(No Model.)

2 Sheets—Sheet 1.

J. TAYLOR.

GAS MOTOR ENGINE.

No. 443,082. Patented Dec. 16, 1890.

FIG. 3

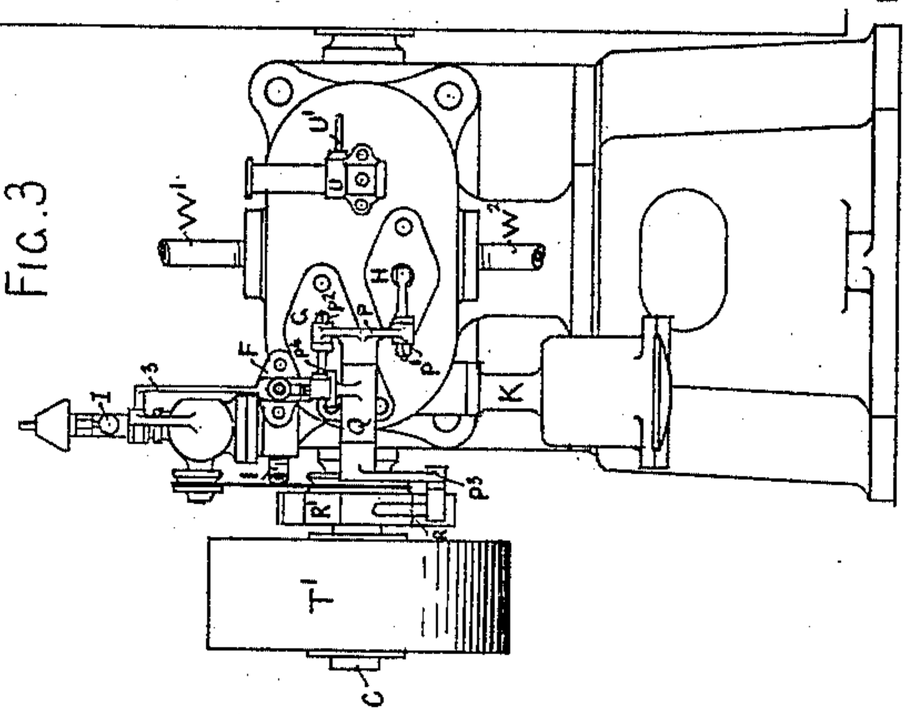


FIG. 1

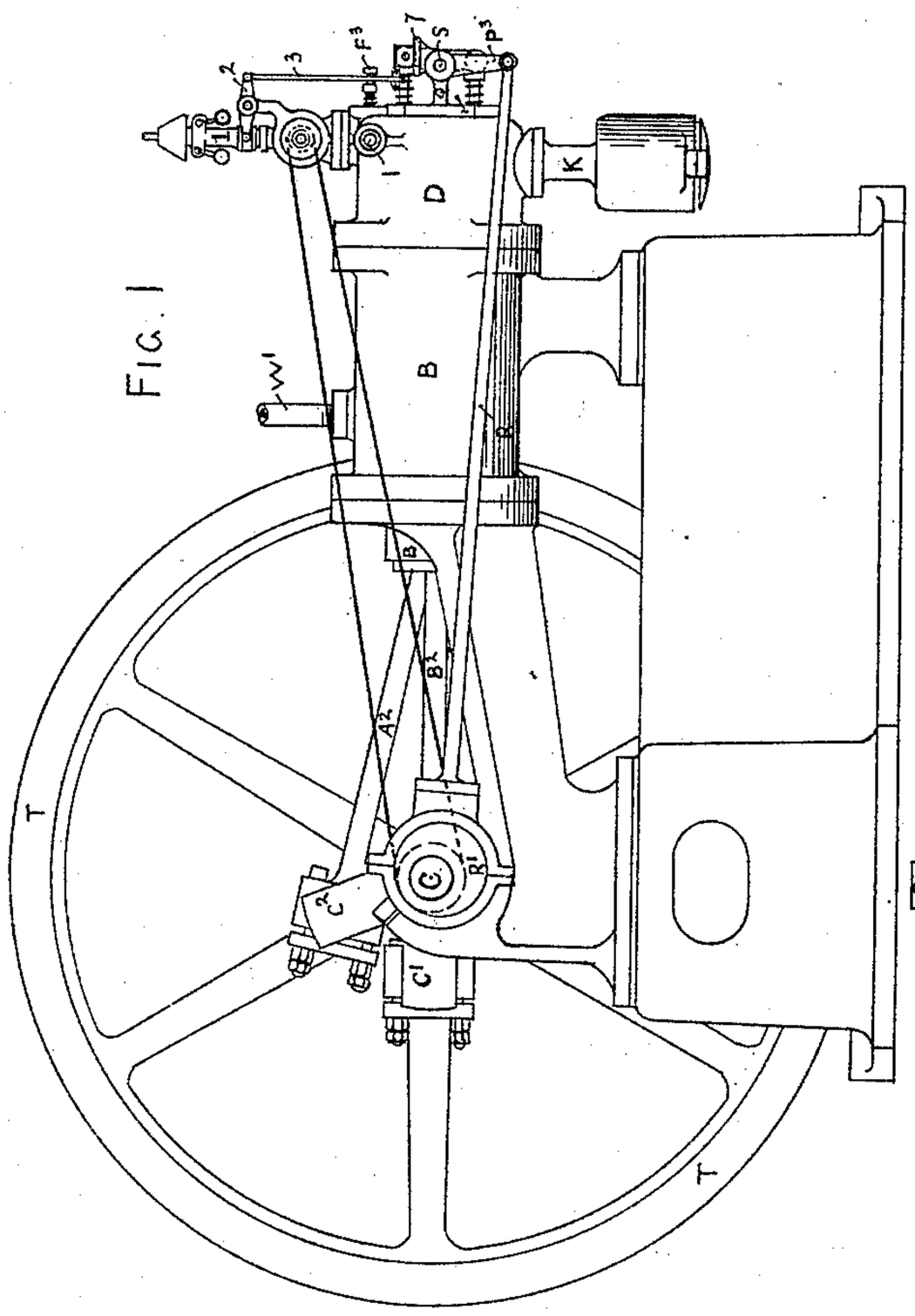
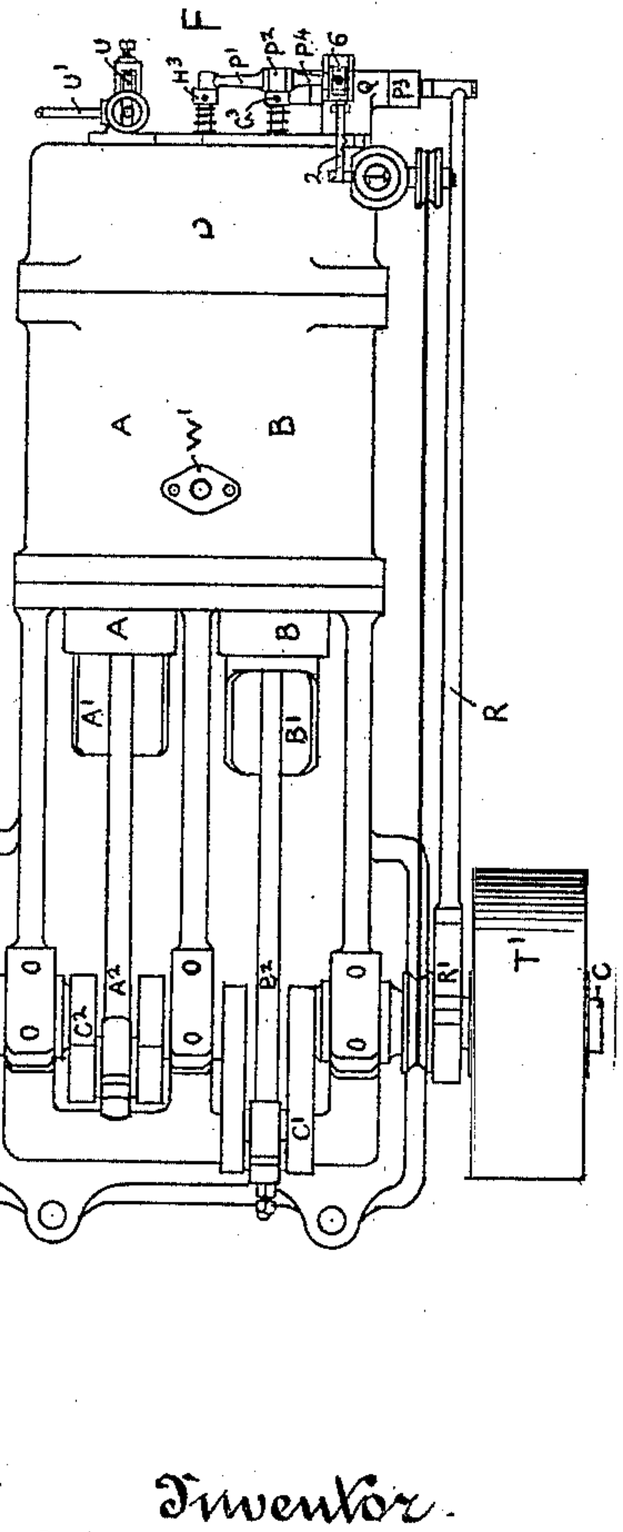


