(No Model.)

3 Sheets—Sheet 1.

R. F. SMITH.

GAS ENGINE.

No. 347,656. Patented Aug. 17, 1886.

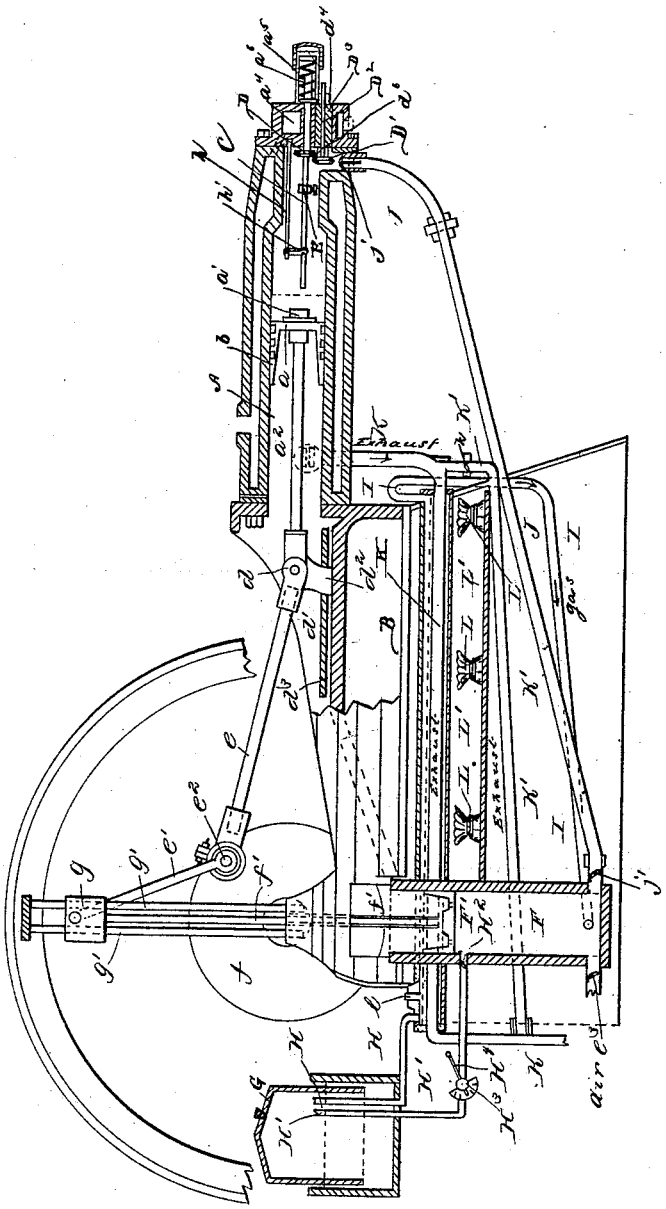

Fig. 1.

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(No Model.) 3 Sheets—Sheet 2.

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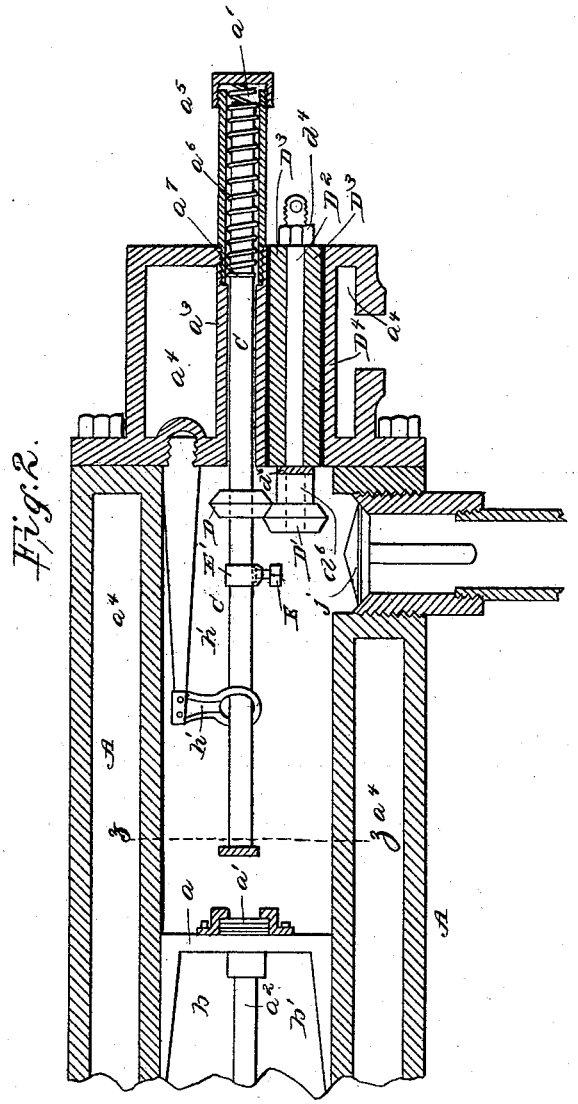
Fig. 2.



