(No Model.)

J. CHARTER.

GAS ENGINE.

No. 370,242. Patented Sept. 20, 1887.

Fig. 1.

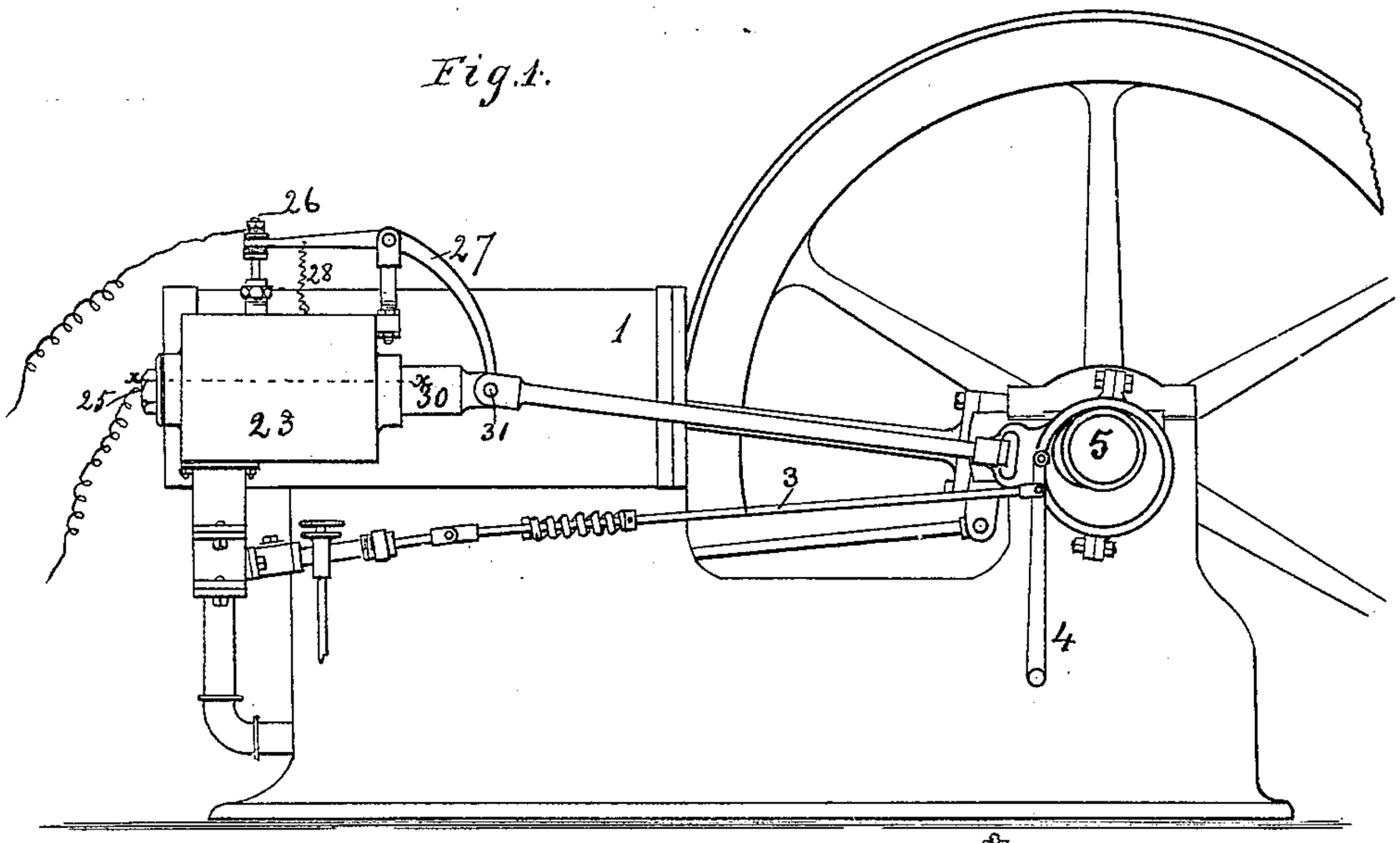


Fig. 4

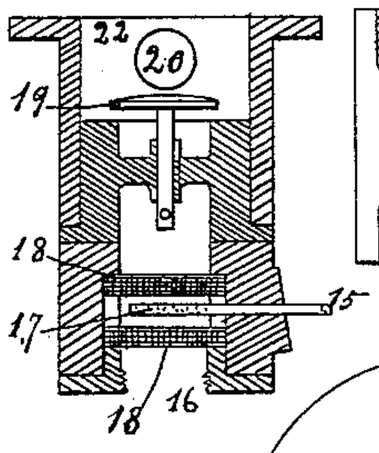


