(No Model.)

C. W. WEISS.

GAS ENGINE.

No. 419,806. Patented Jan. 21, 1890.

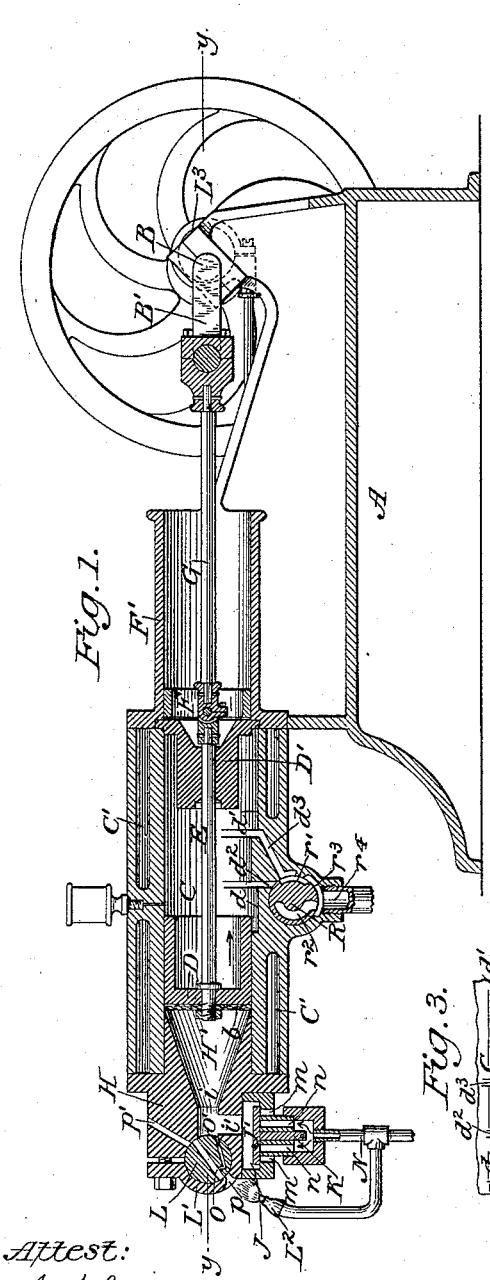

Fig. 1.

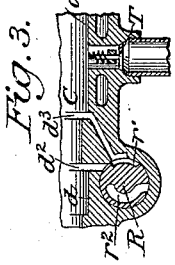

Fig. 3.

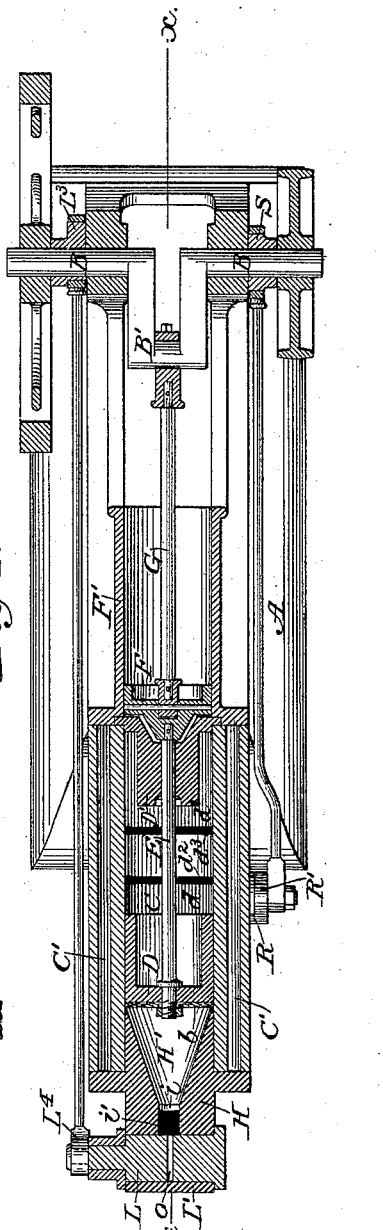

Fig. 2.

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UNITED STATES PATENT OFFICE.

CARL W. WEISS, OF BROOKLYN, ASSIGNOR OF ONE-HALF TO CHARLES KRUSE, OF NEW YORK, N. Y.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 419,806, dated January 21, 1890.

Application filed May 25, 1889. Serial No. 312,072. (No model.)

To all whom it may concern:

Be it known that I, CARL W. WEISS, of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Gas-Engines; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, making a part of this specification.

This invention relates to that class of engines which are driven by the energy of exploding gases and known as "gas-motors," and has for its object to simplify the construction thereof and to increase their efficiency by permitting the exploded charge to expand to the utmost before it is exhausted, and then cooling it within the cylinder without reducing its volume, its expansion, exhaust, and the intake of a fresh charge all being accomplished during a single revolution of the crank-shaft driven by the piston.

