

No. 759,093.

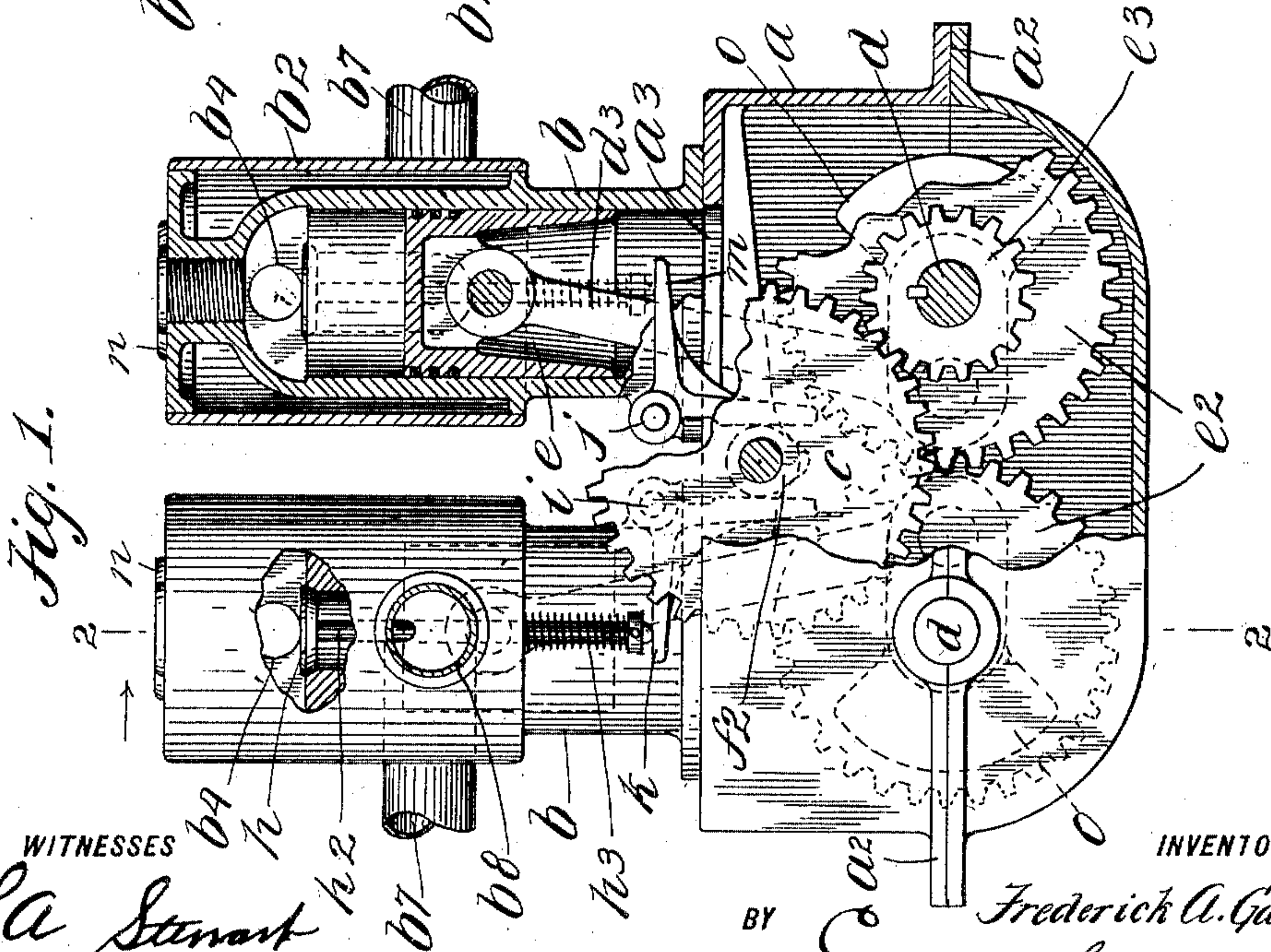