FIG. 2



Witnesses.
H. L. Davis.
J. M. Copenhaver.

Inventor.
John Taylor
By F. F. Brown
Attorney

(No Model.)

2 Sheets—Sheet 2.

J. TAYLOR.

GAS MOTOR ENGINE.

No. 443,082. Patented Dec. 16, 1890.

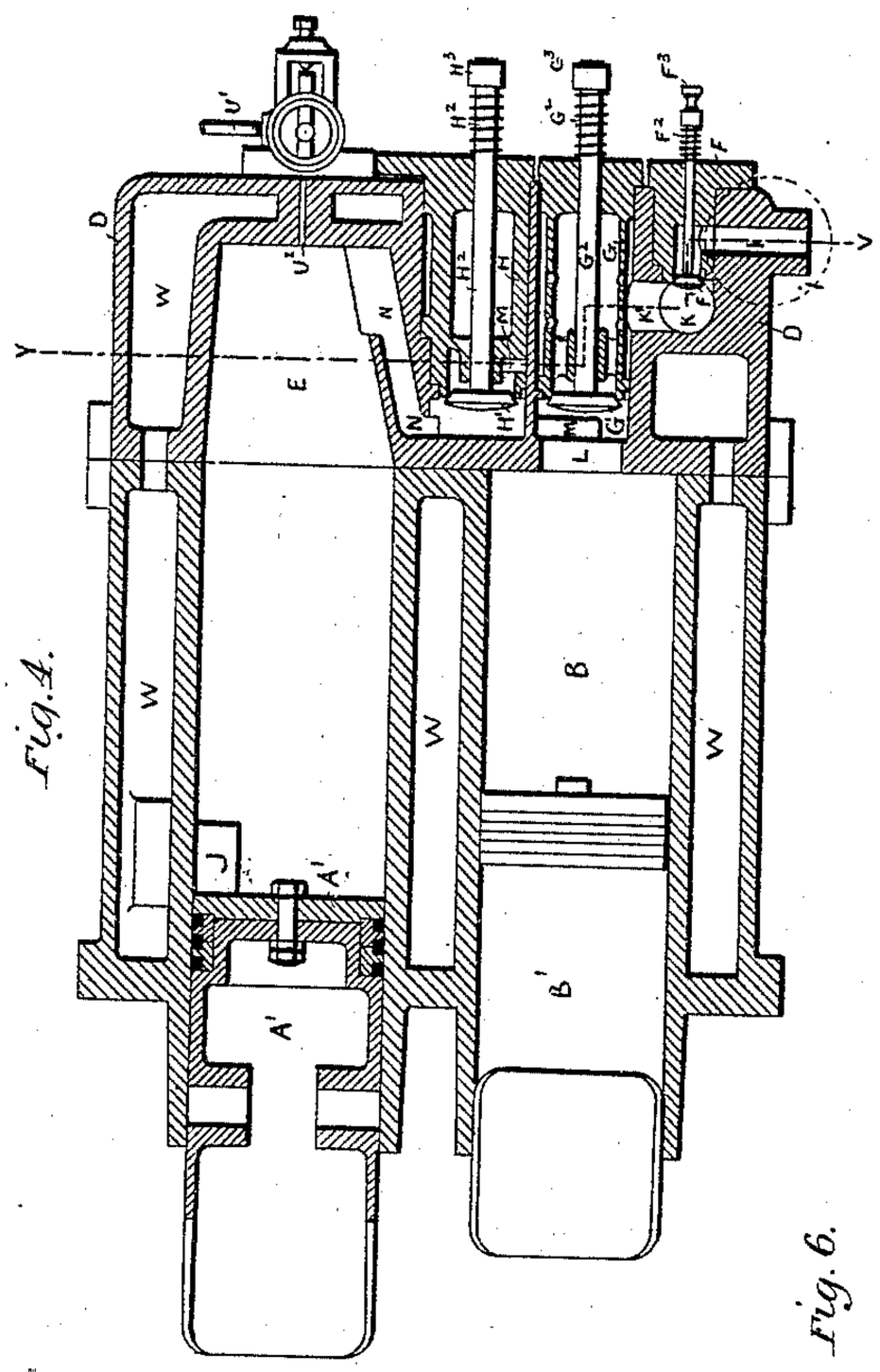


Fig. 4.

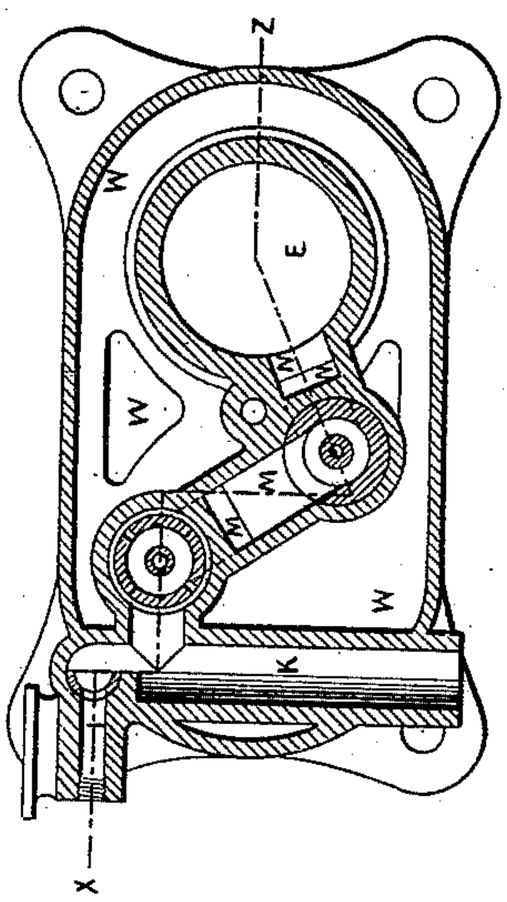


Fig. 7.

