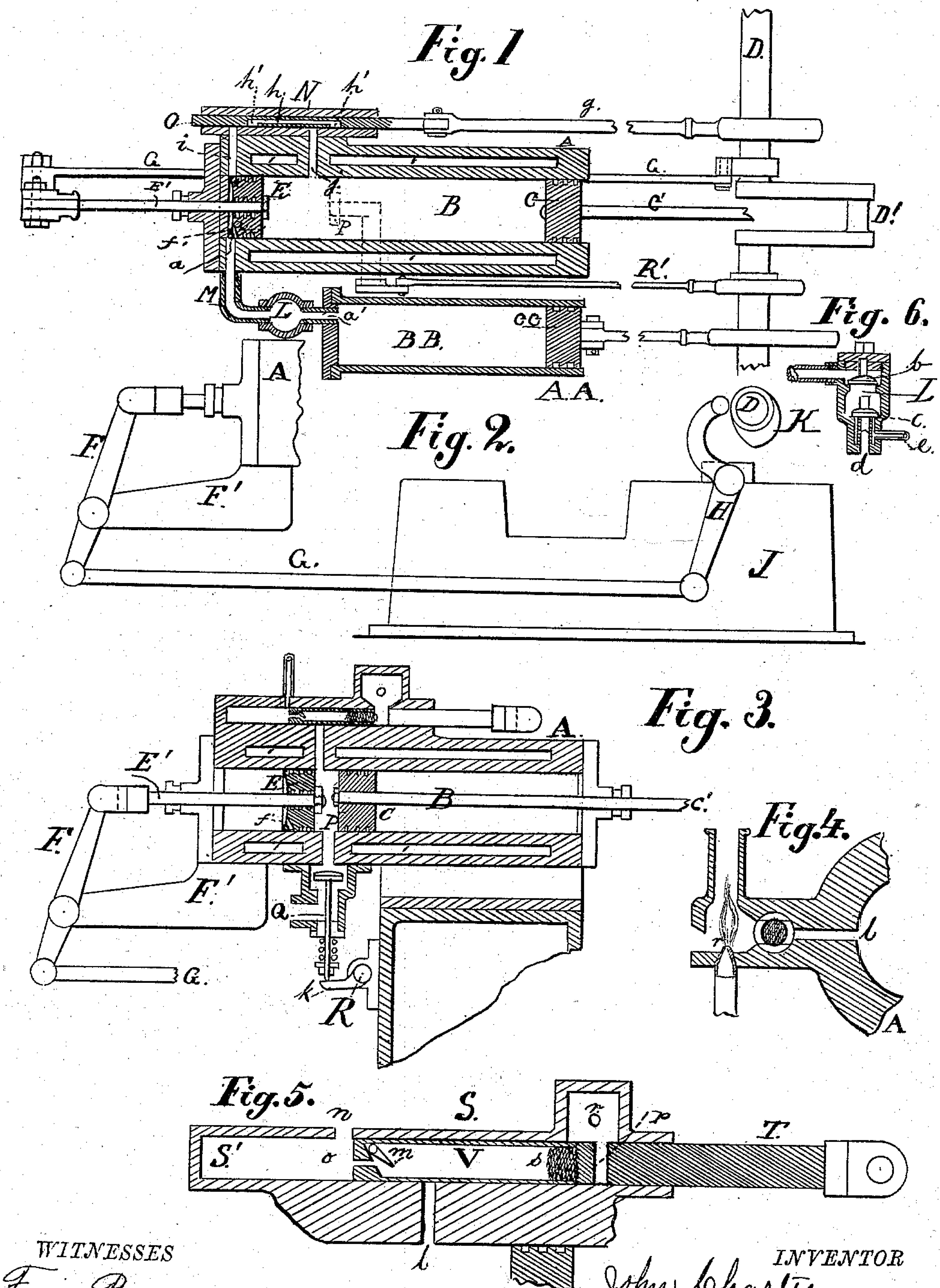
(No Model.)