It consists in a novel construction and combination of the several parts of the machine, substantially as hereinafter described and claimed.

In the accompanying drawings, Figure 1 is a central vertical section through the improved engine in line $x\ x$ of Fig. 2. Fig. 2 is a central horizontal section through the same in line $y\ y$ of Fig. 1, and Fig. 3 a sectional detail illustrating a modification in the exhaust-port for the cylinder.

Similar letters indicate like parts in each of the figures.

A represents the base of the engine; B, the crank-shaft mounted in suitable bearings upon one end of said base; C, the working-cylinder mounted to extend out horizontally from the opposite end of the base, being secured thereto in the customary manner; D, the piston working in said cylinder; E, the piston-rod working through the outer head of the cylinder and attached to a suitable cross-head F, moving in a cylindrical guide F′; and G, the pitman coupling said cross-head to the crank B′ on the shaft B.

The working-cylinder C is encircled by a water-jacket C′, which may be either formed in the casting or by means of an outer casing, and the cylinder is closed at its inner end by a head H, formed with a conical recess H′ in its inner face, which enlarges gradually from a central inlet-port i of comparatively small diameter to the full diameter of the inner periphery of the cylinder. This conical recess serves as the explosion-chamber for the cylinder. The inlet-port i is made to communicate by a suitable open passage i' with the induction-valve chamber J and with a suitable igniting device. The induction-valve may be of any approved form; but, preferably, it is made to consist of a disk J′, mounted upon and guided by a vertical stem K in position to cover automatically by its weight the air and gas inlets m and n, the outer larger inlet m being made to communicate with the outer air and the inner smaller inlet n with a gas-supply pipe N.

The igniting device consists of a cylindrical rotating valve L, mounted to oscillate in a suitable inclosing-casing L′. This cylindrical valve L has a passage o pierced diametrically through it to register in one position of the valve both with a flame-inlet p and with an opposite outer vent p' in its casing, and has also a second smaller passage o' branching from the diametric passage o to communicate with the inlet-port i of the working-cylinder when said diametric passage is in register with the flame-inlet p. A burner L^2 is placed beneath said inlet p, so as to present thereto a constant flame.

The igniting-valve L is operated in unison with the movements of the piston D at the proper moment by means of an eccentric L^3 on the crank-shaft B, coupled to a rock-arm L^4 on the outer end of the valve.

The piston D is formed of a hollow cylinder of a length about one-third, more or less, that of the working-cylinder, and having its outer end, which faces the central inlet-port for the gases, closed. A central cylindrical displacing-block D′, of a diameter slightly less than the internal diameter of the hollow piston, is mounted at the outer end or head of the piston-cylinder in position to enter the recess in the piston when the latter attains the end of its stroke in that direction. The inner face of the piston is preferably covered, as at b, with a layer of asbestus or other non-conducting material. Recesses d and d'

are formed in the inner periphery of the piston-cylinder of a width embracing about one-fourth, more or less, of its circumference—the one d' to extend from the rear end of the cylinder toward the middle for about one-third its length, and the other d at about the middle of the length of the cylinder for about one-half the length of the first. Free communication is established between these two recesses during a portion of the stroke of the piston through passages d^2 and d^3, leading from each to a cylindrical rotating valve R, mounted in the casing of the cylinder, and which is formed with a recess r' in its periphery adapted to establish communication between said passages when properly brought into register therewith by a movement of the valve. The peripheral recess r' in the valve serves also to establish communication at the proper time between the passage d^3, leading to the outer end of the cylinder, and a recess r^3 in the inner periphery of the valve-seat or casing, communicating either with a radial exhaust-port r^4 in said casing or, if preferred, with a recess r^2, formed longitudinally in the valve to open outwardly at either end thereof, and which, by reason of the elasticity of its thin outer concentric wall, as shown in Fig. 1, will allow the valve to be fitted more closely in its seat. These several passages and recesses in the casing, the valve-seat, and valve are so placed and arranged in relation to each other as that so soon as by a movement of the valve communication is cut off through the valve between the passages d^2 and d^3 communication will be established between the passage d^3 and the exhaust-port in the valve, and vice versa.

The rocking of the valve R is effected at the proper moment and in proper synchronism with the movements of the piston by means of an eccentric S on the main shaft coupled to a rock-arm R′ on the end of the valve, as shown in Fig. 2.

