No. 657,576. Patented Sept. 11, 1900.

H. SMITH.

GAS ENGINE.

(Application filed May 11, 1899.)

(No Model.)

Fig. 1.

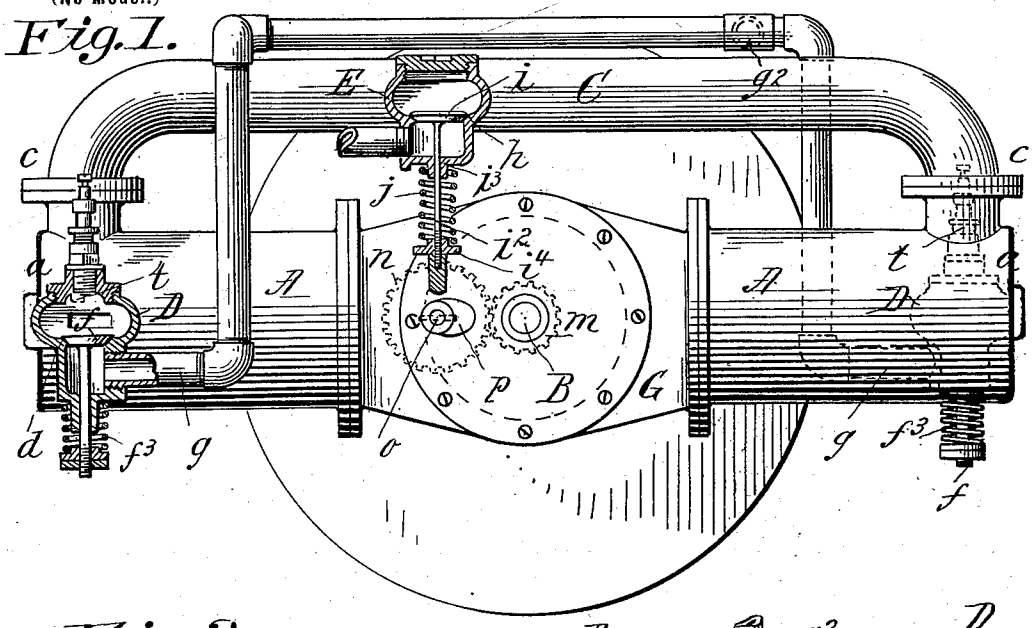


Fig. 2.

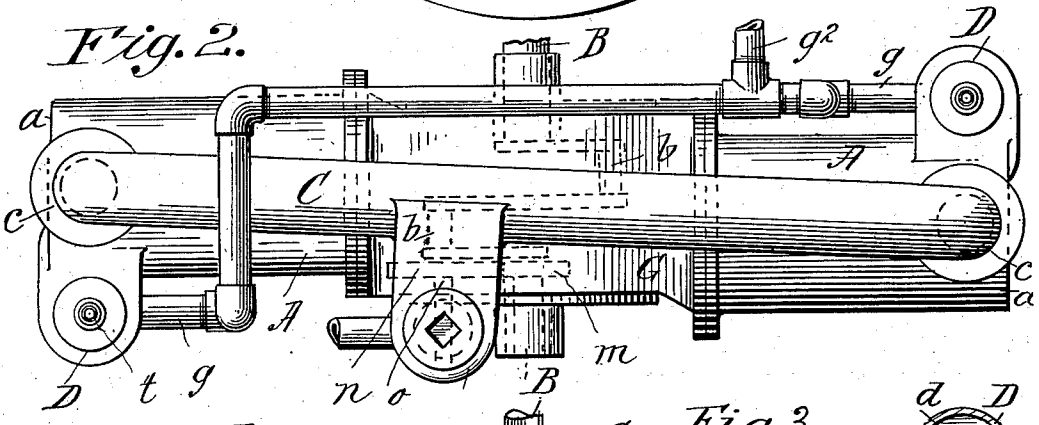
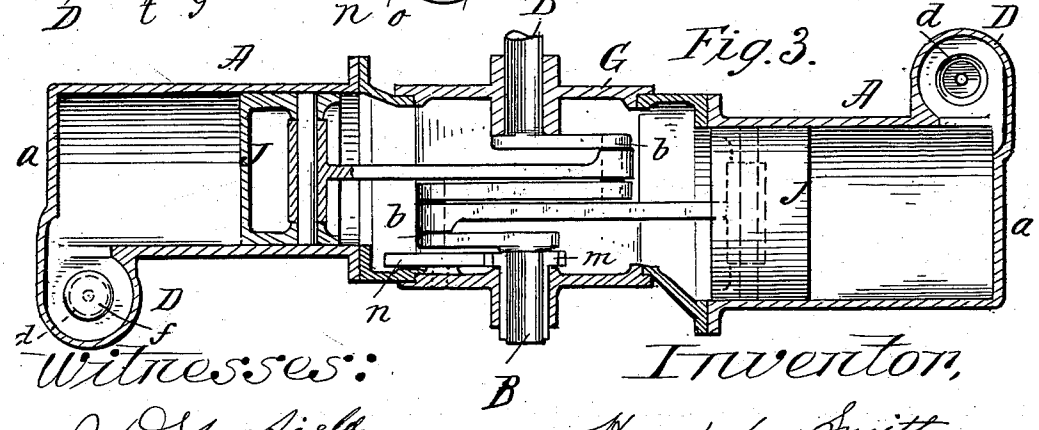


Fig. 3.