J. CHARTER.

GAS ENGINE.

No. 270,203. Patented Jan. 9, 1883.



WITNESSES

Franz Burger

Jas Charter

INVENTOR

John Charter

By Manahan & Ward

His Attorneys.

N. PETERS, Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

JOHN CHARTER, OF STERLING, ILLINOIS.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 270,203, dated January 9, 1883.

Application filed July 10, 1882. (No model.)

To all whom it may concern:

Be it known that I, JOHN CHARTER, a citizen of the United States, residing at Sterling, in the county of Whiteside and State of Illinois, have invented certain new and useful Improvements in Gas-Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

My invention pertains to that class of gas-engines in which mixed gas and air are used as a motor-power by being exploded while under a compression greater than one atmosphere; and my improvements consist essentially in certain novel devices for compressing such mixture, and placing the same intermittently, while under compression, behind the working-piston in condition and position to be discharged.

In the drawings, Figure 1 is a plan view of a machine embodying my invention. Fig. 2 is a side elevation of mechanism used for actuating the displacer E. Fig. 3 is a sectional side elevation of part of my machine. Fig. 4 is a detached transverse sectional elevation of the igniter and a segment of the working-cylinder. Fig. 5 is a sectional plan view of the igniter and a part of said cylinder, the igniting-slide T being shown at the limit of its outstroke. Fig. 6 is a detached sectional side elevation of the devices for admitting the gas and air into the working-cylinder and permitting the transfer of the same therefrom.

A is a cylinder having therein the cylindrical chamber B.

C is a working-piston fitted to play reciprocally in the chamber B, and suitably attached by means of the rod C′ to the crank D′ of the axle D. The latter is attached by gearing, belting, or in other suitable manner to the machinery to be operated. To the axle D is affixed the usual fly or balance wheel. (Not shown.) The inner end of the chamber B is traversed reciprocally by the displacer E. The latter is actuated by a short shaft or rod, E′, the inner end of which passes loosely through such adjuster, and is provided with a head, and the other end of which, passing loosely through the inner head of the cylinder A, is pivotally attached to the walking-beam F, fulcrumed on the stud F′, which is rigidly affixed to the lower side of the cylinder A, or to any other suitable part of the machine. The walking-beam F is operated, as shown in Fig. 2, by having its lower end jointed to a horizontal rod, G, the other end of which is also jointed to the vertical bell-crank H, fulcrumed, as shown, on the base J.

On the axle D is formed the cam K, which at each revolution of the axle D engages and actuates the upper end of the bell-crank H, and through the medium of the intervening mechanism described draws the displacer E to the inner end of the cylinder A.

A A is a supply or charging cylinder having within it the chamber B B, wherein works reciprocally the charging-piston C C, which is driven coincidently with the piston C by the axle D.

L is a valve-chamber located on the tube M, which communicates through such chamber from the inner end of the chamber B B at the opening *a′* to the inner end of the chamber B through the opening *a* therein.

In the valve-chamber L are seated the two upwardly-opening valves *b* and *c*, the valve *b* being above the junction of the tube M entering such chamber from the cylinder A A, and below the tube M as it enters such chamber L from the cylinder A, and the valve *c* being below both junctions of the tube M with said chamber L. A tube, *d*, admits the air into the chamber L, and a tube, *e*, the gas. The end of the tube *e* encircles that of the tube *d*, so that the one valve, *c*, opens or closes both the said tubes with one action.

In Fig. 1 the piston C is represented at the limit of its outstroke, to which it has been carried by the force of the explosion. The piston C C, having also a crank-connection with the axle D, is by the latter drawn concurrently with the piston C to the limit of its outstroke. By this action of the piston C C there is drawn into the chamber B B a mixture of air and gas, the valve *c* rising automatically and the gas and air passing, in any desired proportions, through the chamber L and opening *a′* into the chambers B B. As the piston C C, by the further revolution of the axle D, is carried on its instroke, it forces the gaseous mixture then before it in the chamber B B through the opening a', valve b, chamber L, and tube M and opening a into the inner end of the chamber B.

