No. 620,080. Patented Feb. 21, 1899.

A. A. VANSICKLE.

GAS ENGINE.

(Application filed Nov. 13, 1897.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

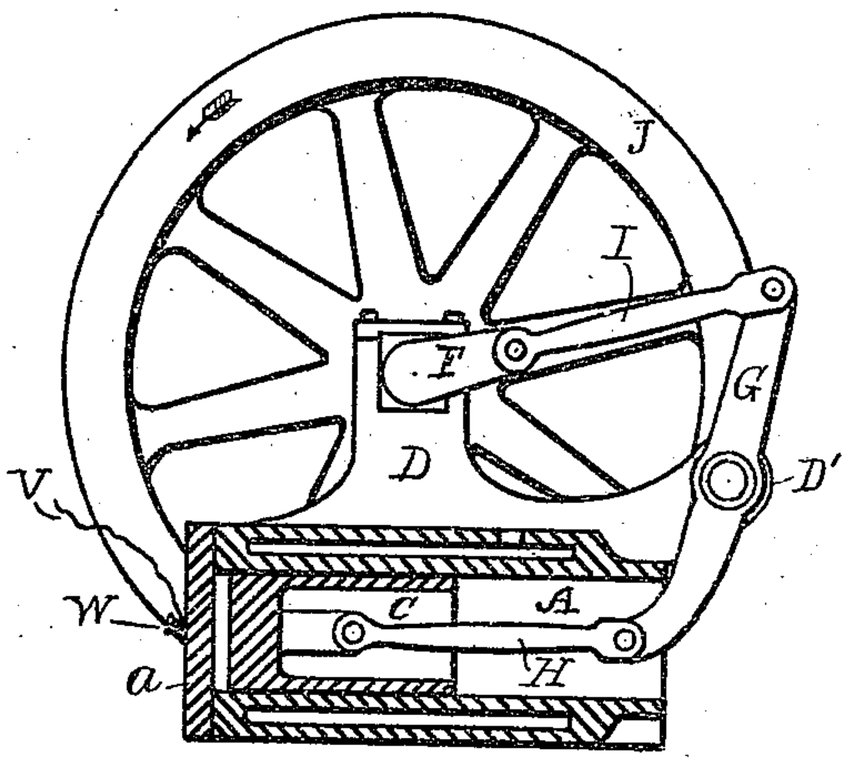


Fig. 2.

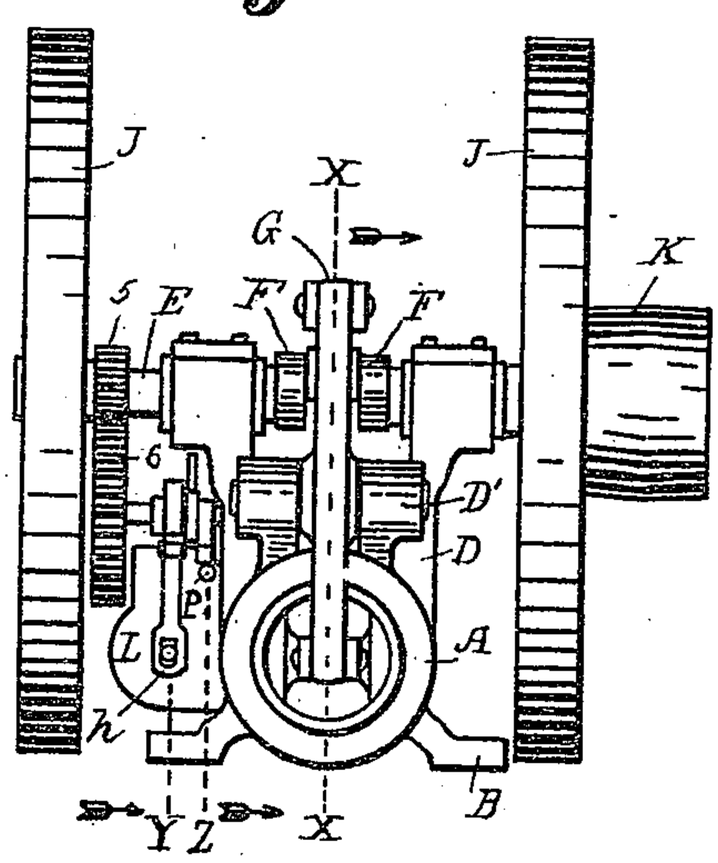


Fig. 3.

