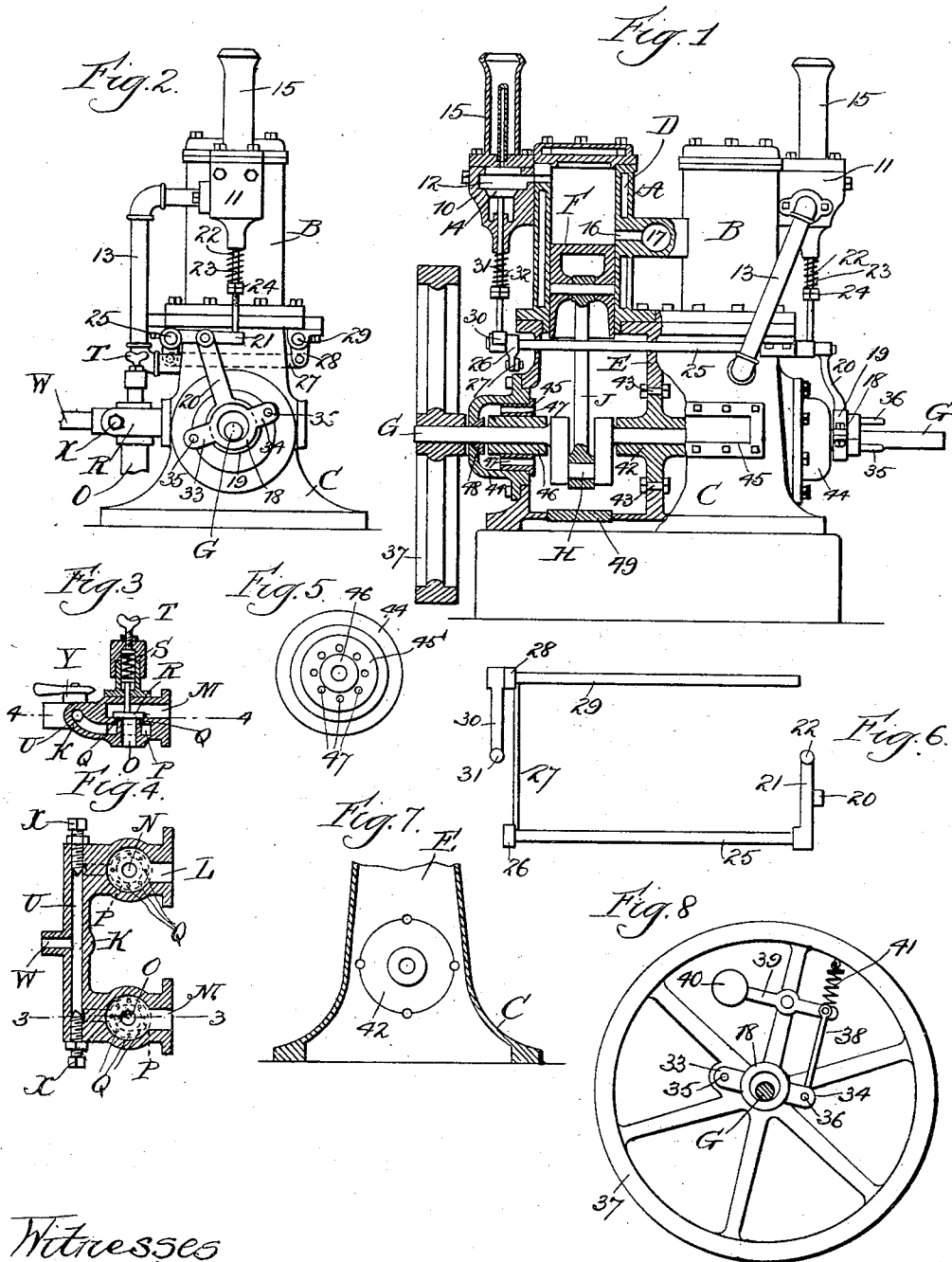


(No Model.)

O. COLBORNE.
GAS ENGINE.

No. 579,860.

Patented Mar. 30, 1897.



