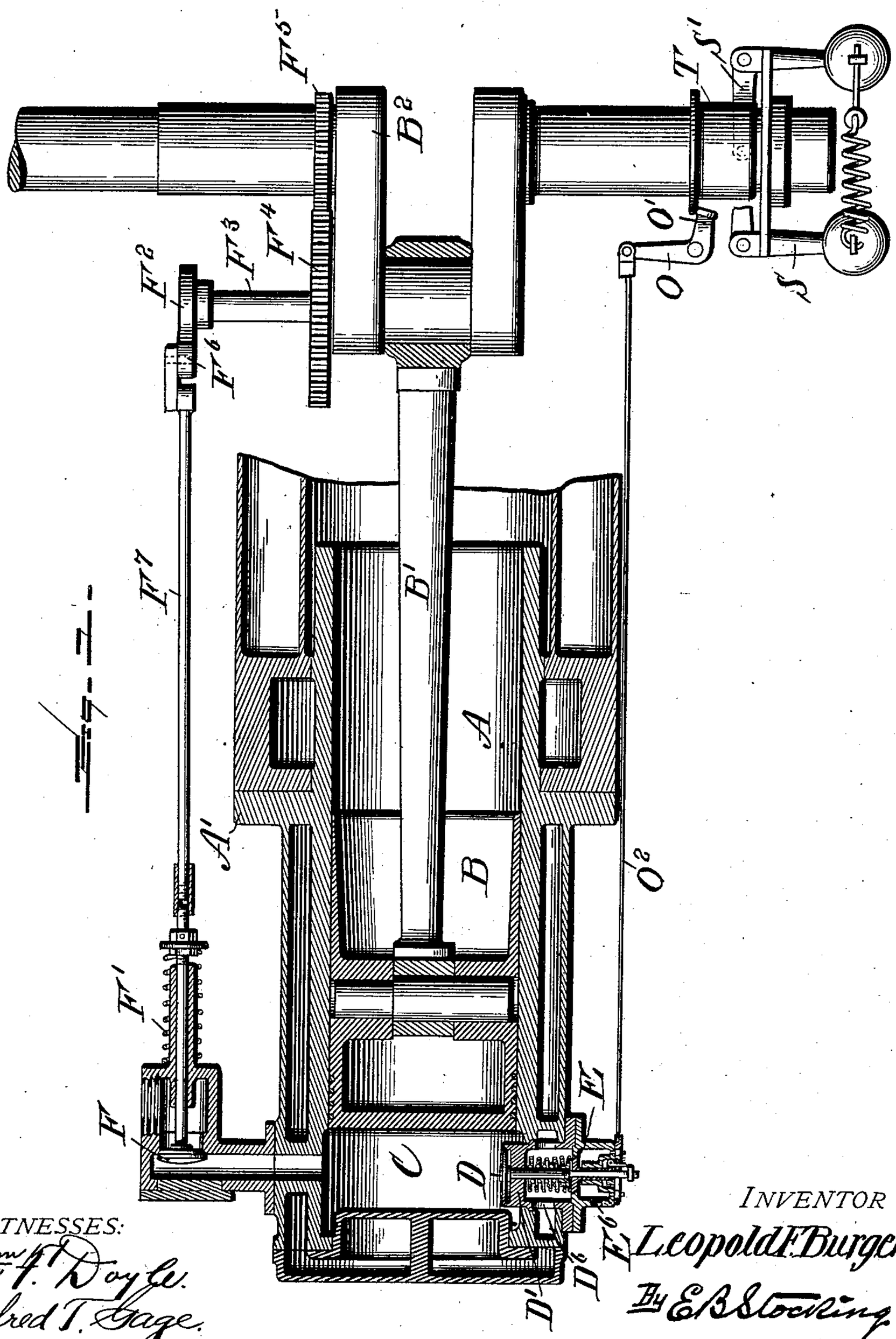
No. 722,671. PATENTED MAR. 17, 1903.

L. F. BURGER.

GAS ENGINE.

APPLICATION FILED OCT. 21, 1901.

NO MODEL. 2 SHEETS—SHEET 1.



WITNESSES:

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Alfred T. Gage.

INVENTOR

Leopold F. Burger,

By E. B. Stocking

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THE NORRIS P... WASH...