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(No Model.) 3 Sheets—Sheet 3.

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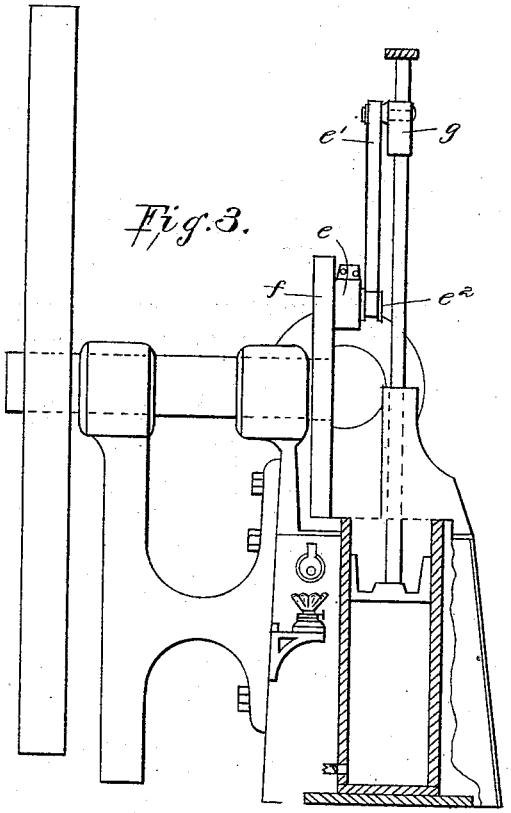
Fig. 3.



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UNITED STATES PATENT OFFICE.

REUBEN F. SMITH, OF PLEASANT HILL, ALABAMA.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 347,656, dated August 17, 1886.

Application filed April 8, 1886. Serial No. 198,251. (No model.)

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.

This invention has relation to improvements in gas-engines, having for its object, principally, to provide a simple and effective electrical igniter or circuit-breaker to produce a spark or means for the ignition of the gas in the power-cylinder, and also to utilize the heat of the power-cylinder exhaust-pipe by adapting it to impart or give off its heat to the hydrocarbon in the carbureting cylinder or chamber; and the invention consists of the combinations of parts, including their construction, substantially as hereinafter fully set forth, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a longitudinal sectional elevation of my improved gas-engine. Fig. 2 is an enlarged detail sectional view showing more fully the igniter proper. Fig. 3 is a partly-sectional end elevation of the invention.

In the embodiment of my invention I employ a power-cylinder, A, of the construction shown, or other suitable form, and a generator or carburetor, B, disposed preferably, for convenience, under the cylinder. The cylinder A is suitably mounted in position in any known way, and is provided with a piston, *a*, fitted to move air and gas tight therein and having about in its center a cushion or yielding surface, *a'*, to break the concussion and lessen wear and tear of the piston in its action, as will be hereinafter readily understood. This cushion or yielding surface, fully disclosed in a previous application of mine, comprises a number of spring-metal disks or plates held removably, so as to be replaced after well worn, or any one or more requiring renewal by others within, keepers forming a socket upon the face of the piston for their reception, as clearly shown in Fig. 2. This piston is provided along its rear edges with a rearwardly-projecting cylindric flange, *b*, for guiding the same in the cylinder A, while centrally from the rear side of said piston projects its stem or rod a^2, making connection with the cross-head *d*, guided in its movement by a downwardly-projecting arm, *d'*, having lateral flanges d^2 at its extreme lower end entering grooves d^3, made in the engine plate or casting, as fully shown in Fig. 1.