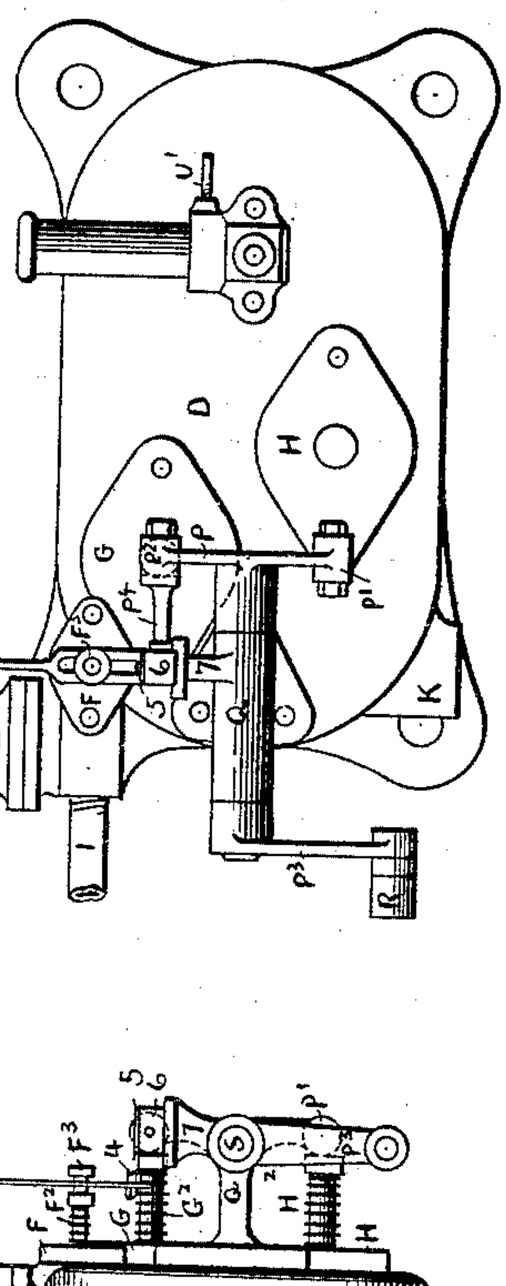


Fig. 6.

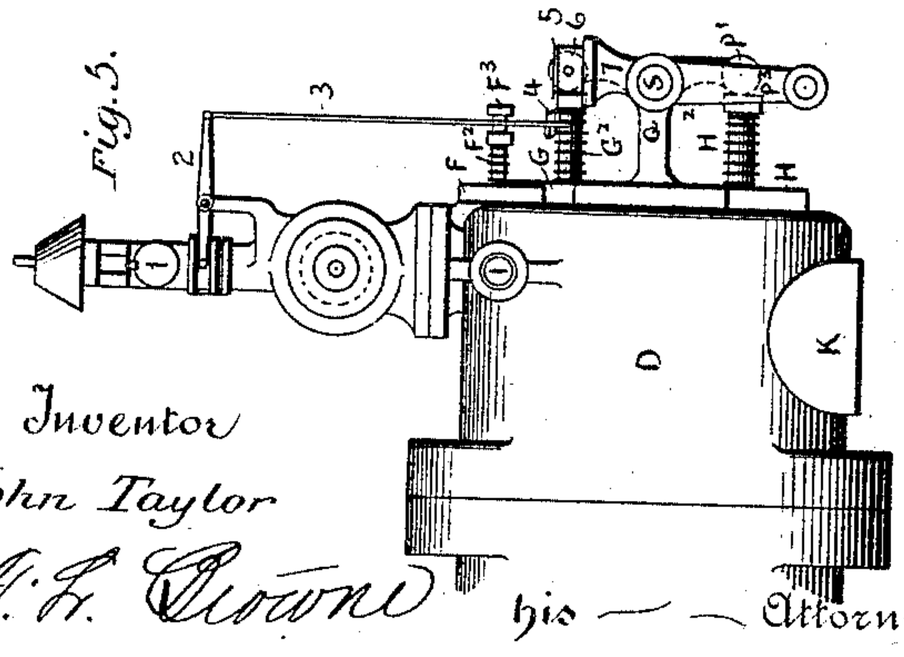


Fig. 5.

Witnesses

Wm. Norton

W. C. Brundage

Inventor

John Taylor

by J. F. Brown his — — Attorney

UNITED STATES PATENT OFFICE.

JOHN TAYLOR, OF NOTTINGHAM, ENGLAND.

GAS-MOTOR ENGINE.

SPECIFICATION forming part of Letters Patent No. 443,082, dated December 16, 1890.

Application filed June 13, 1889. Renewed November 24, 1890. Serial No. 372,432. (No model.) Patented in England January 15, 1889, No. 708; in France May 1, 1889, No. 184,758; in Belgium May 4, 1889, No. 64,302, and in Spain May 20, 1889.

To all whom it may concern:

Be it known that I, JOHN TAYLOR, of the firm of John Taylor & Sons, a subject of the Queen of Great Britain, and a resident of Nottingham, in the county of Nottingham, England, have invented certain new and useful Improvements in Gas-Motor Engines, (for which I have obtained a patent in Great Britain, No. 708, dated January 15, 1889; in France, No. 184,758, dated May 1, 1889; in Belgium, No. 64,302, dated May 4, 1889, and in Spain, dated May 20, 1889,) of which the following is a full, clear, and exact specification.

