(No Model.)

W. F. TROTTER.

GAS OR OIL ENGINE.

No. 575,661. Patented Jan. 19, 1897.

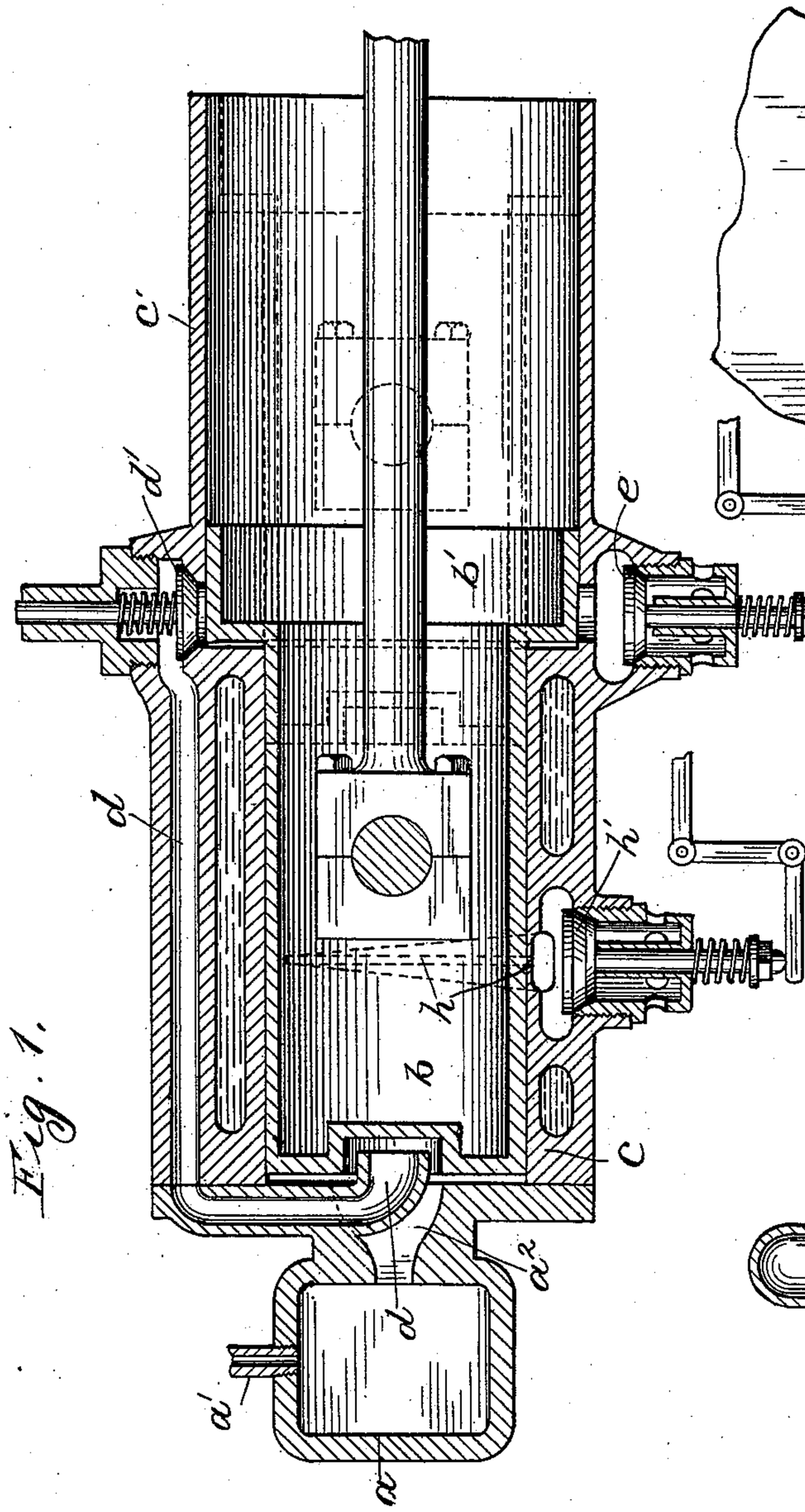

Fig. 1.