Witnesses:

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UNITED STATES PATENT OFFICE.

HINSDALE SMITH, OF SPRINGFIELD, MASSACHUSETTS.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 657,576, dated September 11, 1900.

Application filed May 11, 1899. Serial No. 716,386. (No model.)

To all whom it may concern:

Be it known that I, HINSDALE SMITH, a citizen of the United States of America, and a resident of Springfield, in the county of Hampden and State of Massachusetts, have invented certain new and useful Improvements in Gas-Engines, of which the following is a full, clear, and exact description.

This invention relates to improvements in a type of gas or explosive engine which comprises a pair of cylinders oppositely arranged but axially coincident, each having a piston operating on a common crank-shaft, the outer ends of both cylinders being connected by a common comparatively-large bow-shaped conduit which constitutes a continuation of the explosion-chambers of both cylinders and permits simultaneously the action of the exploded gas oppositely inwardly on both pistons. In the engine of the aforesaid type as heretofore proposed so far as known to me a common valve-chest has been provided in connection with the conduit extensions forming part of the explosion-chambers for both the cylinders, in which valve-chest were provided both an inlet-valve for supplying gas into the engine for both the cylinders and an exhaust-valve, and in the operation of such engine after the gas has been entered into the valve-chest and conduit extensions leading therefrom into both cylinders and exploded therein, because the then oppositely-moving pistons (which force the dead gas outwardly from the ends of the cylinders and toward the valve-chest and to some extent through the exhaust-valve in the valve-chest) are incapable of expelling all of the dead gas, a certain proportion of the latter remains in or near the valve-chest or in each conduit at opposite sides thereof and between such chest and the cylinders with which they are connected, and so therefore upon the admission through the same valve-chest of fresh gas to be drawn by suction created by the approaching pistons in the opposite cylinders such fresh gas encounters the residue of dead gas from the preceding explosion and necessarily becomes commingled therewith, whereby of course the efficiency of the engine is lessened.

The object of the present invention is to construct a gas-engine with the axially-coincident oppositely-arranged cylinders each having a piston therein operating upon a common intermediately-disposed crank-shaft, the outer ends of both cylinders being connected by a common bow-shaped conduit in which there is an exhaust-valve, and with separate gas admission or inlet valves for each of the cylinders all in such manner that as the pistons outwardly recede oppositely from each other upon the explosion of the gas the pistons drive the dead gas beyond the admission-valves into the common bow-shaped connecting-conduit for exit as to a large proportion thereof through the exhaust-valve arranged in said bow-shaped conduit, and such spent gas as driven by the pistons, as aforesaid, beyond the points of admission of the fresh gas insure that upon the next entrance of fresh gas the same will not be commingled with the spent gas, and all as will hereinafter more fully appear.

The invention consists in the construction and arrangement of the parts and appliances in the engine of the aforesaid type all substantially as will hereinafter fully appear, and be set forth in the claims.

Reference is to be had to the accompanying drawings, in which my present improvements are indicated, and in which—

Figure 1 represents a side view of the improved engine, one of the admission-valves at the outer end of one of the cylinders and the common exhaust-valve being shown in vertical section. Fig. 2 is a plan view of the engine. Fig. 3 is a horizontal sectional view.

Similar characters of reference indicate corresponding parts in all of the views.

In the drawings, A A represent the two cylinders, both of which are arranged axially coincident, but opposite and separate from each other, united by the intermediate casing G, their outer ends *a* being closed.

B represents the crank-shaft, having the double crank *b b*, to which connecting-rods are secured, which are also connected to the pistons J.

C represents the bowed conduit, the end portions *c c* of which are connected with the outer ends of the cylinders A A outside of the piston, such conduit uniting the outer

end portions of both the cylinders and constituting continuations of the explosion-chambers thereof.

D D represent admission-valve casings, each of which inwardly opens into the end of the cylinder and is provided with the valve-seat d, the inwardly-opening valve f, and with each of these valve-casings D outside of the valve is connected the gas-inlet conduit g, both of these conduits having connected thereto the common supply-pipe g^2 for the gas or vapor taken therethrough from a suitable gas-supply receptacle or carbureter, and each valve-stem f^2 has applied thereto in a usual manner a comparatively-light closing-spring, the reaction of which may be overcome by the suction exerted after an explosion-stroke when the pistons move inwardly.

