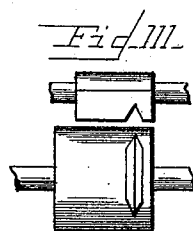
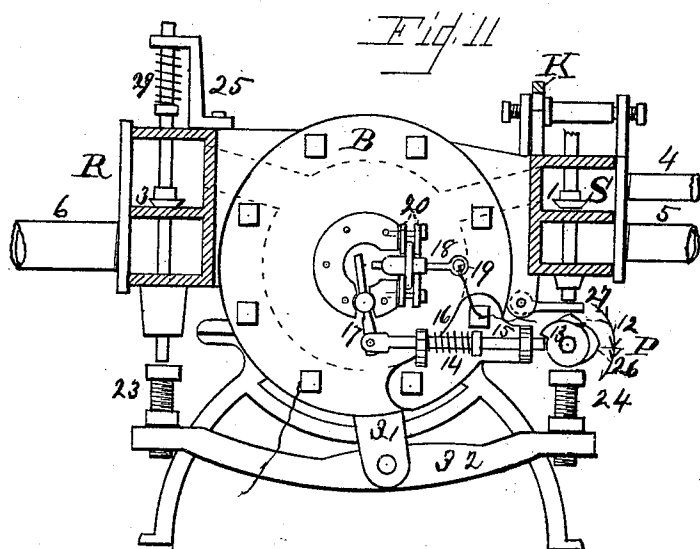
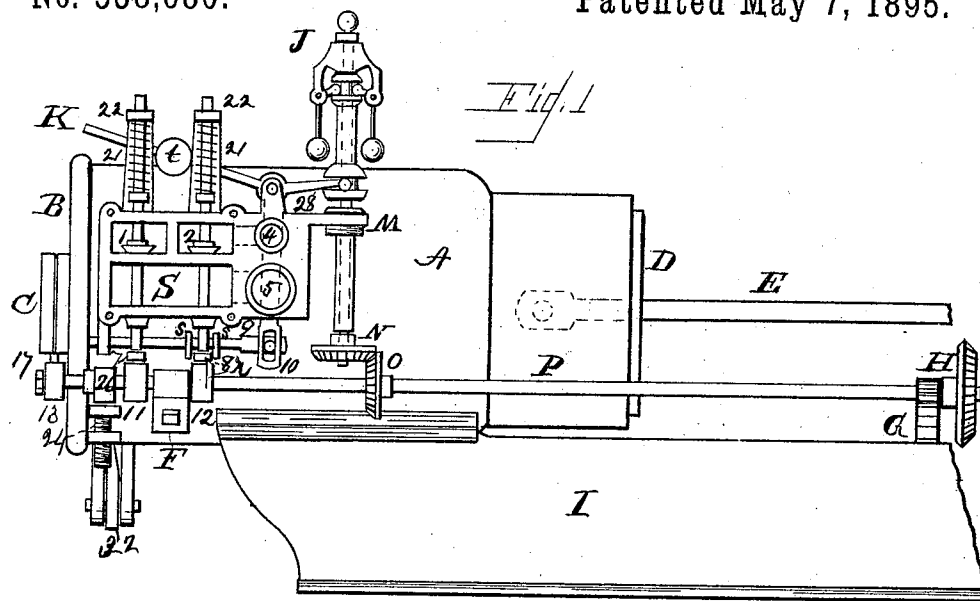


(No Model.)

L. M. JOHNSTON.
GAS ENGINE.

No. 538,680.

Patented May 7, 1895.



Witnesses
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Inventor
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UNITED STATES PATENT OFFICE.

LAWRENCE M. JOHNSTON, OF DAYTON, OHIO.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 538,680, dated May 7, 1895.

Application filed April 4, 1894. Serial No. 506,300. (No model.)

To all whom it may concern:

Be it known that I, LAWRENCE M. JOHNSTON, a citizen of the United States, residing at Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Gas-Engines; and I do hereby declare that the following is a full, clear, and exact description of the invention, which 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 the letters and numerals of reference marked thereon, which form a part of this specification.

My invention relates to improvements in gas engines, the features of which will be fully hereinafter described and claimed.

The object of my invention is the construction of a simple and effective engine, in which the propelling power is mixed air and gas in proportions highly explosive.

The mechanism is illustrated in the accompanying drawings, in which—

Figure I is a side view of the engine, omitting the shaft, balance-wheel, the plate closing the valve-box, and a part of the gear. Fig. II is a rear-end view with the sides of the valve-boxes removed. Fig. III is an enlarged plan view of the cam and pivotal plate.

Like letters and numerals designate like parts in all the views.

The general features of the engine are like those in general use.