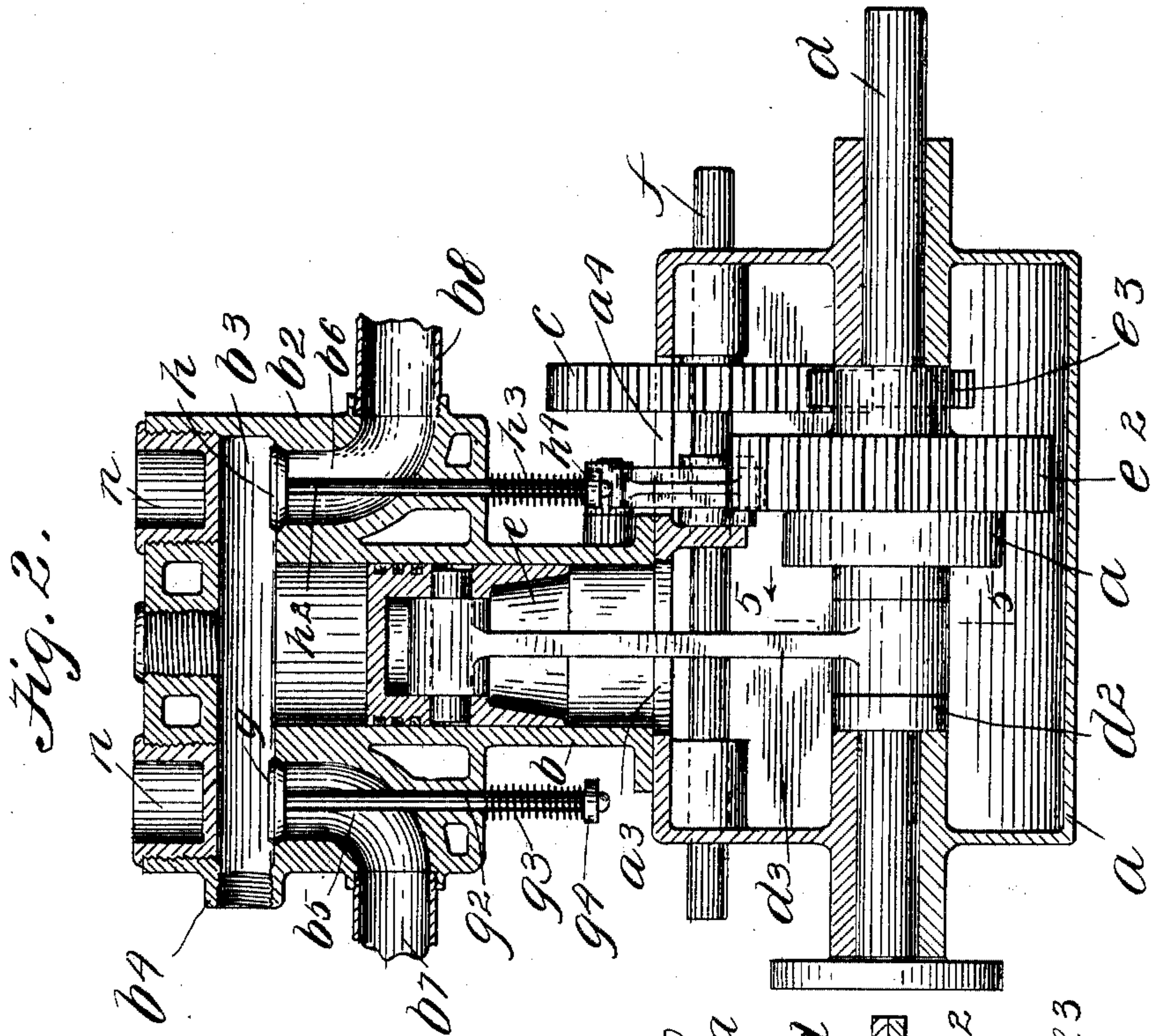
PATENTED MAY 3, 1904.

