(No Model.) 3 Sheets—Sheet 1.

P. T. COFFIELD.

GAS ENGINE.

No. 579,789. Patented Mar. 30, 1897.

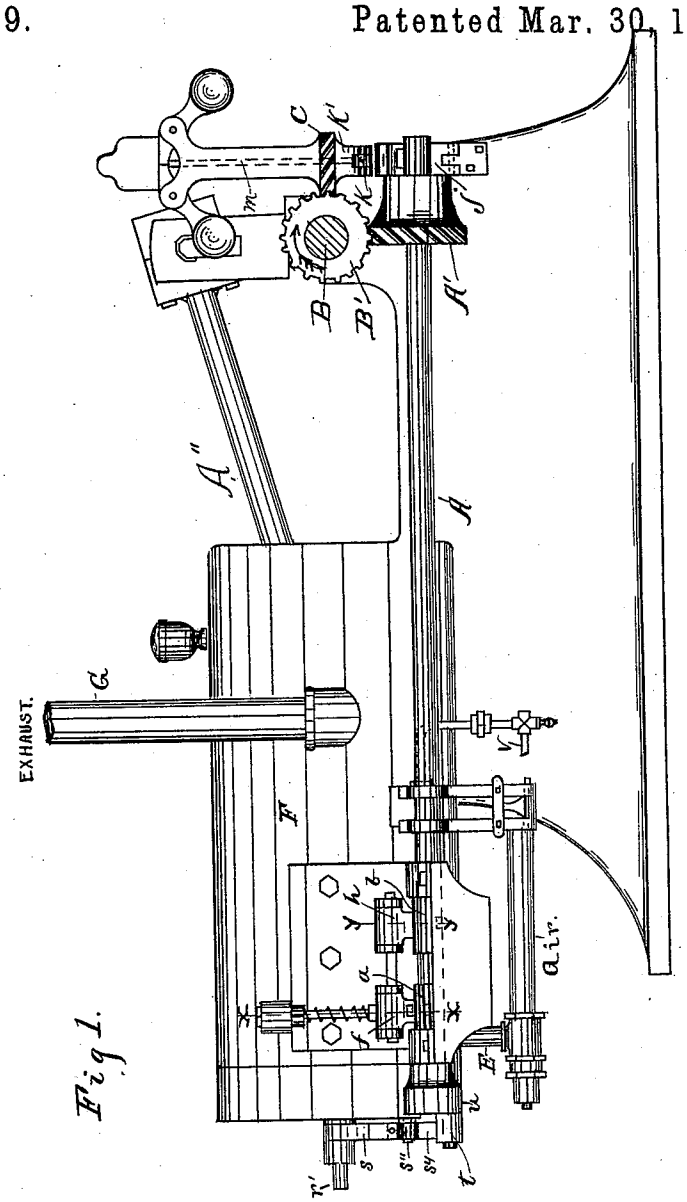

Fig 1.

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By R. J. McCarty.
his ATTORNEY:

(No Model.) 3 Sheets—Sheet 2.

P. T. COFFIELD.

GAS ENGINE.

No. 579,789. Patented Mar. 30, 1897.

Fig 2.

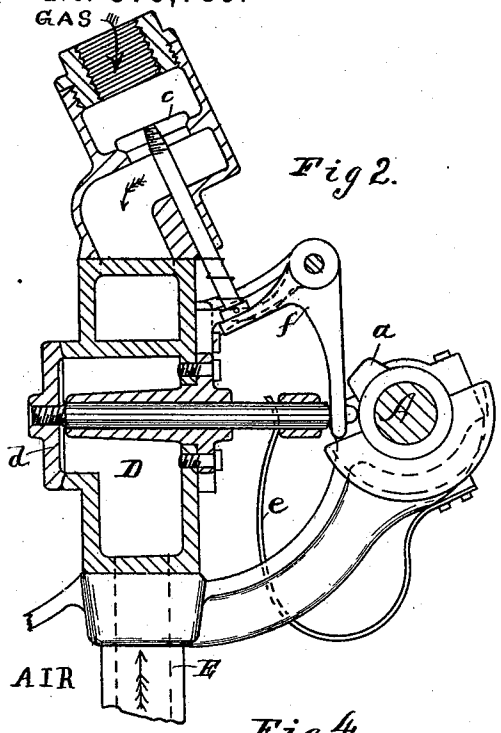


Fig 3.