Fig. 5.

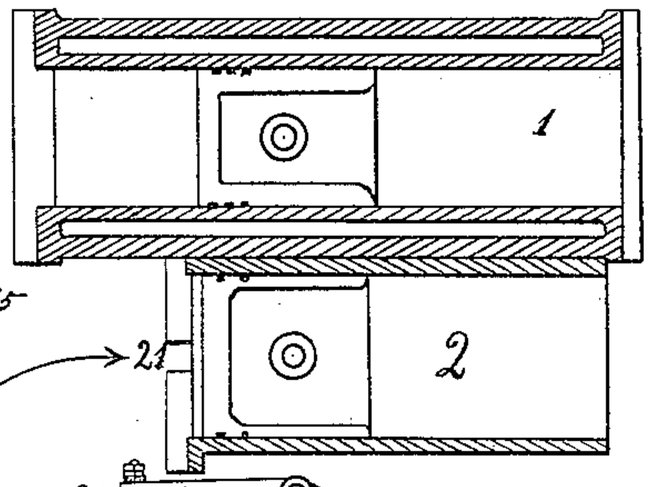


Fig. 3.

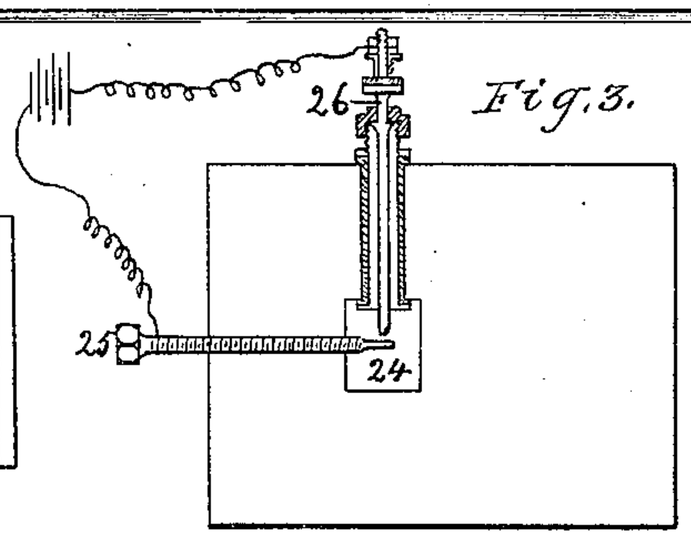


Fig. 6.

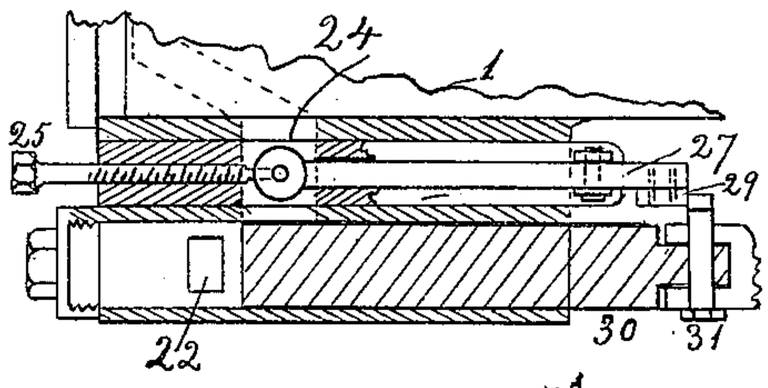


Fig. 2.