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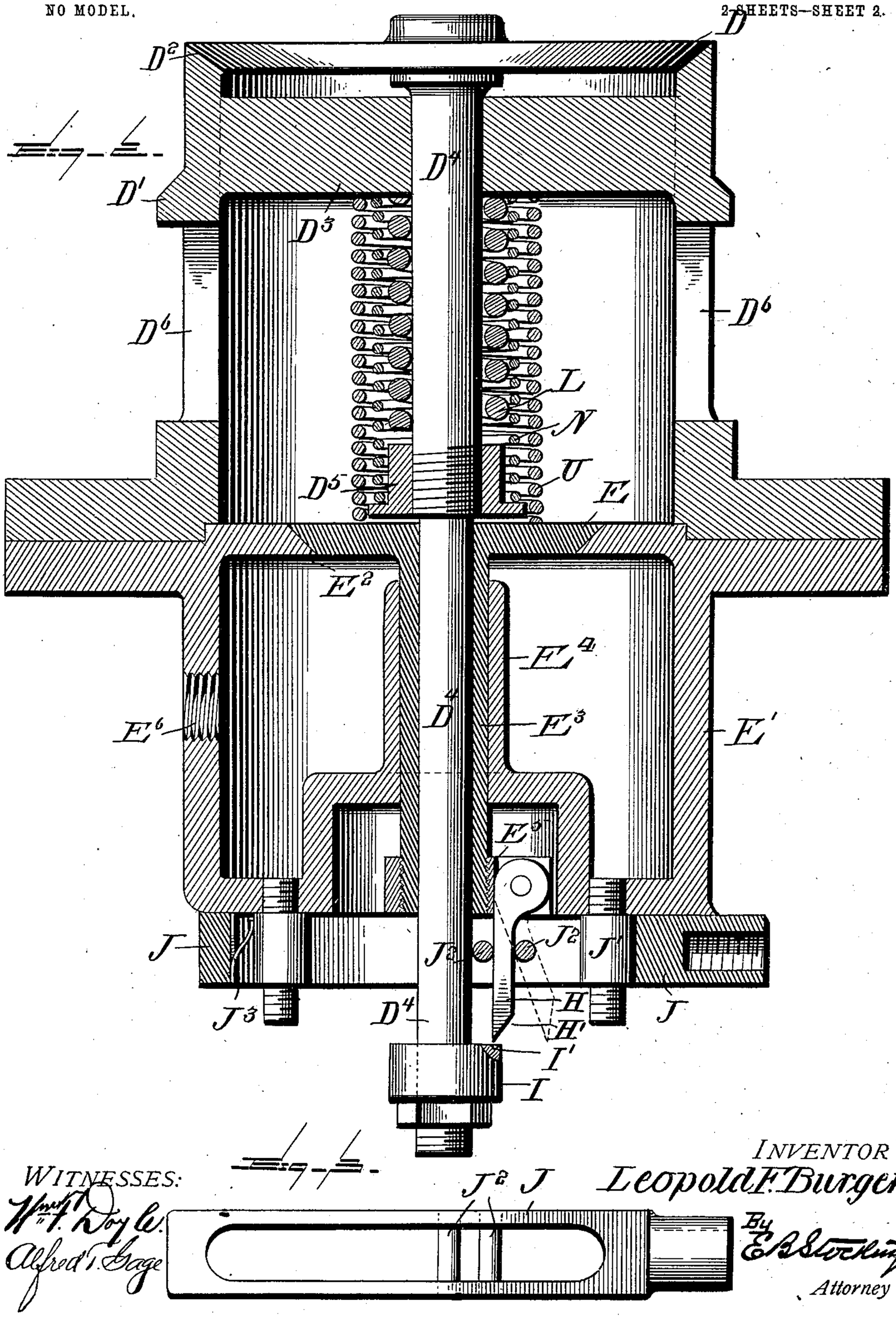

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UNITED STATES PATENT OFFICE.

LEOPOLD F. BURGER, OF ANDERSON, INDIANA, ASSIGNOR TO WOOLLEY FOUNDRY AND MACHINE WORKS, OF ANDERSON, INDIANA.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 722,671, dated March 17, 1903.

Application filed October 21, 1901. Serial No. 79,374. (No model.)

To all whom it may concern:

Be it known that I, LEOPOLD F. BURGER, a citizen of the United States, residing at Anderson, in the county of Madison, State of Indiana, have invented certain new and useful Improvements in Gas-Engines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to gas-engines, and particularly to a governing-valve and its cooperating parts.

