(No Model.) 2 Sheets—Sheet 1.

G. F. CONNER.

GAS ENGINE.

No. 548,628. Patented Oct. 29, 1895.

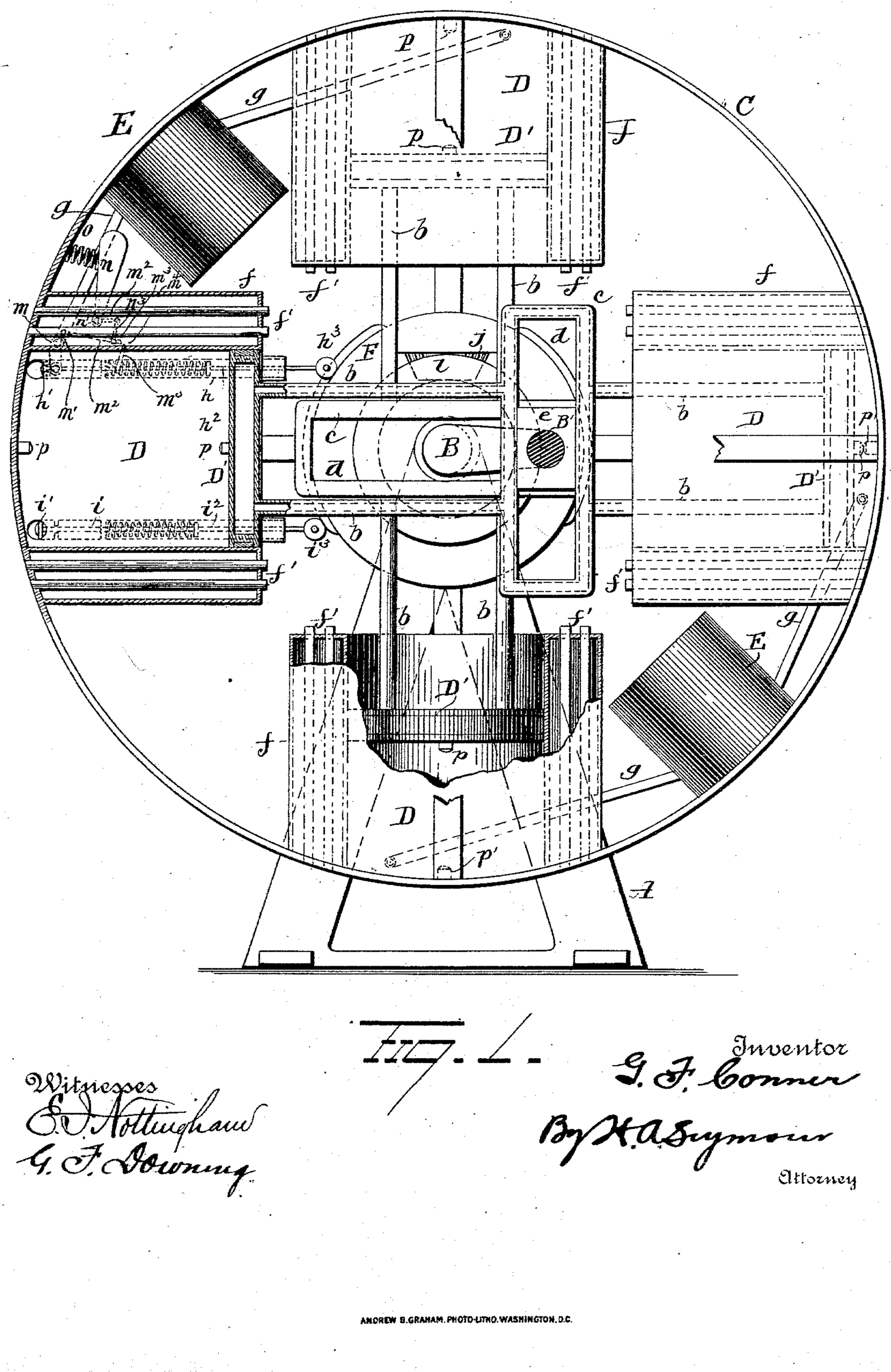

Fig. 1.

