(No Model.)

2 Sheets—Sheet 1.

E. R. GILL.

GAS ENGINE.

No. 536,029. Patented Mar. 19, 1895.

Fig. 1.

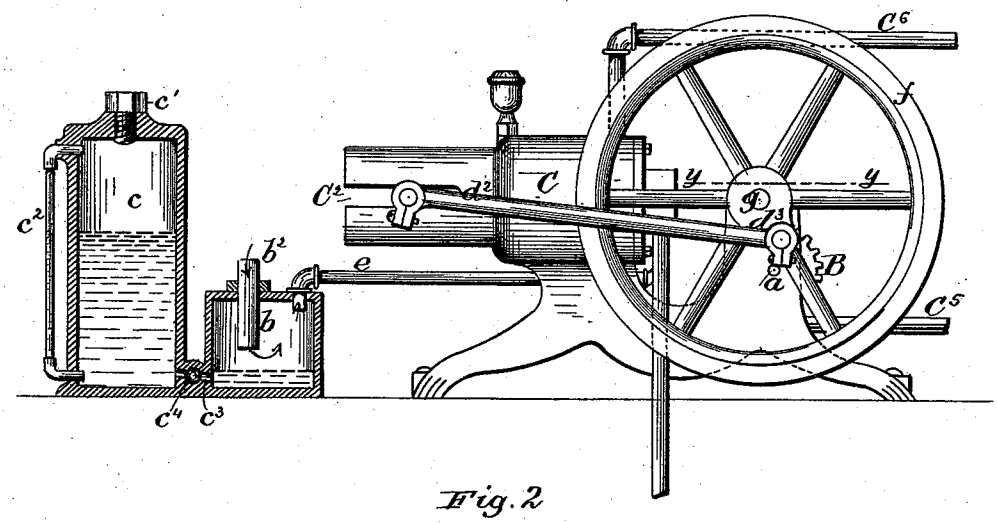
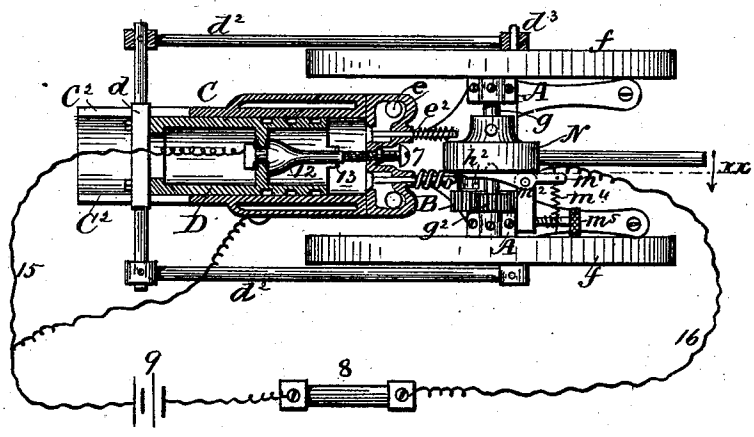


Fig. 2.



WITNESSES

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C. D. Heinrichs

INVENTOR

Edwin R. Gill

by E. E. Masson, Attorney.

(No Model.)

2 Sheets—Sheet 2.

E. R. GILL.

GAS ENGINE.

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Fig. 3.

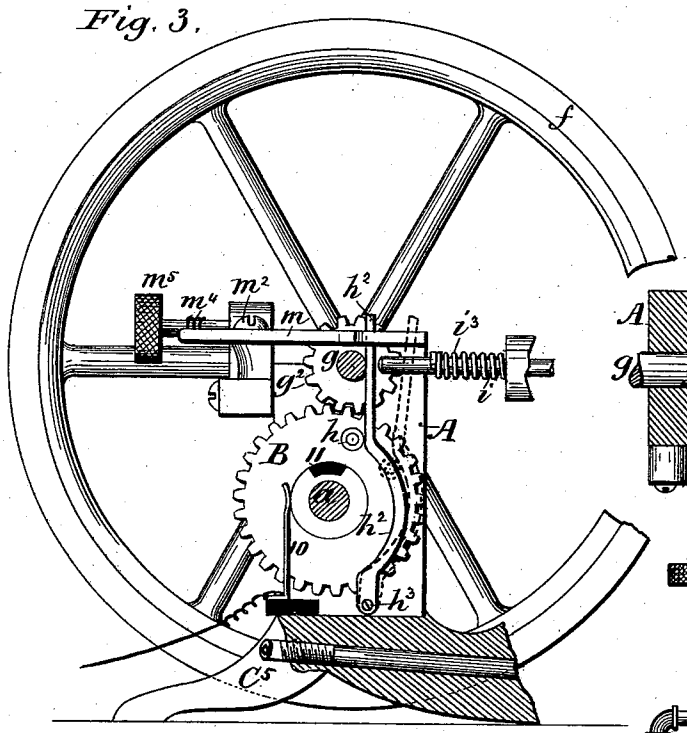


Fig. 4.