F. A. GARDNER.
GAS ENGINE.

APPLICATION FILED SEPT. 22, 1903.

NO MODEL.

2 SHEETS—SHEET 1.



WITNESSES

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C. E. Mulvaney

INVENTOR

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Frederick A. Gardner
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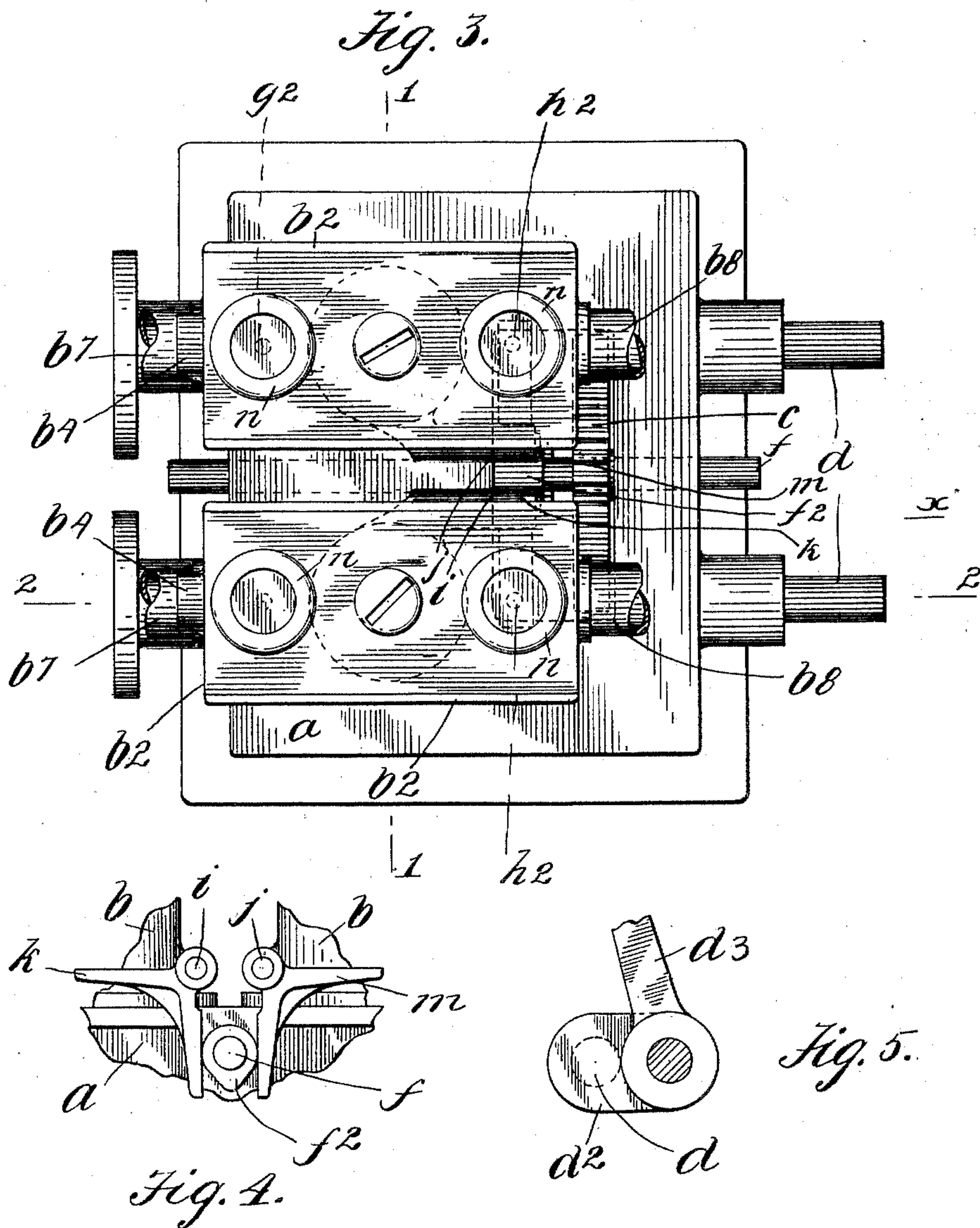
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2 SHEETS—SHEET 2.



WITNESSES
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UNITED STATES PATENT OFFICE.

FREDERICK A. GARDNER, OF CATSKILL, NEW YORK.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 759,093, dated May 3, 1904.

Application filed September 22, 1903. Serial No. 174,174. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK A. GARDNER, a citizen of the United States, residing at Catskill, in the county of Greene and State of New York, have invented certain new and useful Improvements in Gas-Engines, of which the following is a specification, such as will enable those skilled in the art to which it appertains to make and use the same.

This invention relates to gas-engines and other engines of this class; and the object thereof is to provide an engine of this class having two parallel power-shafts and adapted to turn said shafts in opposite directions; and with this and other objects in view the invention consists in an engine of the class specified constructed as hereinafter described and claimed.