To the cross-head *d* is pivotally or axially connected the one end of a pitman, *e*, whose opposite end is connected to a wrist-pin, e^2, eccentrically secured to a disk, *f*, mounted upon the main drive-shaft of the engine. The link or pitman *e'* is also connected to wrist-pin e^2, and its upper end is connected to a slide or sleeve, *g*, fitted upon upright parallel rods or bars *g' g'*, suitably connected together at their upper ends and fastened at their lower ends upon the engine-casting, or an extension thereof, the function of which slide or sleeve will be seen farther on.

Within the cylinder A is also arranged a stem or rod, C, the same being supported near one end so as to have movement within an eye or ring at the lower end of a pendant, *h'*, of a horizontal bar or bracket, *h*, screwed into the inner side of one head of the cylinder A. The rod C is inclosed for a portion of its length within a tube, a^3, of the cylinder-head A, which tube a^3 extends through the one end portion of the water-jacket a^4 of the cylinder-head. The stem or rod C is extended a short distance beyond the tube or one end of the water jacket or cylinder, which extension thereof is inclosed by a second tube or casing, a^5, having screw-connection with the one end of the tube a^3, being arranged in alignment therewith. This second tube or casing contains a helical spring, a^6, one end of which bears against one end of the said second tube or casing, which has a cap screwed thereon; and the other end of said spring rests or bears against a washer, a^7, secured upon the rod or stem C, whereby the action or pressure of said spring is brought to bear upon said rod or stem, being distended in its normal condition, a space therefore being left in the outer end of the tube a^5, for the movement toward the same of the stem or rod when it is acted upon, as will appear farther on. Upon this stem, within the cylinder A, is secured a double-beveled disk or piston, D, one of whose beveled surfaces rests upon a similar beveled disk or piston, D', secured upon one end of a spindle or rod, D^2, which is

inserted into an insulating (porcelain it may be) bushing, D^3, disposed or held in a tube, D^4, also projecting from the one end of the cylinder A within the one end portion of the water-jacket a^4. The outer end of this spindle or rod serves as an electrical conductor or electrode when put into circuit, in the usual way, with the dynamo, as in practice it is. The outer end of the electrode or rod D is held in place by a nut, d^4, which also clamps in place a washer or packing, d^5, placed upon the other projecting portion of the electrode or rod, and a sleeve, d^6, also placed upon the latter between the disk D′ and washer or packing d^5. The double-beveled surfaces of the disks D D′ furnish an extended area of wearing and contacting surface for generating the required spark or means for breaking the electrical current. There being play in the stem or rod C, the connecting-disks D D′ are beveled, so as to securely provide for the engagement of the sides of said disks; and a further object in thus beveling said disks is to produce friction between the same, and thus keep the contacting edges bright and conductive, insuring the accomplishment of the desired result. Also arranged upon the stem or rod C, intermediately of its free end and the disk D, and adjacent to the latter, is a band or ring, E′, having a pendent weight, E, screwed into the lower surface of said ring, with the inner end of the screw bearing against the rod, and thus serving to fix the band or ring and weight from accidental movement or shifting from its point of adjustment. The object of this contrivance is, by reason of its weight on the rod C, serving as it does as a counter-balance therefor, to effectively hold one side of the disk D in contact with the disk D′, and thus insure their engagement at all times, preventing liability of the shifting-around movement of the stem under the action of its spring after it has been struck by the piston in breaking the circuit to produce the igniting-spark.

F is the air and gas charging pump, within which is disposed the air and gas tight packed piston or plunger F′, the same having its rod or stem f' suitably connected, about centrally, to the slide or sleeve g, above described, which rod or stem thus receives its movement through the eccentric or disk f, link or pitman e', and said slide or sleeve g.

