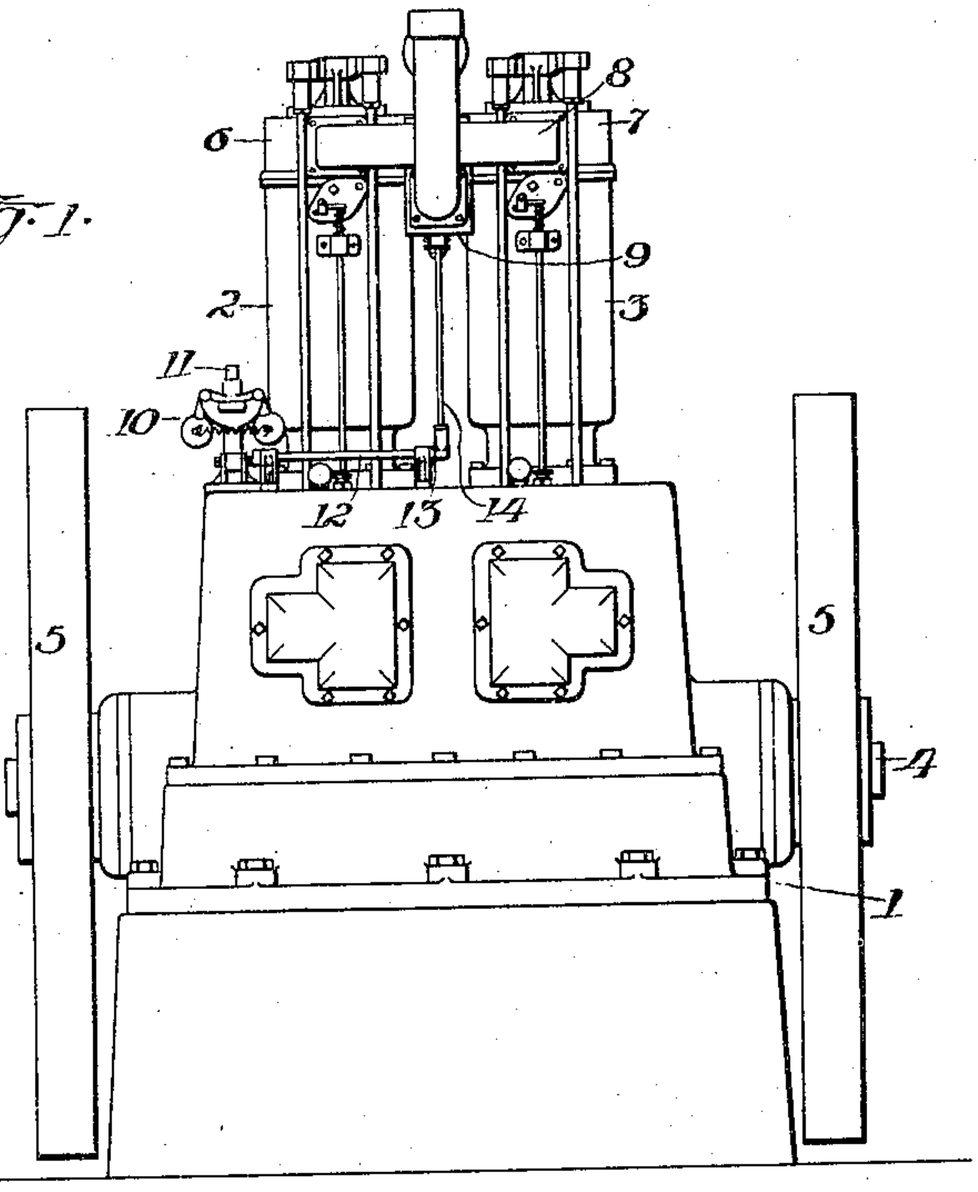
No. 845,159. PATENTED FEB. 26, 1907.

# W. K. ANDREW.

## GAS ENGINE.

APPLICATION FILED NOV. 26, 1906.

Fig. 1.