In Fig. 1 the displacer E is represented at the limit of its instroke—a position to which it passes as the piston C C, in the progress of its instroke, forces such displacer by compressing behind it the gaseous mixture aforesaid. The outer face of the displacer E is slightly concave, and a diagonal orifice, f', in such displacer connects such concavity with the tube M through the inlet-port a, whereby the pressure of the gaseous mixture is interposed between the outer face of the displacer E and the end of the chamber B, and forces the displacer to the end of its instroke in the chamber B, as shown in Fig. 1. The displacer E entirely fills a cross-section of the chamber B, and therefore when at the limit of its instroke serves as a partition therein. When the displacer E is in the position shown in Fig. 1 that part of the chamber B between its inner end and such displacer is filled with gaseous mixture in a state of compression.

On the side of the cylinder A is attached the sleeve N, in which reciprocates the slide O, actuated by the rod g, eccentrically attached to the axle D. The slide O is provided with a hollow chamber, h, having side openings, h', at each end thereof, which communicate with the outlet i and inlet j of the cylinder A when such slide O is at the limit of its instroke.

It will be noticed that the displacer E at the limit of its instroke cuts off communication between the inlet j and chamber B, and at the limit of its outstroke in like manner closes the inner end of the outlet i.

P is an exhaust-port in the bottom of the cylinder A, located slightly outward from the inlet j and communicating with the outer air through the positive valve Q, which latter is actuated by the spur k on the rock-shaft R, which is oscillated by the rod R′, eccentrically collared on the axle D. When the piston C is on its instroke the valve Q is raised and the exhaust-port P thereby opened, through which the products of the former combustion are driven by the incoming piston C. The displacer E remains at the limit of its instroke, forming a temporary partition transversely in the chamber B, until the piston C has progressed sufficiently inward to close the exhaust-port P, when the cam K on the axle D, engaging the upper end of the bell-crank H through the intermediate mechanism before described, instantly draws the displacer E to the inner end of the chamber B.

Coincidently with the last movement of the displacer E, the slide O passes inward, and the side openings, h', of the chamber h therein, register respectively with the outlet i and inlet j, by which means communication is opened for the passage of the gaseous mixture from the outside to the inside of the displacer E, while the latter is making its outstroke. The slide O is then moved outward, so as to close the outer end of the inlet-port j, when the compressed charge now in position in the chamber B between the displacer E and piston C is fired and exploded. The explosion carries the piston C to the end of its outstroke, and communicates like action through the medium of the axle D to the charging-piston C C, which fills the chamber B B with the intermixed gas and air drawn in through the valve c in the chamber L. The reverse action of the piston C C forces the gaseous mixture then in front of it through the chamber L and tube M into the chamber B behind the displacer E, and moves the latter to the end of its instroke, thus forming temporarily an apartment between such displacer and the inner end of the chamber B in which the charge of gaseous mixture is compressed by the cylinder in readiness for the next explosion, when the action before described is repeated. The instroke of the displacer E serves also to sweep the burned gases from the inner end of the chamber B to the exhaust-port P in the bottom thereof, where such displacer is met by the incoming of the piston C, which drives the burned gases from the opposite end of the chamber B to the exhaust-port P, and thus by the joint action of the displacer E and piston C the burned gases throughout the entire area of the chamber B are forced out through the exhaust-port P.

The degree of compression of the gaseous mixture will be proportioned to the relative capacity of the space between the displacer E, when at the end of its instroke, and the inner end of the chamber B, plus the tube M and chamber L, and the capacity or internal area of the chamber B B. As the latter chamber may be increased indefinitely, it is obvious that the compression, and therefore the power of the explosion, may be increased to any desired extent without enlarging the cylinder A.