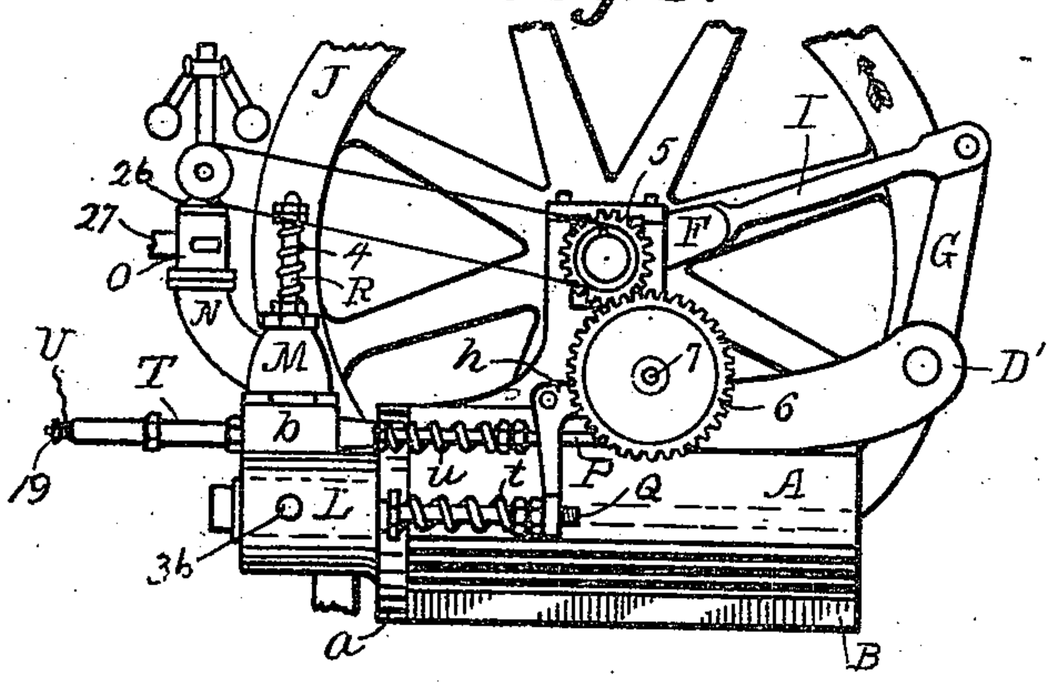


Fig. 4.

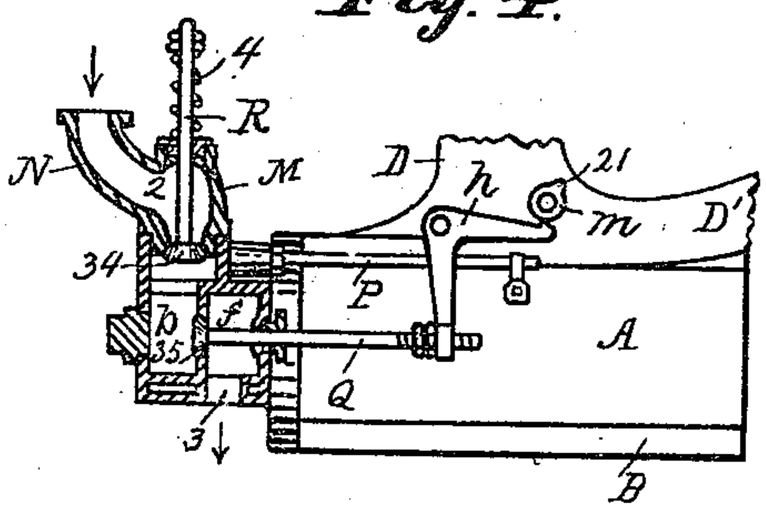


Fig. 5.