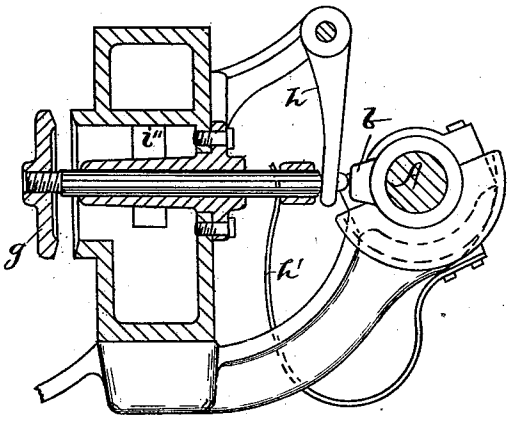


Fig 4.

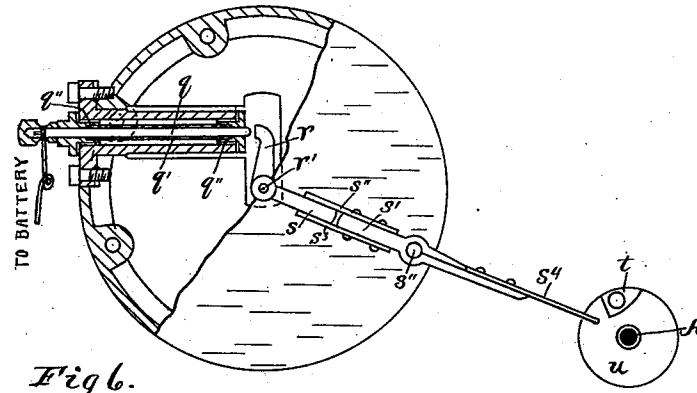


Fig 5.

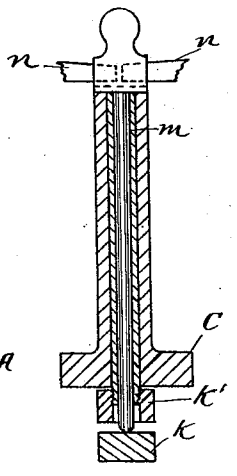


Fig 6.

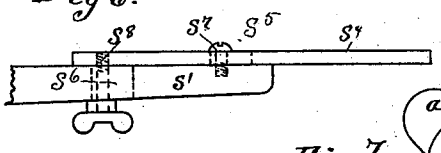
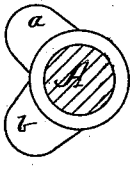


Fig 7.



WITNESSES:

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(No Model.) 3 Sheets—Sheet 3.

P. T. COFFIELD.

GAS ENGINE.

No. 579,789. Patented Mar. 30, 1897.

Fig 8.

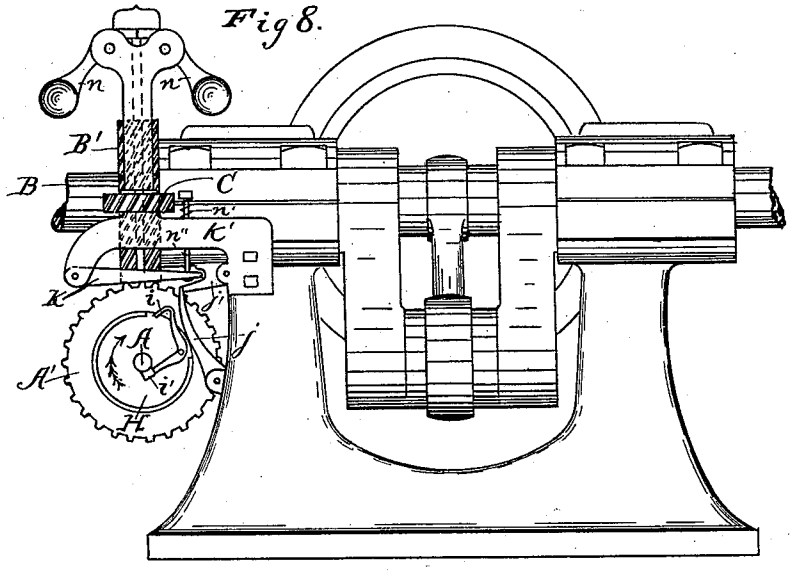


Fig 9.