Witnesses
E. D. Nottingham
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Attorney

(No Model.) 2 Sheets—Sheet 2.

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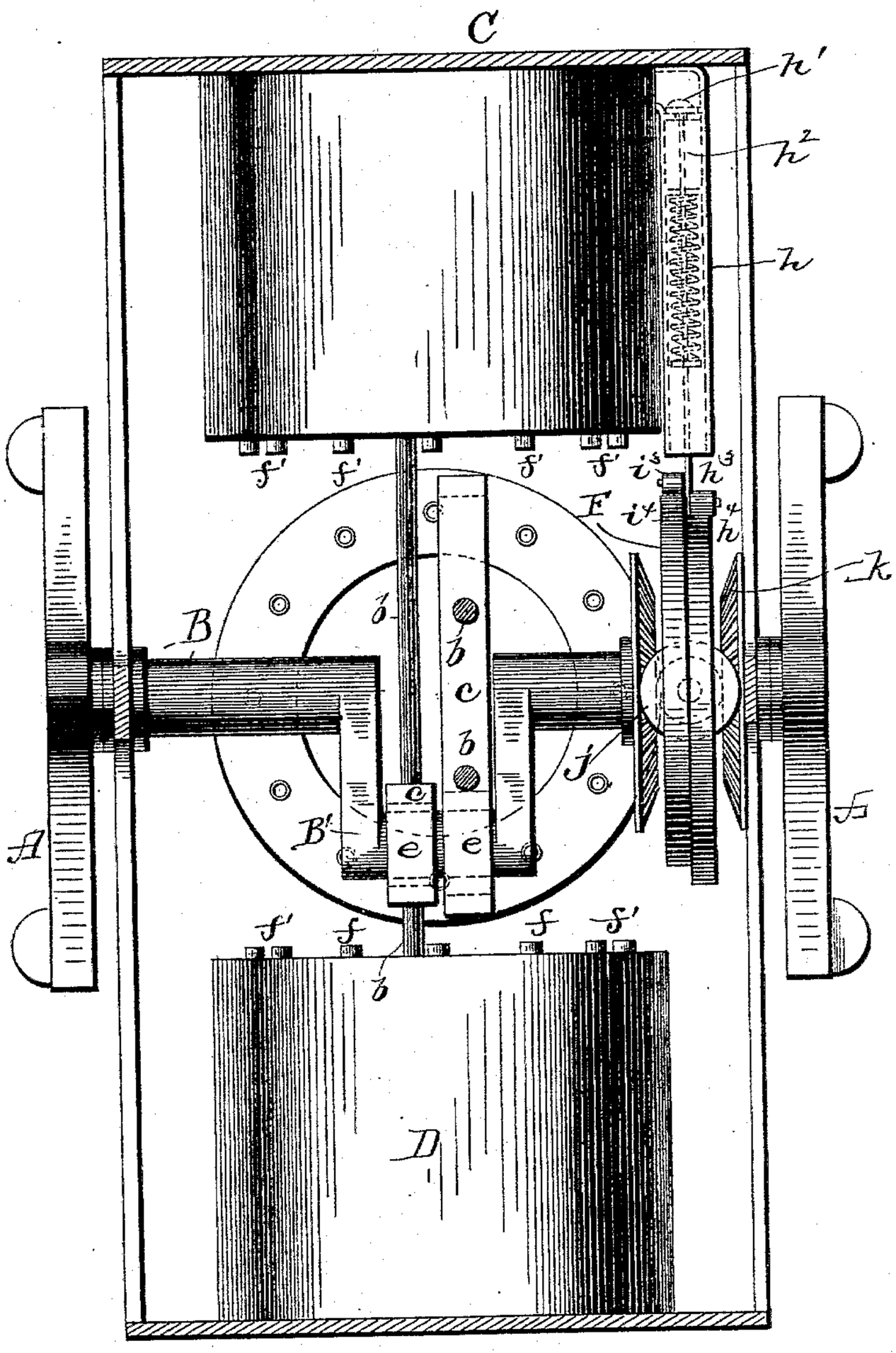

Fig. 2.