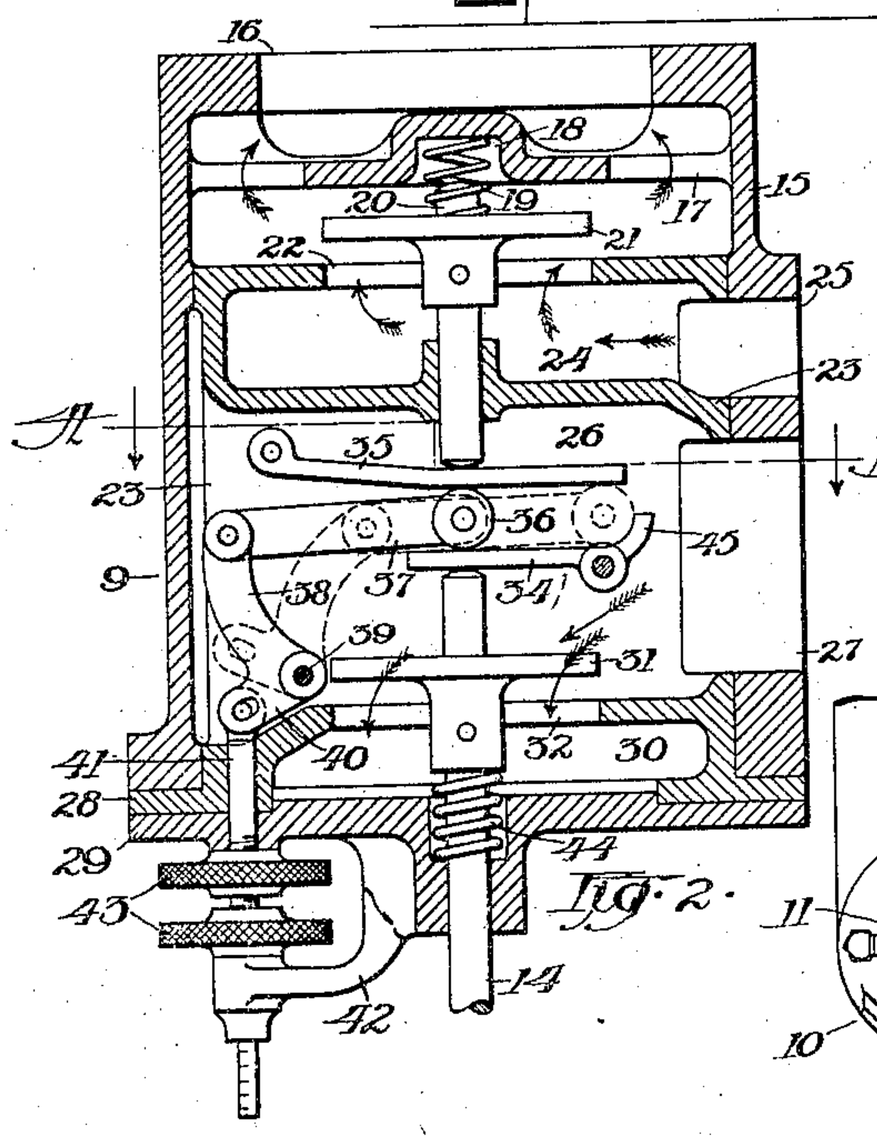




Fig. 2.

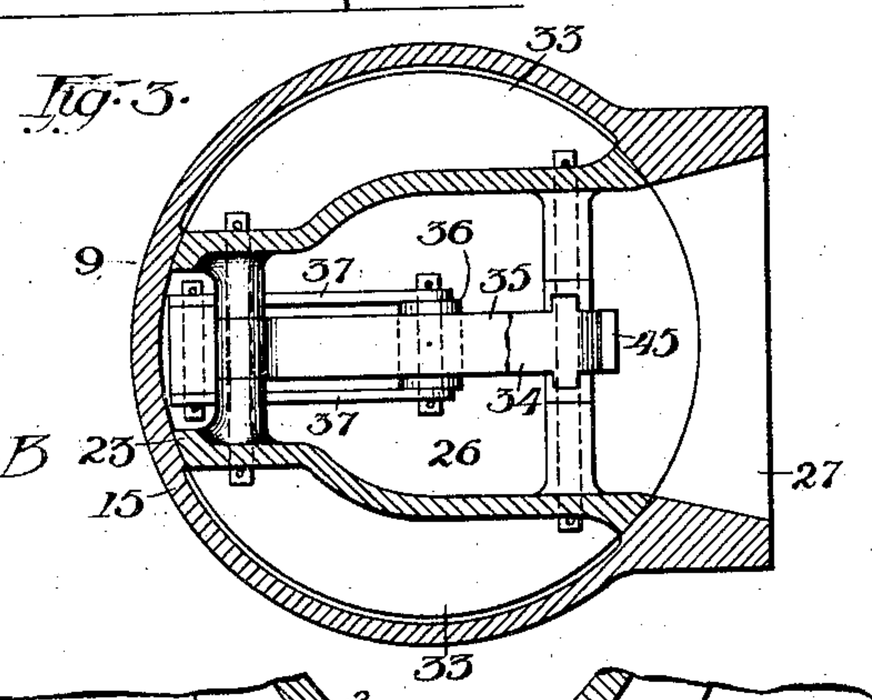



Fig. 3.