In the lower end of the pump-barrel is an air-inlet valve, e^3, which will be further hereinafter referred to.

G is an airometer or air-receiver, with its upper part telescoping and movable within the lower receiving part, which contains to a certain height, as well understood, water, above which and within said movable part is contained or stored air, said latter part having a plugged opening to admit, in first putting the machine in action, atmospheric air, as will again be referred to hereinafter. Projecting or extending up within this air-receiver, a short distance above the level or surface of the water therein, are two pipes, H H′, one, H, leading to and for conducting air into the generator or carburetor B, before referred to, while the other, H′, leads to and receives air from the air and gas charging pump F, which is provided at its inlet end (the one connecting with the pump) with a check-valve, H^2, and intermediately of the latter and the air-receiver G with an air-regulating valve, H^3. The action of this latter valve H^3 is adapted to be self-acting or automatic in practice, among other ways by connecting the one end of its lever or handle H^4, being provided with such, to the rising and falling or movable part of the air-receiver G, it may be by a cord or chain passed over a pulley supported at a fixed point or upon the stationary part of the receiver, and the other end of said lever having a weight attached to it. From this it is obvious that as the movable part of the air-receiver rises and continues to rise to its maximum height, which is due to the ingress or increase of the supply of air, the cord or chain will be drawn upon, which in turn will move the said lever, which movement of the latter will cause the valve to shut off the supply of air to said receiver, the valve having been previously so adjusted or disposed in the pipe H′ as to close the passage upon such movement of said movable part of the air-receiver. Upon the lowering or falling of the movable part of the air-receiver, which of course takes place as air is withdrawn, it is also apparent that the weighted end of the valve-lever will effect the reverse movement of the valve, and thus again open the passage in the pipe for the flow of the air to the receiver, which action of the valve will continue as long as the apparatus is in action. The check-valve H^2 will open and admit into the pipe H′ air or a weak mixture at the first part of the delivering or down stroke of the pump piston or plunger, which charge would mostly be delivered into the power-cylinder through the pipe J. As the pump-piston reaches near its upstroke it uncovers a valved pipe, e^3, admitting an additional volume of air to the pump, and as the pump-piston starts to descend, or on the downstroke, this air is forced into the air-receiver.

To the lower end of the pump F is connected the air-gas pipe I, which connects in an approximately siphonic manner with the generator or carburetor B, the combined air and gas or air-gas passing thereinto, as indicated by the arrows; also connecting with the lower end of the pump F is a second pipe, J, leading to and passing, under the action of the pump-piston or plunger, the explosive mixture into the ignition-chamber of the power-cylinder A, directly opposite to the circuit-breaker or igniter-disks D D′. The pipe J is provided with a valve, j', closing its supply end, as shown.

K is the power-cylinder exhaust-pipe, connecting with the exhaust-chamber of said cyl-

inder, and passing longitudinally through the generator or carburetor B, near its bottom, and consequently through the hydrocarbon, which is introduced into the carburetor or generator through the plugged opening *l*, whereby the heat of said pipe will be imparted or given off to the hydrocarbon, and thus keep the same warm, which facilitates the carbureting process. Should the heating or warming action of the exhaust-pipe upon the hydrocarbon become too great, the exhaust from the cylinder can be diverted, so as to prevent its passing through that part of the exhaust-pipe disposed within the generator or carburetor, a branch pipe, K′, being provided to connect with the said exhaust-pipe intermediately of the cylinder and the generator or carburetor, and with the discharging end of said exhaust-pipe, said branch pipe passing exteriorly of the generator or carburetor. When, however, it is not desired to pass the exhaust through the branch pipe, the same may be cut off therefrom by means of a valve, *k*, provided in the branch pipe K′ near the connection of the pipe K with the generator or carburetor.

In order to heat or warm the hydrocarbon at the outset before the machine has been put into action, I arrange lamps L upon a suitable support, L′, below the generator or carburetor, exposing the bottom or lower surface of the latter to the action of the flame thereof, as shown, which of course is extinguished when the machine has begun to work.