Witnesses
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UNITED STATES PATENT OFFICE.

OLIVER COLBORNE, OF CHICAGO, ILLINOIS.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 579,860, dated March 30, 1897.

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To all whom it may concern:

Be it known that I, OLIVER COLBORNE, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Gas-Engine, of which the following is a specification.

This invention relates to gas-engines.

The object of the invention is to simplify and improve the construction of machines of this class and to render the same more efficient in operation.

The invention consists, substantially, in the construction, combination, location, and relative arrangement of parts, all as will be more fully hereinafter set forth, as shown in the accompanying drawings, and finally specifically pointed out in the appended claims.

Referring to the accompanying drawings and to the various views and reference-signs appearing therein, Figure 1 is a view, partly in side or front elevation and partly in vertical central section, of an engine embodying the principles of my invention. Fig. 2 is an end elevation of the same. Fig. 3 is a detached detail view, in vertical section on the line 3 3, Fig. 4, of the air and gas inlet attachment. Fig. 4 is a detail sectional view on the line 4 4, Fig. 3. Fig. 5 is a detached detail view of the journal cap and bearing of the main shaft. Fig. 6 is a detached detail view of the arms for actuating the valve for controlling the admission of the explosive charge to the cylinders. Fig. 7 is a broken sectional view illustrating the method of mounting the movable journal-bearing for the shaft in the division-wall. Fig. 8 is a detached detail view of the governor mechanism for controlling the valve-actuating apparatus.

The same reference-sign is employed to designate the same part wherever it occurs throughout the several views.

In the particular form of the engine illustrated in the drawings embodying the principles of my invention I have shown a double-cylinder engine, the two cylinders A B being formed separately and then bolted or otherwise suitably secured to the base C, but it is obvious that, if desired, the cylinders may be formed integral with the base C. If desired, and as shown, the cylinders A B may be provided with the usual water or other cooling

jacket, as indicated at D. The base C is constructed to form an air-tight chamber having a partition-wall E, thereby forming practically two air-tight chambers, one for each cylinder, and the pistons F forming one side or wall of each chamber. The main shaft G is arranged to pass through the chambers of base C and to be received in suitable journal-bearings having peculiarities of construction and arrangement which will presently be more specifically pointed out. The cranks H, driven by the piston-rods J of the two pistons F, are preferably arranged at an angle of one hundred and eighty degrees with respect to each other, and each crank is arranged in the closed chamber of the base corresponding to the cylinder in which the piston operated by that crank works. From this arrangement it will be seen that when one piston is moving in one direction the other piston is moving in the opposite direction.

I will now describe the construction and operation of the machine whereby the charge is delivered to the working cylinders.

Suitably bolted or otherwise mounted on the base C is a casting K, having two chambers L M, respectively arranged in communication with the chambers of base C. For future convenience I will designate the chambers in base C as the "mixing-chambers."

Each of the chambers L M is provided with a passage N O, opening to the outer air, and adjacent to each passage N O in the body of the casting K is formed a recess or raceway P, encircling, but out of communication with, the passages N O, and the recesses or raceways P are in communication with the chambers L M through a series of holes or openings Q.

A valve R is arranged in each chamber L M to cover the series of openings Q and also the passages N O, said valve being normally held to its seat by means of a spring S, the tension of which may be readily regulated and adjusted by means of a suitably-arranged set-screw T, said spring S permitting the valve to be raised to uncover said openings and passage for a purpose and in a manner which will presently more fully appear.

The casting K is provided with a channel U, communicating at the respective ends thereof with the recesses or raceways P. Communicating with channel U, intermediate

the ends thereof, is a connection W, leading to a source of gas-supply. A three-way valve *y*, arranged at the juncture of connection W and channel U, serves to control the admission of gas to the chambers L M, and hence also to the mixing-chambers, and also enables the supply of gas to be cut off from either or both mixing-chambers at will.

