

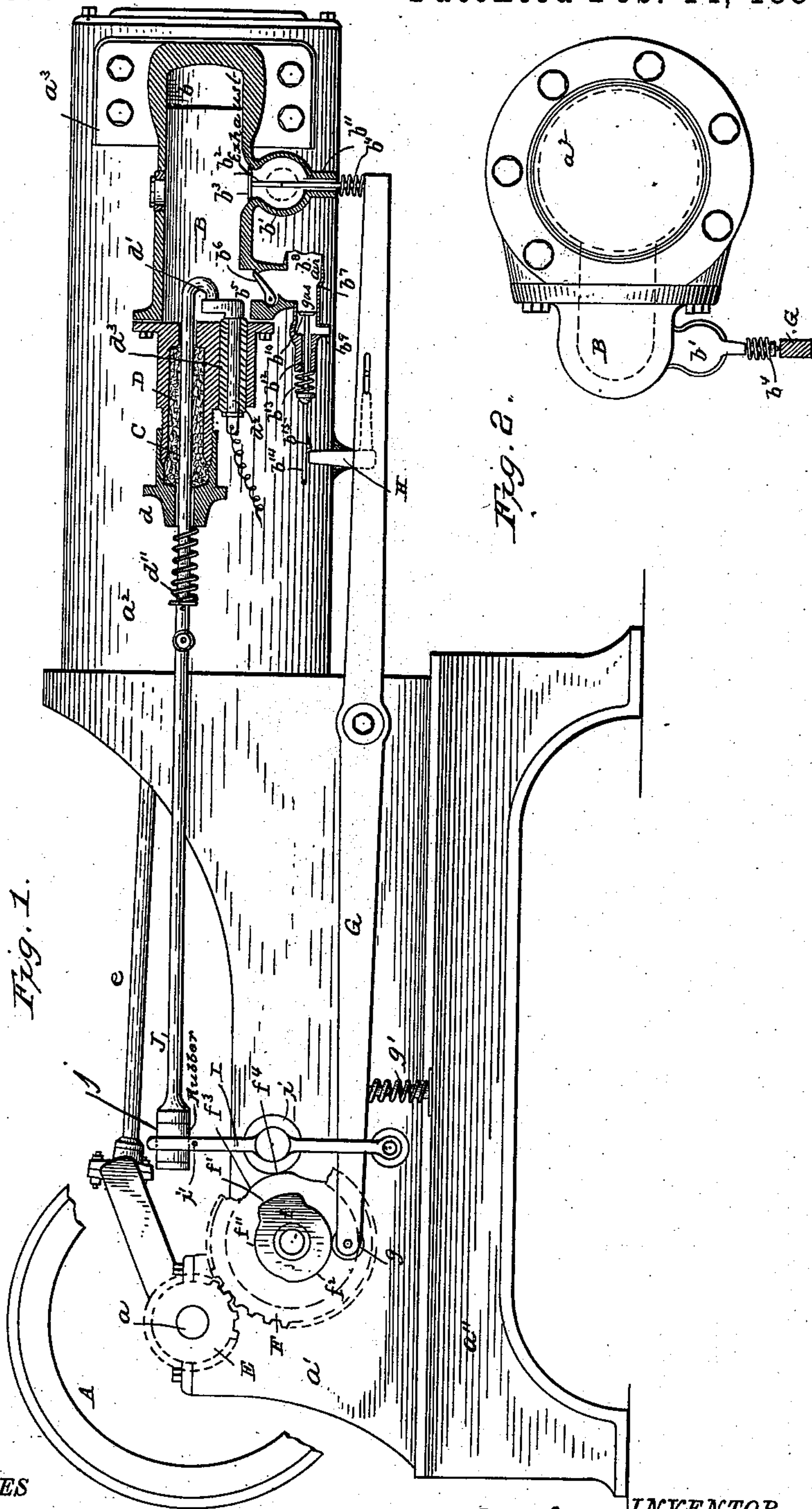
(No Model.)

R. F. SMITH.

GAS ENGINE.

No. 377,962.

Patented Feb. 14, 1888.



WITNESSES
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GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 377,962, dated February 14, 1888.

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To all whom it may concern:

Be it known that I, REUBEN F. SMITH, a citizen of the United States of America, residing at Pleasant Hill, in the county of Dallas and State of Alabama, have invented certain new and useful Improvements in Gas-Engines, of which the following is a specification, reference being had therein to the accompanying drawings.

10 This invention pertains to certain new and useful improvements in gas-engines, having for its object the provision of simple and efficient means for introducing and exhausting the charges, and also a simple and efficient igniting device located in the ignition-chamber in
15 such manner as to be readily accessible.

To these ends the invention consists in the detail construction, combination, and arrangement of the parts, substantially as hereinafter
20 fully set forth, and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a view in side elevation of a gas-engine embodying my invention, parts being shown in section. Fig. 2 is an end view of the piston-cyl-
25 inder and ignition-chamber.