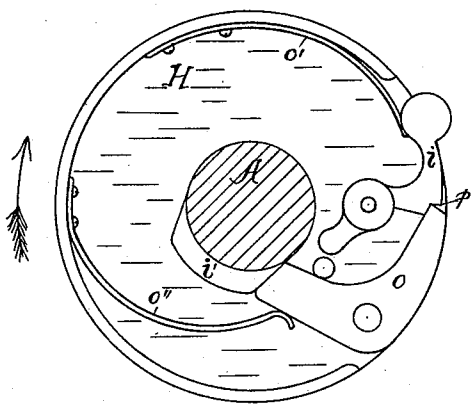


Fig 10.

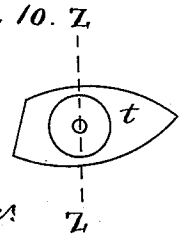
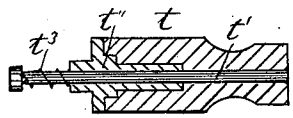


Fig 11.



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UNITED STATES PATENT OFFICE.

PETER T. COFFIELD, OF DAYTON, OHIO, ASSIGNOR TO W. P. CALLAHAN & CO., OF SAME PLACE.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 579,789, dated March 30, 1897.

Application filed November 16, 1896. Serial No. 612,210. (No model.)

To all whom it may concern:

Be it known that I, PETER T. COFFIELD, 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 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 the letters of reference marked thereon, which form a part of this specification.

My invention relates to improvements in gas-engines.

The object of the said invention is to provide mechanism for regulating the speed of the engine and at the same time reduce the wear upon the essential parts by allowing them to remain at rest when the speed of the engine rises above that required, and also to obtain the full power of the engine by allowing the piston to travel back and forth in the cylinder without being called upon to compress extra charges of air between the power strokes, thus saving this extra power and obtaining the greatest economy in the use of fuel.

The foregoing objects are accomplished by stopping the side shaft of the engine in such a position that the cam which opens and closes the exhaust-valve will be in a position to hold the valve open to allow the air to pass freely in and out through it as required by the movement of the piston.

A further object of the invention is to provide a simplified construction of the igniting devices for firing the power charges in a manner that avoids an unnecessary consumption of the battery, by which the explosions are timed while the engine is in motion.

The accompanying drawings illustrate the various features of my invention, and to which reference is now made, as follows:

Figure 1 is a side elevation of a gas-engine constructed in accordance with my invention. Fig. 2 is an enlarged vertical sectional view of the admission-valve on the line *x x* of Fig. 1. Fig. 3 is a similar view of the exhaust-valve on the line *y y* of Fig. 1. Fig. 4 is a view of the cylinder-head, part of which is broken away to reveal the inner or stationary electrode. Fig. 5 is an enlarged vertical section through the governor. Fig. 6 is a detail view of the igniter-rod. Fig. 7 is a cross-section of the side shaft, showing the relative positions of the cams that operate the valves. Fig. 8 is an end view of the engine, showing the mechanism for controlling the movement of the side shaft. Fig. 9 is an enlarged elevation of the mechanism for controlling the movement of the side shaft, showing some modification over that shown in Fig. 8. Fig. 10 is an enlarged view of the cam for regulating the contact of the electrodes. Fig. 11 is a section on the line *z z* of Fig. 10.

Throughout the specification similar letters of reference indicate corresponding parts in the several views.