The valve R and the eccentric S actuating it are so adjusted with reference to the piston D as that at the complete instroke of the piston the exhaust-port in the valve is in free communication with the outer end of the cylinder, and so remains until the piston has completed its outstroke. So soon as this point is reached the communication between the piston-cylinder and the exhaust is cut off by the movement of the valve R, and communication is at once established through the passages d^2 and d^3 in the casing and the recess r' in the valve between the spaces on the two opposite sides of the piston.

While it is preferable to control the exhaust positively by means of the valve R, by which the displacing-passages d^2 and d^3 are governed, as described, the exhaust-port may be controlled by an independent valve T, to be either actuated by the movement of the piston or to be left free to operate automatically, as shown in Fig. 3 of the drawings.

In the operation of this improved motor, so soon as the charge has exploded, it is allowed to expand fully and fill the entire cylinder as the piston makes its complete outstroke, so that its tension is reduced to atmospheric pressure. Upon the return-stroke of the piston the exploded charge is displaced and made to flow from the compression to the exhaust side of the piston through the passages d^2 d^3, and is thereby so far cooled and condensed by contact with cooling-surfaces as that the reduction of its pressure is carried to the point at which a fresh charge will be drawn into the inner end of the cylinder through the inlet-valve, the valve opening automatically by reason of the superior pressure of the air and gas under it. So soon as the piston has made the first half of its instroke the communication between the opposite sides of the piston is cut off and the fresh charge in front of the piston is compressed into the conical recess or explosion-chamber H′ in readiness for firing. The firing is effected at the moment the instroke of the piston is completed by the movement of the valve L, which, by bringing the passage o, charged with burning gas, into communication with the cylinder at that moment, permits of an ignition of the charge. Hence at each outstroke and instroke of the piston, producing a single revolution of the crank-shaft, the exploded charge, by propelling the piston to its extreme length of stroke outward, is expanded until its tension is reduced to about that of the atmosphere, and is then displaced to the opposite side of the piston by the return-stroke, so as to cool it without diminishing its volume, thereby so far reducing its pressure as to cause the inflow of a fresh supply of mingled air and gas at the inlet. At the half return-stroke the waste charge of burned gas has passed to the exhaust side of the piston and the communication between the two sides is cut off, so that the further movement of the piston to the end of its stroke compresses the fresh charge until the stroke is completed and the charge exploded to repeat the cycle.

I claim as my invention—

1. A gas-engine having a single piston working in a single cylinder provided at its outer end with an exhaust-vent and at its inner end with a supply-port for the admission of an explosive charge, the middle of the cylinder and its outer or exhaust end being connected by communicating passages governed by a valve moving in synchronism with the piston, whereby said communicating passages are closed as the piston, impelled by the explosion of the gaseous charge, makes its outstroke, and upon the return-stroke said passages are opened during the first portion and closed during the remainder of said stroke, thereby permitting during the outstroke a full expansion of the exploded charge and during the instroke a displacement of the burned charge to the exhaust side and an indraft and compression of a fresh charge at

the compression side of the piston preparatory to an explosion at the end of said instroke, substantially in the manner and for the purpose herein set forth.

2. In a gas-engine, a single cylinder having passages establishing communication between the middle of its length and its outer end and recesses in its inner periphery connecting with said passages, a valve controlling said communication and the communication between the outer end of the cylinder and an exhaust-vent, and a piston working in said cylinder and actuating mediately said valve, substantially in the manner and for the purpose herein set forth.

3. In a gas-engine, a single cylinder having an explosion-chamber at its inner end and an exhaust-port at its outer end, a hollow extended piston moving in the cylinder, a displacing-block at the outer end of the cylinder, upon which the piston is carried at the end of its outstroke, passages establishing communication between the middle of the cylinder and its outer end, and a valve actuated mediately by the movement of the piston and controlling said passages, substantially in the manner and for the purpose herein set forth.

4. A gas-engine constructed, substantially as described, of a single cylinder having an explosion-chamber at its inner end, an exhaust-port at its outer end, and a passage establishing communication between the middle of its length and said outer end, and which is provided with a piston moving therein over the ports into said passages, an inlet-valve for the charge, an igniting device connecting with the explosion-chamber, a crank-shaft coupled to the piston, and valves actuated thereby to control the igniting device, the exhaust-port, and the communicating passage, all arranged and operating substantially as set forth, so that during one revolution of the shaft the exploding charge shall, after propelling the piston outwardly and thereby expelling the previously-exploded charge through the exhaust, be displaced from one side of the piston to the other upon its return-stroke, and thereby so expanded and cooled as to create an indraft for a fresh explosive charge, which shall be compressed into the explosion-chamber by the completion of said return-stroke.

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

CARL W. WEISS.

Witnesses:
A. N. JESBERA,
E. M. WATSON.