E represents the casing or inclosure formed as a part of or having connection with an intermediate part of the common connecting-conduit C for both the cylinders, said casing having therein the valve-seat h, upon which closes the exhaust-valve i, the valve-stem i^2 of which depends vertically through and beyond the guide i^3 therefor and has at its extremity the shoulder i^4, between which and the base of the valve-casing E is the spiral spring j, which maintains the valve normally closed.

Upon the crank-shaft B, preferably located within the intermediate casing G, is the pinion or small spur gear-wheel m, meshing with which is a gear-wheel n of double its size, which is mounted upon a short stud-shaft o, which is rotatable in unison with the gear-wheel n, and said stud-shaft has at its outer end, which is extended to the exterior of the said intermediate casing G, the cam p, which has one rotation to every two rotations of the crank-shaft and which cam each time it turns exerts an endwise-forcing action against the extremity of the stem of the exhaust-valve, which is arranged in the path of this cam, whereby periodically and properly the exhaust-valve is positively and mechanically opened after each explosion-stroke of the simultaneously-operating pistons.

In the operation of the engine after an explosion-stroke the opposite pistons move inwardly, causing by their suction the opening of the respectively-provided admission-valves $f\,f$ for and at the outer ends of both the cylinders, the dead gas by the working or explosion strokes of the piston having been driven outwardly beyond the admission-valves into the common cylinder-extension conduit C and in large part expelled therefrom through the then-opened exhaust-passage, and the next outward stroke of both pistons, which move oppositely from each other, compresses the last-entered gas in the ends of the cylinders and in the common conduit and cylinder-extension, crowding any residue of the dead gas which may have remained in the intermediate part of the said conduit C more closely toward the exhaust-valve, and after the second outward piston-stroke which compresses the gas the latter is exploded by the electric igniting devices (indicated at l) within the casings D D for the admission-valves, such igniting devices being of a common and well-known form and constituting no part of the present invention, and inasmuch as the pistons in their outward working stroke drive the dead gas, as described, well into the common conduit C to be exhausted therefrom there is an avoidance of a mixture of the next incoming fresh gas with the residue of the spent gas which may not have issued through the exhaust-passage therefor. Next after each explosion-stroke the comparatively-slight remnants of the dead gas not discharged out of the engine are "side-tracked," so to speak, in the bowed conduit E and are not mixed with the next incoming fresh charge. There is neither any pressure above atmospheric pressure in the bowed conduit E at the end of the exhaust-stroke of the pistons, nor is the exhaust-valve left open for the slightest instant after the pistons have started inwardly on their suction-strokes next following the expulsion of the dead gas.

It will be understood that in this engine the exhaust-valve at the moment of explosion is surrounded by the undischarged residue of dead gas from the previous explosion, whereby it is protected from the fire occurring on each side of it by the ignition of the pure gas, and the exhaust-valve is thus maintained much cooler, preventing overheating, which is of common occurrence in the ordinary forms of gas-engines, and it is understood that the inlet-valves are not subject to the overheating, although directly in contact with the flame at each explosion, as they are cooled at every other stroke by the incoming charge of cool air and gas.

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

1. In a gas-engine, in combination, the two cylinders, oppositely arranged and having their outer ends closed, and having pistons therein, the common crank-shaft located between the cylinders with which both pistons are connected, the common conduit connected with the outer ends of both cylinders, and constituting an always-open passage from the one cylinder to the other, a separate admission-inlet connected with the outer end of each cylinder, and a valve for each of said inlets, a common exhaust-passage and an exhaust-valve provided in an intermediate part of said common cylinder-connecting conduit, and an exhaust-valve-operating mechanism, substantially as and for the purpose set forth.

2. In a gas-engine, in combination, the two cylinders, oppositely arranged and having their outer ends closed, and having pistons therein, the common crank-shaft located between the cylinders with which both pistons are connected, the common conduit connected

with the outer ends of both cylinders, and constituting an always-open passage from the one cylinder to the other, a valve-casing provided and inwardly opening into the outer end of each cylinder and constructed with a valve-seat, and an admission-valve provided to normally close upon each valve-seat, a gas-inlet conduit connected with each valve-casing, a common exhaust-passage and an exhaust-valve provided in an intermediate part of said common cylinder-connecting conduit, and an exhaust-valve-operating mechanism, substantially as and for the purpose set forth.

Signed by me at Springfield, Massachusetts, this 10th day of May, 1899.

HINSDALE SMITH.

Witnesses:
WM. S. BELLOWS,
M. A. CAMPBELL.