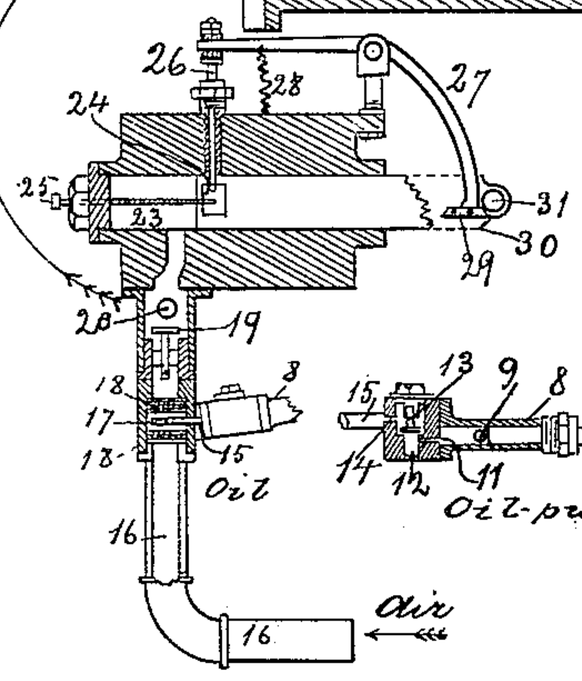
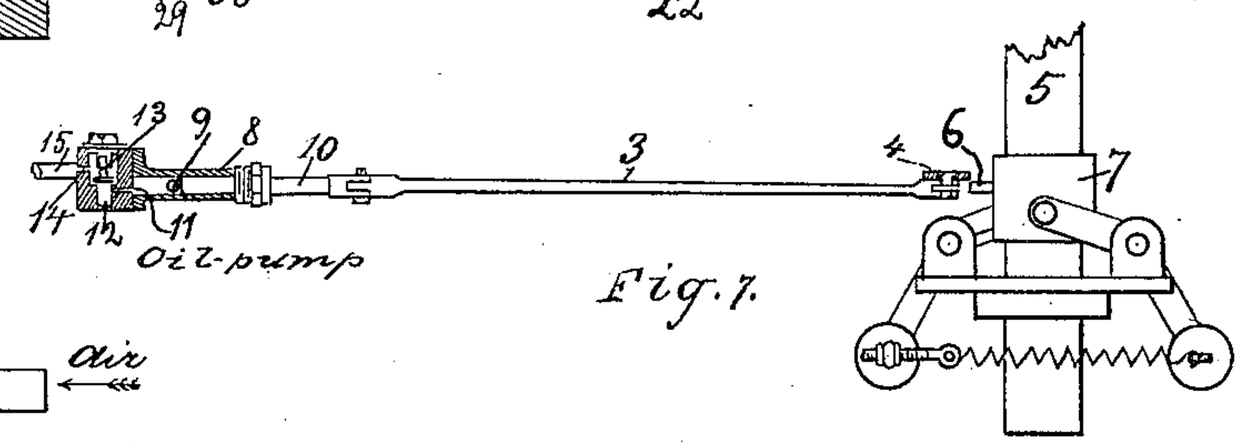


Fig. 7.



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UNITED STATES PATENT OFFICE.

JOHN CHARTER, OF STERLING, ILLINOIS.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 370,242, dated September 20, 1887.

Application filed May 20, 1887. Serial No. 238,869. (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 has reference to certain improvements in gas-engines; and it consists, essentially, in certain additions, hereinafter described, to the structure shown and patented to me in United States Letters Patent No. 356,447, dated January 25, 1887, for improvements in gas-engines, by means of which vaporized gasoline or like oil is substituted in the explosive mixture for the gas mentioned in said former organization; and my present invention consists, further, in certain novel mechanism whereby electricity is utilized to ignite the explosive mixture in the power-cylinder, in lieu of a gas-jet and its adjunctive mechanism used for said purpose in the aforesaid organization.