A designates a side shaft suitably mounted parallel with the bed of the engine and driven from the crank-shaft B through spiral gears A′ and B′. The gear B′ also drives a similar gear C on a centrifugal governor, of which further mention will be made.

a and *b* designate two cams rigid on the shaft A and occupying relative positions, substantially as shown in Fig. 7. The cam *a* operates in connection with valves *c* and *d*.

D designates the mixture-chamber, to which gas is admitted through the valve *c* and air is introduced through pipe E. This chamber communicates with the interior of the cylinder F through the valve *d*, which is returned to its closed position by a spring *e*. The valves *c* and *d* are simultaneously opened by a tappet or bell-crank lever *f*, one arm of which actuates the valve *d* and is pressed by the cam *a*, and the other arm of which actuates the valve *c*.

g designates an exhaust-valve mounted adjacent to the admission-valve *d* and also opening into the power-cylinder. This valve is operated by the cam *b* and intervening tappet *h*, which operates on the stem of said valve in a manner similar to the operation of the admission-valve *d*.

h′ is a spring that closes said valve when the latter is released by the cam.

i″ is an exhaust-port communicating with the main exhaust-pipe G.

As shown in Fig. 3, the exhaust-valve is being held open by its cam. The said valve remains in this position until just before the admission-valve *d* is opened by its respective

cam. During the revolutions of the shaft A it necessarily follows that these valves are alternately opened and closed for the admission of mixture and the exhaust of the burned gases and air, and which continues during the normal or working speed of the engine. Whenever the engine has attained a higher speed than is required, it is important and highly desirable that the valves and adjunctive devices be protected from wear due to a needless operation of said parts, and that the piston A'' may travel back and forth without having to compress extra charges of air. To accomplish this, I have provided means for stopping the movement of the side shaft A, consisting of the following mechanism: The spiral gear A' runs loose on the side shaft and has attached thereto and running in unison therewith a disk H, that has pivoted to it a gravity-dog *i*, which is adapted to engage with a lug *i'*, projecting from the shaft A, or to be brought to a position to avoid coming in contact with said lug, as will presently appear.

j designates a pawl pivoted to the bed of the engine in line with the dog *i*.

j' is a pivotal piece that may be moved to a position to throw the pawl *j* out to engage with the dog *i* to release the latter from engagement with the lug *i'* and thereby permit the side shaft A to stop, or the pivotal piece *j'* may be moved upon its pivot away from said pawl *j* to avoid the latter affecting the dog *i*. As the speed of the engine increases sufficiently to enable the governor to affect the pawl *j* through the intervening mechanism the dog *i* is tripped and the shaft A is thereby stopped with the cam *b* in a position to hold the exhaust-valve *g* open, as shown in Fig. 3, thus permitting a free passage of air from the cylinder and relieving the piston A'' from the unnecessary work of compressing said air. This mechanism is shown in Fig. 8.

k designates a lever having a fulcrum on a bracket *k'* on the bed of the engine. The inner end of said lever *k* engages with the pivotal piece *j'* to move said piece.

Referring to Figs. 5 and 8, *m* designates a governor-rod movable against the upper side of the lever *k* by the governor-arms *n n* as said arms are elevated by the speed of the engine. When the said governor-arms are lowered by the decreasing speed, the lever *k* is drawn upward by the expansion of a helical spring *n'*, that surrounds the upper portion of a bolt *n''*, that passes loosely through an opening in the bracket *k'* and has its lower end connected to the lever *k*. It will thus be seen that as the speed of the engine increases the governor-rod *m* presses downwardly the lever *k*, which in turn presses downwardly on its pivot the piece *j'*, which moves outwardly the pawl *j* in the path of the dog *i*. The rotation of the disk H brings the free end of the dog in contact with said pawl, and the locking end of said dog becomes disengaged with the lug *i'*, and the shaft A ceases to rotate until a connection between said dog and lug is reëffected by the decreasing speed of the engine.