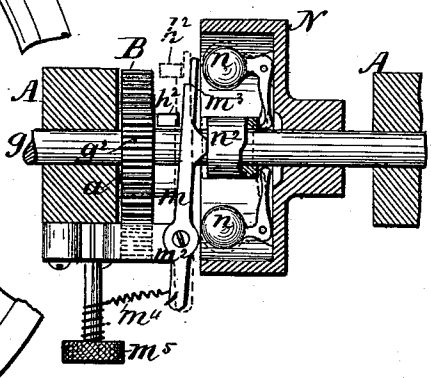
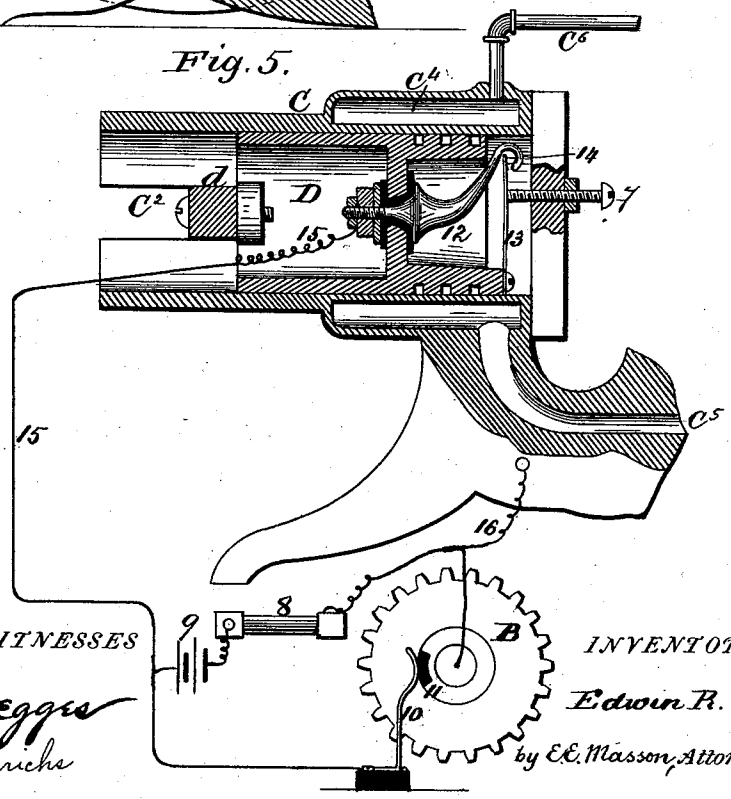


Fig. 5.



WITNESSES

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UNITED STATES PATENT OFFICE.

EDWIN R. GILL, OF INDEPENDENCE, MISSOURI, ASSIGNOR TO LA VEINE, GILL & CO., OF SAME PLACE.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 536,029, dated March 19, 1895.

Application filed September 30, 1893. Serial No. 486,850. (No model.)

To all whom it may concern:

Be it known that I, EDWIN R. GILL, a citizen of the United States, residing at Independence, in the county of Jackson, State of Missouri, have invented certain new and useful Improvements in Gas-Engines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to that class of engines in which the expansive force of a mixture of air and gas exploded in the engine cylinder acts directly upon the piston; and the object of my improvement is to provide an engine of this class with simple and inexpensive means for governing and regulating the admission of carbureted air into the cylinder, and the exhaust thereof; also peculiar means for regulating the position of the piston within the cylinder at the moment that the electrically produced explosion of the gas takes place; also other new means that will be hereinafter described and pointed out in the claims. I attain these objects by the construction illustrated in the accompanying drawings, in which—

Figure 1 is a side view of a gas engine constructed in accordance with my invention, the gasoline holder and carburetor thereof being shown in section. Fig. 2 is a top view of said gas engine with the cylinder and its piston in horizontal central section. Fig. 3 is a vertical section of the engine through its shaft on line $x\ x$ of Fig. 2. Fig. 4 is a horizontal section of the governor and its adjuncts on line $y\ y$ of Fig. 1. Fig. 5 is a central vertical section of the cylinder and its piston with the spark coil and the cog-wheel shown diagrammatically thereunder in the electric circuit.