The invention has for an object to provide a construction of the air and gas valves by which they may be operated independent of each other or simultaneously when coupled together through the action of a governor-controlling device.

A further object of the invention is to provide an automatically-controlled arrangement of the valves by which the air is admitted from all sides of the gas-entrance, thus effecting the most desirable mixing of the fuel.

Another object of the invention is to provide a construction of the valve adapted to operate upon a single stem and having between the valves the controlling-springs therefor.

Other and further objects and advantages of the invention will be hereinafter pointed out, and the novel features thereof specifically defined by the claims.

In the drawings, Figure 1 is a horizontal longitudinal section through an engine embodying these improvements. Fig. 2 is a similar view, upon an enlarged scale, through the mixing and governing valves; and Fig. 3 is a detail plan of the slide-bar.

Like letters of reference indicate like parts in the several figures of the drawings.

This invention is capable of application to any form of explosive-engine; but for the purposes of illustration an engine of a four-cycle type is shown, which receives an impulse or explosion every second revolution of the crank-shaft if the governor so permits, as it is operated on the hit-and-miss plan and only allows the engine to receive gas when it is under the speed at which the governor is set. This engine is composed of a cylinder A and suitable casing A′, adapted to receive the piston B, which is connected by a pitman B′ with a crank-shaft B^2 at the opposite end of the engine and adapted to be driven by any desired power. At the closed end of the cylinder a combustion or explosion chamber C is provided and has communicating therewith any well-known form of igniting apparatus. The air and gas are drawn in this chamber through the air-valve D and gas-valve E, the former of which is supported in a frame D′, having a valve-seat D^2 at one end and a cross-web D^3 to support the stem D^4 of air-valve D. This stem is provided with a collar D^5, threaded or otherwise secured thereon and against which a spring N is adapted to bear at one end, while the other end thereof bears against the web D^3. This spring has a tendency to close the valve, while between the collar D^5 and the web a second heavier spring L is placed and is of less length than the distance between the collar and web. When the valve D has almost opened to its full stroke, the spring L acts as a cushion to the parts carried by the valve-stem and also renders them noiseless, and by so doing the shock or blow upon the parts is avoided, which prevents a crystallization of the metal from which the valve is formed. The valve-casing D′ admits the air through a series of openings D^6 at the sides thereof, while the gas enters at the bottom of the casing, so that the air rushes in from the sides toward the central column of gas and effects a thorough automatic mixing of the fuel. The valve E is mounted in a casing E′, having a valve-seat E^2, and the valve is provided with a sleeve E^3, surrounding the stem D^4 of the valve D, the lower portion of which stem is of less diameter than its upper portion. The sleeve E^3 of the gas-valve passes through a guide-tube E^4 of the casing and is provided at its outer end with a pivoting-lug E^5, adapted to receive a dog or pawl H, which coöperates with a collar I, adjustably secured to the end of the stem D^4 and provided with a recess I′, into which the point H′ of the dog H may extend. The gas is admitted to the valve E through a suitable opening E^6 in the casing E′, and this valve is normally held in its closed position by means of a spring U, extending between the upper face of the valve and the

web D^3. When the dog H is in position shown by dotted lines in Fig. 1, the valves are entirely independent and only the air-valve operates automatically in the suction of the engine. Different methods may be employed for connecting the valves together, which is their relation in the normal operation of the engine, and they are only disconnected when the engine gets above its rated speed. One form of mechanism for accomplishing this result is shown by the slide-bar J, mounted upon suitable roller-bearings J′ and provided with pins J^2 upon opposite sides of the dog H, so that in the reciprocation of the slide the dog will be thrown into or out of alinement with the collar I. This movement can be effected through the rods O^2, extending to the crank-arm O, pivotally mounted upon the engine and provided with an arm O′, lying in the path of a sleeve T, loosely mounted upon the driving-shaft and reciprocated by means of the usual ball and spring of the governor mechanism S, having the arms S′, connected to the sleeves. It will thus be seen that as the speed increases and the balls separate the sleeve will be drawn toward the governor and the bar J reciprocated through the rod O^2 to remove the dog H from the collar I, as shown by dotted lines in Fig. 2, thus leaving the valves independent of each other, so that the suction of the engine only opens the air-valve D. The slide-bar J may be restored to its normal position, as shown by full lines in Fig. 2, by means of any suitable device—for instance, a spring J^3—when the speed decreases to the proper extent. An exhaust-valve F is also provided, which is normally closed by a spring F′ and opened at the proper periods by a cam F^2 upon a counter-shaft F^3, driven by the gear F^4 in mesh with a small pinion F^5, carried upon the driving-shaft B^2. This cam bears against a suitable friction-roller F^6, carried at one end of the valve-rod F^7, and the parts are properly geared to open the exhaust once in every two revolutions of the crank-shaft and to retain the same open during one-half of a revolution of the crank-shaft. It should also be noted that the several concentric springs L, N, and U are alternately wound in opposite directions to prevent them from running into each other in their operation. For instance, the spring L is wound to the left, the spring N is wound to the right, and spring U is again wound to the left.