In Fig. 9 I have shown some modification in the mechanism for regulating or controlling the movement of the side shaft A and by means of which the jar or movement due to the dog interlocking with the lug *i'* is considerably lessened. In this modified form the dog *i* is substantially the same in operation and has a pivotal connection with the disk. Instead of locking immediately with the lug, however, it locks with a pawl *o*, which is also pivotally connected to said disk. The said dog and pawl are pressed normally into operative positions by springs *o'* and *o''*, that are secured to the flange of the disk. The pawl *o* is in contact with the side shaft A or the lug *i'* at all times, the ascent from said shaft to the lug, and vice versa, being so gradual that there is no perceptible jar or jolt when the outer end of the pawl *o* locks with the notch *p* in the dog. As shown in Fig. 9, the dog and pawl are interlocked with each other and with the lug on the shaft, so that the disk and shaft will rotate together.

Referring to another feature of the invention, in Fig. 4 *q* designates the stationary electrode, which is suitably mounted in an insulating-sleeve *q'* and in bushing *q''* in the cylinder-head. *r* is the movable electrode, which is mounted rigidly on a shaft *r'*, projected through the cylinder-head, and to the outer end of which shaft there is rigidly attached the igniter-rod, which consists of two parts *s* and *s'*, the latter part having a fulcrum at *s''* on the head of the cylinder. A desirable yielding nature is imparted to said igniter-rod by uniting the two members *s* and *s'* by means of two plate-springs *s''* and *s³*, which are attached to the part *s'*. The outer end of said part *s'* has also attached a similar resilient plate *s⁴*, which projects into the path of a cam *t*, mounted on a disk *u*. The latter disk is keyed to the shaft A. By thus providing the igniter-rod with a resilient nature an easy and soft contact of the electrodes is had, and the life of these devices is thereby prolonged.

As shown in Fig. 6, the igniter-rod may be adjusted longitudinally by providing the respective parts *s'* and *s⁴* with oblong slots *s⁵* and *s⁶*, through which screws *s⁷* and *s⁸* enter to secure said parts. The latter screw is provided with a thumb-nut to tighten said parts when moved to the desired length. The contact of the electrodes may be regulated by changing the position of the cam *t*, which may be adjusted to present its pointed end toward the igniter-rod to lengthen the periods intervening between the sparks or ignitions. The position in which said cam is shown in Fig. 4 is such as to cause a quicker contact of the electrodes. As shown in Fig. 11, the cam is mounted upon a rod *t'* and interlocks with a plug *t''*, that is also mounted on said rod and fits tightly in an opening in the disk *u*. The said cam is fixed to the rod *t'*, so that in

changing its position the said cam is drawn outwardly against the tension of a spring t^3, that surrounds the inner end of the rod and is inclosed between the head of said rod and the plug t''. In drawing the said cam outwardly it is disengaged from the plug t'', and it may then be turned to reverse its position, after which the action of the spring t^3 will draw the cam into engagement with the plug t''.

In Fig. 1, v designates an inlet-pipe for the admission of gasolene as a means for furnishing the power; but inasmuch as the gasolene attachment constitutes no part of the present invention it is not deemed necessary to describe it further.

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

1. In a gas-engine, the combination with a crank-shaft, and a centrifugal governor geared thereto; of a side shaft; a loose-running gear mounted thereon, and driven continuously from the crank-shaft; a disk driven with said gear; a pivotal dog carried on said disk, and mechanism actuated by the variable speed of the centrifugal governor to effect an engagement of said dog with the side shaft, or to permit of the disengagement of said parts, substantially as and for the purposes specified.

2. In a gas-engine, the combination with the power-cylinder provided with a valve-chamber in its side; a gas-admission valve opening into said chamber, and a mixture-admission valve, and an exhaust-valve opening into the power-cylinder; of a side shaft; cams mounted on said shaft; tappets interposed between said cams and the stems of the respective valves; a loose-running gear on said shaft continuously driven from the crank-shaft; a pivotal dog carried around by said gear and adapted to interlock said gear with the side shaft; a centrifugal governor, and mechanism controlled by the variable speed of said governor, substantially as and for the purposes specified.

