

B. E. HALVERSTADT.
GAS ENGINE.

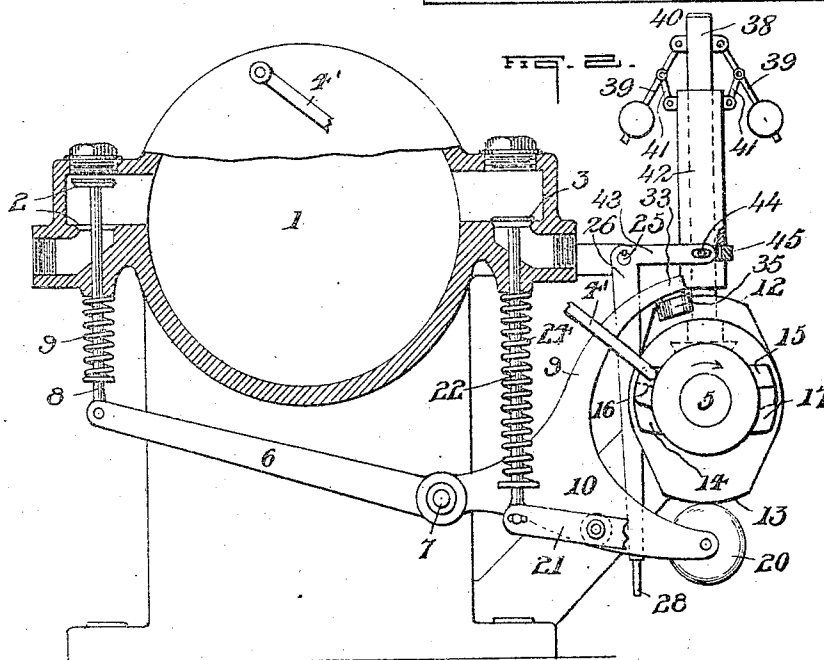
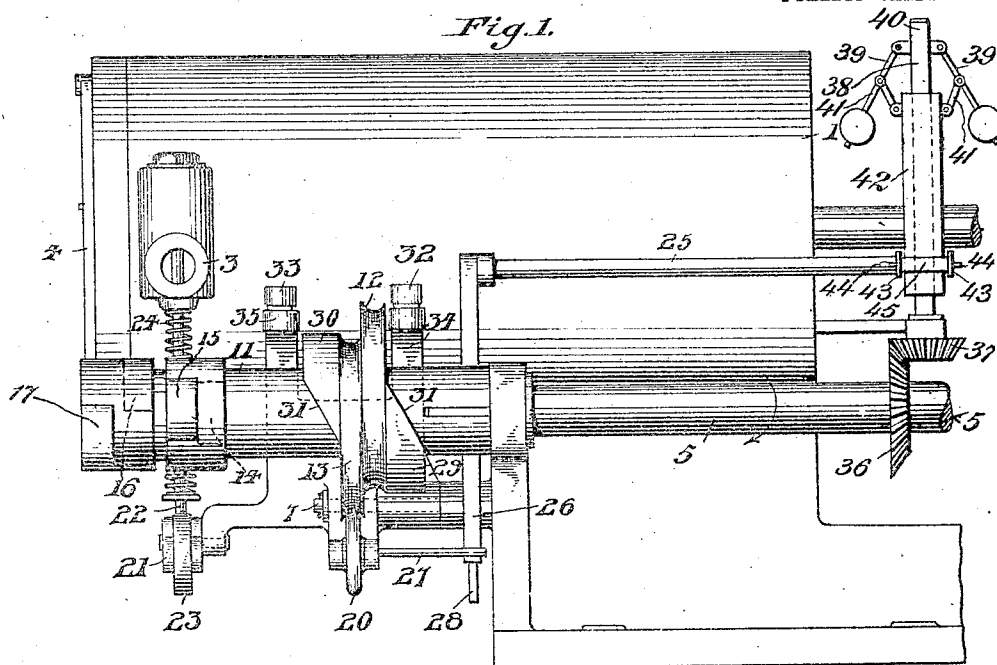
APPLICATION FILED AUG. 23, 1907. RENEWED SEPT. 7, 1909.