The operation of the engine is based upon the well known principle that two revolutions of the fly-wheel and its shaft complete the cycle by which the air and gas are drawn into the cylinder by the first outward movement of the piston, and compressed by its first inward or backward movement; at the completion of which the mixture is ignited or exploded, the force of the exploded gases pushing the piston forward in its second outward movement; at the completion of which the exhaust valve opens, and the fly-wheel moves the piston back in its second backward movement. By this movement the piston expels the exploded gases and leaves the cylinder ready to take in a new charge.

The features used relate in part to a pneumatic carburetor which consists of an air tight receptacle c having on top thereof an opening provided with an air tight plug c', through which opening said receptacle can be filled with gasoline. The receptacle c has a glass tube c^2 in communication therewith at the top and bottom to show the height of the liquid therein. The receptacle c is also provided with a tubular opening c^3 in its side, adjacent to its bottom and said opening is controlled by a cock c^4. The opening c^3 is in communication with the sides of a chamber b adjacent to its bottom, to permit a small amount only, of gasoline to flow into the chamber b through the opening c^3 until it has reached the top of said opening, as it will prevent air from passing from the chamber b into the receptacle c until the level of gasoline in said chamber is a little below the top of the opening c^3, when the feeding will be repeated. By this construction the more non-volatile portions of the gasoline are used first, as it flows from the bottom of the receptacle c, and the more volatile portions become mixed with the non-volatile residuum in the chamber b and convert said residuum into a gasoline liquid having substantially the same density as at the beginning of the operation. The apparatus is thus provided with a uniform volatile fluid. The chamber b is provided with a vertically retained tube b^2 passing through its closed top, to direct against the surface of the gasoline, the current of air sucked by the engine when it is in operation. Said air impinging upon the gasoline becomes carbureted, and thus is combustible and rendered explosive. It is directed from the top of the chamber b to the rear end of the cylinder C of the engine through the pipe e. The rear end of said pipe is controlled by a spring valve e^2 which closes the induction opening as soon as the forward movement of the piston D is completed and consequently the explosive mixture will begin to be compressed as soon as the momen-

tum of the fly wheels brings back said piston. When the piston has nearly reached the rear end of its course, the charge within the rear end of the cylinder is ignited by an electric spark (as will be described). The expansion of the gases pushes the piston forward, and with it the cross head d secured to its front end. The arms of said cross head pass through slots C^2 in the sides of the forward portion of the cylinder, the edges of said slots serving as guides for the arms of the cross head. On the ends of said arms the forward ends of connecting rods d^2 are pivoted on the crank pins d^3 of the fly-wheels f, through which motion is imparted to the latter, and to their shaft g. Upon said shaft g is mounted a pinion g^2 which meshes with a cog wheel B mounted upon a stud a that projects inwardly from one of the bearing blocks A of the shaft g. The diameter of the wheel B is double that of the pinion g^2 so that said wheel makes one revolution to two revolutions of the pinion. The wheel B carries on one of its sides a stud with roller h to operate the exhaust valve i. For this purpose a lever h^2 has its lower end pivoted at h^3 to one of the bearing blocks A of the frame, and its upper portion is adapted to bear against the rear end of the valve stem of the valve i, and open said valve by pushing it against the resilience of the spring i^3, that is coiled upon the valve stem and has its rear end secured thereto, while its front end rests against the head of the valve seat.

The inner face of the lever h^2 is a semi-cylindrical concave against which the roller h bears, to keep the exhaust valve open during half a revolution of the pinion g^2, and this takes place every second revolution of said pinion. This action occurs when the piston starts back after an explosion or impulse stroke, the exhaust valve being closed by its spring when the roller h reaches the lower end of the concave face of the lever h^2. The cylinder has as usual a water jacket C^4, that is supplied with water by a pipe C^5 and escapes through the pipe C^6.

To control the speed of the engine a horizontal lever m is pivoted at m^2 to a bracket secured to one end of one of the bearing blocks A. One end of said lever is provided on one side with a notch to form a shoulder m^3 to engage when pushed sidewise, with the free end of the vertical lever h^2 and retain the latter when the engine is running too fast. When the lever h^2 is thus retained in engagement with the end of the horizontal lever m, it prevents the exhaust valve from closing until the speed of the engine is so reduced that a spring m^4 attached to the end of the lever m (opposite its shouldered end) can overcome the centrifugal force of the balls n of the governor. Said governor consists of a chambered pulley N mounted upon the shaft g, and having lugs projecting from its inner face. To said lugs angular levers are pivoted that have the balls n formed on their outer arms, while the ends of their inner arms bear against the inner end of a sleeve n^2 loosely mounted upon the shaft g. The outer end of said sleeve bears against a projection located on the side of the lever m about half way between its pivot and its shouldered end m^3. By this construction when the balls n are forced laterally by centrifugal power, the sleeve n^2 is pushed outwardly against the lever m and causes its shouldered end m^3 to engage with and retain the lever h^2 as shown by dotted lines in Fig. 3, and the latter prevents the exhaust valve from closing, until the speed of the engine is so reduced that the spring m^4 can overcome the centrifugal force of the balls n, and the exhaust valve i becomes closed by the spring i^3 upon its stem. After this action the engine can draw in a charge and obtain a new impulse as before. If the exhaust valve was not closed the piston moving in and out of the cylinder would simply suck in air, in and out through the opening controlled by said valve and could not draw in a charge of explosive gas.

