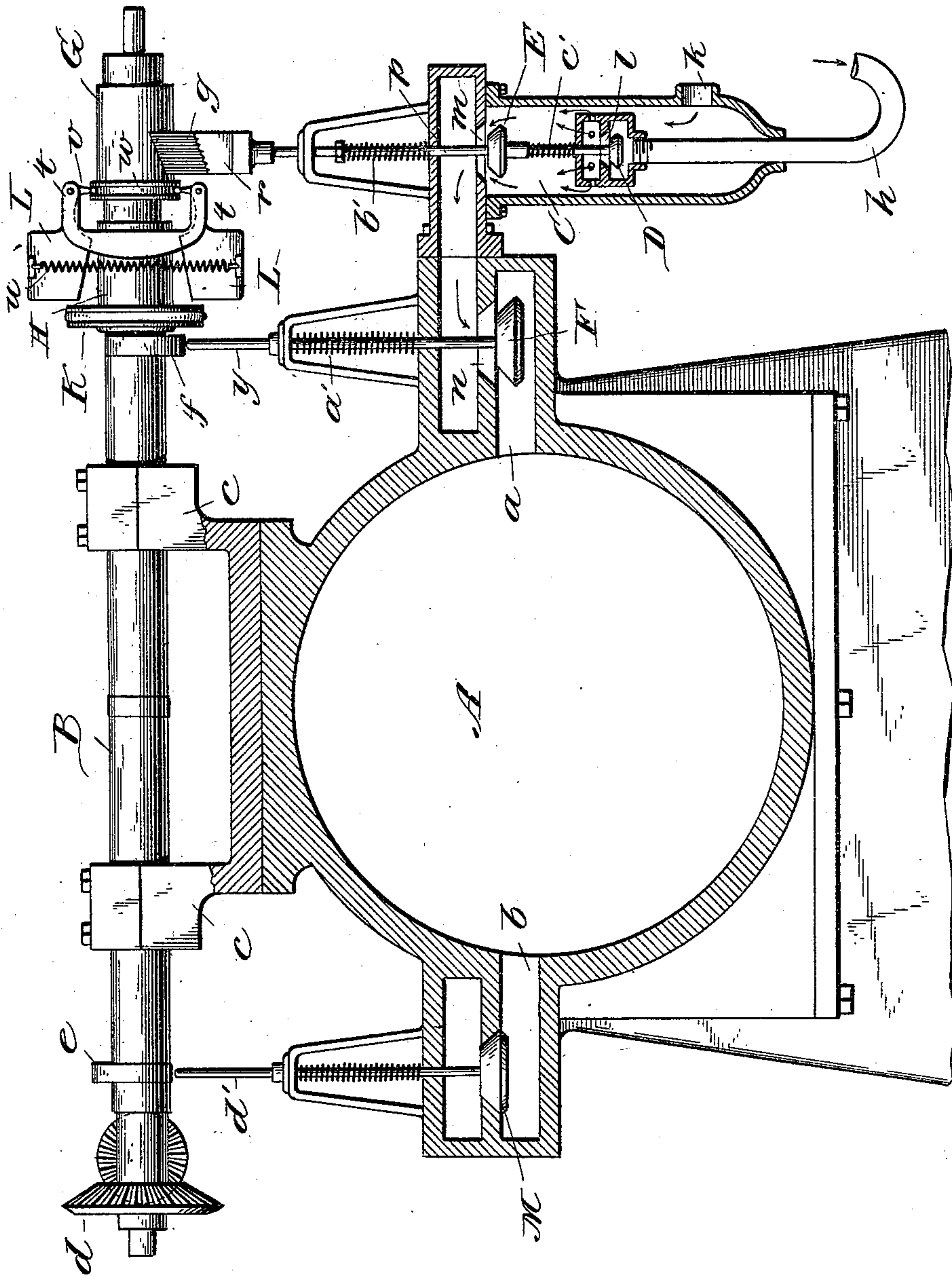


(No Model.)

H. G. CARNELL.  
GAS ENGINE.

No. 556,086.

Patented Mar. 10, 1896.



Witnesses:  
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# UNITED STATES PATENT OFFICE.

HARRY G. CARNELL, OF DAYTON, OHIO.

## GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 556,086, dated March 10, 1896.

Application filed June 22, 1895. Serial No. 553,662. (No model.)

*To all whom it may concern:*

Be it known that I, HARRY G. CARNELL, a citizen of the United States, and a resident of Dayton, in the county of Montgomery and State of Ohio, have invented a certain new and useful Improvement in Gas-Engines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawing, forming part of this specification.

My invention relates to devices for the automatic regulation of the quantity of the explosive mixture supplied to the igniting-chamber of gas-engines to conform to the work to be performed, so that the amount of the charge of constant quality may be automatically varied as may be required, and in connection with this automatic regulation I arrange the inlet-valves so that the regulation may be adjusted much more accurately than has heretofore been accomplished.

It has been customary in gas-engines to arrange, by means of a governor acting upon the inlet-valves, to regulate the quantity of mixture admitted to suit the varying loads, and it has also been customary to accomplish this regulation by means of the cone-shaped cam acting upon the inlet-valve stem, the location of the cam being controlled by a governor, so that the inlet-valve may be opened to a greater or less extent as required. Where cone-shaped cams have been used to accomplish this regulation, however, the inlet-valves have not been of a character that would insure positive and prompt action in closing the valve at the moment the cam ceases to act upon the valve, and consequently the result has been that the use of such cone-shaped cams has not been successful in preventing a variation of speed of the engine.