936,318.

Patented Oct. 12, 1909.

2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

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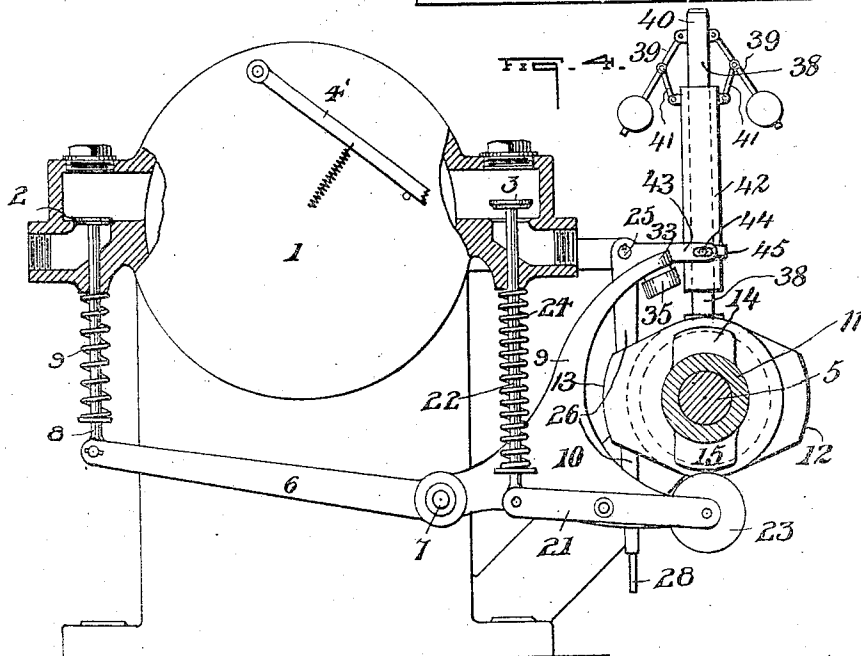
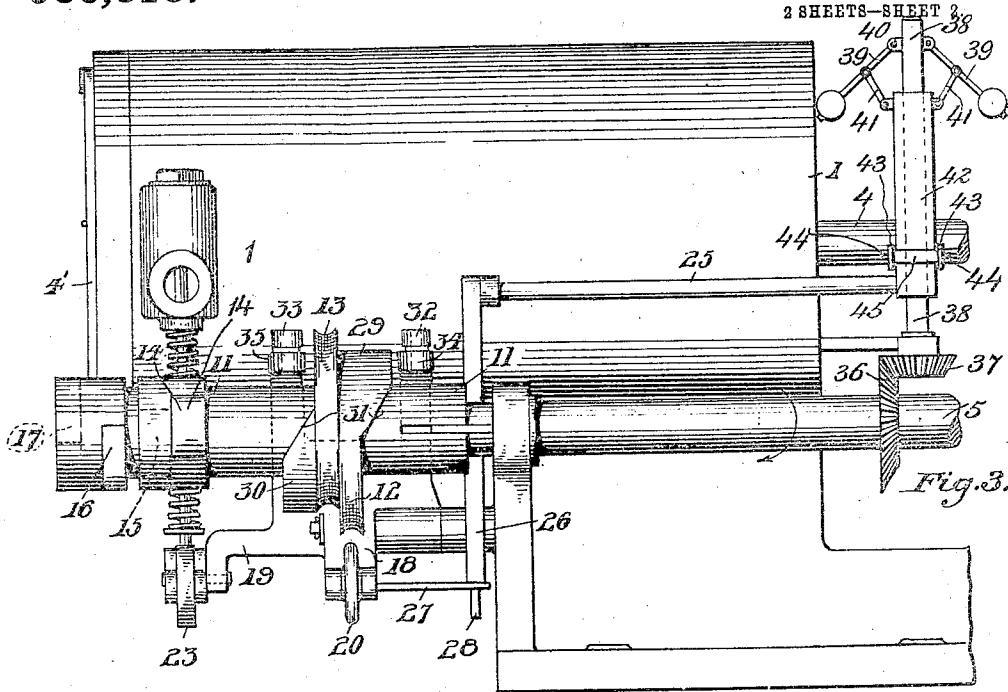
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UNITED STATES PATENT OFFICE.