I ignite and discharge the compressed mixture as follows: On the top of or in any suitable relation to the cylinder A, I place the horizontal hollow cylinder S, which communicates through the inlet-port l with the chamber B behind the piston C at the limit of its instroke. In the chamber S′ of the cylinder S reciprocates the igniting-slide T, which is actuated by an eccentric or cam connection with the axle D, or with any part of the machinery which will give it the desired motion. In the lower end of the slide T is formed the chamber V, which communicates through an inwardly-opening valve, m, at its inner end with the chamber S′. The latter is furnished with the external inlet, n, for the admission of air, and the opening o for the admission of gas to feed the igniter. When the slide T is moved to its outstroke it uncovers the inlets n and o, and permits the gas and air entering thereat to fill the lower end of the chamber S′, in which the movement of the slide T has created a vacuum. As the slide T passes to its instroke it closes the inlet-ports n and o, and the mixed air and gas confined in the chamber S′ pass through the valve m into the chamber V of the slide T.

At the upper end of the chamber V there is a transverse port, p, through the slide T, which communicates, through the intervening gauze cover or flame-check s, with the chamber V. The port p registers alternately at each end, and at the outstroke of the slide T takes flame from the external gas-jet, r, and at the instroke of such slide transfers such flame through the inlet-port l and explodes the charge in the chamber B. The air and gas in the chamber V feed the flame in the port p during its transit from the gas-jet r to the inlet-port l.

The figures 1 1 1 represent water-jackets.

I do not limit myself to the precise construction or location of the parts as shown, for it is obvious that by closing the outer end of the chamber B, as shown in Fig. 3, and connecting the extreme ends of the chamber B by an external tube, M, furnished with a chamber, L, and its internal valves, b and c, the piston C can be made to perform the functions of the piston C C, in addition to its present ones, except that the action of pumping and compressing the mixture would be by a motion the reverse of that of the piston C C. Neither is it essential that the displacer E traverse a portion of the working-cylinder A; but such displacer, either singly or in duplicate, may be seated in an independent cylinder perpendicular or in any other relation to the cylinder A and communicating therewith. But a prominent feature of my invention is the employment of a movable displacer, which shall alternately hold the explosive charge under compression and open avenues for the transmission of such charge to a position for explosion against the working-piston, and which displacer shall also assist in expelling the burned gases. A check-valve, with usual governor, can be placed on tube M.

The advantages of my invention are self-evident. By it is attained simplicity of construction with great power and certainty in action. It is well known to those familiar with the explosive character of mixed air and gas that the force of such explosion is proportioned to the degree of compression of the mixture or compound; and as the compressing capacity of the cylinder A A and piston C C may be increased at will, as aforesaid, it is plain that there is practically no limit to the degree of compression of the explosive mixture other than that of the strength of the machinery.

What I claim as my invention, and desire to secure by Letters Patent of the United States, is—

1. In a gas-engine, the combination and arrangement, substantially as shown, of a displacer, E, a working-cylinder, A, provided with the chamber B, a piston, C, charging-cylinder A A, piston C C, communicating-tube M, and valvular chamber L, whereby such displacer E alternately serves as a wall of the compression-chamber and opens avenues for the transmission of the explosive mixture to the cylinder A and piston C, for the purpose herein specified.

2. The combination, in a gas-engine, of the cylinder A, piston C, axle D, cylinder A A, piston C C, tube M, valve-chamber L, displacer E, slide T, and the mechanism shown for actuating the aforesaid parts, all operating together and for the purpose described.

3. The combination of cylinder A, piston C, cylinder A A, piston C C, tube M, having the valve-chamber L, communicating between the chambers of such cylinders, the displacer E, and slide O, whereby such displacer E and piston C sweep the burned gases from the cylinder A, the cylinder A A and piston C C compress the gaseous mixture in the end of the chamber B, and the displacer E and slide O open avenues for the transmission of the compressed mixture to a position to be exploded against the piston C, substantially as shown and for the purpose mentioned.