The invention is fully disclosed in the following specification, of which the accompanying drawings form a part, in which the separate parts of my improvement are designated by suitable reference characters in each of the views, and in which—

Figure 1 is a sectional side view looking in the direction of the arrow x of Fig. 3; Fig. 2, a section on the line 2 2 of Fig. 1 and on the line 2 2 of Fig. 3; Fig. 3, a plan view; Fig. 4, a detail of a cam device which I employ, and Fig. 5 a section on the line 5 5 of Fig. 2.

In the practice of my invention I provide an engine of the class described which comprises a base-casing a , which is preferably composed of two parts connected at a^2 and which is provided in the top thereof with two cylinder-openings a^3 , over which are placed cylinders b , and the top of the casing a is also provided with an opening a^4 to accommodate a gear-wheel c , hereinafter described, and other parts of the construction.

Passing horizontally through the bottom casing a and preferably at the points where the separate parts thereof are connected are two parallel shafts d , each of which is provided within the casing a with a crank d^2 and crank-rod d^3 , and the crank-rods d^3 are each connected with a piston e , one of which is mounted in each of the cylinders b . As shown in the drawings, the pistons e are preferably

what are known as "drum-pistons;" but any suitable piston may be employed. Each of the shafts d is also provided within the casing a with a large gear-wheel e^2 , and these gear-wheels mesh, as shown in Fig. 1, and by means thereof the shafts d are turned in opposite directions, as hereinafter described. One of the shafts, d , is also provided with a smaller gear-wheel e^3 , and passing horizontally through the top portion of the casing a parallel with the shafts d and over the same is a cam-shaft f , to which the wheel c is secured, and said wheel c operates in connection with the wheel e^3 on one of the shafts d , and the cam-shaft f is provided adjacent to the wheel c with a cam f^2 . (Shown in dotted lines in Fig. 1 and in full lines in Fig. 4.)

Each of the cylinders b is provided at the top thereof with a casing b^2 , formed integrally therewith in the usual manner and also forming a water-jacket and within which is a transverse explosive-chamber b^3 , and these explosive-chambers b^3 are parallel with the corresponding shafts d , and each is in communication centrally thereof with one of the cylinders b .

Each of the explosive-chambers b^3 is provided at one end with a screw-threaded opening b^4 , by means of which an ordinary igniting device may be connected therewith, and said igniting device, which forms no part of this invention and is therefore not shown, may be of any desired construction and is operated in any desired manner. Each of the casings b^2 is also provided with two ports or passages b^5 and b^6 , which open laterally, as shown at b^7 and b^8 , that part of said ports or passages which communicate with the explosive-chamber b^3 being arranged vertically, as clearly shown in Fig. 2. The port or passage b^5 at each side constitutes an inlet for the gas, while the corresponding port or passage b^6 constitutes an exhaust. The ports or passages b^5 are provided with valves g , having valve-stems g^2 , which extend downwardly through the bottom of the casing b^2 , and are provided at their lower ends with springs g^3 , which bear on the bottom of said casing and on collars g^4 , secured to the lower ends of the valve-stems, and these springs normally serve

to hold the valves g closed. The ports or passages b^6 at each side are provided with valves h , having stems h^2 , which pass downwardly through the bottom of the casing b^2 , and are
 5 provided with spiral springs h^3 , which bear on the bottom of said casing b^2 and on collars h^4 , secured to the lower ends of said valve-stems h^2 , and these springs also serve to hold the valves h closed.

10 Pivoted at i and j between the wheel c and the cylinders b are two bell-crank levers k and m , one arm of each of which is normally held horizontally in such a manner that the lower ends of the valve rods or stems h^2 of the ex-
 15 haust-valves h rest thereon, while the other arms of said levers extend downwardly at the opposite sides of the cam f^2 on the cam-shaft f .

Each of the casings b is also provided in the
 20 top thereof with two plugs n , which are located directly over the valves g and h , and the object of these plugs is to facilitate the cleaning out of the explosive-chambers b^3 , the passages b^5 and b^6 , and the cleaning of the valves
 25 g and h .

The shafts d , which constitute the power-shafts of the device, are, in fact, crank-shafts, and each is preferably provided with a counterbalance-weight o , the object of which is to
 30 balance the pistons e and the crank and crank-rod with which the same are connected.