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GAS-ENGINE.

936,318.

Specification of Letters Patent. Patented Oct. 12, 1909.

Application filed August 23, 1907, Serial No. 339,807. Renewed September 7, 1902. Serial No. 516,542.

To all whom it may concern:

Be it known that I, BERTRAM E. HALVERSTADT, a citizen of the United States, residing at Leetonia, Columbiana county, State of Ohio, have invented or discovered new and useful Improvements in Gas-Engines, of which the following is a specification.

My invention relates to gas engines and consists in providing means whereby the valves and the igniter are operated at the first revolution of the crank shaft after the governor has released the valve and igniter controllers or has assumed the position whereby gas may be again supplied to the cylinder.

Heretofore, it has been common to arrange the control of the valves and the igniter so that the valve shaft, which makes one revolution while the crank-shaft makes two revolutions, will operate the valves and the igniter at every revolution of the valve-shaft, or at every other revolution of the engine shaft. It is apparent that, in such a method of regulation, the speed of the engine will materially decrease after the governor has operated to permit the gas to be supplied to the cylinder, due to the fact that the engine has to make two revolutions after the governor has operated, as described, before another explosion can take place. With my invention, but one revolution at most of the crank shaft is required after the governor has set free the devices for supplying gas before another explosion can occur. By my invention, therefore, the regulation is more perfect and the weight of the fly-wheel may be greatly reduced.

Referring to the drawings, Figure 1 is a side elevation of a portion of a gas engine embodying my invention; Fig. 2, an end view, partly broken away; Fig. 3, a view similar to Fig. 1, the parts being in a different position; and Fig. 4, an end view of the parts in the same position, parts being in section and broken away.

On the drawings, 1 represents the cylinder of my gas engine; 2, the exhaust valve; 3, the inlet valve; and 4', the igniter arm, the details of the latter being omitted as they are well known.

4 is the piston rod and 5, the valve operating shaft, the latter being driven in any desired manner from the former, so that the valve shaft shall rotate, as is usual, but once while the crank shaft rotates twice.

6 represents a lever pivoted on the pin 7 below the cylinder, one end of the lever being pivotally connected to the stem 8 of the exhaust valve 2, which will be closed by the spring 9 when the lever is free to be actuated by the spring. The end of the lever opposite the end attached to the valve stem 8 is forked into upper and lower branches 9 and 10.

The shaft 5 has thereon the sleeve 11 which is rotatable with the shaft and slidable thereon, and carries three pairs of cams 12 and 13; 14 and 15, and 16 and 17, the first two pairs of cams being between the said branches 9 and 10 of the lever 6. The members of each pair of cams lie on opposite sides of the sleeve 11 but staggered with reference to each other, that is, they lie in different planes.

The lower branch 10 has two lateral branches 18 and 19, the former extending forwardly to a position under the sleeve and is provided with the roller 20 which may cooperate with either of the cams 12 or 13, as will be explained. The branch 19 carries the lever 21, having pivoted thereto at one end the stem 22 of the valve 3 and at the other end the roller 23, which may cooperate with either the cams 14 and 15, as will be presently explained. The valve 3 is seated by the spring 24 as soon as the lever 21 is free to yield. The cams 16 and 17 are arranged to engage with the lever 4' and lift the same and thereby cause an electric spark in a manner well known.