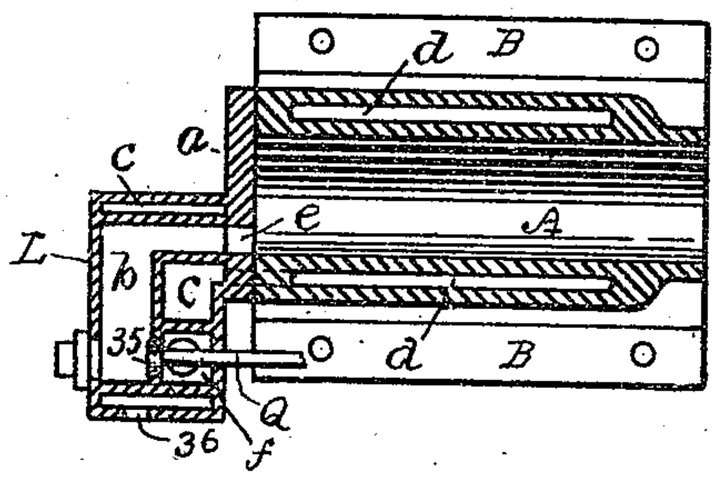
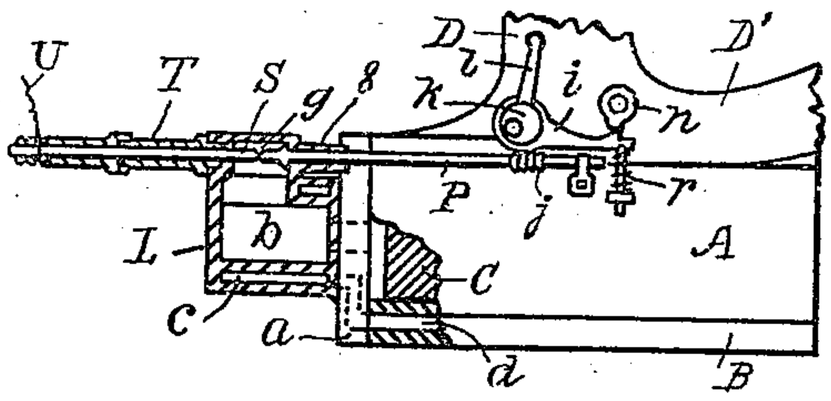


Fig. 6.



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No. 620,080.

Patented Feb. 21, 1899.

A. A. VANSICKLE.

GAS ENGINE.

(Application filed Nov. 13, 1897.)

(No Model.)

2 Sheets—Sheet 2.

Fig. 7.

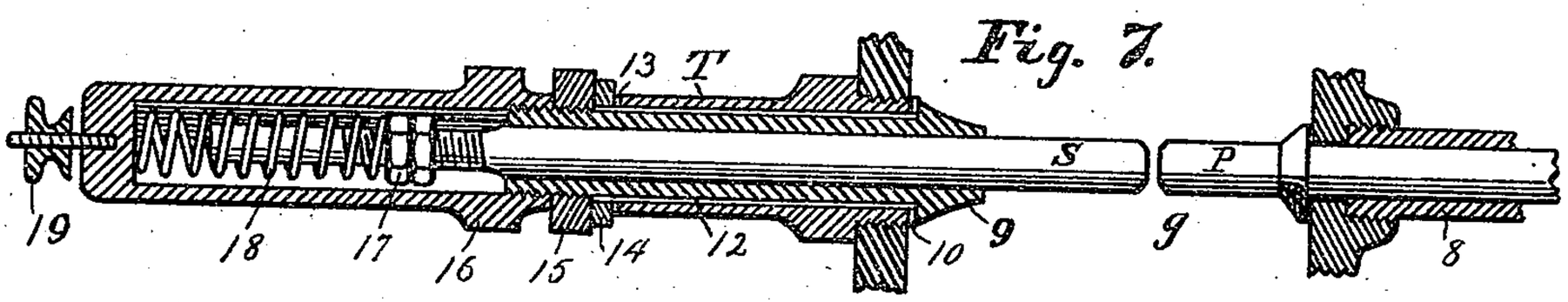


Fig. 8.

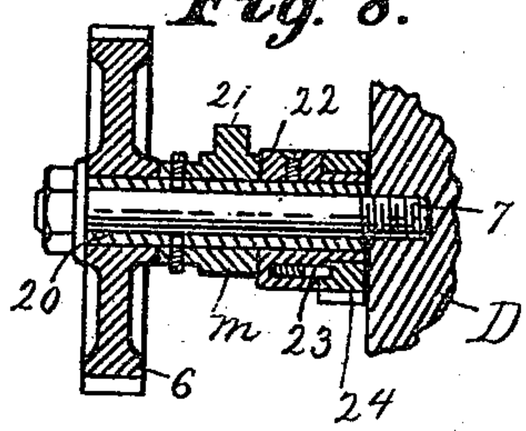


Fig. 9.