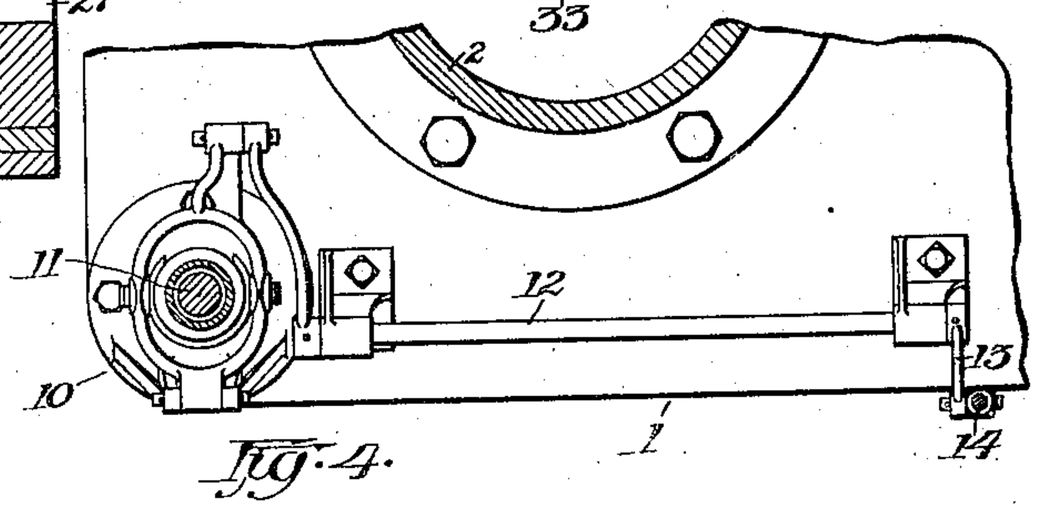



Fig. 4.

Witnesses:
F. N. Daggett.
F. W. Hoffmeister.

Inventor:
William K. Andrew.
By E. W. Burgess
Attorney.

# UNITED STATES PATENT OFFICE.

WILLIAM K. ANDREW, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO INTERNATIONAL HARVESTER COMPANY, A CORPORATION OF NEW JERSEY.

## GAS-ENGINE.

No. 845,159. Specification of Letters Patent. Patented Feb. 26, 1907.

Application filed November 26, 1906. Serial No. 345,246.

*To all whom it may concern:*

Be it known that I, WILLIAM K. ANDREW, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Gas-Engines, of which the following is a specification.

My invention relates to gas-engines, generally and specifically to means for governing the volume of explosive mixture admitted thereto without changing the proportions of gas and air comprising said mixture.

It consists in providing a valve mechanism adapted to regulate the supply of gas and air, which mechanism is controlled by a governing device operatively connected with a moving part of the engine, and means for adjusting the valve mechanism in a manner to vary the proportions of air and gas as desired.

Referring to the drawings forming a part of the specification, Figure 1 represents an end elevation of a gas-engine having my improved valve mechanism attached thereto. Fig. 2 is a detached sectional elevation of the valve mechanism. Fig. 3 is a cross-section of Fig. 2 on line A B, and Fig. 4 is a detached detail showing the preferred manner of connecting the valve mechanism with a governor device.

Similar reference-numerals denote like parts throughout the several views.

1 represents the bed of a common form of two-cylinder gas-engine; 2 and 3, the cylinders mounted thereon; 4, the engine-shaft, and 5 fly-wheels mounted thereon. The cylinders are provided with heads 6 and 7, in which are mounted the inlet and exhaust valves, which are operatively connected with the cam-shaft in any preferred manner. A gas-conduit 8, having its opposite ends communicating with the combustion-chambers in the cylinder-heads, is connected near its central portion with a source of gas-supply and is provided with the usual valve mechanism controlling the admission of explosive mixture to either power-cylinder. In addition to the regular valve mechanism I provide a volume-controlling and mixture-proportioning valve mechanism 9, located between the source of gas and air supply and the regular valve mechanism and operatively connected with a common form of governor mechanism 10, mounted upon a vertical shaft 11 and deriving motion from the engine-shaft by any of the usual means. In its preferred form I connect the governor mechanism to a rock-shaft 12, mounted upon the bed of the engine and having a lever-arm 13 flexibly connected with the lower end of a valve-operating rod 14, connected at its upper end with the valve mechanism 9.