Witnesses
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UNITED STATES PATENT OFFICE.

GEORGE F. CONNER, OF RACINE, WISCONSIN.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 548,628, dated October 29, 1895.

Application filed January 5, 1895. Serial No. 533,910. (No model.)

To all whom it may concern:

Be it known that I, GEORGE F. CONNER, a resident of Racine, in the county of Racine and State of Wisconsin, 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.

My invention relates to an improvement in gas-engines, and more particularly to that class known in the art as "explosive-gas engines," one object of the invention being to so construct a gas-engine that it will serve as its own balance-wheel.

A further object is to so construct an engine that the explosive shall be carried by the engine and automatically supplied to the pistons of the engine during the operation of the same.

A further object is to produce a multiple-cylinder engine constructed and adapted to revolve bodily and carry fluid to operate the engine; and the invention consists in certain novel features of construction and combinations and arrangements of parts, as hereinafter set forth, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a side elevation, partly in section and partly broken away. Fig. 2 is a plan view.

A A represent suitable standards, in which a shaft B, having a crank-arm B′, is fixed. A wheel or drum C is mounted to revolve on the shaft B, and to the inner face of this wheel or drum a series of cylinders D (four being shown in the drawings) is secured, within each of which a piston D′ is located and adapted to reciprocate. Each piston is preferably provided with two rods *b b*, the rods of diametrically-opposite pistons being connected with a common cross-head *c*. Each cross-head is made with an elongated opening *d*, in which a block *e* is adapted to slide, and both blocks *e* are mounted on the crank-arm B′ of the shaft.

In explosive-gas engines the great heat created by the continuous exploding of the gas tends to heat the cylinder and parts which operate therein to a very high degree, and thus seriously affect the successful operation of the engine. To overcome this difficulty and prevent the cylinder from becoming abnormally hot, it has been proposed to surround it by a water-jacket and to provide apparatus whereby to cause a circulation of water through said jacket. Such apparatus is expensive and the results accomplished have not been thoroughly satisfactory. In order to prevent the abnormal or over heating of the cylinders, I propose to surround them with water jackets or chambers *f*, through which a series of air-tubes *f′* passes, so that when the engine is in motion currents of air will be made to pass through said flues and maintain the temperature of the water, and consequently the cylinder, at a low degree. The pistons, piston-rods, and cross-heads are made hollow and filled with water to prevent them from becoming abnormally heated.

Tanks E are secured to the wheel C between the cylinders D and adapted to contain gasoline or other hydrocarbon fluid, which is conducted therefrom by means of pipes *g* to valve-chambers or pipes *h*, which latter communicate at one end with the outer ends of the respective cylinders. The pipes or chambers *h* are open at their inner ends for the admission of air, which mixes with the gasoline as it enters the cylinder, and are made of a length to extend, preferably, beyond the inner ends of the cylinders, so that as the engine revolves air will be drawn into them by centrifugal action or suction. Another pipe or valve-chamber *i* communicates with each cylinder for receiving the exhausted or burned gas.