This invention relates to gas-motor engines; and the object of my invention is to obtain by improved and simple means an impulse or working stroke at each revolution of the engine when in full work. To effect this purpose I have two cylinders arranged, preferably, side by side, each fitted with a piston and connecting-rod actuating a crank-shaft with two cranks in same, one placed at an angle of sixty-five degrees, or thereabout, in advance of the other. One of these cylinders is for drawing in, mixing, and compressing the charge of gas and air, which I call the "compressing-cylinder," and the other cylinder is for obtaining power by the ignition of the charge, in the manner hereinafter described. This cylinder I call the "working-cylinder." To the outer end of these cylinders farthest away from the crank-shaft I attach a strong and suitably-formed casting containing the distributing-valves and a receptacle or chamber called the "exploding-chamber," which latter forms the end of and is a prolongation of the working-cylinder. This casting I call the "breech end." In this breech end I fit three or more cylindrical flanged valve-seatings, each carrying a mushroom or other shaped valve fitted with a stem working in suitable guides. Each stem is fitted at its outer end with a collar, between which and the outer guide a spiral spring on the stem is compressed every time the valve is raised from its seating. This insures the return of the valve to its seating at each revolution of the engine. One of these valves, called the "gas-valve," is for the admission of gas to the air-valve or air-passage. The second valve, called the "air-valve," is for the admission of the mixture of gas and air to the compressing-cylinder, and the third valve, called the "admission-valve," is for the admission of the compressed charge from the compressing-cylinder to the exploding-chamber of the working-cylinder by a suitable port or ports. All these valves I make, preferably, to open one way, and, to insure their acting in a thoroughly reliable and quiet manner, I prefer to actuate the opening and closing of the gas and air valves by one end of a double-ended lever or tappet and the opening and closing of the admission valve or valves by the opposite end of the same lever or tappet, the said lever or tappet being fixed in the center, or thereabout, to a shaft working in suitable bearings. This shaft receives a rocking or reciprocating motion by a second lever and rod from an eccentric or cam on the crank-shaft, or by other suitable means, in such a manner that the gas and air valves are opened and closed during the outward stroke of the compressing-cylinder piston and the admission-valve is opened and closed during the inward or return stroke of the same piston, or these valves may be worked automatically without levers or tappets.

The operation of the engine is as follows: On the first outward stroke of the compressing-piston toward the crank-shaft, when turning the fly-wheel by hand or other suitable means, a suitable mixture of gas and air is drawn past the gas and air valves into the compressing-cylinder during the whole outward stroke, at the termination of which the gas and air valves are closed by the lever described above, or automatically. On the return of the piston this charge is compressed to the necessary density and forced past the admission-valve into the exploding-chamber of the working-cylinder, where it is fired by any suitable means. The effect of the ignition of the charge is to propel the piston of the working-cylinder outward, and thus make a working stroke of the engine, until the piston near the termination of its stroke uncovers an exhaust-port, which is formed in the working-cylinder within one-eighth of the stroke, or thereabout, of the outer end of

the stroke of the piston, which it uncovers and covers during its travel. The products of combustion being under pressure escape rapidly through the exhaust-port until they are reduced to about the atmospheric pressure in the cylinder. At this moment, owing to the angular advance of the crank of the compressing-cylinder, the charge of gas and air from this latter is being forced past the admission-valve into the exploding-chamber, where it drives the products of combustion before it and out of the exhaust-port until all, or nearly all, of the products of combustion are expelled through the exhaust-port by the time that this is covered again by the piston on its return-stroke. After the exhaust-port is covered and during the remainder of the return-stroke this piston drives back the mixture of gas and air into the exploding-chamber and compresses it to the requisite density, ready for ignition at the commencement of another outward stroke.

The gas-valve is opened and closed by suitable means from the air-valve, or from the lever opening the latter, and the connection between the two valves is connected to and controlled by the engine-governor in such a manner that when the engine exceeds its normal speed the connection between the two valves is broken and the gas-valve remains closed, thus admitting no gas until the engine again resumes its normal speed.