The cylinder A is mounted on the frame I, and on the forward end of which (cut away in the drawings) is mounted in suitable bearings the crank-shaft, and to which are attached the balance-wheels or wheel. A pinion is attached to this shaft, that engages a spur wheel of a parallel shaft, and on the outer end of said shaft is a bevel wheel which engages the miter-wheel H, both of equal diameters. The wheel on the engine-shaft is just one-half the diameter of the other, and consequently the operating valve-shaft revolves just once to two revolutions of the engine-shaft. The rear portion of the cylinder has the usual cavities extending around it, through which water is flowed to keep the same cool. The forward end is open, and the rear end is closed by the head B. At the center of this head is a raised portion, that opens

into the cylinder, and is chiefly closed by the cap C. Within this part and the cap is held the pivots of the igniting electrode 17. In a cavity of the right side is held the other electrode 19, which is insulated by the material 20 from metallic contact with the cylinder. The wire attached to one pole of a battery is connected with the cylinder, and the other is attached to electrode 19. The valve operating shaft P is held in bearings F and G, the former attached to the side of the cylinder and the latter to the frame. On the inner end of this shaft is attached the miter-wheel H. The wheel O is attached at the side of the cylinder to drive the governor J by engaging the miter-wheel N on the governor shaft, then in order the cam 12 to raise the gas valve, cam 11 to raise the air valve, cam 26 to raise the exhaust valve, and cam 13, to operate the igniter.

The valve-box S on the near side of the cylinder is closed by a cover. It comprises two compartments above and only one below. The upper compartments contain the puppet-valves, the left, the valve 1, and the right the valve 2. The left compartment communicates with the interior of the cylinder, as shown in dotted lines at Fig. II. The pipe 4 conveys the gas into the right upper compartment, and the pipe 5 conveys the air into the lower compartment. The stem of the valve 1 bears on the pivotal plate 7, whose free end bears on the face of the cam 11. This valve is held firmly on its seat by the spiral spring 21, which bears between the head of the standard 22 and a collar on said valve-stem. By the same means the puppet-valve 2 is held to its seat, and the stem of which bears on the pivotal plate 8, which is identical with plate 7, with this exception, that of the notch which engages the angular rim on the face of cam 12, when plate 8 is carried to the right. This plate is held between the two arms s, s, attached to the rod 9. The operating-arm, connected to the governor J, comprises the arm K for the weight t, the arm 10 and the arm 28, which engages the groove in the sleeve of the governor. The rod 9 is coupled to the arm 10, and movement is thereby given to the pivotal plate 8.

The exhaust valve-box R is on the back side of the cylinder and has two compartments.

The upper contains the valve 3, and communicates with the interior of the cylinder—as shown by dotted lines at Fig. 2. This valve is operated by the cam 26, and the motion is conveyed to the valve, through the pivotal arm or lever 32 suspended in ears 31 on the under side of the cylinder. The screws 23 and 24 with their locknuts are used to adjust the lift of said valve. The valve is held to its seat by the spiral spring 29 or otherwise, to keep said valve to its seat, and cause the arm to bear against its cam. The piston D is connected by the pitman E to the crank-shaft in the usual manner, and this piston makes two movements to and fro, for each explosion of the mixed air and gas. The air valve is raised at every second outward movement of the piston, and the gas-valve is only raised as it is required by the action of the governor, to maintain a proper speed for the engine, and when so required the two supply valves are raised simultaneously.

The rod 15, held in lugs of the plate 16, is connected to the igniter 17. The spiral spring 14 serves to hold the electrode 17 or igniter against the electrode 18, 19 being the battery wire and close to the face of cam 13, so that when the highest point of said cam is passed, the contact is suddenly broken and a spark of electricity results, which explodes the mixed air and gas in the cylinder. The gas enters through the pipe 4, and on the valve 2 being raised, it enters the under compartment. The air entering through the pipe 5 is mixed with the gas in this compartment. Then on the raising of the valve 1 the mixture enters the cylinder, and is exploded as above specified.

The operation of the engine is briefly thus: As the piston is moved outward the action of the supply valves admits the mixed air and gas into the cylinder, the return of the piston compresses the same, and as the outward

movement again occurs, the mixture is exploded, thereby forcing the piston outwardly and giving motion to the shaft through the pitman and crank. When the piston has about completed its outward movement, the exhaust valve is raised by its cam, and the products escape through the pipe 6. The gas valve is only raised when by the action of the governor, the notched pivotal plate 8 is carried to the right sufficiently, to engage the angular projection *r* of the cam, and thereby holding the valve up to receive the gas as above described; and if the speed becomes too rapid the governor holds the notched bearing plate to the left side, and no explosion takes place until the speed is lessened, when said plate engages the cam and the valve is again raised.

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

1. The combination of the shaft P revolving once to two revolutions of the crank shaft, the cam 12 with angular rim *r* the valve 2 to admit the gas to the mixing chamber, the notched pivotal plate 8, and the cam 11, and valve 1 to admit the mixture to the cylinder A, substantially as described.

2. The combination of the shaft P geared to the engine shaft, the notched pivotal plate 8, the cam 12 with its angular projection to engage said plate, the valve 2 with its stem and its spiral spring 21, the engaging arms *s, s* of the reciprocating-rod 9 and the governor arm 10 to operate the same, substantially as described.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

LAWRENCE M. JOHNSTON.

Witnesses:

B. PICKERING,
MICHAEL CAHILL.