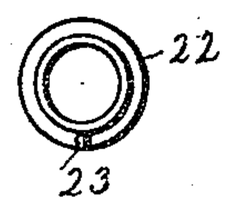


Fig. 10.

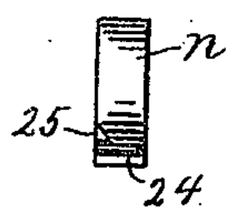


Fig. 11.

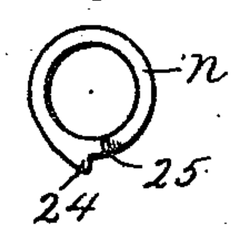


Fig. 12.

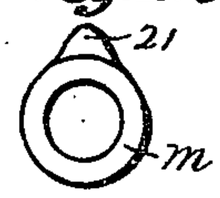
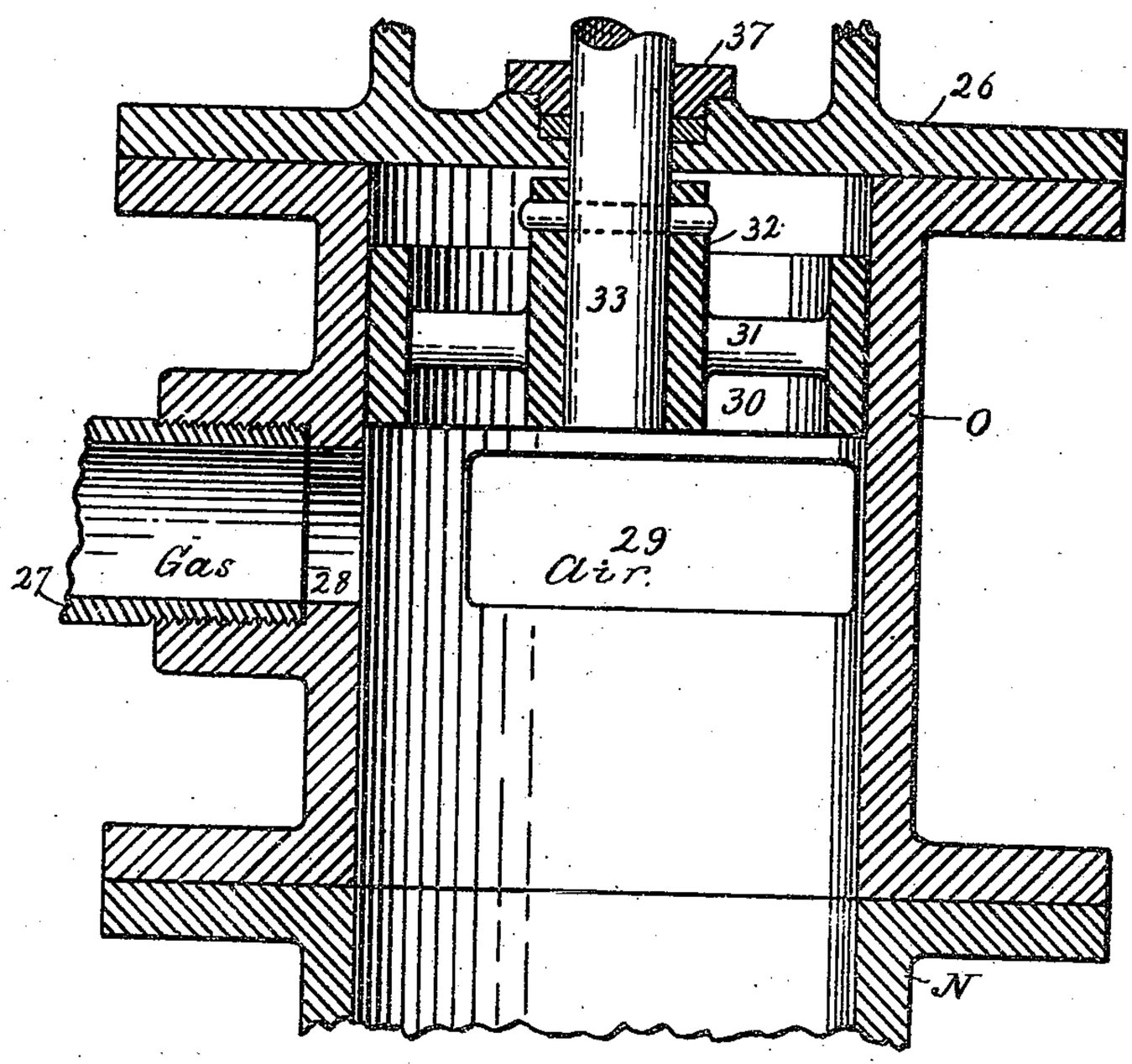


Fig. 13.