In those engines in which illuminating or other manufactured gas is required in the combination of the explosive mixture it is obvious that it is practicable to use such engines only where communication can be established with such gas, and this restriction would limit the use of such engines, for the most part, to localities in which such gas was manufactured, and would preclude the use of such engines in smaller cities and villages and other situations remote from gas-works. One prominent advantage, therefore, in substituting vaporized oil for the former gas consists in the fact that it renders the use of the engine feasible in every locality, whether near or remote from gas-manufactories. Another advantage of the employment of said oil, as aforesaid, is in the reduced expense thereof as compared with the manufactured gas.

The advantage of the substitution of the electrical igniter for the gas-jet in the former construction results from the fact, first, that the requisite electricity can be and is, in my construction, generated by the machine itself, and therefore the means of ignition is not, as in said former construction, dependent upon exterior communication with gas pipes or mains, but, like the use of the oil aforesaid, can be employed in any locality, however isolated; and, second, as the electrical ignition occurs in the inlet-port of the power-cylinder it is neither seen nor heard, and there is therefore avoided what, to some, are the objectionable features of the puff, smoke, and smell of a flame-igniter.

As my invention consists of the two departments—of means for vaporizing and using oil in the explosive mixture and mechanism for utilizing the electrical igniter—and the remainder of my machine is in construction and operation substantially such as shown in my said former patent, I do not deem it necessary to show or describe said residue of the machine further than to exhibit and explain the relation thereto and operation of my present improvements.

I generate electricity in the machine which I have thus far operated by means of a small dynamo attached to the machine and operated by the balance-wheel thereof; but inasmuch as there is nothing new in such generation of the electricity the latter can be provided in various modes, and I do not deem it essential to incumber this description with an illustration of the one mode at present employed by me.

In the drawings, Figure 1 is a side elevation of a machine embodying my present invention. Fig. 2 is a partial longitudinal section in the line passed vertically through the center of the cut-off chamber 32. Fig. 3 is an enlarged detail, partially in section, of a portion of the upper parts of Fig. 2. Fig. 4 is an enlarged vertical section of some of the lower parts of Fig. 2. Fig. 5 is simply a longitudinal vertical section through the center of the power and supply cylinders, exhibiting the inlet-port in the end of the latter for the admission of the explosive mixture, (the arrow connecting Figs. 2 and 5 showing the communication between the opening in the tube of Fig. 2 and said inlet-port in Fig. 5.) Fig. 6 is an enlarged partial horizontal section in the line *x x* of Fig. 1. Fig. 7 is a detail, partially in section, of the oil-injector,

which at the same time acts, as hereinafter described, as a regulator, and the relation of the same to the governor, the latter being constructed and seated on the main shaft, as more particularly described in said former patent.

The power-cylinder 1 and supply-cylinder 2 are seated relatively, provided with pistons, and operated as described and shown in said former patent. The reciprocating rod 3 is actuated, as in said former construction, by having its outer end pivotally connected to the vertically-oscillating arm 4, and near the upper end of the latter, the lower end of said arm being pivoted to the bed of the machine, and its upper end furnished with a friction-roller, which, in the rotation of the main shaft 5 of the machine, intermittently traverses the crescent flange or cam 6, formed on the sliding collar 7, seated loosely on said shaft, being held adjustably thereon by a suitable spring. The collar 7 is adapted to be shifted back and forth by the governor, as fully described in said former patent, so that the increased speed of the engine will serve to draw the flange 6 out of the path of said friction-roller, and cause the latter to traverse merely the rounded exterior of the collar 7, under which condition no movement will be imparted to the rod 3.

The inner end, 10, of the rod 3 is fitted to fill and reciprocate in a smaller cylinder, 8, Fig. 7, and here is afforded the means for injecting the oil. A small opening, 9, is formed in the wall of the cylinder 8, through which the required amount of oil passes into the cylinder 8 by hydrostatic pressure, the oil-reservoir being placed at an altitude slightly above said opening.

The instroke of the rod 3 drives the amount of oil then in the cylinder 8 through a small opening, 11, in the wall of the vertical chamber 12, in which chamber is seated the upwardly-opening automatic valve 13.