4. In a gas-engine, the displacer E seated in the cylinder B, and by means of suitable actuating mechanism playing reciprocally in the inner end of such chamber B, substantially as shown, and for the purpose described.

5. In a gas-engine, the cylinder A, having the chamber B, the slide O, provided with a chamber, h, having the openings h' therein, and the displacer E, reciprocated by suitable means in one end of such chamber B, in combination, whereby there is formed at intervals a temporary separate chamber at one end of such chamber B, and alternate communication established between such temporary chamber and the residue of said chamber B, substantially as shown, and for the purpose specified.

6. In a gas-engine, the combination of the following parts: cylinder A, piston C, cylinder A A, piston C C, axle D, suitably connected with said pistons, tube M, having the valve-chamber L, displacer E, and reciprocating slide O, whereby the explosive force which drives outward the piston C serves, through the medium of the axle D, to impart the outstroke to the piston C C, and thereby fill the cylinder A A with the gaseous mixture, which, on the succeeding instroke of the piston C C, is compressed between such displacer and the inner end of the chamber B, to be transmitted coincidently with the last part of the instroke of the piston C through the slide O to the opposite side of such displacer, the latter having meanwhile moved to the inner end of the chamber B, substantially as shown, and for the purpose specified.

7. In a gas-engine, the pistons C and C C, working respectively in the cylinders A and A A, axle D, tube M, having the valve-chamber L between such cylinders, the slide O, displacer E, reciprocated by suitable means, and air and gas tubes d and e, in combination, substantially as shown, and for the purpose described.

8. In a gas-engine, a working-cylinder, A,

provided with an exhaust-port, P, and inlet-ports a and j and outlet-port i, working-piston C, arranged to expel the burned gases from the chamber B of such cylinder, and through the medium of the axle D to actuate a supplementary piston, C C, working in a secondary cylinder, A A, having communication with the interior of the cylinder A, displacer E, arranged to act reciprocally in the interior end of such chamber B, and the reciprocating slide O, all arranged and operating together substantially as shown, and for the purpose specified.

9. In a gas-engine, the cylinder A, having a chamber, B, a displacer, E, and the mechanism shown for actuating the latter, whereby such displacer forms alternately a wall for the compression-chamber and cut-off for the ports a and j, substantially as shown, for the purpose named.

10. The combination of the cylinder A, having a chamber, B, provided with the ports i and j, the displacer E, and reciprocating slide O, provided with a chamber, h, and openings h', all operating together substantially as shown, whereby there is temporarily formed a separate chamber in the end of the chamber B, and alternately with the formation of such temporary chamber temporary communication established between the latter and the residue of said chamber B, substantially as shown, and for the purpose mentioned.

11. In a gas-engine, the combination of the cylinders A and A A, their respective pistons, the axle D, the communicating-tube M, displacer E, and slide O, whereby the inner end of the chamber B of the cylinder A is intermittently separated and alternately employed as a supply and discharge chamber, substantially as shown, and for the purpose named.

12. In a gas-engine, the reciprocating slide O, having the chamber h and openings h' therein, arranged to register intermittently with the outlet i and inlet j of the chamber B, coincidently with the passage of the displacer E to the end of such chamber, substantially as shown, and for the purpose named.

13. In a gas-engine, the igniting-cylinder S, provided with a chamber, S′, and inlets n and o, in combination with the slide T, having the chamber V, valve m, and transverse port p, substantially as shown, and for the purpose specified.

14. In a gas-engine, the cylinder S, provided with a chamber, S′, and inlets n and o thereto, the slide T, having the chamber V, valve m, and duplex registering-port p, in suitable relation to the gas-jet r, in combination with the cylinder A, having igniting-port l, substantially as shown, and for the purpose mentioned.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN CHARTER.

Witnesses:

WILLIAM MANAHAN,

C. N. MUNSON.