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UNITED STATES PATENT OFFICE.

ALEXANDER A. VANSICKLE, OF INDIANAPOLIS, INDIANA, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THOMAS F. SCULLIN AND HENRY C. JORDAN, OF SAME PLACE.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 620,080, dated February 21, 1899.

Application filed November 13, 1897. Serial No. 658,481. (No model.)

To all whom it may concern:

Be it known that I, ALEXANDER A. VANSICKLE, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented certain new and useful Improvements in Gas-Engines; and I do 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, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

This invention relates to explosive-engines in which a mixture of gas and atmospheric air is employed as a means of propulsion; and it consists in the novel devices and combination and arrangement thereof whereby the mixture is effected, admitted, controlled, exploded, and exhausted, and in the novel form and arrangement of chambers embraced in the cylinder-head, as will be more fully described hereinafter and claimed.

My object is to generally improve the details of construction of gas-engines, particularly of that class which are designed to be used in a limited space and upon unstable foundations and which shall be composed of but few and simple parts in a compact form, the whole adapted to operate with the least jarring or unsteadiness, and this is fully attained in my invention, which is, furthermore, cheaply constructed and is durable and economical in use.

Referring to the drawings, Figure 1 represents a central vertical sectional view on the line X X of Fig. 2; Fig. 2, a rear elevation; Fig. 3, a side elevation; Fig. 4, a side view of the cylinder and a vertical section of explosion-chest, taken on the line Y of Fig. 2; Fig. 5, a central sectional view taken on a horizontal line through the cylinder and explosion-chest; Fig. 6, a side view of the cylinder, showing a fragment in section and a vertical section of explosion-chest, taken on the line Z of Fig. 2; Fig. 7, a central sectional view of the igniter, showing details of construction; Fig. 8, a central sectional view of the mechanism for operating the igniter and exhaust-valve. Figs. 9, 10, 11, and 12 are detail views of parts of Fig. 8, and Fig. 13 is a vertical central sectional view of the combined governor-valve and mixing-chamber.

The details of construction embody parts which separately are familiar to mechanics and therefore require no minute description as to material shape or proportion; but stress is laid herein upon the advantageous combination of such parts.

The cylinder A is of the usual type, having a head *a* at one end and the opposite end open and is provided with a water-space *d*. The cylinder, together with the base-flanges B, forms the support for the whole machine, the flanges, frame D, and arms D′ being preferably cast integrally with the cylinder. The frame has suitable journal-boxes, in which the main shaft E is mounted transversely above the cylinder and at a low elevation to economize space. Twin cranks F F are attached to or forged in the main shaft, and the latter carries suitable balance-wheels J J, to one of which a belt-pulley K is attached, or other suitable means may be employed for transmitting power.

A rocking arm or lever G is suitably journaled at or near its center at the outer ends of the arms D′ for transmitting the power from the piston C to the cranks and main shaft in connection with the connecting-rods H and I. The length of the rocking arm in relation to the stroke of the piston is important, the greatest length practically being the most advantageous. The point of suspension is designed to be sufficiently removed above the center of the cylinder to provide for a proportionately long radius for the lower end of the lever, and the latter is curved in toward the cylinder, so that the point at which it is pivoted to the connecting-rod is approximately on the center line of the cylinder when the piston is taking the effect of the explosion. The upper end of the lever is also long enough to provide for a comparatively long radius in its travel compared to the throw of the crank, the advantage being greatest when its upper end reaches a level of the crank-pin when the latter stands at its upward limit—that is, on its "quarter." This arrangement provides

for applying or transmitting the maximum power from the lever to the crank during the greatest distance of its travel, while the compression is produced in the minimum distance of travel.