Referring to the drawings, A represents the ordinary fly-wheel, the crank-shaft of which is secured at its ends in suitable journal-boxes supported in the usual frame, a' , resting on its base a'' . To the forward end of this frame a' is secured, in the ordinary manner, one end of the piston-cylinder a^2 , which upon one side, near
30 its outer end, is provided with a flanged extension, a^3 , for securing thereto on a line parallel with the piston-cylinder the ignition-chamber B. An opening or passage-way, b , is formed in the side of the cylinder a^2 , forming a connection between said cylinder and chamber, as shown.
40 It will be seen that the terminal of the bore of this ignition-chamber coincides with the opening or passage-way b , leading into the piston-cylinder when said chamber is bolted in position.

45 Integral with the bottom side of the chamber B is a small approximately globe-shaped chamber, b' , having an upper beveled edge opening into the chamber B, as shown; and this chamber b' has a small tubular extension, b'' , through the aperture in which is passed
50 the stem b^2 of the exhaust-valve b^3 , seated upon the beveled edge of the opening between the

chambers B and b' . The lower extended end of this stem b^2 has a coil-spring, b^4 , encircling the same and bearing at one end against the
55 end of the tubular extension b'' and a nut on the end of said stem, as shown. In one side of this globular chamber b' is formed an opening, at which point is connected one end of a pipe or tube (not shown) for conveying the
60 exhaust or products of combustion passing through said chamber b' , as customary.

Near the forward lower end of the ignition-chamber B is formed a short extension, through which passes the inlet-opening b^5 , wherein is
65 disposed a check-valve, b^6 . To the lower end of this short extension is secured or formed integral therewith a pipe, b^7 , which opens into the inlet-opening b^5 , as shown. The pipe b^7 has an opening, b^8 , for admission of air, and
70 at its other opposite end said pipe has a right-angular extension, b^9 , for the admission of gas. Within this pipe b^7 is disposed a valve, b^{10} , to regulate the inflow of gas, the stem b^{12} of said
75 valve being projected through a tubular extension of the pipe b^7 and encircled on its outer portion by a coil-spring, b^{13} . It will be seen that the valve b^{10} normally rests against its
80 beveled seat formed on the inner surface of the pipe b^7 . To the outer end the stem b^{12} of the gas-valve b^{10} is pivotally secured one end of a short rod, b^{14} , provided with a short lug or
85 projection, b^{15} , as shown.

C is a horizontally-disposed rod passed through an ordinary stuffing-box, D, secured
90 to the forward end of the ignition-chamber B, said stuffing-box being fitted with an ordinary cap, d , as shown. The inner end of this rod projects a short distance within the ignition-chamber, and is bent, as shown, so as to have
95 a short forwardly-projecting end, d' . The outer end of this rod C is encircled by a coil-spring, d'' , bearing against the cap d , and a pin passed transversely through said rod.

Through a suitable aperture in the forward
95 end of the ignition-chamber is passed an insulated electrode, d^3 , incased by a porcelain tube, d^3 , as shown. The inner end of this insulated electrode projects in the ignition-chamber, and is bent at right angles, as shown,
100 while the outer end has an ordinary nut screwed thereon. To this outer end of the insulated electrode is connected one end of an ordinary electric wire, leading from any suit-

able dynamo, (not shown,) from which also leads a second wire, (not shown,) connected to any suitable part of the gas-engine.

E is a small pinion or gear-wheel secured upon one end of the crank-shaft a , and to this crank-shaft is connected, in the ordinary manner, one end of a piston-rod, e , the other end of which is of course connected to the ordinary piston head, (not shown,) working in the cylinder a^2 .

F is a second pinion or gear-wheel of twice the diameter of the pinion or gear-wheel E. This wheel F is secured in position by means of a stud in the side of the frame a' , and is designed to gear with the pinion or gear-wheel E, as shown. On the outer face of this gear-wheel F is formed a flange, f , the edge of which is composed of a cam, f' , a depression, f'' , and a straight circular portion, f^2 . On the inner face of the gear-wheel F is formed a flange, f^3 , which has a cam, f^4 , as shown.

G is a long normally-horizontal lever fulcrumed at about its center upon a projecting pin of the frame a' . The forward end of this lever G carries a small roller, g , which is always in contact with the edge of the flange f on the outer face of the gear-wheel F, said end of the lever being held slightly elevated by means of a coil-spring, g' , bearing against the under side thereof, two corresponding studs of said lever and the base a' being encircled by said spring, as shown. The rear end of this lever G normally rests near the lower end of the stem b^2 of the exhaust-valve b^3 .

H is a bell-crank lever fulcrumed to a short downwardly-projecting flange of the cylinder a^2 , the rear end of the horizontal arm of said bell-crank lever being secured to the inner side of the lever G by means of a pin or bolt projected through an oblong slot in said lever, as shown. The upper end of the vertical arm of this bell-crank lever bears against the flange or projection b^{15} on the rod b^{14} of the stem of the gas-inlet valve.