It sometimes happens that it is desirable to admit different relative quantities of gas to the two mixing-chambers. I therefore mount in each end of channel U an adjusting-screw X, arranged to control the communication between said channel and the chambers L M. By suitably adjusting said screws the amount of gas admitted to said chambers is regulated and controlled. Bolted or otherwise suitably mounted on each cylinder A B is a casting 10 11, having a chamber 12 formed therein, which I will term the "ignition-chamber." Each ignition-chamber 12 is arranged in communication with one end of its cylinder A B, as shown. A suitable pipe or other convenient channel or passage 13 communicates at one end with the ignition-chamber 12 and a mixing-chamber, it being understood that such a connection is provided between the ignition-chamber and the mixing-chamber of each cylinder. A valve 14 is arranged in each ignition-chamber to control the opening from pipe or other connection 13.

I will now describe the operation of the construction so far described.

Suppose the piston F, for instance, to be moving toward the top end of the cylinder shown in Fig. 1. It will be readily seen that a vacuum is created in the inclosed mixing-chamber in which crank H operates. This will cause the valve R, which controls the passage N and the openings Q in the chamber L, to be unseated against the action of its spring and will cause a flow of gas through connection W, channel U, recess P, and openings Q into chamber L, and also a draft of air 45 through passage N into said chamber. It will be observed that the passages or openings Q are inclined toward the opening of the passage N. Therefore the several jets of gas surrounding the single jet of air are projected 50 into the jet of air and hence become mixed therewith. From the chamber L the mixed gas and air is drawn into the mixing-chamber of cylinder A. When piston F begins its movement toward the opposite end of chamber A, the valve R is immediately seated, thereby cutting off the escape of the mixed gas and air from the mixing-chamber of cylinder A except through the connection or passage 13 from said mixing-chamber to the ignition-chamber 12 of said cylinder. Continued movement of the piston F effects a compression of the mixed air and gas in the mixing-chamber, until finally, by the means presently to be described, the valve 14 in the ignition-chamber is unseated and the required charge of the explosive mixture is at once admitted through the ignition-chamber to the

opposite end of the cylinder A. When the piston F completes its downstroke and again begins to move toward the end of the cylinder, the operation above described with respect to casting K and the mixing-chamber is repeated. The valve 14 is seated thereby, cutting off all egress of the charge from the cylinder A. Continued movement of the piston F thereafter effects a compression of the charge in the cylinder to the required degree for the charge to be ignited. The explosion then occurs and the piston is actuated.

The charge may be ignited by any suitable igniting means. As an illustrative device for accomplishing this purpose I have shown a form of the usual igniting-tube, as 15, for each cylinder, each igniting-tube being in communication in the usual manner with its corresponding ignition-chamber 12.

While I have described the cycle of operation with respect to only one of the cylinders, it will be readily understood that the same description will apply to the other cylinder.

Leading from each cylinder is an exhaust-passage 16, adapted to be covered and uncovered at the required points by the pistons to permit the exhaust of the products of combustion and the closing of the exhaust at the required time. The exhaust-passages deliver into a suitably-arranged exhaust connection 17.

Remembering that the cranks for the two cylinders are arranged at an angle of one hundred and eighty degrees apart, it will be seen from the foregoing description that an explosion occurs in each cylinder at each complete reciprocation of its piston and that two explosions or impulses are obtained at each complete revolution of the shaft G.

I will now describe the means for actuating the valves 14, it being remembered that it is necessary to actuate said valves of the two cylinders alternately in order to secure the results above mentioned.

An eccentric 18 is mounted upon and actuated by the main shaft G, and mounted upon said eccentric is a strap 19, carrying an arm 20, having pivotal connection with an arm 21, arranged to engage the rod 22 of the valve carried in the casting 11, and which controls the admission of the explosive charge to cylinder B. When, therefore, the arm 20 is moved in one direction by its actuating-eccentric, the valve-rod 22 is engaged and the valve carried thereby unseated, and when said arm is moved in the opposite direction the spring 23 causes said valve to seat, said spring being, as shown, interposed between the casting 11 and adjustable nuts 24, carried upon rod 22.