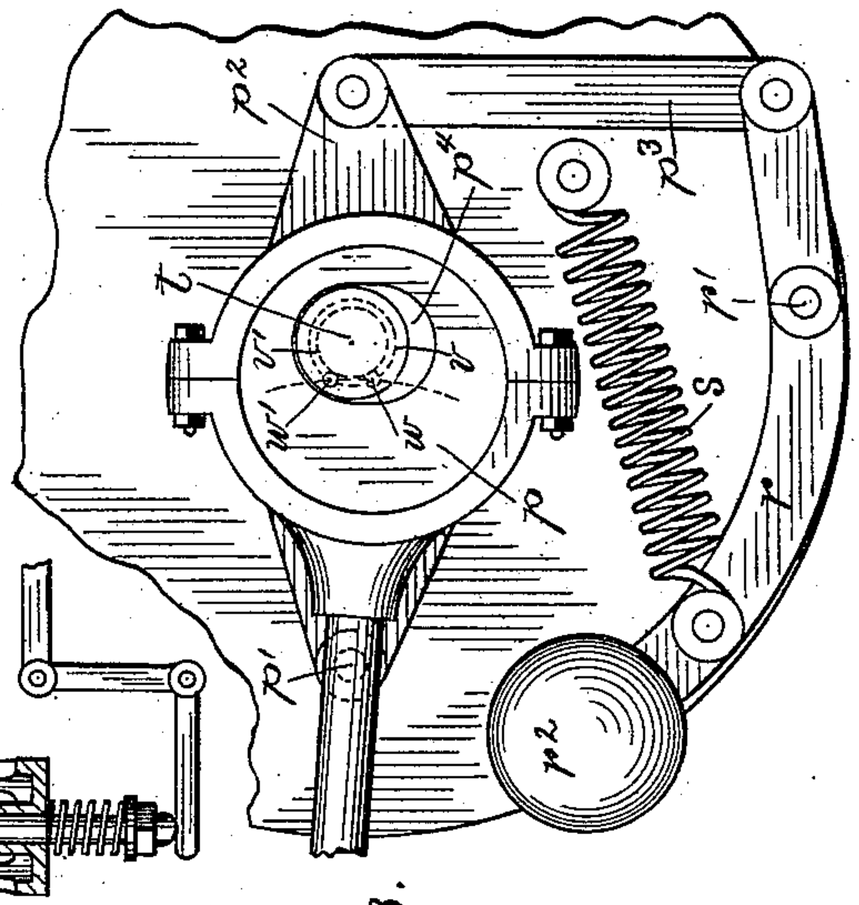

Fig. 3.