Now in order to fully carry out my invention I construct the various chambers, valves, and connections so that they shall be, as far as practicable, supported by the cylinder-head, so that in constructing and repairing small parts only are required to be handled and so that valves and chambers may be readily accessible and so that the valve-operating rods may be small and compactly arranged.

The cylinder-head *a* is preferably cast integrally with the explosion-chest L, the latter being cored out and divided by suitable partitions, so as to form a water-chamber *c*, having an inlet 36 and connected by a passage through the head *a* with the cylinder-chamber *d*, and also providing an explosion-chamber *b* and exhaust-chamber *f*. The explosion-chamber *b* has a communicating-passage *e* with the cylinder, and it also communicates with the igniting-chamber *g*, situated conveniently above the main body of the chest L and alongside of the upper part of the explosion-chamber, to which is attached the inlet-valve chamber M, at the bottom of which is seated the inlet-valve 34, connected to the stem R and normally held closed by the spring 4, pressing between the chamber and suitable adjusting-nuts at the upper end of the stem. Vapor is admitted to the valve-chamber M through the supply-pipe 27, mixer O, and controlled by a suitable governor 26, operating the governor-valve 30, and through the pipe N and passage 2. The governor mechanism may be of any suitable type operated by the main shaft to force the valve 30 down over the inlet-ports when the engine is at rest and raise and open said ports variably when in operation. The port 28 admits gas, and the port 29, which may consist of two apertures, one at either side, admits atmospheric air in the approximate proportion of twelve parts air to one of gas, they being mixed in the chamber O. The governor-valve 30 consists of a hollow piston neatly fitting into the cylindrical chamber O and has a central hub 32, connected by arms 31 to the rim. The hub is suitably secured to the stem 33, which is connected to any suitable governor-operating mechanism, as before stated. A suitable packing-gland 37 is provided.

The exhaust-valve 35 normally closes the passage leading to the atmosphere and is held to its seat by means of the spring *t* pressing against adjusting-nuts on its attached stem Q and also by the pressure of each explosion. This stem and valve are operated by means of the bell-crank lever *h* and cam *m*.

The igniter comprises the two essential parts for throwing of an electric spark—that is, a positive and a negative pole. The pole P consists of a plunger sliding in a packed guide 8 and has a suitable collar to prevent its being drawn outward by the pressure of the spring *u*, which withdraws it from each contact with the opposite pole. Near the opposite end are ratchet-teeth *j*, extending as annular rings around the body, which are engaged by a heel on the trip-lever *i* in contact with the igniter-cam *n*. This trip-lever is supported on an eccentric *k*, having a lever *l*, so that the movement thereof toward the explosion-chest shall draw its contact end forward of the swell on the cam to delay ignition when starting the engine. A spring *r* presses the lever *i* against the cam *n*. The opposite pole S is stationary, but is cushioned by the spring 18 in the casing 16, the amount of cushion being regulated by the nut 17. The pole is supported and guided by the sleeve 9, in which it fits closely, but may slide therein. This sleeve is supported by the case T, in which it is insulated by a mica sleeve 12 and end washers 10 and 13. A wire U, secured by the binding-screw 19, and a wire V, secured by the binding-screw W, provide with a suitable battery an electric current when the poles are in contact.

The gear-wheel 6 is secured to a sleeve 20, which rotates on the stud 7, attached to the frame D. The cam *m*, after being set so that the swell 21 shall be in its proper operative position to control the exhaust, is secured to the sleeve 20 by suitable means. The hub 22 fits over the sleeve 20 and is adjustably secured thereto and has one end reduced in diameter, over which the cam *n* fits revolubly. A transverse hole in the front face of the larger part of the hub contains a clutching-plunger 23, pressed outward by a small spiral spring, the outer end of the plunger engaging a notch 25 in the adjacent side of the cam *n*, by which the cam is carried around with the hub to operate the igniter, but may travel in a reversed direction when caught by the shoulder of the swell 24 on the cam in case the engine should be started backward accidentally, thus preventing ignition.

The operation is as follows: The balance-wheel being rotated in the direction of the arrow, the piston C as it travels outward draws the mixed gas and air past the valve 34 into the explosion-chamber *b*, and when the suction caused by the piston ceases the valve 34 closes. The piston on its return inward stroke compresses the charge, which is exploded by means of an electric spark from the igniter when the crank has passed its center and the piston is forward, as shown in Figs. 1 and 6, the latter being driven outward in its course. Upon its return inward the exhaust-valve 35 is opened and the burned gas escapes through the port 3. The above operations are repeated automatically.