While the valve in the ignition-chamber of cylinder B is unseated, the valve in the ignition-chamber of cylinder A should be seated, and vice versa. In order to accomplish these reverse movements simultaneously and from the same eccentric, I mount arm 21 upon a shaft 25, by means of which said shaft is

rocked when said arm is actuated. Shaft 25 extends in suitable bearings alongside the engine and to an arm 26, carried upon its opposite end, pivotally connected with one end of a link 27, the other end of said link being pivotally connected to an arm 28, mounted upon a rock-shaft 29, similar in arrangement to shaft 25, but on the opposite side of the engine. Carried by shaft 29 is an arm 30, arranged to engage the rod 31 of valve 14, whereby said valve may be actuated in one direction against the action of spring 32, similar in all respects to spring 23. By this construction the valves for the cylinders are alternately actuated in opposite directions from the same eccentric.

In order to automatically regulate the amount to which these admission-valves are opened, thereby regulating the amount of the explosive charge admitted to the cylinders, and hence, also, thereby regulating and controlling the speed of the machine, I provide an arrangement for controlling the degree of eccentricity of strap 19, and hence thereby regulate the throw of arm 20, and hence, also, of valve-rods 22 and 31. This result is accomplished and controlled by the speed of the shaft G in the following manner in the form of the construction shown, which is merely illustrative of the principles involved and to which I do not limit myself. The eccentric comprises a hollow sleeve, upon one end of which the strap 19 is mounted. This sleeve is provided with oppositely-extending arms 33 34, respectively carrying pins or projections 35 36. Mounted upon to revolve with shaft G is a governor-wheel 37. The sleeve 18 is arranged to be loosely slipped over the shaft G, and the end 35 thereof is pivotally supported by the governor-wheel 37, while the other end 36 is pivotally connected to a rod or link 38, having pivotal connection at its opposite end with one end of a lever 39, pivotally mounted intermediate its ends upon a wheel 37 and which carries at its opposite end the weight 40. A spring 41 is arranged to counteract the effect of the weight 40. The normal position of the weight 40 and spring 41 is such as to hold the sleeve 18 at its greatest degree of eccentricity relative to the shaft G.

When the shaft, and with it the governor-wheel 37, begins to revolve, the weight 40 is thrown toward the periphery of the wheel 37 by centrifugal force, thereby throwing the opposite end of lever 39 toward the center of the wheel and against the tension of spring 41. When the centrifugal force upon weight 40 overcomes the spring 41, the rod 38 is projected endwise, carrying with it the arm 36, and hence moving the sleeve more nearly concentric with shaft G, thereby decreasing the eccentricity of said sleeve and hence decreasing the throw of arm 20, and hence also of the valve-rods 22 and 31, thereby regulating the amount of charge admitted to the cylinders by the speed of the engine. Of course

it will be readily seen that the governor may be set for any desired speed.

It may be desirable to withdraw the shaft G for repairs or other purposes. This operation has heretofore been attended with difficulties and has necessitated the complete dismemberment of the machine. In order to avoid this difficulty and to provide a construction which permits the rapid and easy withdrawal of the shaft from the machine, and at the same time to provide an air-tight wall between the mixing-chambers in base C, I provide a plug-bearing 42 for the shaft and removably mount the same in an opening of the division-wall E of sufficient size to permit the cranks to pass therethrough. The plug-bearing is of a shape and size to fit tightly in the opening in wall E and is provided at various points around the periphery thereof with seats, each adapted to receive one half of the securing-bolt 43, the inner wall of the opening in which said plug is placed being formed with corresponding and registering seats, each adapted to receive the other half of said bolts 43, whereby the bearing 42 is removably secured in place. I desire it to be understood that the principle involved in this feature of my invention may be embodied in many different specific forms of construction. I do not limit myself, therefore, to the exact form shown. When it is desired to remove the shaft, the fly-wheel 37 is removed therefrom, the hand-hole plate 45 is removed, the bolts 43 are removed, the piston-rods J detached from the shaft, and the shaft can then be readily drawn out endwise.