25 is a rock shaft operated by the engine governor hereinafter to be described. This shaft has secured thereto the pendent arm 26, which when swung to the front of Fig. 3 may have its lower end thrown on top of the rigid pin 27 secured in the branch 18 of the lever 6, when the cam 12 or 13 has lowered the forward end of the lever. The pin 28 in the end of the arm 26 is a stop to engage the side of the pin 27. The sleeve 11 also carries opposite the cams 12 and 13, the cams 29 and 30, which have each an incline 31 running diagonally of the axis of the sleeve, the incline on the cam 29 running from the cam 12 to the right and on the cam 30 to the left. The upper branch 9 of the lever 6 has the two branches 32 and 33 lying over the sleeve, one branch on one side of the cams 12 and 13 and the other branch on the other side. These

branches carry rollers 34 and 35 arranged to be engaged by the cams 29 and 30 at each revolution of the sleeve, when the lever 6 is locked by the arm 26. This action of the cams 29 and 30 will cause the sleeve 11 and all the cams thereon to reciprocate back and forth every full revolution. As the inclines 31 are between the cams 12 and 13, the reciprocations take place when the cams are horizontal and therefore out of engagement with the roller 20, and there is no obstruction to prevent the sleeve moving longitudinally whenever either of the inclines 31 rides against either of the rollers 34 or 35. The inclines 31 are of such a length that either the cam 12 is thrown above the roller 20 or the cam 13 is thrown above the same.

The cams 14 and 15 are shifted as the sleeve reciprocates so as to first present one above the roller 23 and then the other. The cams 16 and 17 as they reciprocate will be in position to operate the igniter lever 4' at any half revolution after the arm 26 releases the lever 6.

The shaft 5 carries the bevel gear 36, meshing with the bevel gear 37 on the governor shaft 38, carrying the arms 39 of the centrifugal governor 40 of a well-known type. The arms 39 are connected by the links 41 to the sleeve 42 slidable on but rotatory with the shaft 38. The rock-shaft 25 is provided with the forked arm 43 pivoted to the pins 44 on the collar 45 on the sleeve, this collar being in a groove (see Fig. 2) in the sleeve, so that the collar may follow the reciprocations of the sleeve but cannot rotate with it.

If the parts are as in Figs. 1 and 2, the cam 13, being in engagement with the roller 20, has caused the lever 6 to be rocked so as to open the exhaust valve 2. As the cam 13 passes from the roller 20, the valve 2 closes. Following this the cam 15 actuates the lever 21 so as to open the inlet valve 3. The cam 15 then releases the lever 21 and the spring 22 closes the valve 3. Toward the close of the compression stroke, the cam 17 actuates the igniter lever 4'. Then the explosion of the gases occurs and the working stroke takes place. These steps are repeated until the speed of the engine is so great as to cause the governor to rock the shaft 25 and bring the lower end of the arm 26 over the pin 27. This locks the exhaust valve open and holds the lever 6 so that the cams 12, 13, 14 and 15 cannot actuate the valves. When the arm locks the lever 6, the rollers 34 and 35 are held down so that the cams 29 and 30 pass between, and alternately engage, the said rollers, thus causing the reciprocation of the sleeve 11. As soon as the speed of the engine slows down to a certain rate, the governor removes the arm 26 from the pin 27, whereby the rollers 20 and 23 are permitted to follow

the outlines of the cams which happen to be in their planes at the particular instant of the release of the pin 27. The sleeve 11 does not reciprocate while the arm 26 is inactive because one of the cams 29 and 30 passes under one of the rollers 34 and 35 while they are in their raised position; it is only when the rollers 34 and 35 are lowered and the cams 29 and 30 are passing between them that the reciprocation takes place. It is thus seen that, by making the cams in pairs and causing them alternately to come into position for actuating the valves, I have provided a means whereby, as soon as the governor acts to release the pin 27, the gas is exploded as early as the first revolution of the engine.

The first suction-stroke of the engine after the governor permits the inlet valve to be opened, that is, after the engine speed falls below a predetermined rate, fills the cylinder with explosive gases in the well-known manner.

