

UNITED STATES PATENT OFFICE.

HINSDALE SMITH, OF SPRINGFIELD, MASSACHUSETTS.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 663,475, dated December 11, 1900.

Application filed May 17, 1899. Serial No. 717,125. (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, or approximately so, 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 inward on both pistons.

In the engine of the type aforementioned constructed as heretofore proposed a single common valve chest or chamber has been provided in communication with the common conduit extensions formed as parts or continuations of the explosion-chambers for both the cylinders, in which valve-chest both an inlet-valve for supplying gas into the engine for both cylinders and an exhaust-valve for the exhaust from both of the cylinders to said common extension-conduit were provided. In such engine after the gas entered into said common conduit extension and simultaneously into both the cylinders has been exploded the next stroke of the piston following the explosion or working stroke forces the dead gas endwise outwardly in the opposite cylinders and through the common conduit and cylinder extensions toward and partially out through the discharge-port, the discharge or exhaust valve at such period being open; but at best a certain considerable proportion of the exhaust or dead gas will remain in the chest or chamber in which both the inlet and exhaust valves are provided and also in the said common conduit extension, impairing or preventing a high efficiency in the operation of the engine, because the next incoming supply of fresh gas into the cylinders through one and the same valve-chest and common conduit necessarily becomes admixed with the

considerable residue of the dead gas from the preceding operation.

The object of this invention is to so construct the engine having the axially-coincident oppositely-arranged cylinders, each having a piston therein operating upon a single intermediately-disposed crank-shaft, the outer ends of both cylinders being closed and provided with a common bow-shaped extension-conduit connecting the closed outer end of both cylinders and serving as a continuation of the cylinders, with means separate from the common conduit-cylinder extension into and through which the gas is introduced and conveyed for the exhaust and discharge of the dead gas or residue, and all with the employment in the organization of the engine of but a single exhaust-valve and its fittings and of but a single inlet-valve and fittings and but one igniting or spark-producing device, and on which arrangement is dependent advantages—viz., that a comparatively small proportion of the dead gas remaining after an explosion is regurgitated into the cylinders; that what dead gas does remain after each explosion in that part of the engine in which the exhaust-valve is located serves as a means for protecting the exhaust-valve from becoming excessively heated by the flame of the explosions, and the arrangement of the divided or separate conduits for the introduction of the gaseous charges and for the exhaust of the spent gases serve to increase the radiating-surfaces, which in an air-cooled engine is a great consideration; and to this end the invention consists in a gas-engine or motor having embodied therein the constructions and arrangements or combinations of parts, all substantially as will hereinafter fully appear and be set forth in the claim.

The improved engine is illustrated in the accompanying drawings, in which—

Figure 1 is a side or front elevation of the engine, the exhaust-valve and its fittings being shown in central vertical section. Fig. 2 is a plan view of the engine.

In the drawings, A A represent the two cylinders, which are arranged opposite and separate from each other, with their axes ranging coincident or parallel with each other, both cylinders being united by the intermediate

casing G, their outer ends a being understood as closed. The main and crank shaft B has within the said central casing the double cranks B^2 , to which the connecting-rods B^3 are secured, the same being also connected to the pistons B^4 .

C represents the bowed conduit, the end portions $c c$ of which are connected with the outer end portions of both the cylinders A A, as indicated more particularly in the plan view, Fig. 2, the said conduit C constituting continuations of the explosion-chambers of the two cylinders.

d represents a chamber-inclosing casing having therein a valve-seat opening and a valve which is normally closed by a light spiral spring, all so that as the pistons draw inwardly on their intermediate approaching strokes—that is, on their inward strokes between the explosion-strokes—the induction of vaporized gasoline or gas takes place.

D^2 represents the gas-supplying conduit, which leads into the valve-chamber d , which is in communication with the common cylinder-extension conduit C.

E represents a second bowed conduit, shown as being similar in form to the cylinder-extension conduit C and connected with the end portions of both the cylinders at $e e$, this part E having its arrangement alongside of and parallel with the conduit C, although it might be, if desired, otherwise arranged so long as it forms connection with the ends of both the cylinders.

d^3 represents a chamber-inclosing casing connected and communicating with the middle part of the conduit E, this casing having provided therein a single valve-seat opening or exhaust-port d' , seating on which is the inwardly-opening exhaust-valve d^2 , the stem 53 of which depends for guidance through the tubular guide z and has at its lower end the nut or shoulder 55, reacting against which is the valve-closing spring 57.

E^2 represents an exhaust-conduit for conveying away the discharging dead gas to any point of final discharge suitably distant from the engine.

At J is represented an exhaust-valve-operating cam mounted on the main or crank shaft of the engine and operating on every second rotation of such shaft to mechanically and positively open the exhaust-valve, this exhaust-valve-operating mechanism forming no part of the present invention; but it constitutes the subject-matter of and is more fully and clearly illustrated in Letters Patent of the United States granted to me September 12, 1899, No. 632,763.

The gas-inlet valve being closed at the time the exhaust-valve in the common cylinder connecting exhausting-conduit E is opened, the dead gas on the outward strokes of the pistons next following the explosion-strokes will most naturally and freely pass to the then-opened single exhaust port or outlet, passing thereto from the cylinders through

the common cylinder-exhausting extension-conduit E. Now while there is in the bowed conduit C a residue of dead gas which may not have been exhausted from the engine and also a non-exhausted residue of dead gas in the bowed conduit E on the next suction-stroke in substance only the dead gas in the conduit C will be mixed with the fresh charge, and where both the bowed conduits are provided they may be of comparatively small diameter and capacity, and hence the volume of dead gas to be commingled with the new charge may be greatly less than in any engine heretofore proposed by others of the type comprising the bowed double-cylinder-uniting conduit. The engine herein-described and claimed possesses these distinct advantages: a conversion of the presumed objection of remaining dead gas adjacent the exhaust-valve for the protection of the latter from the explosion-flames, a reduction of the quantity of dead gas which will be admixed with the fresh charge, and a provision by the double conduits C E of such an open construction of the engine-body, especially that portion thereof (the said conduits) in which the compression of the gas is performed, as to give a maximum of exposed surface for air-cooling, and by providing the appliances in the novel arrangement shown an engine of extreme simplicity and economy of construction is produced, requiring, in the engine having the separated cylinder-uniting conduits C E, with the attendant advantages set forth, but a single exhaust-valve and its operating mechanism and a single inlet-valve for the fulfilment of all valve requirements, and the increased advantage which accrues under the exercise of this invention more than compensates for the inconsiderable cost of the added casting E, which constitutes the cylinder-uniting chamber and passage for the independent exhaust.

While it has not been deemed necessary to illustrate the inlet-valve and its fittings or inclosing casing, as a spring-closed valve of ordinary construction may be employed, it will be observed that in practice a counter-part of the exhaust-valve and its fittings, as shown herein, are to be employed, although a lighter spring is usually used upon the inlet-valve, and no mechanical inlet-valve-operating mechanism is combined therewith, the suction of the pistons properly and seasonably drawing the valve open against its spring.

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

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 cylinder-extension conduit C, connected with the outer ends of both cylinders, and provided with a single

valved admission-inlet, and a separate and independent conduit E, also connected to the outer ends of both cylinders, provided in an intermediate part thereof with a single exhaust-port, an exhaust-valve, and an exhaust-valve-operating mechanism, substantially as and for the purpose set forth.

Signed by me at Springfield, Massachusetts, this 11th day of May, 1899.

HINSDALE SMITH.

Witnesses:

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