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

1. In a gas-engine, the combination of the horizontal cylinder, the cylinder-head *a* having the explosion-chest L cast integrally there-

with and comprising the explosion-chamber *b* communicating with said cylinder and extending across the front of said head, the exhaust-chamber *f* situate at the rear of said explosion-chamber and at one side of said cylinder and communicating with said explosion-chamber and provided with the exhaust-valve 35 seated between said explosion and exhaust chambers so that its stem shall project at the side of said cylinder, and the igniting-chamber *g* situate at the top of said chest and communicating with said explosion-chamber; the igniter in said igniting-chamber and having its stem extending at the side of said cylinder, the means for operating said igniter and said exhaust-valve, and the inlet-valve situate at the top of said explosion-chest, substantially as shown and described.

2. In a gas-engine, the combination of the horizontal cylinder, the supporting-frame above the cylinder, the main shaft mounted transversely above the cylinder, the gear-wheel carried by the main shaft, the stud secured to the side of the frame and parallel to the main shaft, the sleeve revoluble on said stud, the gear-wheel secured to said sleeve and meshing with the gear-wheel on the main shaft, the hub adjustably secured to said sleeve and adapted to carry the igniter-cam and provided with the clutch whereby the igniter-cam is driven but permitting the same to be reversed, the igniter-cam loose on said hub and engaged by said clutch whereby it is driven, the trip-lever engaged with and operated by said cam and adapted to and operating an igniter-stem, substantially as shown and described.

3. In a gas-engine, the combination of a horizontal cylinder having the frame thereon, a main shaft mounted transversely above the cylinder, a gear-wheel carried by the main shaft, a stud secured to the side of the frame and parallel to the main shaft, a sleeve revoluble on the stud, a gear-wheel secured to the sleeve and meshing with the gear-wheel on the main shaft, an exhaust-valve cam secured to the sleeve, a bell-crank lever suitably supported and adapted to engage with and operating the stem of an exhaust-valve, a hub adjustably secured to the said sleeve and adapted to carry an igniter-cam and provided with a clutch whereby to drive an igniter-cam in one direction but permitting its rotation in an opposite direction, an igniter-cam loose on the hub and engaged by the clutch whereby it is driven, a trip-lever engaged with and operated by the igniter-cam and adapted to and operating an igniter-stem, substantially as shown and described.

4. In a gas-engine, the combination of the horizontal cylinder, the frame thereon, the igniter having the stem working at the side of the frame and parallel to the cylinder and provided with the ratchet-teeth, the main shaft, the gear-wheel thereon, the stud secured to the side of the frame, the sleeve loose upon the stud and having the gear-wheel secured thereto and meshing with the gear-wheel on said main shaft, the hub adjustably secured to said sleeve and adapted to carry the igniter-cam and provided with the clutch whereby the igniter-cam may be driven in operative direction and reversed in the opposite direction, the igniter-cam loose on said hub and driven by said clutch and provided with the projection having the shoulder at one side, the movable eccentric having the operating-handle and suitably supported, the trip-lever mounted on said eccentric and receiving motion from said igniter-cam and imparting motion to said igniter-stem, substantially as shown and described.

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

ALEXANDER A. VANSICKLE.

Witnesses:

E. T. SILVIUS,

ELMER A. SMITHA.

Correction in Letters Patent No. 620,080.

It is hereby certified that Letters Patent No. 620,080, granted February 21, 1899, upon the application of Alexander A. Vansickle, of Indianapolis, Indiana, for an improvement in "Gas-Engines," was erroneously issued to Thomas F. Scullin and Henry C. Jordan, as owners of the entire interest in said invention; that said Letters Patent should have been issued to the inventor, *Alexander A. Vansickle, Thomas F. Scullin, and Henry C. Jordan, jointly;* said Thomas F. Scullin and Henry C. Jordan being assignees of two-thirds interest only in said patent, as shown by the record of assignments in this Office; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 7th day of March A. D., 1899.

[SEAL.]

WEBSTER DAVIS,
Assistant Secretary of the Interior.

Countersigned:

C. H. DUELL,
Commissioner of Patents.