In the operation of a machine of the class to which the present invention relates, wherein the shaft is arranged to pass through a closed chamber wherein compression takes place, the compression causes the lubricant supplied to the shaft-bearing to be forced out, thereby causing the shaft to become heated and to rapidly wear out its bearings. I have shown an illustrative embodiment of a construction and arrangement of parts whereby the difficulty noted is overcome and at the same time an air-tight box is maintained. I do not desire, however, to be limited to the exact details shown and described, as many variations therefrom would readily suggest themselves to persons skilled in the art and still fall within the spirit and scope of my invention. In the particular form shown I provide a removable cap-piece 44, which I suitably bolt or otherwise form on the base C, and through which the shaft is arranged to pass. Within cap-piece 44 I arrange a flanged sleeve 45', the flange arranged to bear against the inner face of cap-piece 44, as shown. Arranged within sleeve 45' and forming the lining for the bearing of shaft G is arranged a second sleeve 46, of suitable soft metal, as Babbitt metal.

The objection above noted of the lubricant supplied to the bearing being forced out by the pressure developed within the closed

chamber of base C by the compression of the mixed air and gas contained therein is avoided in my construction by providing a series of apertures or passages 47 through sleeve 45 and opening communication from the chamber end of the shaft-bearing to the outer end of said bearing in the space formed by the arching shape of the cap-piece. By this construction the pressure on one end of the bearing is the same as that upon the other, thereby maintaining an equalization which prevents the lubricant from being driven out of the bearing.

In order to prevent an escape of the compressed gases on account of the pressure admitted by the above construction to the space in which the outer end of the bearing is received, I provide the cap-piece with an inwardly-presented conical seat immediately surrounding the aperture in said cap through which the shaft passes, and I loosely mount upon the shaft a correspondingly-shaped plug 48, adapted to be received in said seat. The pressure from within the space formed by the cap-piece operates to press said plug firmly to its seat, thereby effectively preventing escape of the mixed gas and air.

The necessity may sometimes arise for boring out the cylinder where the cylinder and base are formed integrally, or where it may be desired to bore the cylinder without removal thereof, or for boring or trimming the inner surface of the base portion. In order to facilitate access to the interior of the mixing-chamber for these or other purposes, I provide in the floor of the base an opening of suitable size in which as a seat I arrange a suitable plug 49. By removing the plug ready access may be had to the interior of the chamber and by replacing the plug an air-tight chamber is again formed.

It will be understood that the principles of my invention may be embodied in a wide variety of different forms of apparatus. I do not confine or limit myself, therefore, to the exact details shown and described; but,

Having stated the object and nature of my invention, and having shown and described a specific embodiment merely illustrative of the principles of my invention, and having set forth the construction, function, and mode of operation thereof, what I claim as new and of my own invention, and desire to secure by Letters Patent of the United States, is—

1. In a gas-engine, a base comprising an inclosed chamber in which the explosive charge is compressed before being introduced to the explosion-chamber, a driving-shaft arranged to pass through said chamber, a cap-piece for the journal of said shaft provided with a perforation through which the shaft passes, a seat formed around said aperture and a plug mounted on the shaft and adapted to be received in said seat and held therein by the pressure in said chamber; as and for the purpose set forth.

2. In a gas-engine a base comprising a

closed chamber in which the explosive charge is received and compressed before being admitted to the explosion-chamber, a shaft arranged to pass through said chamber, a cap-piece for the journal of said shaft provided with a perforation through which said shaft passes, an inwardly-presented conical seat formed around said aperture and a correspondingly-shaped plug loosely mounted on said shaft and adapted to be received in said seat and held therein by the pressure in said chamber.

3. In a gas-engine, a base comprising a closed chamber, in which the explosive charge is received and compressed before being admitted to the explosion-chamber, a shaft arranged to pass through said chamber, a bearing for said shaft and means for admitting pressure to both sides of said bearing, whereby the lubricant supplied to said bearing is prevented from being forced out; as and for the purpose set forth.

4. In a gas-engine, a base comprising a closed chamber in which the explosive charge is received and compressed before being admitted to the explosive-chamber, a shaft arranged to pass through said chamber, a bearing for said shaft, including a perforated sleeve, and means for inclosing said sleeve, whereby the pressure on opposite sides of said bearing is equalized; as and for the purpose set forth.

