

No. 656,539.

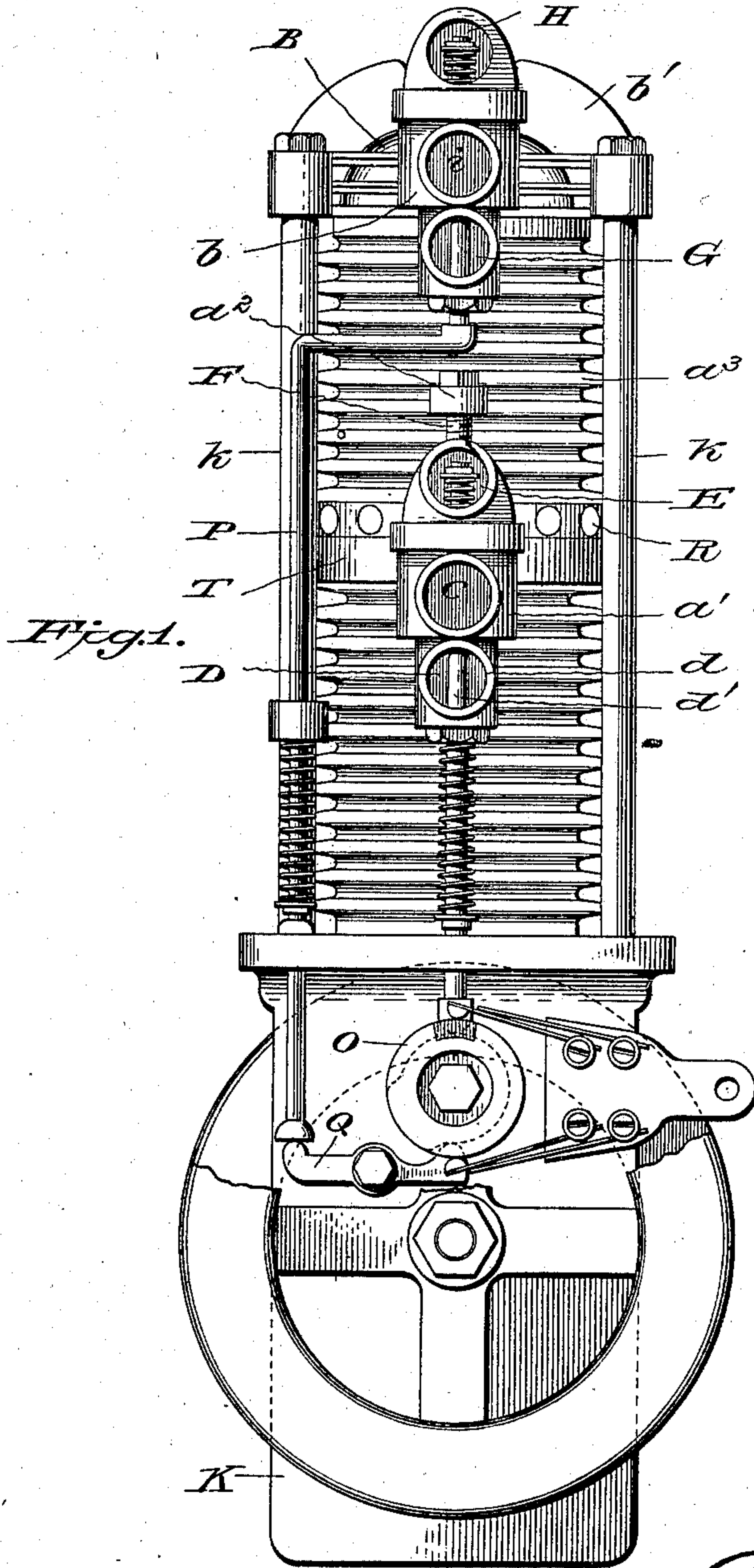
Patented Aug. 21, 1900.

R. A. FRISBIE.
MULTIPLE CYLINDER GAS ENGINE.

(Application filed Dec. 19, 1899.)

(No Model.)