It is the purpose of my invention to make use of the cone-shaped cam, under control of the governor, to automatically regulate the inlet-valve opening, and at the same time apply this construction to such an arrangement of inlet-valves that the automatic regulation may be as perfect as possible and the usual variation of speed entirely obviated.

In the drawing, the figure is a cross-section of the end of the gas-engine, showing the construction and operation of the gas-valves.

A is the cylinder of a gas-engine. *a* is the inlet-opening, *b* the exhaust-opening. Suitably mounted in standards *c c*, secured to the top of the cylinder, is a shaft B driven by the gearing *d*, in connection with the driving mechanism of the machine, and having mounted thereon a series of cams *e, f*, and *g*. These cams are employed to open the inlet and exhaust valves, as will be hereinafter set forth.

*h* is the gas-induction pipe, and *k* the air-port, by means of which the air and gas are introduced into the machine. The gas enters through the valve-opening *l* and mixes with the air in the upper portion of the chamber C. The mixture passes through the valve-openings *m* and *n* on its way to the cylinder. These three openings are closed by the valves D, E, and F.

The valves D and E are mounted on the same valve-stem *p*, the upper end of which is formed with an inclined notched or corrugated top *r*.

Mounted on the shaft B, so as to slide laterally thereon, but to turn with the shaft, is a collar G, upon which is formed the cone-shaped cam *g*, the contacting or outer surface of this cam being inclined laterally and being notched or corrugated to conform with the notches in the top *r* of the valve-stem *p*. Mounted loosely on the shaft, near the collar G, is the governor, consisting of a sleeve H, to which is secured the pulley K for driving the same. The other end of the sleeve is provided with arms *t t*, to which the weights of the governor L L are pivoted, the weights being drawn together by the coiled spring *u*. The ends of these weights are provided with projecting arms *v v*, which extend inward at right angles to the shaft and take into the groove *w* in the collar G.

It will be seen from this construction that as the speed of the governor increases the collar G and the cone-shaped cam will be shifted along the shaft, so that in contacting with the head of the valve-stem *r* the inlet-valves will not be opened to so great an extent. I prefer to notch or corrugate these contacting surfaces to prevent any lateral movement of the collar G in making this contact.

Between the gas and air inlet valves and



the igniting-chamber of the gas-engine I locate the check-valve F, which is opened positively at each cycle of the machine by the cam *f*, operating on the valve-stem *y*. Coiled springs *a'*, *b'*, and *c'* operate to close the valves when the cams release the valve-stems; but the gas and air inlet valves D and E do not depend only upon these springs for prompt closing, but the moment the cone-shaped cam releases the valve-stem *p* the suction or pressure vacuum in the cylinder promptly closes these valves, so that the action of the cone-shaped cam adjusts itself with great nicety, and the exact quantity of mixture to suit the work to be performed is admitted with each cycle.

The position of the cams *f* and *g* is such that the valve F is held open until after the valve E has closed. For convenience the valves E and D are mounted on the same valve-stem *p*; but this is not at all essential, as it can be readily seen that these two valves could be separate, each operated by a cam of its own. M is the exhaust-valve, the valve-stem *d'* of which is depressed by the cam *e* to allow the escape of the exploded mixture upon the back-stroke of the piston.

In the drawing I have shown the inlet-valves open to their fullest extent. As the speed of the machine increases, the cone-shaped cam *g* will be shifted laterally on the shaft B and a smaller opening will be presented for the entrance of the gas and air mixture; but no matter what the opening of the valve the moment the cam releases the valve-stem the suction within the cylinder closes the inlet-valves, and this independent of any action of the spring. Then the check-valve F closes, the explosion takes place, driving the piston forward, the exhaust-valve is opened to allow the escape of the exploded mixture during the back-stroke of the piston; while during the next forward stroke the inlet-valves are again opened and just the

proper quantity of mixture drawn into the igniting-chamber.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a gas-engine, the combination, with the gas-inlet valve opening into an air-mixing chamber and an inlet-valve for the mixture of gas and air opening outwardly, of a check-valve opening inwardly, located between the inlet-valves and the ignition-chamber, with a cone-shaped cam operating upon said inlet-valves to open the same, and a governor to shift said cam to vary the valve-opening, substantially as shown and described.

2. In a gas-engine, the combination, with the gas-inlet valve opening into an air-mixing chamber and an inlet-valve for the mixture of gas and air opening outwardly said valves being provided with a common valve-stem, of a check-valve opening inwardly located between the inlet-valves and the ignition-chamber, with a cone-shaped cam operating upon said inlet-valves to open the same, and a governor to shift said cam to vary the valve-openings, substantially as shown and described.

3. In a gas-engine, the combination, with the gas-inlet valve opening into an air-mixing chamber and an inlet-valve for the mixture of gas and air opening outwardly, of a check-valve opening inwardly located between the inlet-valves and ignition-chamber, with a cam for opening said check-valve, and a cone-shaped cam for opening said inlet-valves, said cams being arranged to hold open said check-valve until the inlet-valves have been released, with a governor to shift said cone-shaped cam to vary the inlet-valve opening, substantially as shown and described.

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