The valve mechanism comprises a cylindrical case 15, having opening 16 at its upper end communicating with the combustion-chamber of the engine. A bar 17 extends across the case below the opening 16 and is provided with a cupped portion 18, coincident with the axis of the case, which is adapted to receive one end of a coiled spring 19, the opposite end of which surrounds a short stem 20, that projects above a plate-valve 21, controlling an opening 22, formed in the upper end of an inserted chambered core portion 23, surrounded by the case 15 and comprising a gas-chamber 24 at its upper end communicating with a source of gas-supply by means of a port 25 through the wall of the case, an air-chamber 26 below the gas-chamber and communicating with the atmosphere by means of a port 27 through the walls of the case, and a flange portion 28, adapted to be clamped against the end of the case by means of a head-piece 29. A chamber 30 is formed between the bottom of the air-chamber and the head-piece, and a valve 31 controls the opening 32 communicating therewith, and vertical air-conduits 33, formed between the inner surface of the case and the body of the case, connect the chamber 30 with an upper chamber portion of the cylinder above the core portion and gas-valve and forming a preliminary mixing-chamber wherein the gas and air unite to form the mixture. The valve 31 is mounted upon the upper end of the valve-operating rod 14, and the rod extends beyond the valve and contacts with one end of a horizontally-arranged lever 34, pivoted at its opposite end between the side walls of the air-chamber. The stem 20 passes through the valve 21 and is received by a vertical bearing in the upper wall of the air-chamber and projecting below the bearing rests upon a lever 35, pivotally connected with the side walls of the air-chamber upon the opposite side of the chamber from the pivot of the first-mentioned lever. The valves are in substantial axial alinement, and between the

two levers is a movable fulcrum, consisting of a roller 36, mounted between the inner ends of links 37, that have their opposite ends pivotally connected with the long arm 38 of a bell-crank lever, pivotally mounted between the side walls of the air-chamber at 39 and having the short arm 40 thereof provided with an elongated opening, by means of which it is connected with the upper end of a controlling-rod 41, slidably mounted in a vertical bearing in the bottom wall of the air-chamber and the head-piece 29. An arm 42 is formed integral with the head-piece and is provided with a bore in axial alinement with the controlling-rod 41, which it receives, and 43 represents adjusting-nuts adapted to adjust the controlling-rod in either direction, and the lower end of the rod is marked in a manner to form an indicator to denote the degree of adjustment made.

Surrounding the valve-rod 14 below the valve 21 is a coiled spring 44, received by a counterbore in the head-piece and operating to lift both valves away from their seats in opposition to the spring 19 and the weight of the valve-rod and connections.

The lever 34 projects beyond its pivotal axis and is provided with a turned-up portion 45, that acts as a bumper to limit the outward movement of the movable fulcrum, as shown by dotted lines in Fig. 2.

In operation the gas-valve 21 and the air-valve 31 are normally open, due to the pressure of the coiled spring 44, and the governor mechanism connected with the valve-rod 14 operates to close the valves in opposition to the pressure of the spring proportionate with the speed of the engine in a manner to control the volume of mixture passing toward the combustion-chambers. The gas-valve having its stem resting upon the pivoted lever will when released move by gravity toward its seat, and the spring above it will insure and accelerate such movement.

By manipulating the adjusting-nuts the roller-fulcrum between the pivoted levers may be moved toward or from the axis of the valves, the effect being when it is moved away from the axis to cause the upper valve to be lifted proportionately relative to the lower, and thus reduce the volume of gas in proportion to the area of the opening. In this manner the proportions of air and gas may be readily controlled, and the governor mechanism connected with the valve mechanism will automaticaliy regulate the volume of the mixture admitted to the combustion-chamber.

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

1. In combination with a gas-engine, a throttling-governor comprising a cylindrical valve-chamber containing separate gas and air chambers having open ports communicating with a source of gas and a source of air supply, respectively, other ports opening out of said chambers, valves controlling said last-named ports, a speed-governor mechanism operatively connected with said valves in a manner causing them to close the ports, and an adjustable lever connection between said valves operative to regulate their relative movement.