The operation will be readily understood from the foregoing description when taken in connection with the accompanying drawings
 35 and the following statement thereof. It will be understood that the engine is started in the manner of other engines of this class, and in this operation we will assume that an explosion has taken place in one of the chambers b^3 ,
 40 by which the corresponding piston and connected crank-rod is driven downwardly, turning its connected shaft, which in turn revolves the other connected shaft, drawing down the other piston in the other chamber b^3 , and the
 45 last-mentioned piston in its downward movement at this time draws into its corresponding combustion-chamber, through its inlet-valve, the gas or other explosive fluid used in the operation of the engine. When the pis-
 50 tons have reached their lowest position, the momentum of the rotating shafts will drive the said pistons upwardly, and during this upward movement the products of combustion remaining in the first-named combustion-
 55 chamber are driven outwardly through the exhaust-valve which has been opened by the operation of the cam f^2 and one of the crank-levers, and the gas or combustible fluid contained in the other explosive-chamber is com-
 60 pressed until the pistons have reached their extreme upper position. At this time the compressed gas or explosive fluid contained within the second-named combustion-chamber is ignited and explodes and drives downwardly
 65 the corresponding piston, carrying with it the

first-named piston, and the downward movement of the first-named piston during the explosion operates to draw into its corresponding combustion-chamber a fresh supply of the gas or explosive fluid, and the momentum of
 70 the rotating shafts continues the operation and drives the pistons upwardly, compressing the gas in the first-named chamber and at the same time exhausting the products of combustion remaining in the second combustion-chamber
 75 through its exhaust-valve, which is operated by means of the cam and the other crank-lever. This operation is continuous, and it will be observed that the movement of the pistons is simultaneous and that an explosion occurs
 80 alternately in each of the combustion-chambers and that there is one explosion in each chamber during every two revolutions of the corresponding shaft, and the connection of
 85 the two pistons and shafts in the manner shown provides an engine in which an almost continuous power is applied to the cranks, depending on a minimum amount of momentum to carry the pistons back to their operative po-
 90 sitions.

The employment of two parallel crank or power shafts d in the manner described and the connection therewith of the counterbalance-weights o , which project in a direction
 95 opposite to that of the cranks, produces a counterbalanced engine and one which operates smoothly and regularly and without the jolt or jar which frequently accompanies the operation of other engines of this class.

In practice the movement or motion of the
 100 shafts d is transmitted to a single supplemental power-shaft, which is not shown, and geared in connection therewith, so as to turn said power-shaft in either direction; but this feature forms no part of this application and
 105 is therefore not shown and described therein.

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

In an explosive-engine, the combination with
 110 a base formed of an upper and lower section, the upper section having in its top a plurality of openings, said sections also having their contiguous edges provided with elongated
 115 bearings, of a pair of cylinders arranged upon the upper section of said base and communicating with the latter through said openings, each of said cylinders having at its upper end a transversely-extending explosion-chamber provided at its ends with inlet and exhaust
 120 ports, said ports being arranged at opposite sides of said cylinder and terminating on a line with the upper end of the cylinder, spring-seated valves arranged in said inlet-ports, a piston arranged in each cylinder, parallel
 125 power-shafts arranged in the elongated bearings of said base and operatively connected to said pistons, said shafts being geared together to rotate in unison, a pinion carried by one of said shafts, a cam-shaft also journaled in said
 130

casing and extending parallel with the power-shafts, a gear-wheel carried by said shaft and meshing with said pinion, said gear-wheel projecting through one of the openings in the
5 upper section of the base, a cam also carried by said cam-shaft, oppositely-arranged bell-cranks pivoted to the cylinders and having their vertical arms arranged at opposite sides of said cam to be alternately actuated by the
10 latter, and spring-seated valves arranged in the exhaust-ports, the stems of said valves projecting into the path of movement of the

horizontal arms of said bell-cranks whereby the latter alternately actuate said valves to free the cylinders of the burned gases.

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In testimony that I claim the foregoing as my invention I have signed my name, in presence of the subscribing witnesses, this 21st day of September, 1903.

FREDERICK A. GARDNER.

Witnesses:

F. A. STEWART,
C. E. MULREANY.