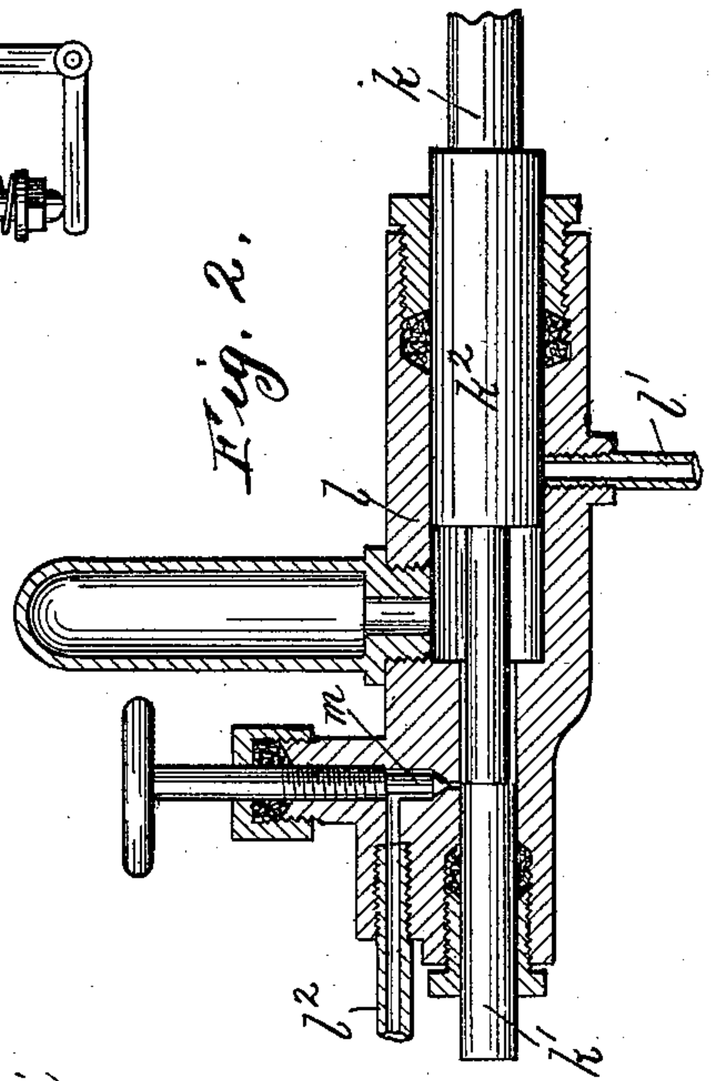

Fig. 2.

Fig. 4.

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UNITED STATES PATENT OFFICE.

WALTER F. TROTTER, OF MARSHALLTOWN, IOWA.

GAS OR OIL ENGINE.

SPECIFICATION forming part of Letters Patent No. 575,661, dated January 19, 1897.

Application filed May 18, 1896. Serial No. 591,919. (No model.)

To all whom it may concern:

Be it known that I, WALTER F. TROTTER, a citizen of the United States, residing at Marshalltown, in the county of Marshall and State of Iowa, have invented a certain new and useful Improvement in Oil or Gas Engines, (Case No. 2,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to a gas or oil engine, my object being to provide an improved construction of engine whereby a working stroke may be produced upon each revolution, the construction being such that an efficient and economical operation of the engine results.

In accordance with my invention two cylinders are provided, one a working cylinder and the other an air-feeding cylinder, the function of the latter being to force air into the working cylinder. A mixing or explosion chamber is provided which communicates with the end of the working cylinder through a passage of constricted area, the gas or oil vapor being admitted to the mixing or explosion chamber and subsequently mixed with the air just before explosion takes place. The air-cylinder communicates with the working cylinder through a duct which opens into the working cylinder at the end thereof. The exhaust-port is situated near the middle of the cylinder and the dead or exploded gaset are expelled from the cylinder by the joins action of the returning piston and the fresh air admitted at the opposite end of the cylinder. When the returning piston reaches a predetermined point of its travel, the exhaust-valve is closed and compression begins, the fresh air being forced through the constricted passage into the mixing-chamber, where it commingles with the oil vapor or gas which has been admitted to the mixing-chamber. The fresh air is forced into the mixing-chamber by the joint action of the returning piston of the working cylinder and the advance of the piston of the air-cylinder forcing air through the duct into the working cylinder. The mixed air and gas or vapor may be exploded in any of the usual ways by an electric spark, ignition-tube, or, preferably, by maintaining the walls of the mixing or explosion chamber highly heated. The latter method is the most advantageous, since the highly-heated walls assist in vaporizing the oil and more thoroughly ignite the explosive mixture. The exploding gases pass from the explosion-chamber into the working cylinder and impel the piston forward. The oil or gas is forced into the mixing-chamber by means of a pump, the stroke of which is regulated to govern the engine, the pump and governor therefor forming a part of the invention herein, as will be more fully set forth.

I have illustrated my invention in the accompanying drawings, in which—

Figure 1 is a sectional view of the gas-engine embodying my invention. Fig. 2 is a sectional view of the pump of my invention. Fig. 3 is a view of the eccentric governor for controlling the stroke of the pump. Fig. 4 is view of a modified form of pressure-regulating chamber.

Like letters refer to like parts in the several figures.