Assuming the parts of the engine to be in the position shown in Fig. 1, the operation is as follows: When the piston B is drawn away from the combustion-chamber C, air and gas enter through the valves D and E, which are connected together by the dog H and operate in unison. The gas is admitted at the lower central portion of the valve-chamber D′ and mingled with the air drawn in from the sides of this chamber, so as to effect a mixing in the valve-casing. In the return movement of the piston the explosive mixture is compressed, and when it is ignited the force of the explosion drives the piston outward again until at the end of its stroke the exhaust-valve is opened and the burned products of combustion allowed to escape until the piston has returned to the inner end of the stroke, when the exhaust-valve is closed and gas and air again drawn into the cylinder by the outward movement of the piston. When for any reason the speed of the engine rises above a predetermined point, the governor, as hereinbefore described, withdraws the dog from engagement with the collar I, so that in the next successive stroke only the air-valve is opened and the gas-valve remains upon its seat.

The simple construction of this engine renders it both durable and effective and obviates the liability of the engine getting out of repair, thus causing troublesome and costly delay.

It will be noted that the travel of the fuel-valve E is less than the air-valve D and the dog H is not engaged by the collar I until the air-valve has partly opened, while the continued movement of the fuel-valve opens the gas-valve. In the closing of the valve a corresponding movement occurs by which the fuel-valve is closed before the air-valve and all waste or escape of fuel thereby prevented.

It will be obvious that changes may be made in the details of construction and configuration of the several parts and that the invention may be applied to different characters of engines without departing from the spirit thereof as defined by the appended claims.

Having described my invention and set forth its merits, what I claim, and desire to secure by Letters Patent, is—

1. In a gas-engine, a governing-valve casing provided with independently-movable air and fuel valves having concentric stems slidingly mounted on each other disconnected from each other when seated, and shiftable means carried by one valve-stem for automatically engaging the other valve-stem and thus connecting said valves to operate in unison; substantially as specified.

2. In a gas-engine, a combination with a combustion-chamber, independently-movable air and fuel valves therefor, concentric springs located between the valves for seating them, means carried by the stems of said valves for connecting said valves to operate in unison, and a speed-governing device adapted to engage and shift said connecting means to disconnect said valves to permit their independent operation; substantially as specified.

3. In a gas-engine, a governing-valve casing having a web, an air-valve therein provided with a stem having a collar thereon, a fuel-valve having a sleeve surrounding said stem beyond said collar, a spring extending from said web to said collar, and a concentric spring extended from said web to one face of the fuel-valve; substantially as specified.

4. In a gas-engine, a governing-valve casing, an air-valve provided with a stem, a fuel-valve having a sleeve surrounding said stem, means for holding said valves upon their seats, a collar upon said air-valve stem, and a projection carried by said valve-sleeve movable into and out of the path of said collar; substantially as specified.

5. In a gas-engine, a governing-valve casing, an air-valve provided with a stem, a fuel-valve having a sleeve surrounding said stem, means for holding said valves upon their seats, a collar upon said valve-stem, a movable projection carried by said valve-sleeve to engage said collar, a slide-bar adapted to control the movement of said projection, and a speed-governor operatively connected to said bar; substantially as specified.

6. In a gas-engine, a governing-valve casing, an air-valve provided with a stem, and a fuel-valve having a sleeve surrounding said stem, means for holding said valves upon their seats, a collar upon said valve-stem, a pivoted dog carried by said valve-sleeve to engage said collar, a slide-bar mounted upon the valve-casing and provided with pins upon opposite sides of said dog, a speed-governor, and a connection extending from said bar to said governor; substantially as specified.