In order to put the machine in operation, the plug of the airometer or air-receiver G is removed and the movable part thereof lifted by hand, when the same will be supplied with atmospheric air, after which the plug is returned to its place. Any suitable hydrocarbon is now placed in the generator or carburetor through the opening *l* and the lamps L lighted. In a few minutes the hydrocarbon will become sufficiently warm or heated to carry on the process of carbureting the air, also admitted into the generator from the air-receiver through the pipe H during its passage over the surface of the hydrocarbon. Now, by turning the fly-wheel by hand the pump-piston F′ will, upon an upward stroke, cause an inrush of air through the valve e^3 and gas through the inlet end of pipe I, (the latter also, in practice, having a check-valve.) While the pump-piston is approaching its highest point the power-piston *a* is moving toward the exhaust-port connecting with the pipe K. Before the piston *a*, however, reaches or uncovers the exhaust-port the pump-piston has begun to descend, forcing a small quantity of the charge into the airometer, the balance thereof being forced into the power-cylinder, and by the time the power-piston has returned about half-way between the exhaust-port and the innermost part of the compressing-stroke the pump-piston will have forced the charge through the check-valve *j* into the cylinder A. As the electrical current is passing through the rods D^2, C, and the disks D D′ the piston *a* arrives near the dotted line *z z*, Fig. 2, striking the rod C, when the disks will be separated, producing the electrical spark, which effects the ignition, and consequently the explosion of the charge, the force of which will impart the return-stroke to the piston *a*. At the same time the distention of the spring *a*, previously under compression by the contact of the piston *a* with rod C, will return the latter to its former position, and again cause its disk D to engage with the disk D′ of the electrode or rod D^2, which action of parts will be repeated throughout the operation of the machine.

In lieu of the ordinary oil-lamps L, for the first heating of the hydrocarbon in the carburetor or generator, there may be arranged under the latter gas-burners, and the heating of the same therefore be effected by means of gas.

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

1. The combination, in a gas engine, with the power-cylinder piston, of the rods having beveled contacting-disks, one of said rods being insulated to receive an electrical current, substantially as and for the purpose set forth.

2. In a gas-engine, the combination, with the power-cylinder piston, of the rods having contacting-disks, one rod having a returning-spring, and the other rod being insulated to receive an electrical current, substantially as and for the purpose specified.

3. In a gas-engine, the beveled contacting-disks secured upon and in combination with the rods C D^2, one of said rods having a returning-spring and the other rod being insulated to receive an electrical current, as shown and described.

4. In a gas engine, the combination, with the pump-piston, the airometer, and the carburetor, said carburetor and pump-piston cylinder connected with said airometer, of the power-cylinder piston, and the rods or stems having beveled disks secured thereon, said power-cylinder and pump-piston cylinder connected by a valved pipe, substantially as shown and described.

5. In a gas-engine, the combination, with the carburetor and the lamps arranged below the same, of the airometer connected to said carburetor, and the pump-piston cylinder connected by valved pipes with said airometer and carburetor, substantially as shown and described.

6. In a gas-engine, the combination, with the airometer, the carburetor, the pump-piston, and the pipes connecting said airometer and carburetor, and the pump-piston cylinder, of the power-piston cylinder, the exhaust-pipe connected thereto and passing through the carburetor, and the valved pipe connecting said pump-piston cylinder and the power-cylinder, substantially as shown and described.

7. In a gas-engine, the power-cylinder with

its piston and exhaust-pipe, and the circuit-breaker comprising the separable disks with their rods, one rod having spring-pressure and adapted to be acted upon by the said piston, and the other rod to receive an electrical current, in combination with the charging-pump having pipe-connection with said power-cylinder, the air-receiver having pipe-connection with the charging-pump, the generator or carburetor receiving the exhaust-pipe of the said power-cylinder and having pipe-connection with said air-receiver, together with the drive-shaft and its disk actuating through pitmen and a slide, the power-cylinder piston, and the pump-piston, substantially as and for the purpose set forth.

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

REUBEN F. SMITH.

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