3. In a gas-engine, the combination with a power-cylinder, a mixture-admission valve; and an exhaust-valve controlling ports in the side of said cylinder; and a gas-admission valve adjacent to said mixture-valve; of a cam-shaft; a loose-running gear on said shaft, continuously driven by the crank-shaft; a pivotal dog carried by said gear; a centrifugal governor geared to the crank-shaft; and mechanism controlled by said governor adapted to effect an engagement of said dog with the cam-shaft to rotate the latter and thereby cause an alternate opening of the valves as described, or to enable a disengagement of said dog with the cam-shaft and thereby cause said shaft to stop, at which time the exhaust-valve is held open, substantially as and for the purposes specified.

4. In a gas-engine, the combination with a crank-shaft; a centrifugal governor geared thereto; a gas-admission valve opening into a mixing-chamber; a mixture-admission valve, and an exhaust-valve controlling ports in the side of the cylinder, of a side shaft provided with cams to operate said valves; a gear loosely mounted on said shaft, and continuously driven by the crank-shaft; a dog adapted to interlock said gear with the side shaft; a centrifugal governor geared to the crank-shaft, and mechanism actuated by the speed of said governor, whereby said engagement of the dog with the side shaft is effected or prevented, according to the variable speed of the governor, substantially as and for the purposes specified.

5. In a gas-engine, the combination with a crank-shaft, a centrifugal governor geared thereto, and a side shaft having a gear loosely mounted thereon and driven from said crank-shaft, of a lever actuated by the increasing speed of said governor, a spring controlling said lever when the latter is free from the control of the governor, a disk movable with the gear on the side shaft, a dog carried on said disk, and mechanism interposed between said dog and lever for effecting a disengagement of said dog with the side shaft, and for permitting such engagement, substantially as and for the purposes specified.

6. In a gas-engine, the combination with a crank-shaft, a centrifugal governor geared thereto, and a side shaft having a gear loosely mounted thereon and driven by said crank-shaft, of a lever movable by said governor as the speed of the engine increases, a spring controlling said lever when the latter is free from the control of the governor, a pivotal piece inclosing the end of said lever, and movable in either direction by said lever, a dog adapted to interlock the side shaft with the gear thereon, and a pawl movable by said pivotal piece to a position to release said dog from engagement with said shaft, and to permit said dog to become reëngaged with said shaft, substantially as and for the purposes specified.

7. In a gas-engine, the combination with a gas-admission valve controlling the inlet of gas to a mixing-chamber, and a mixture-admission valve controlling the admission of the explosive mixture to the power-cylinder, a bell-crank lever to simultaneously open said valves, a side shaft, and a cam thereon to actuate said lever, a gear loosely mounted on said side shaft, and driven by the crank-shaft, a dog pivoted to said gear, and adapted to interlock said gear with the shaft, and mechanism interposed between said dog and the governor, whereby the said gear is enabled to run loose on the shaft, and the shaft permitted to stop, substantially as and for the purposes specified.

8. In a gas-engine, the combination with a crank-shaft, a governor geared thereto, and a side shaft, of a loose-running gear on said shaft driven from the crank-shaft, a dog carried on said gear and adapted to interlock said gear with the shaft and cause them to

rotate together, mechanism interposed between said dog and the governor, and adapted to unlock said gear and shaft, an igniter-rod, and a cam on said shaft adapted to actuate said igniter-rod, the said cam being susceptible of an adjustment to lessen or increase the contact of the electrodes, as herein shown and described.

9. In a gas-engine, a movable electrode, in combination with an igniter-rod consisting of two members having their adjacent ends inclosed between resilient plates s'' and s^3, and a similar plate s^4 attached to the outer end of said rod, substantially as herein shown and described.

10. In a gas-engine, an igniter-rod consisting of two members having their adjacent ends inclosed between resilient plates, and a similar plate attached to its outer end, in combination with a reversible cam adapted to vary the movement of said igniter-rod, a side shaft upon which the said cam is carried, and mechanism affected by the governor for controlling the movement of said shaft, substantially as described.

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

PETER T. COFFIELD.

Witnesses:
R. J. McCARTY,
W. B. NEVIN.