7. In a gas-engine, a valve-casing having inlet-openings at one side of a transverse partition therein, an air-valve at the outlet of said casing, a fuel-valve disposed centrally in said partition between the sides of said casing to introduce the fuel into a surrounding column of air, and a shifting connector carried by the stem of one valve to engage a projection on the stem of the other valve; substantially as specified.

8. In a gas-engine, a valve-casing, an air-valve provided with a stem passing through a bridge-wall, a fuel-valve surrounding said stem, a collar upon said stem between said valve and bridge-wall, a spring for restoring the air-valve extending from said collar to said bridge-wall, and a spring extending from said bridge-wall to the surface of the fuel-valve; substantially as specified.

9. In a gas-engine, a valve-casing, an air-valve provided with a stem passing through a bridge-wall, a fuel-valve surrounding said stem, a collar upon said stem between said fuel-valve and bridge-wall, a spring for restoring the air-valve extending from said collar to said bridge-wall, a spring extending from said bridge-wall to the surface of the fuel-valve; and a cushioning-spring surrounding said valve-stem between the collar and bridge-wall; substantially as specified.

10. In a gas-engine, a valve-casing, an air-valve provided with a stem passing through a bridge-wall, a fuel-valve surrounding said stem, a collar upon said stem between said fuel-valve and bridge-wall, a spring for restoring the air-valve extending from said collar to said bridge-wall, a spring extending from said bridge-wall to the surface of the fuel-valve, and a cushioning-spring surrounding said valve-stem between the collar and bridge-wall, said springs being spirally wound in opposite directions to each other; substantially as specified.

11. In a gas-engine, a valve-casing provided at one end with a valve-seat and inlet-openings at the sides beneath the same, a tubular guiding portion projecting centrally inwardly at the opposite end of the casing and having an enlarged recess at its outer end, a partition beyond said guiding portion provided with a valve-seat, an air-valve adapted to seat at one end of the casing and having a stem projecting through said guiding portion, a fuel-valve adapted to seat in said partition and having a sleeve surrounding the stem of the air-valve and projected through and beyond the guiding portion, a connecting device carried by the stem of the fuel-valve within said recess, and means carried by the end of the air-valve stem to engage said device; substantially as specified.

12. In a gas-engine, a governing-valve comprising independently-movable air and fuel valves having concentrically-extended stems, and laterally-movable means carried by one valve-stem to engage the other valve-stem for connecting said stems together to permit a preliminary opening of the air-valve before the fuel-valve and a further movement of both valves in unison and a closing movement of the air-valve after the fuel-valve has been first seated; substantially as specified.

13. In a gas-engine, the combination of a cylinder, a piston therein, an exhaust-valve, automatically-operated air and fuel valves adapted to move in unison, shiftable means carried by one of said valves and engaging the other valve for connecting and disconnecting said valves to permit independent movement of the air-valve, a crank-shaft driven from said piston, a speed-governor on said shaft, a connection from said governor to the connecting means between the air and fuel valves, and an operating-cam for the exhaust-valve geared from the crank-shaft to open said valve at every second rotation of said shaft; substantially as specified.

14. In a gas-engine, the combination with a cylinder, of a piston therein, a combustion-chamber at one end of said cylinder, a valve-casing provided with a mixing-chamber having air-inlets in its side walls and extended into said combustion-chamber, air and fuel valves, a partition forming a bottom for the mixing-chamber having therein a central seat for the fuel-valve and adapted to admit the fuel centrally of the air-inlets and concentric springs within said mixing-chamber operating in opposite directions to close said valves; substantially as specified.

15. In a gas-engine, the combination with a cylinder, of a piston therein, a combustion-chamber at one end of said cylinder, a valve-casing provided with air and fuel valves and projected into said chamber, means within

said valve-casing for mixing the air and fuel in its passage therethrough, shiftable means carried by one of said valves and engaging the other valve for connecting said air and fuel valves together for automatic operation to open and close independently during part of their movements and in unison during the balance thereof and means for disconnecting said shiftable means to permit an independent automatic operation of the air-valve; substantially as specified.

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

LEOPOLD F. BURGER.

Witnesses:
F. E. BUXTON,
H. BENEFIEL.