5. In a gas-engine, a base, comprising a closed chamber in which the explosive charge is compressed before it is admitted to the explosion-chamber, a shaft arranged to pass through said chamber, a bearing for said shaft, comprising a cap-piece and a sleeve provided with apertures or passages opening communication between the interior of said chamber and the space formed by said cap-piece, as and for the purpose set forth.

6. In a gas-engine, a base, comprising a closed chamber, in which the explosive charge is compressed before it is admitted to the explosion-chamber, a shaft arranged to pass through said chamber, a bearing for said shaft, comprising a cap-piece, a perforated sleeve arranged in said cap-piece and opening communication between the interior of said chamber and the space formed by said cap-piece, and a second sleeve of soft metal arranged in said perforated sleeve and adapted to be in contact with said shaft; as and for the purpose set forth.

7. In a double-cylinder gas-engine, a base, a shaft arranged to pass through said base, a removable bearing for said shaft, comprising a plug through which the shaft is arranged to pass and provided with peripheral seats, corresponding seats arranged in said base and bolts adapted to be partly received in both seats; as and for the purpose set forth.

8. In a gas-engine, a base comprising a closed chamber, a partition-wall arranged to divide said chamber into two compartments, each compartment arranged in communica-

tion with a source of explosive-supply, a cylinder arranged to communicate with each compartment, the piston of each cylinder forming a part of the inclosing wall of its corresponding compartment, a passage arranged to open communication between each compartment and the explosion-chamber of its corresponding cylinder, valves arranged to control said passages, a crank-shaft arranged to pass through both of said compartments, and means operated by said shaft for operating said valves; as and for the purpose set forth.

9. In a gas-engine, a base comprising a closed chamber, a partition-wall arranged to divide said chamber into two compartments, a cylinder mounted on said base and arranged to communicate with each compartment, the piston of each cylinder forming part of the inclosing wall of its corresponding compartment, each compartment communicating with a source of explosive-supply and also with the explosion-chamber of its corresponding cylinder, valves arranged in said communications, a common shaft for both of said compartments, and means for actuating alternately from said shaft the valves controlling the communications between said compartments and the explosion-chambers of said cylinders; as and for the purpose set forth.

10. In a gas-engine, a base comprising an inclosed chamber, cylinders mounted thereon and in communication with said chamber, a piston arranged in each cylinder, division-walls arranged to divide said chamber into as many compartments as there are cylinders, the piston in each cylinder forming a part of the inclosing wall of a compartment, each compartment in communication with a source of explosive-supply, and also with the explosion-chamber of its corresponding cylinder, a single crank-shaft arranged to pass through all of said compartments and means actuated thereby for controlling said communications; as and for the purpose set forth.

11. In a gas-engine, a base comprising a closed chamber, a pair of cylinders mounted thereon, in communication with said chamber, a partition-wall arranged to divide said chamber into compartments, the piston in each cylinder forming a part of the inclosing wall of a compartment, each compartment in communication with a source of gas-supply and with the outer air, and also in communication with the explosion-chamber of its corresponding cylinder, valves arranged in said communications for controlling the same, a crank-shaft common to both compartments, means actuated thereby for operating said valves in opposite directions, and a governor for controlling said valve-operating means; as and for the purpose set forth.

12. In a gas-engine, a base comprising a closed chamber, a partition-wall arranged to divide said chamber into two compartments, each compartment in communication with a source of explosive-supply, a cylinder and

piston for each compartment, the pistons forming part of the inclosing wall of their corresponding compartments, a passage arranged to open communication between each compartment and the explosion-chamber of its corresponding cylinder, a valve arranged in each passage, a crank-shaft journaled in said base and arranged to pass through said compartments, a movable eccentric mounted on said shaft, means operated by said eccentric for controlling said valves, and means actuated by the speed of said shaft for moving said eccentric to vary the eccentricity thereof; as and for the purpose set forth.