Within the respective pipes or chambers *h i* valves *h′ i′* are located, the valve *h′* being located in the pipe or chamber *h* at a point above or beyond where the pipe *g* from the tank or reservoir E communicates therewith. Valve-rods h^2 i^2 project inwardly from the valves, and at their inner extremities are provided with rollers h^3 i^3, which are maintained normally in contact with the respective peripheries h^4 i^4 of a cam F, which latter is mounted loosely on the shaft B and for a reason hereinafter explained made to rotate one-half as fast as the engine. In order to cause the cam to thus rotate, a bevel-pinion *j* is loosely mounted in an opening therein and projects from the respective faces thereof, said pinion meshing, respectively, with bevel-gears *k l*,

the gear *k* being secured to the wheel C and the gear *l* being keyed to the crank-shaft B. From this arrangement of gearing it is apparent that as the engine rotates the pinion *j* will ride around the shaft B at a speed just one-half that of the engine.

In each pipe *g*, preferably at a point in proximity to the valve-chamber *h*, a valve *m* is located, and to the stem of said valve a crank-arm *m'* is secured. To the free end of said crank-arm an arm m^2 is pivotally connected and made at its free lower end with a knife-edge m^3, adapted to be engaged by the knife-edge m^4 of an arm m^5, secured to the valve stem or rod h^2. A weighted or centrifugal governor *n* is pivotally connected at *n'* to the cylinder D or water-jacket and provided with a downwardly or inwardly projecting arm n^2, to the free end of which one end of a rod n^3 is pivotally connected, the other end of said rod being pivotally connected to the arm m^2. The arms m^2 m^5 are maintained normally in line with each other by means of a spring *o*, which bears at one end against the governor *n* and at the other end against the wheel C. From this construction and arrangement of parts it will be seen that when the valve-rod h^2 is moved outwardly by the cam F the arm m^5 will push against the arm m^2 and cause the valve *m* in the pipe *g* to be opened to admit gasoline into the valve-chamber, the outward movement of said rod also opening the valve *h'* and permitting the charge of gasoline and air which has entered the pipe or valve-chamber *h* to pass into the cylinder. When the rod h^2 moves inwardly, the valve *h'* will be again closed. Should the speed of the engine become abnormal, the governor *n* will move outwardly by centrifugal action against the resistance of the spring *o*, and thus cause the arm m^2 to move out of the path of the arm m^5, so that the valve *m* in the gasoline-supply pipe cannot be operated to admit more gasoline to the pipe or chamber *h* until the engine again assumes its normal speed.

It is of course to be understood that each cylinder will be provided with mechanism for admitting the explosive to the cylinder and controlling the same, and will be duplicated for the various cylinders.

It will be seen that when the wheel C, carrying the cylinder D, revolves, the pistons D', being connected with the stationary crank-shaft, will reciprocate in said cylinders. The first part of the stroke of a given piston will act to draw into the respective cylinder the carbureted air, the valves being operated to permit such operation, as above explained, and the second part of the stroke will serve to compress said carbureted air. At this point the gas will be exploded by an electrical spark between the points at *p* or by means of the usual incandescent tube, if desired. At the first half of the second revolution of the engine the impulse of the exploding gas will be imparted to the engine as it expands. During the last half of the second revolution of the engine the burned gas will be forced out of the cylinder through the pipe or chamber *i*, the valve *i'* in said pipe or chamber being operated by the eccentric periphery of the cam F. It will thus be seen that but one explosion of gas occurs in a given cylinder during two revolutions of the engine. Hence the necessity of causing the cam F, which operates the valves, to make one revolution to two of the engine.

In the usual type of gas-engines where but one cylinder is employed and one explosion to two revolutions of the engine it is necessary to use very heavy balance-wheels to secure uniform motion. With my engine the balance-wheel is dispensed with, and the whole engine serves as its own balance-wheel, having the weight of the cooling apparatus and gasoline tanks or reservoirs to increase its inertia. By my arrangement of engine explosions in two cylinders will occur during each revolution of the engine, thus giving a continuous series of impulses and causing a continuous and uniform rotation of the engine. I do not, however, wish to limit myself to any particular number of cylinders, and where an odd number of cylinders is employed the pistons will preferably be provided with single rods connected independently to the crank-arm B'.