In order that my invention may be fully understood and readily carried out and into effect, I will proceed to describe the accompanying sheet of drawings, reference being had to the letters and figures marked thereon.

Figure 1 is a side elevation of a gas-motor engine on my improved system. Fig. 2 is a plan of the same. Fig. 3 is an end elevation at the cylinder end of the same engine. Fig. 4 is a longitudinal section in plan through the center line of the cylinder, and along line *x z*, Fig. 7, of the breech end D. Fig. 5 is an enlarged side elevation of breech end D, Fig. 1. Fig. 6 is an enlarged end elevation of the same. Fig. 7 is a transverse sectional elevation of breech end D along the line *c y*, Fig. 4.

Similar letters and figures refer to similar parts throughout the several views.

In the views, A is the power or working cylinder, and B the compressing-cylinder, both arranged alongside one another, with their respective pistons A′ and B′ connected by the connecting-rods A^2 and B^2 to their respective cranks C^2 and C′ in crank-shaft C, crank C′ being preferably made at an angle of sixty-five degrees, or thereabout, in advance of C^2. To the other end of the cylinders A and B, I attach a breech end D, in which is formed the exploding-chamber E and suitable seatings, as shown, in which are fitted cylindrical valve-seatings F, G, and H, secured to breech end D by studs or bolts and nuts and forming pressure-tight joints therewith. These valve-casings F, G, and H are fitted, respectively, with mushroom-valves F′, G′, and H′, each formed with a stem working in suitable guides, as shown, and collars F^3, G^3, and H^3. Spiral springs on stems F^2, G^2, and H^2 are compressed between the collars F^3, G^3, and H^3 and valve-seating guides F, G, and H every time the valves are raised from their seatings. These springs insure the return of the valves F′, G′, and H′ to their seatings at every revolution of the engine.

Valve F′ is the gas-valve for the admission of gas from the supply-pipe I to the mixing-port K′, where it mixes with a supply of air drawn in through air-passage K and along port K′, through the holes shown in valve-casing G, and past the air-valve G′, when opened into the compressing-cylinder B.

Valve H′ is the admission or compound valve for admitting the compressed charge or compound from compressing-cylinder B by port M, past valve H′, along port N into the exploding-chamber E.

Valves G′ and H′ will work automatically; but to insure their acting quickly and reliably valve H′ is opened by the tappet P′, carried by one end of the double-ended lever P, and valve G′ by the tappet P^2, carried at the opposite end of lever P. The lever P is carried at or about its center by shaft S, working in bearing Q, bolted to D. On the opposite end of shaft S another lever P^3 is fastened, which is connected by rod R to the eccentric R′, or a suitable cam fixed on crank-shaft C. This eccentric imparts a rocking or reciprocating motion to lever P and opens and closes alternately valves G′ and H′.

The opening of the valve F′ for the admission of gas is regulated by the governors 1 1, lever 2, and rod 3, carrying a steel V-shaped tappet 4, which are so adjusted that during the ordinary working of the engine at its normal speed their position is the same as that shown in the drawings, and is such that during the outward stroke of the piston B′ a steel knife-edged tappet 5 (fastened to the die 6, sliding on guide 7 and receiving motion from lever end P^3 by the arm P^4) comes in contact with, during its forward motion, the V-shaped tappet 4 on rod 3, and by this means opens the gas-valve F′ at the same time that the air-valve G′ is opened. The lower end of rod 3 is forked and slides freely in a groove turned in collar F^3 of gas-valve F′, so that any motion given to tappet 4 is imparted to rod 3 and gas-valve F′ simultaneously.

When the engine is running above its normal speed, the governor-balls 1 1 rise, lower the outer end of lever 2 and rod 3, so that the V-tappet 4 is moved out of the path of the tappet 5, by which means gas-valve F′ is not opened for the admission of gas to the engine until it has resumed its ordinary speed again.