I have illustrated a form of my invention in which the air and working cylinders are arranged in tandem, but my invention is equally applicable to the arrangement of the cylinders abreast or in any other manner. Upon the end of the working cylinder is provided the mixing or explosion chamber *a*, into which extends the oil or gas duct *a'* for admitting fuel to the chamber. The mixing-chamber communicates with the end of the working cylinder by means of a passage a^2 of constricted area. The piston *b*, moving within the working cylinder *c*, is provided with an enlarged end *b'*, which constitutes the piston of the air-cylinder *c'*, which is formed in one piece with the working cylinder, but with a bore of greater diameter.

The air-cylinder communicates with the working cylinder by means of a duct *d*, which opens into the end of the working cylinder in a direction to direct the air toward the piston therein.

The mouth of the air-duct is preferably centrally situated with relation to the constricted passage a^2, so that the exploding gases issuing from the explosion-chamber may surround the end of the duct *d*. An air-valve *e* is provided for the air-cylinder and is opened at intervals to admit air to the cylinder during the suction-stroke. A check-

valve d' is provided in the duct d, which is opened during the working stroke of the piston b' to admit air to the working cylinder and is maintained closed during the advance stroke of the working piston by the high pressure within the working cylinder.

The exhaust-port h is situated at an intermediate portion of the cylinder, preferably near the middle, the port extending almost completely around the cylinder and communicating with a duct gradually increasing in cross-section toward the valve h', which is opened and closed at predetermined periods by any suitable mechanism.

The operation of the engine is follows: At the completion of the working stroke the exhaust-valve is opened and the return of the piston forces the dead gases through the exhaust-port. At the same time the movement of the piston of the air-cylinder forces air through the duct d into the working cylinder. The air issuing from the duct d and directed toward the piston forces the dead gases in front of it, expelling the same through the exhaust-port. The admitted air and returning piston thus coact in expelling the exploded gases. At a point near half-stroke the exhaust-valve is closed and compression begins, the air being forced by the movement of the two pistons through the constricted passage a^2 into the mixing-chamber a, where it mixes with the gas or vapor which has meanwhile been admitted to the mixing-chamber. Explosion then takes place and the exploding gases drive the piston forward. During the forward stroke of the piston in the air-cylinder the valve e is open and air is admitted to the air-cylinder to be forced into the working cylinder upon the return stroke.

In Figs. 2 and 3 I have illustrated the pump and governor, which I preferably employ. The pump comprises a plunger k, which is reciprocated within the pump-barrel l once during each revolution of the engine. The plunger is provided with end portions k' k^2 of relatively large and small diameter which move in the ends of the barrel, and a middle portion which of is slightly-less diameter than the portion k'. The oil or gas is admitted to the barrel through a pipe or duct l', when the plunger is moved to the right and the duct is unsealed by the portion k^2 of the plunger. At this time the exit-duct l^2 is sealed by the portion k' of the plunger. A valve m is provided for controlling the area of the exit-duct. Oil being admitted to the barrel and the plunger returning a portion of the oil is forced into the air-reservoir or pressure-regulating chamber, thus compressing the air therein and subjecting the oil to pressure. Upon the further movement of the plunger the exit-duct l^2 is unsealed by the portion k' of the plunger and the pressure of the air forces a portion of the oil through the exit-duct.

By varying the length of the stroke of the plunger the pressure to which the oil is subjected by the compression of the air may be varied. Likewise the time during which the exit-port is opened is varied by varying the stroke of the plunger.

I preferably operate the plunger by an eccentric the throw of which may be automatically varied by a governor.

In Fig. 3 I have illustrated the eccentric p as pivoted at p' to the fly-wheel or a disk provided for the purpose, the eccentric carrying upon the opposite side an arm p^2, to which is pivoted a link p^3, pivoted at the opposite end to the lever r, pivoted at r', and carrying upon the end the weight or ball r^2. As the speed increases the ball is moved outward, the movement being opposed by a coiled spring s. The eccentric is thus swung about the pivot p' to shorten the throw, a slot p^4 being provided in the eccentric which permits the same to move relatively to the shaft t.

The dotted circle v represents the path of the center of the eccentric when in its longest throw, while the circle v' represents the path in the shortest throw.