My improvements are very simple and compact in construction and are effectual in all respects in the performance of their functions.

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

1. An engine constructed and adapted to revolve bodily and carry its supply of fuel with it, substantially as set forth.

2. In an engine, the combination with a fixed crank shaft, a wheel mounted and adapted to revolve thereon, power cylinders carried by this wheel, and supply reservoirs for the fuel carried by the wheel, these reservoirs in communication with the cylinders, whereby to supply them with explosive, substantially as set forth.

3. In an engine, the combination with a fixed shaft, of a wheel mounted to turn thereon, radial cylinders carried by the wheel, water jackets surrounding these cylinders and air passages extending through these jackets to the periphery of the wheel whereby the motion of the wheel creates a suction to cause a constant circulation of air through the air passages, substantially as set forth.

4. In a gas engine, the combination with a fixed crank shaft and a wheel revolubly mounted thereon, of a series of cylinders secured to said wheel, reservoirs secured to said wheel for containing hydrocarbon, valve chambers communicating with said cylinders, pipes connecting said reservoirs with the valve chambers, means for controlling the supply of gas to the cylinders, and pistons in said

cylinders connected with the crank shaft, substantially as set forth.

5. In a gas engine, the combination with a crank shaft and a wheel mounted thereon, of a series of cylinders secured to said wheel, pistons in the cylinders and connected with the crank shaft, oil reservoirs secured to the wheel, valve chambers communicating with the cylinders and with said oil reservoirs, said valve chambers being open at one end to admit air, and means for controlling the passage of air and oil from said valve chambers into the cylinders, substantially as set forth.

6. In a gas engine, the combination with a fixed crank shaft and a wheel mounted thereon, of a series of cylinders secured to the wheel, pistons in said cylinders and connected with the crank shaft, chambers communicating at one end with the cylinders and open at their other ends, said chambers extending some distance inwardly toward the center of the wheel so as to create suction to draw air into them when the engine revolves, and means for controlling the admission of air and oil into the cylinders, substantially as set forth.

7. In a gas engine, the combination with a fixed crank shaft and a wheel mounted thereon, of a series of cylinders secured to said wheel, pistons in said cylinders and connected with the crank shaft, oil reservoirs carried by the wheel, chambers communicating with the cylinders and with said reservoirs, said chambers being adapted to admit air, a valve in each chamber, a cam to operate said valves, and means for causing said cam to revolve at one-half the speed of the engine, substantially as set forth.

8. In a gas engine, the combination with a fixed crank shaft, of a wheel mounted thereon, cylinders secured to said wheel, pistons in said cylinders and connected with the crank shaft, an inlet valve chamber and an outlet valve chamber communicating with each cylinder, valves in said chambers, a cam adapted to operate said valves, a pinion mounted loosely in said cam and gear wheels meshing with said pinion, one of said gear wheels being secured to the crank shaft and the other to the wheel, whereby to cause said cam to rotate at one-half the speed of the engine, substantially as set forth.

9. In a gas engine, the combination with a fixed crank shaft and a wheel mounted thereon, of a series of cylinders secured to said wheel, pistons in said cylinders and connected with said crank shaft, oil reservoirs carried by the wheel, valve chambers communicating with the cylinders at one end thereof and open at the other end to admit air, valves in said chambers, means for operating said valves, a pipe for conducting oil from said reservoirs to said valve chambers, a valve in each pipe, an arm carried by the stem of the first-mentioned valve, an arm carried by the valve in said pipe and adapted to be engaged by said first-mentioned arm, and a centrifugal governor connected with the arm connected with the valve in the oil supply pipe, so that when the engine reaches an abnormal speed the governor will act to move the arm connected with the valve in the supply pipe out of line with the arm carried by the stem of the first-mentioned valve, substantially as set forth.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

GEORGE F. CONNER.

Witnesses:
ERASTUS C. PECK,
ALBERT L. ANDERSON.