-box, *a*, to cross-heads S, connecting-rod O, crank-shaft P, and fly-wheel T. The journal boxes or bearings A^2 are cast on the side of the frame A′, so as to admit the working parts of the engine between the frame and the bearings, and bring the fly-wheel T and the driving-pulley U on the outside and close to the bearings, thereby rendering the machine very compact. The upper or heated portion of the cylinder is provided with a water-jacket, *j j*, for cooling, and the lower end of the cylinder is enlarged to give it a capacity equal the combined product of the area and stroke of the power end and passage D at the side of the cylinder. The piston C, which is made to fit the smaller or power end of the cylinder, is double-walled or cored out at the top, the lower end being cup-shaped and provided with an enlargement or ring, C^2, which works gas tight in the enlarged end of the cylinder. At either end of the piston are metallic packing-rings.

When the piston C is at its forward stroke, as in Fig. 1, it will be seen that there is a space, B B, formed between the piston C and cylinder A. This space B is made to communicate with the outside atmosphere by a port or ports, *r*, in the cylinder A, and at each forward stroke of the piston it is surrounded and filled by a fresh charge of atmospheric air, so that a constant current of air is kept up in and around the piston, which serves to keep it comparatively cooled. At one side of the cylinder is a passage, D, cast perpendicularly with the cylinder and partly surrounding it and opening into it by ports *b* b^2. One of these ports, b^2, opens into the lower end of the cylinder, and the other, *b*, is so situated as to be uncovered by the piston when at its forward stroke, Fig. 1. This port *b*, opening into the cylinder just above the piston-head when at its forward stroke, is made to extend or broaden across the cylinder nearly equal its inside diameter, so that the combustible gases entering the cylinder in a broad thin layer forces out the burned or used gases that may be left in the cylinder from the previous explosion.

The passage D is provided with an air-check valve, F, and air-pipe M, which supplies unmixed atmospheric air, while at the lower end of the passage D, and fastened to the frame A′, is a gas-valve, G, which controls the amount of gas necessary to mix with the air to form the cylinder-charge. This valve G is held to its place by means of a spring, *g*, and opened at the proper time by a rod, G′, acted upon by a cam from the main shaft P. Gas enters the valve-box G from a pipe, L, and enters the passage D through a number of small holes, *p*, so as to mix intimately with the air entering the cylinder through port b^2.

Working perpendicularly at one side of the cylinder A is a valve-slide, H, which serves to ignite the cylinder-charge. This slide is held in position by a covering, J, which is bolted to the valve-seat, and carries a chimney, J′, in which burns a flame, *f*. In the cover J is a port, *d*, opening against the outer face of the slide H.

K is a recess or funnel-shaped passage cast inside the cylinder near the top, and opening against the inner face of the slide, with a small port, *k*. This port *k* may be made very small, as it only serves to ignite the cylinder-charge; consequently there is comparatively little pressure against the slide H, which may be kept gas-tight without the aid of springs generally used for this purpose. The passage K is made funnel-shaped, so as to come into more extended contact with the cylinder-gases, and is placed as near the top of the cylinder as convenient. The gas, which has a natural tendency to rise, being lighter than the air, rises to the top of the cylinder, filling the passage K, while the less highly-combustible gases remain next to the piston-head. This stronger charge in K, when ignited by means of the slide H, will be thrown with some force into the cylinder-charge, thereby igniting the charge more rapidly.

When the slide H is in one position, the port *h* is filled with combustible gas from a pipe, *f′*, by means of a narrow port or groove, *c*. The passage *h* thus charged passes over the chimney-flame *f* just before coming over the port *k* for firing the compressed cylinder-charge. At the opposite side of the cylinder, and as near the top as practicable, is bolted a valve-box, which carries a lift-valve, E, and exhaust-pipe N. This valve E is held in position gas-tight by the pressure within the cylinder, and is seated by means of a spring, E^3, and opened through a rod, E′, acted upon by a cam on the main shaft P.

As the engine makes an explosion at every outstroke of the piston, and the combustible gases to be exploded enter the cylinder under compression and through a port to be uncovered by the piston, it will be seen that there is never a vacuum formed in this end of the cylinder, and consequently there can be no suction or drawing in of atmospheric air through the valve E.

Having described the various parts of the engine, except such as are of ordinary construction, its operation is as follows: The piston C, as it ascends, draws in a combustible charge of gas or vapor and air into the lower end of the cylinder, the air entering through a check-valve, F, and gas from the valve G, which is at this time opened through the action of the cam. The air and gas, entering passage D and meeting at right angles, are thoroughly mixed by means of a perforated plate, *p*, between the cylinder-head and the frame A′. At a certain point of the piston's stroke the valve G closes, and only air is admitted to fill the passage D. The piston having completed its stroke, the gases in the upper end of the cylinder are compressed in a space behind the piston and at this point fired, driving the piston down, compressing the charge in the lower end of the cylinder and forcing it through the passage D and port *b* into the upper end of the cylinder; but before the piston has completed its full stroke, and just before the port *b* is uncovered to admit the fresh charge, the exhaust-valve E is opened and the pressure within the cylinder falls to atmospheric pressure. At this instant the fresh charge, entering in a broad thin layer just above the piston-head, forces out any burned or used gases that may be left in the cylinder from the previous explosion, when the valve E suddenly closes, cutting off the combustible gases, which by the upward stroke of the piston are again compressed and fired. This cycle of operations is repeated at every revolution of the crank-shaft.

As has been hereinbefore stated, only unmixed air is allowed to enter the passage D, and this air entering the cylinder in a broad thin layer in advance of the combustible charge does not mix with but carries the burned gases in front of it, itself escaping with the burned gas, thereby preventing the fresh combustible charge coming in contact with the burned or used gases left in the cylinder from the previous explosion.

It will be seen that I do not make use of a scavenging-charge of air for clearing out the cylinder, but each fresh combustible charge on entering the cylinder acts itself as a scavenger, thereby making the exhaust of the burned gases so complete as not to require a scavenging-charge of air.

The supply of gas to suit the varied load on the engine may be regulated by means of a governor, attached in the ordinary way, which is made to throttle the gas in pipe L by means of what is known as a "butterfly-valve."

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

1. In a gas-motor engine, the combination of the cylinder A, having the enlarged end, the piston C, having the enlarged head working in the enlarged end of the cylinder, unobstructed port *r* in the cylinder, communicating with the outer air, and passage D, provided with air and gas valves F and G.

2. In a gas-motor engine, the combination of the cylinder A, having the enlarged end, the piston C, having the enlarged head working in the enlarged end of the cylinder, port *r* in the cylinder, communicating with the outer air, passage D, and ports *b* b^2, communicating with the enlarged and reduced portions of the cylinder, air-valve F at one end of passage D, gas-valve G at opposite end thereof, perforated plate *p* between the gas-valve G and the port b^2, and discharge-valve E, adapted to be opened just before the pis-

ton has uncovered the port *b*, substantially as described.

3. The combination, in a gas-engine, of the cylinder A, piston C, air-jacket B′, and unobstructed ports r r^2 for keeping up a constant current of air in and around the piston, as and for the purpose specified.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in presence of two witnesses.

CEPHAS SHELBURNE.

Witnesses:

WM. WARREN, Jr,

J. R. PERDUE.