13. In a gas-engine, a base forming a closed chamber, a partition-wall arranged therein to divide the same into two compartments, a cylinder mounted on said base, arranged to communicate with each chamber, the pistons of said cylinders forming a part of the inclosing wall of its corresponding chamber, a shaft arranged to pass through both chambers, a passage from each of said chambers to the explosion-chamber of its respective cylinder, valves arranged to control said passages, an eccentric mounted on said shaft, and means actuated by said eccentric for simultaneously and positively operating said valves; as and for the purpose set forth.

14. In a gas-engine, a base forming a closed chamber, a partition-wall arranged to divide said chamber into compartments, cylinders mounted on said base and each in communication with a compartment, the pistons of each cylinder forming a part of the inclosing wall of its respective compartment, each compartment in communication with a source of explosive-supply, a passage arranged to open communication between said compartments and the explosion-chamber of their respective cylinders, valves arranged in said passages, a crank-shaft common to all of said compartments, a movable eccentric mounted thereon, means actuated by said eccentric for simultaneously actuating said valves, and means actuated by the speed of rotation of said shaft for moving said eccentric automatically, thereby varying the eccentricity of the eccentric; as and for the purpose set forth.

15. In a double-cylinder engine, a valve arranged to control the admission of the explosive charge to each cylinder, and a pair of rock-shafts mounted on opposite sides of said engine and connected together to rock in opposite directions, an arm mounted on each shaft, said arms arranged to engage and actuate said valves to unseat the same, and means for rocking one of said shafts; as and for the purpose set forth.

16. In a double-cylinder gas-engine, a valve arranged to control the admission of the explosive charge to each cylinder, a rock-shaft mounted on opposite sides of the engine and connected together to rock in opposite directions, an arm mounted on each shaft, said arms arranged to engage said valves and un-

seat the same, a main driving-shaft, an eccentric mounted thereon, and communications between the eccentric and one of said shafts for actuating the same; as and for the purpose set forth.

17. In a double-cylinder gas-engine, a valve arranged to control the admission of the explosive charge to each cylinder, a pair of shafts mounted on opposite sides of said engine and connected together to rock in opposite directions, an arm mounted on each shaft and adapted to engage said valve and unseat the same, a main shaft, an eccentric actuated thereby, communications between said eccentrics and one of said shafts for rocking the same, a governor mounted on said main shaft, connections between said governor and said eccentric for varying the eccentricity of the latter; as and for the purpose set forth.

18. In a double-cylinder gas-engine, a valve arranged to control the admission of the explosive charge to each cylinder of said engine, means for simultaneously seating one and unseating the other of said valves, comprising a crank-shaft, a governor-wheel mounted thereon, a sleeve pivotally mounted on said governor-wheel, said sleeve being normally held eccentric to said shaft, connections between said governor and wheel, whereby the eccentricity of said sleeve is varied with the speed of said shaft, and connections between said sleeve and said valves, whereby the movements of said valves are simultaneously regulated; as and for the purpose set forth.

19. In a double-cylinder gas-engine, a valve arranged to control the admission of the explosive charge to the cylinders of said engine,

and means for simultaneously seating one of said valves and unseating the other of said valves, comprising a crank-shaft, a governor-wheel mounted thereon, a sleeve having oppositely-extending arms, one of said arms being pivotally mounted on said governor-wheel, a weighted lever carried by said governor-wheel, a link connection between said lever and the other arm of said sleeve, a spring arranged to normally counterbalance said lever and to hold said sleeve in eccentric relation to said shaft, and connections actuated by said sleeve for operating said valves, whereby the amount of opening of both of said valves is simultaneously regulated; as and for the purpose set forth.

20. In a double-cylinder gas-engine, a base divided into air-tight compartments, the piston of each cylinder forming part of the inclosing wall of its corresponding compartment, each compartment in communication with the explosion-chamber of its respective cylinder, in combination with a casting having mixing-chambers, each in communication with a piston-chamber, means for delivering air to said mixing-chambers, a gas-supply connection common to both of said mixing-chambers, and means for independently regulating the amount of gas admitted to each of said mixing-chambers; as and for the purpose set forth.

In witness whereof I have hereunto set my hand this 20th day of December, 1895.

OLIVER COLBORNE.

Attest:

F. H. THATCHER,
S. E. DARBY.