The operation of the engine is as follows: On the first outward stroke of the compressing-piston B′ toward the crank-shaft C, when turning the fly-wheel T by hand or otherwise, a supply of gas and air in proper proportions

is drawn, respectively, past the gas and air valves F′ and G′ into the compressing-cylinder B during the whole outward stroke of the piston B′. At the termination of this stroke valves F′ and G′ are allowed to return to their seatings by the action of lever P^2, and thus prevent the compound of gas and air returning thereby. On the return of piston B′ the compound in cylinder B is partially compressed to the necessary density, and is forced along port M past admission-valve H′, which is opened at the proper time by tappet P′ into the explodingchamber E and cylinder A. When piston B′ reaches the end of its inward stroke, the whole of the gaseous compound, except that which remains in clearance and port M, is driven into chamber E and cylinder A, and the valve H′ is closed at the same time to prevent the return of the compound to B. At this instant piston A′, owing to the angularity of cranks C′ and C^2, has made a little more than half its return-stroke in cylinder A, and in further completing its stroke toward D forces back the gaseous compound from A into chamber E, where it is further and completely compressed to the requisite density. Port U^2 connects chamber E with igniting-tube U, which is kept red-hot by a burner supplied by gas-pipe U′. The compressed compound in E is fired by the igniting-tube U or by any other suitable means. The effect of the ignition of the charge in E is to propel piston A′ outward, and thus make a working stroke of the engine until piston A′, having traveled about seven-eighths, or thereabout, of its stroke, commences to uncover exhaust-port J, formed in the working-cylinder A, and completely uncovers the same by the time it has reached the outer end of its stroke. The products of combustion being under pressure escape rapidly through the exhaust-port J until they are reduced to about atmospheric pressure in the cylinder. At this moment, owing to the angular advance of crank C′, the gaseous compound from cylinder B is being driven by piston B′ past the admission-valve H′ into chamber E and cylinder A, where it drives before it the products of combustion out of the exhaust-port J, until all, or nearly all, of these products are expelled thereby by the time that exhaust-port J is covered again by piston A′ on its return-stroke, which is effected by the momentum of the fly-wheel T. After the exhaust-port J is again covered by the piston A′ and during the remainder of the return-stroke, piston A′ drives back the gaseous compound from cylinder A into chamber E, and at the same time compresses the compound up to the requisite density, as before explained, ready for ignition at the commencement of another outward stroke of piston A′. Nearly simultaneous with the outward working and the return exhausting and compressing strokes of piston A′ in the power-cylinder A the piston B′ of the compressing-cylinder B is drawing in its gaseous compound, partially compressing it and forcing it past valve H′ into chamber E and cylinder A, as before explained, so that when the engine is in full work there is always a gaseous compound compressed to the requisite density in chamber E, ready for being ignited at the commencement of every outward stroke of the working-piston A′. The eccentric R′ is keyed on the crank-shaft C in such a position in relation to cranks C′ and C^2 that the valves F′ and G′ are opened, as before described, when the piston B′ is making its outward stroke, and closed again at the termination of such stroke, and the valve H′ is opened when the piston is making its inward stroke, and closed again at or about the termination of such inward stroke.

Cylinders A and B, chamber E, and valve-seating casings in breech end D are water-jacketed at W W W, as shown on the drawings, to prevent overheating, cold water entering through the inlet W^2 and the heated water leaving by outlet W′.

I have described my improved arrangement and construction of gas-motor engines as applied to horizontal engines; but it is equally applicable to vertical or diagonal engines.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed and constructed, I declare that what I claim is—

1. In a gas-engine, the combination of the compression-cylinder A, the working-cylinder B, the single breech connected to said cylinders and having the explosion-chamber E, pistons A′ and B′, working in the respective cylinders, automatically-actuated valves F′, G′, and H′, double-ended lever P, shaft S, lever P^3, rod R, and eccentric R′, all substantially as set forth.

2. In a gas-engine, the combination of the cylinder B, the cylinder A, the breech connected to said cylinders and having the explosion-chamber E, pistons A′ and B′, working in the respective cylinders, automatically-actuated valves F′, G′, and H′, lever P, shaft S, lever P^3, rod R, eccentric R′, and the governor 1, and intermediate mechanism for controlling the valve F′, all substantially as set forth.

In testimony that I claim the foregoing I have hereunto set my hand this 24th day of May, 1889.

JOHN TAYLOR.

Witnesses:
H. WALKER HILL,
J. H. TAYLOR.