I make the cams 12 and 13 with grooves so as to guide or keep the cam 30 and the sleeve in proper relative positions, but other means may be used for the purpose.

I do not wish to limit myself in the precise elements and combinations shown and described, as it is apparent that various other means could be used to reciprocate the sleeve and operate the valves, or to provide means of admitting gas on the part revolution of the engine.

I claim—

1. In a gas engine, a gas inlet valve, means preventing the opening thereof when the speed of the engine reaches a predetermined rate, and mechanical means for opening the said valve for any suction-stroke provided the speed of the engine has dropped below said rate.

2. In a gas engine, a gas inlet valve and an ignition device, means for preventing the opening of the valve when the speed of the engine reaches a predetermined rate, and mechanical means for opening the said valve and actuating the ignition device in series at the next suction-stroke of the engine after the speed thereof falls below said rate.

3. In a gas engine, a gas inlet valve, a valve-operative device, means for opening the said valve at certain positions of the said device while the speed of the engine does not reach a predetermined rate, means for preventing the opening of the valve when the said rate is reached, and mechanical means for opening said valve between the said certain positions of said valve-operating device upon the reduction of the engine speed below said predetermined rate.

4. In a gas engine, an exhaust valve, means for locking it open while the speed of the engine is at or above a predetermined rate, and means independent of the gas

pressure for releasing the locking means for any suction-stroke provided the speed of the engine has dropped below said rate.

5 5. In a gas engine, a gas inlet valve, a plurality of speed cams for actuating the same, means for making the said cams inoperative to actuate the valve, and means for causing the cams to be alternatively in position to operate the valve when released.

10 6. In a gas engine, a gas inlet valve, a pair of spaced cams for actuating the same, means for bringing the cams alternatively in position to operate the valve, means for preventing the valve from actuation by said
15 cams and for releasing said preventing means so that the cam in position aforesaid may actuate the valve.

20 7. In a gas engine, a rotary cam shaft, a sleeve rotatable with but slidable on the shaft and carrying a pair of oppositely placed but staggered cams, a gas valve adapted to be actuated by the cams, means for preventing the cams from actuating the valve, and means for causing the sleeve to
25 reciprocate during such preventing operation, so that the cams shall be alternatively in position to actuate the valve when released.

30 8. In a gas engine, inlet and exhaust valves, an igniter arm, a cam shaft, double cams thereon for operating the valves and igniter arm, means to make the cams inoperative when the engine speed reaches a certain value, and means to reciprocate the
35 cams to cause the engine to operate at the first revolution after the action of the cams is made operative.

9. In a gas engine, a cam-shaft, double cams rotated thereby, a means for governing

the speed of the engine, and means for 40 reciprocating the cams to continue the operation of the engine at the first revolution after the action of the governing means.

10. In a gas engine, a cam-shaft, a sleeve on the cam-shaft carrying cams, a speed governing device, and means for sliding the
45 cams on the shaft to continue the operation of the engine at the first revolution after the action of the governing means.

11. In a gas engine, a cam shaft, double 50 cams thereon off-set from each other, gas valves operated by said cams, means for reciprocating the cams alternately at each half revolution of the crank shaft whenever the engine exceeds a predetermined speed, and
55 means for making the cams inoperative until the engine speed has been reduced to said predetermined speed.

12. In a gas engine, a reciprocable sleeve, off-set cams thereon, a gas valve, a valve operating element engageable by one or the
60 other of said cams according to the position of the same, means for preventing the cams from engaging said element when the speed of the engine reaches a predetermined value, and means for reciprocating the sleeve so as
65 to bring the cams consecutively in the plane of the valve-operating element so that when the speed of the engine falls to said predetermined value, the first cam to be in the
70 said plane will actuate the said element.

Signed at Leetonia, Ohio, this 16 day of August 1907.

BERTRAM E. HALVERSTADT.

Witnesses:

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A. Z. BALLANTYNE.