I is a normally-vertical lever fulcrumed at its lower end to the side of the frame a' . To about the center of this lever is connected thereto a roller or wheel, i , designed to be constantly in contact with the flange f^3 on the inner periphery of the gear-wheel F, a portion of said wheel being broken away in Fig. 1 to more clearly show said flange. The upper end of this vertical lever I is projected through a slot formed in the forward widened end of a connecting-rod, J, said slot being provided at its rearmost end with rubber or suitable elastic packing, j , as shown, to prevent jarring of the parts. The rear end of this connecting-rod J is pivotally connected to the forward projecting end of the rod C, as shown, the forward end of said connecting-rod being held in its proper horizontal position by means of a transverse pin, i' , passed through the lever I. From what has been said it will be seen that by means of the cam and depression formed with the flange f of the gear-wheel F the lever G will be caused to act upon the exhaust and

gas-inlet valves, respectively, and that the cam on the flange on the inner periphery of said wheel will, through the agency of the vertical lever I and connecting-rod J, force the rod C from contact with the end of the insulated electrode as against the action of its spring.

It will be understood that there is one power-stroke of the piston in two revolutions of the crank-shaft.

The operation is as follows: Assuming that there was a charge of air and gas in front of the piston, and also a part in the ignition-chamber, and that the cam f^4 on the flange f^3 of the gear-wheel F came in contact with and pressed the roller or wheel i , the lever I caused the separation of the rod C from contact with the electrode d^2 , and a spark is produced and the mixture or charge ignited. At this point the piston (not shown) is driven to the opposite end of its cylinder, and consequently the crank-shaft is forced to its opposite horizontal position. As the piston reaches the end of its power-stroke the pinion or gear-wheel E will have made one-half revolution and the gear-wheel F one-quarter revolution. This will bring the cam f' of the flange f in contact with the roller g , causing the depression of the forward end of the lever G, and consequently the elevation of the rear end thereof, which will force the exhaust-valve from its seat, and the same will remain unseated until the momentum of the fly-wheel drives the piston to the opposite end of its cylinder. At this point the depression f'' of the flange f comes in contact with the roller g , causing the closing of the exhaust-valve, and by reason of the coil-spring causes the forward end of said lever to be elevated, and consequently the lowering of the rear end thereof, thus pulling downward on the horizontal arm of the bell-crank lever, which will effect the unseating of the gas-inlet valve b'' by reason of the vertical arm of said lever pressing rearwardly against the flange or projection b^{15} of the rod b^{14} , connected to the stem of said valve. The gas-inlet valve will be thus held open while the piston is making the backward stroke by reason of the momentum of the fly-wheel, and thus draw in the charge of air and gas. The charge being thus drawn into the cylinder and chamber, the inlet-valve is closed immediately upon the straight curved portion f^2 of the flange f coming in contact with the roller on the end of the lever G, the exhaust being also closed. During this latter movement the piston makes the compression-stroke, compressing the charge into the space in front of the piston-head, usually called the "compression-space," and also in the ignition-chamber. As the piston completes its compression-stroke and is about ready to start on the return-stroke, the cam f^4 on the inner flange of the gear-wheel F suddenly presses against the roller i of the vertical lever I, forcing said lever rearward against the rubber cushion in the end of the connecting-rod J, causing said rod to push rearwardly on the rod

C as against the action of its coil-spring, separating the bent end of said rod C from contact with right-angular end of the insulated electrode d^2 , causing a spark and thus igniting the charge. It will be understood that a current of electricity is passing through the insulated electrode and the rod C, one wire, as before stated, from a small dynamo (not shown) being connected to said electrode and from there to any part of the engine.

Any suitable governor (not shown) may be employed to regulate the supply of gas to the engine.

I claim as my invention—

1. In a gas-engine, the combination, with the gear-wheels, the cylinder, and ignition-chamber, together with the inlet and exhaust valves, of the horizontally-disposed lever having a roller secured to one end in engagement with a cam of one of said gear-wheels, the coil-spring, and the bell-crank lever, all arranged substantially as shown and described.

2. In a gas-engine, the combination, with the gear-wheels, the cylinder, the ignition-chamber, and the insulated electrode, of the vertical lever carrying the roller engaging a cam on the inner periphery of one of said gear-wheels, the connecting-rod, and the spring-held rod having a bent end normally in contact with the

flanged end of said electrode, substantially as shown and described.

3. In a gas-engine, the combination of the gear-wheels, the vertical lever, the spring-held rod, the connecting-rod having a slot formed in one end thereof, provided with an elastic cushion, and the horizontally-disposed lever having a spring-bearing and engaging a cam of one of said gear-wheels, as and for the purpose stated.

4. In a gas-engine, the combination, with the piston, its cylinder, the crank-shaft, and the pinion or gear-wheel, of the large pinion or gear-wheel, the outer flange having a cam and a depression, the inner flange provided with a cam, the ignition-chamber, the electrode, the spring-held inlet and exhaust valves, the horizontally-disposed lever carrying a roller, the bell-crank lever having one end secured to said former lever, the vertical lever having a roller, the connecting-rod, and the spring-held rod having a bent inner end, all constructed and arranged substantially as shown and described.

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

REUBEN F. SMITH.

Witnesses:

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J. W. BAILEY.