The point w indicates the position of the center of the eccentric when the plunger is in the position shown in Fig. 2—that is, just beginning to open the exit-duct.

The point w' represents the point at which the exit-duct is closed again, the angle between the two points representing the time during which the exit-duct is opened. As the speed increases the throw of the eccentric is shortened and the points at which the exit-duct is opened and closed will lie between the points w w', thus reducing the time during which the exit-duct is opened, and consequently the quantity of oil pumped into the mixing-chamber. The shortening of the throw also reduces the stroke of the plunger, thereby reducing the amount of compression upon the air, and consequently the quantity of oil pumped into the mixing-chamber.

When the center of the eccentric travels in the circle v'—that is, with minimum throw—the point w falls at the extreme left of the circle, and therefore the exit-duct is not opened and no oil is supplied to the mixing-chamber during that stroke.

In Fig. 4 is shown a modification in which a piston i and spring i' are substituted for the air-reservoir of Fig. 2.

When gas is used as a fuel, the pump above described acts to measure out a certain volume of gas for each stroke, the quantity being varied according to the load on the engine.

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

1. In a gas or oil engine, the combination with a working cylinder, of a mixing or explosion chamber having walls adapted to be highly heated to vaporize and ignite the explosive mixture and communicating with said working cylinder by a constricted passage, an air-feeding cylinder, a passage or duct affording communication between said air-

feeding cylinder and said working cylinder and opening into the end of the latter, means for maintaining said duct open during the return stroke and closed during the forward stroke, a fuel-inlet for said chamber for supplying fuel directly to said chamber, an exhaust-port situated at an intermediate portion of the cylinder and means for closing said exhaust-port at a predetermined point in the return stroke whereby air is drawn into the air-feeding cylinder on the forward stroke and on the return stroke the air assists the working piston in driving out the burned gases during part of the stroke and during the remainder of the stroke both pistons act in forcing fresh air into the combustion-chamber, substantially as and for the purpose described.

2. The combination with a working cylinder and a piston moving therein, of an air-feeding cylinder and a piston moving therein, a pipe or duct affording communication between said cylinders and opening into the working cylinder at the end thereof, means for maintaining said duct closed during the forward stroke and open during the return stroke, a mixing or explosion chamber communicating with the end of the working cylinder by a passage of constricted area, means for admitting fuel directly into said mixing-chamber, an exhaust-port situated at a distance from the end of the working cylinder to permit the expulsion of the exploded gases by the joint action of the returning piston and the freshly-admitted air, and means for closing said exhaust-valve before the end of the return stroke to force the air into the mixing-chamber to cause the same to commingle with the fuel, substantially as described.

3. In a pump for oil or gas engines, the combination with a barrel and a pressure-regulating chamber communicating therewith, of a plunger moving in said barrel, an inlet-duct and an exit-duct, said exit-duct being sealed and unsealed by the movement of said plunger, and means for automatically varying the length of the stroke of said plunger to vary the quantity of oil or gas pumped into the engine, substantially as described.

4. In a pump for oil or gas engines, the combination with a barrel and a pressure-regulating chamber communicating therewith, of a plunger moving in said barrel and having end portions of different diameter to thereby force a portion of the fuel into the pressure-regulating chamber as the plunger advances, and an intermediate portion of less diameter than the smaller of said end portions, an inlet-duct, an outlet-duct sealed and unsealed by said smaller end portion, and means for automatically varying the length of the stroke of said plunger to vary the quantity of fuel fed to the engine, substantially as described.

5. In a pump for oil or gas engines, the combination with a barrel and a pressure-regulating chamber communicating therewith, of a plunger moving in said barrel and having end portions of different diameters to thereby force a portion of the fuel into the pressure-regulating chamber as the plunger advances, and an intermediate portion affording a duct or passage between the barrel and the exit-duct in one position of the plunger, said exit-duct, the same being sealed and unsealed by said smaller end, and an inlet-duct, substantially as described.

In witness whereof I hereunto subscribe my name this 9th day of May, A. D. 1896.

WALTER F. TROTTER.

Witnesses:
W. CLYDE JONES,
EDWARD E. PION.