The impulse imparted by the rod 3 forces the oil against the lower face of the valve 13, raising the latter, and causes the oil to pass out of the chamber 12 through the higher opening, 14, in the opposite wall therein and into the horizontal tube 15, communicating therewith at its outer end, and having its inner end projected into the vertical air-tube 16. That portion of the tube 15 which is projected transversely into the air-tube 16 has perforations 17 around its entire periphery, to permit the escape of the oil therein in small distributed quantities. In the air-tube 16, above and below the perforated end of the tube 15, are seated, respectively, a series of annular sieves or perforated plates, 18, in order that the oil escaping through the perforations 17 may be more thoroughly atomized and disseminated by and through the ascending current of air in the tube 16.

The lower end of the air-tube 16 has communication in any suitable manner with the outer atmosphere, and the outstroke of the piston in the supply-cylinder 2 draws the air up through the air-tube 16, through the perforated plates 18, through the automatic valve 19 seated in said air-tube, out through the opening 20 in said air-tube, and through the tube (not shown but indicated by the arrow aforesaid) connecting said opening 20 with the opening 21 in the inner end of the cylinder 2. Thus the explosive mixture is drawn into the cylinder 2, and the returning instroke of the piston in the said cylinder 2 forces the mixture back through said tube connecting openings 20 and 21, and the valve 19 having meanwhile closed of its own gravity, said mixture is forced through the vertical opening 22 into the cut-off chamber 23, Fig. 2, and from this through the inlet-port 24 in the power-cylinder 1, where, under compression, as fully described in said former patent, said mixture is ready for ignition and explosion.

The hydrostatic or gravity pressure of the oil is not sufficient of itself and without the aid of the rod 3 to force the oil past the valve 13 by opening the latter, and therefore when the reciprocal action of the rod 3 is intermitted, as aforesaid, no oil is passed into the air-tube 16, and the velocity of the engine is thereby reduced until the re-engagement of the rod 3 with the cam or flange 6 again imparts a propelling force to the oil. Thus the rod 3 operates as a regulator to the feed as well as an injector of the oil.

The atomizing, vaporizing, and thoroughly mixing of the oil with the air has its initiative where the current of incoming air comes in contact with said oil at the perforations 17, and is continued throughout the process of being drawn into the supply-cylinder 2 and driven therefrom into the power-cylinder 1, as aforesaid, until at the period of the admission of the explosive mixture in said power-cylinder said air has become thoroughly vaporized and intermixed with the coincident charge of air. The advantage of thus distributing the oil throughout the air is, that substantially all of the oil is taken up in the air, and thus each succeeding charge is of the same quality and strength as the preceding ones, and no diminution of power is experienced, as is the case where the exhalations of the volatile portions of the oil are solely relied upon to impregnate the air, and where there will constantly remain a residuum of a constantly-decreasing volatility.

The electrical ignition is communicated to the explosive charge in the following manner: A horizontal screw-bolt, 25, having its outer end suitably connected by wire to an electric battery or other generator, is screwed into the end of the machine, so that its inner end is projected through the side of and into the inlet-port 24 of the power-cylinder. A vertical pin, 26, is passed downward through the machine, so that its lower end projects through the upper side of and into said inlet 24 in position to be intermittently brought into contact with the inner end of the bolt 25. A lever, 27, vibrating in a vertical plane is suitably fulcrumed near its longitudinal center