As the power of the spring m^4 attached to one end of the lever m substantially establishes the speed of the engine, it is desirable that its tension or strength should be regulatable. For this purpose one end of said spring is partly wound upon the stem of a screw m^5 that is inserted into a screw tapped perforation in the bracket on the side of one of the bearing blocks A.

To ignite the gases in the cylinder every second time that the piston nearly reaches the rear end of its course, an ordinary spark-coil 8 and a battery 9 are used. They are employed in connection with a spring contact 10 secured to, but insulated from the frame of the engine, and having its upper end in contact with the hub of the cog-wheel B, and during a small portion of each revolution with an insulation plug of mica 11 inserted into said hub. The piston of the engine carries also in its center but insulated therefrom, a curved finger 12 preferably coated with porcelain, the rear end of which is bent over substantially in the form of a hook 14. Said piston carries also attached to its rear end a flat spring 13, the upper end of which is received loosely within the bent hook 14. Through the head of the cylinder C, a screw 7 is made to pass adjustably, its point projecting therein a sufficient distance to strike and slightly push forward the spring 13 before the piston reaches the rear end of its course, and breaks the contact of the upper end of the spring with the finger 12. When the piston is moving forward, it carries therewith the insulated finger 12 and the spring 13, with the upper end of the latter in contact with the hooked end of said finger, and thus with a closed circuit at that point. The circuit is then from the engine frame, its piston and spring 13 to the insulated finger 12, and thence by the wire 15 attached to the front end of said finger to battery 9 and from said battery to the spark-

coil 8; and thence by wire 16, back to the engine frame. Every time the piston comes back to the rear end of its course the spring 13 strikes against the butting screw 7 and causes a break in the electric circuit at the upper end of the spring 13; but as a spark is desired at that point, every other time only, that the piston reaches the rear end of its course, the insulated plug 11 is inserted in the hub of the cog-wheel B. Said plug insulates the spring contact 10 from said hub for a length of time at every second revolution of the shaft *g*, when said spark should occur between the finger 12 and spring 13. Otherwise the said circuit will be closed between the spring 10 and the hub of the cog-wheel B, and prevent the production of a spark at that time between spring 13 and finger 12.

Having now fully described my invention, I claim—

1. In a gas engine the combination of a cylinder having a screw through its rear head, a piston having secured to its front end a cross-head, a spring secured to the rear end of the piston and a hooked finger insulated from the piston but carried thereby and adapted to make and break an electric circuit with the spring of said piston substantially as described.

2. In a gas engine the combination of a cylinder having a screw entering therein through its head, a piston in said cylinder, a hooked finger insulated from the piston but carried thereby, and a spring secured to the piston and adapted to have its free end removed from contact with said finger by the adjustable screw in the cylinder head substantially as described.

3. In a gas engine the combination of a cylinder having an exhaust valve in one end and slots in its sides lengthwise thereof, a piston having cross-head passing through said slots, connecting rods pivoted to said cross head, a fly-wheel, its shaft, and bearing blocks, a pinion g^2, governor pulley N and sleeve n^2 upon said shaft, governor ball-levers pivoted within said pulley, the gear wheel B having roller thereon, the curved lever h^2 the pivoted lever M, and its adjustable retaining spring substantially as described.

4. The combination of the driving shaft of a gas engine and its bearing blocks, a pinion g^2, governor pulley N and sleeve n^2 upon said shaft, governor ball-levers pivoted within said pulley, the gear wheel B having roller thereon, the curved lever h^2 the pivoted lever m having a shoulder on one end, and its adjustable retaining spring at the opposite end substantially as described.

5. The combination of the driving shaft of a gas engine and its bearing blocks, a pinion upon said shaft, the gear wheel B meshing with said pinion and having an insulating plug in the periphery of its hub, the insulated spring-contact bearing upon said hub, the cylinder of the engine having the adjustable screw 7 projecting inside thereof, the piston having a spring 13 secured to its rear end, and the insulated curved finger 12, with a battery, spark-coil, and an electric circuit substantially as described.

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

EDWIN R. GILL.

Witnesses:
GEORGE BOWER,
NATE REECE.