2. A throttling-governor for gas-engines comprising, in combination, a cylinder having an open end in communication with the combustion-chamber of an engine and its opposite end closed, a gas-chamber and an air-chamber intermediate said ends, and a dividing-wall between said chambers, an inlet-port communicating with said gas-chamber and a source of gas-supply, and an inlet-port communicating with said air-chamber and a source of air-supply, an outlet-port communicating with said gas-chamber and the open end of said cylinder, an outlet-port communicating with said air-chamber, air-conduits communicating with said air-outlet port and the open end of said cylinder, a valve controlling said gas-outlet port and opening outward from said gas-chamber, said valve having a stem projecting through a bearing formed in said dividing-wall and extending into said air-chamber, a valve controlling said air-outlet port and opening inward into said air-chamber, a valve-controlling rod having a bearing in the closed end of said cylinder and projecting through said air-controlling valve substantially in axial alinement with the stem of said gas-controlling valve, and having an intervening space therebetween, independent levers pivoted upon opposite sides of said stems and contacting with the ends thereof, an adjustable fulcrum between said levers, and means for adjusting said fulcrum lengthwise of said levers.

3. A throttling-governor for gas-engines comprising, in combination, a cylinder having an open end in communication with the combustion-chamber of an engine and its opposite end closed, separate gas and air chambers within said cylinder intermediate its ends, and a dividing-wall between said chambers, a gas-inlet port communicating with said gas-chamber and a source of gas-supply, and an air-inlet port communicating with said air-chamber and a source of air-supply, an outlet-port communicating with said gas-chamber and the open end of said cylinder, an outlet-port communicating with said air-chamber, air-conduits communicating with said air-outlet port and the open end of-said cylinder, a valve controlling said gas-outlet port and opening outward from said gas-chamber, said valve having a stem projecting through a bearing formed in said dividing-wall and extending into said air-chamber, a valve controlling said air-outlet port and opening inward into said air-chamber, a

valve-controlling rod having a bearing in the closed end of said cylinder and projecting through said air-controlling valve substantially in axial alinement with the stem of said gas-controlling valve, and having an intervening space therebetween, independent levers pivoted upon opposite sides of said stems and contacting with the adjacent ends thereof, an adjustable fulcrum between said levers, means for adjusting said fulcrum lengthwise of said levers, said means comprising a longitudinally-movable rod mounted in said cylinder and flexibly connected with said fulcrum, and means for adjusting said rod longitudinally.

4. A throttling-governor for gas-engines comprising, in combination, a cylinder having an open end in communication with the combustion-chamber of an engine and its opposite end closed, separate gas and air chambers within said cylinder intermediate its ends, and a dividing-wall between said chambers, a gas-inlet port communicating with said gas-chamber and a source of gas-supply, an air-inlet port communicating with said air-chamber and a source of air-supply, an outlet-port communicating with said gas-chamber and the open end of said cylinder, an outlet-port communicating with said air-chamber, air-conduits communicating with said air-outlet port and the open end of said cylinder, a valve controlling said gas-outlet port and opening outward from said gas-chamber, said valve having a stem projecting through a bearing formed in said dividing-wall, a valve controlling said air-outlet port and opening inward into said air-chamber, a valve-controlling rod having a bearing in the closed end of said cylinder and projecting through said air-controlling valve substantially in axial alinement with the stem of said gas-controlling valve and having an intervening space therebetween, independent levers pivoted upon opposite sides of said stems and contacting with the adjacent ends thereof, an adjustable fulcrum between said levers, means for adjusting said fulcrum lengthwise of said levers, said means comprising a longitudinally-movable rod mounted in said cylinder, means for adjusting said rod longitudinally, and a lever-and-link connection between said rod and said movable fulcrum.

5. A throttling-governor for gas-engines comprising, in combination, a cylinder having an open end in communication with the combustion-chamber of an engine and its opposite end closed, separate gas and air chambers within said cylinder intermediate its ends, and a dividing-wall between said chambers, a gas-inlet port communicating with said gas-chamber and a source of gas-supply, and an air-inlet port communicating with said air-chamber and a source of air-supply, an outlet-port communicating with said gas-chamber and the open end of said cylinder, an outlet-port communicating with said air-chamber, air-conduits communicating with said air-outlet port and the open end of said cylinder, a valve controlling said gas-outlet port and opening outward from said gas-chamber, said valve having a stem projecting through a bearing formed in said dividing-wall and extending into said air-chamber, a valve controlling said air-outlet port and opening inward into said air-chamber, a valve-controlling rod having a bearing in the closed end of said cylinder and projecting through said air-controlling valve substantially in axial alinement with the stem of said gas-controlling valve and having an intervening space therebetween, a speed-governor mechanism operatively connected with said valve-controlling rod in a manner causing said valve to move toward said port, a spring operative to move said valve in an opposite direction, independent levers pivoted upon opposite sides of said valve-stems and contacting with the adjacent ends thereof, an adjustable fulcrum between said levers, and means for adjusting said fulcrum lengthwise of said levers.

WILLIAM K. ANDREW.

Witnesses:
B. C. WAIT,
W. J. CARNEY.