upon the machine, and has its inner end loosely attached to the upper end of the pin 26. The upper end of the pin 26 is connected by wire to the battery or other electrical generator, as aforesaid, and said pin is suitably insulated from both the lever 27 and from the machine. In my present construction I use insulating rubber washers. A drawing coiled spring connects the inner end of the lever 27 with the machine, and serves to hold the lower end of the pin 26 in contact with the adjacent end of the horizontal bolt 25, under which condition the electrical circuit is complete. On the side of the outer end of the lever 27 is formed a shoe or cam, 29, and in the instroke of the cut-off plunger 30. A projected transverse bolt, 31, Fig. 2, in said plunger passes over and rides upon the cam 29, holding the contiguous end of the lever 27 down and the lower end of the vertical pin 26 up and out of contact with the adjacent end of the bolt 25 until in the outstroke of the plunger 30 the bolt 31 passes off of the cam 29 and releases the lever 27, when the spring 28 draws the pin 26 again into contact with the bolt 25. The breaking of the circuit by the action aforesaid of the bolt 31 upon the lever 27 occasions an electric spark to pass from the horizontal bolt 25 to the adjacent end of the vertical pin 26, which spark in its passage ignites the explosive charge in the inlet-port 24, which of course is instantly communicated to the residue of said charge in the power-cylinder. The cut-off plunger 30 is reciprocated in the cut-off chamber 23 by an eccentric connection at its outer end to the main shaft 5 in precisely the manner described and shown in said former patent, when said plunger performed the two functions of a cut-off for the inlet-port 24, and also assisted in the ignition of the charge. In my present construction said plunger 30 performs the two functions of a cut-off for said inlet-port 24, and serves to break the electric current, as aforesaid, through the medium of said lever 27. The movement of the plunger 30 is so adjusted that the inner end thereof closes the outer end of the inlet-port 24 just previous to the ignition of the explosive charge in said port, as aforesaid, and keeps said port closed until after the explosion of the charge in the power-cylinder.

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 of the air-tube 16, provided with perforated transverse partitions 18, the cylinder 8, provided with the opening 9 therein, the reciprocating rod 3, and the communicating tube 15, provided with perforations 17, substantially as shown, and for the purpose described.

2. In a gas-engine, the combination of the air-tube 16, having intermittent communication with the supply-cylinder 2, and provided with perforated transverse partitions 18, the automatic valve 19, the supply-cylinder 2 and piston therein, the perforated tube 15, projected within said air-tube, and means, substantially as shown, for intermittently forcing the proper quantity of oil through said perforations, substantially as shown, and for the purpose described.

3. In a gas-engine, the combination of the supply-cylinder 2, provided with a piston therein, the air-tube 16, communicating with said cylinder and provided with means for distributing the air therein, the tube 15, having the perforations 17 projected within said air-tube, and means, substantially as shown, for forcing the oil through and out of said tube 15, substantially as shown, and for the purpose described.

4. In a gas-engine, the combination of the bolt 25, suitably connected with the electrical battery or generator, and having one of its ends projected within the inlet-port 24, and pin 26, also connected with the battery or other electrical generator and insulated from the remainder of the machine, and having one of its ends projected within the inlet-port 24, the lever 27, attached to said pin 26, provided with the cam 29, the plunger 30, adapted to engage said cam, and the spring 28, whereby the current of electricity passing through said pin and bolt is intermittently broken and the charge ignited, substantially as shown, and for the purpose described.

5. In a gas-engine, the combination, substantially as shown, with the feed-tube of a gas-engine, of the chamber 12, provided with valve 13 and openings 11 and 14, and having a perforated communication with the interior of said air-tube, cylinder 8, provided with oil-entrance 9, piston 3, a sliding collar, 7, provided with cam 6, means for holding the outer end of piston 3 in engagement with said collar, and a suitable governor to move said cam in and out of engagement with said piston 3, for the purpose described.

6. In a gas-engine, the combination of the chamber 12, provided with ports 11 and 14, the valve 13, seated in said chamber, the cylinder 8, provided with oil-entrance 9, and piston 3, adapted to be thrown in and out of action by a governor, substantially as shown, and for the purpose described.

7. In a gas-engine, the combination of the air-tube 16, the chamber 12, communicating with said tube and provided with ports 11 and 14, the valve 13, seated in said chamber, cylinder 8, provided with oil-entrance 9, piston 3, and means, substantially as shown, for imparting reciprocal movement to said piston and intermitting the same, whereby said piston performs the double function of an injector and regulator.

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

JOHN CHARTER.

Witnesses:

JOHN G. MANAHAN,

ANDREW J. UPHAM.