2 Sheets—Sheet 1.



Witnesses
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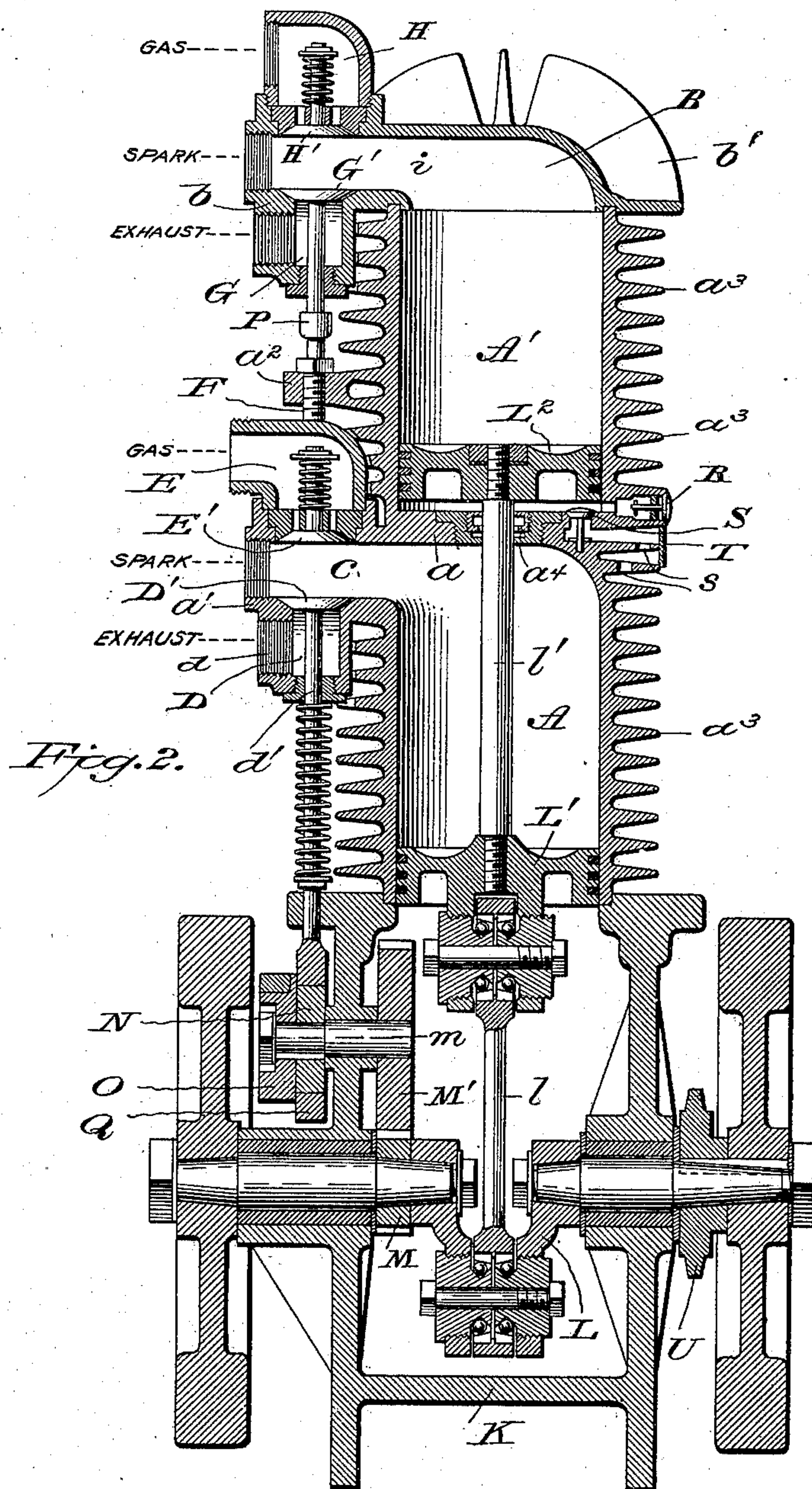


Fig. 2.

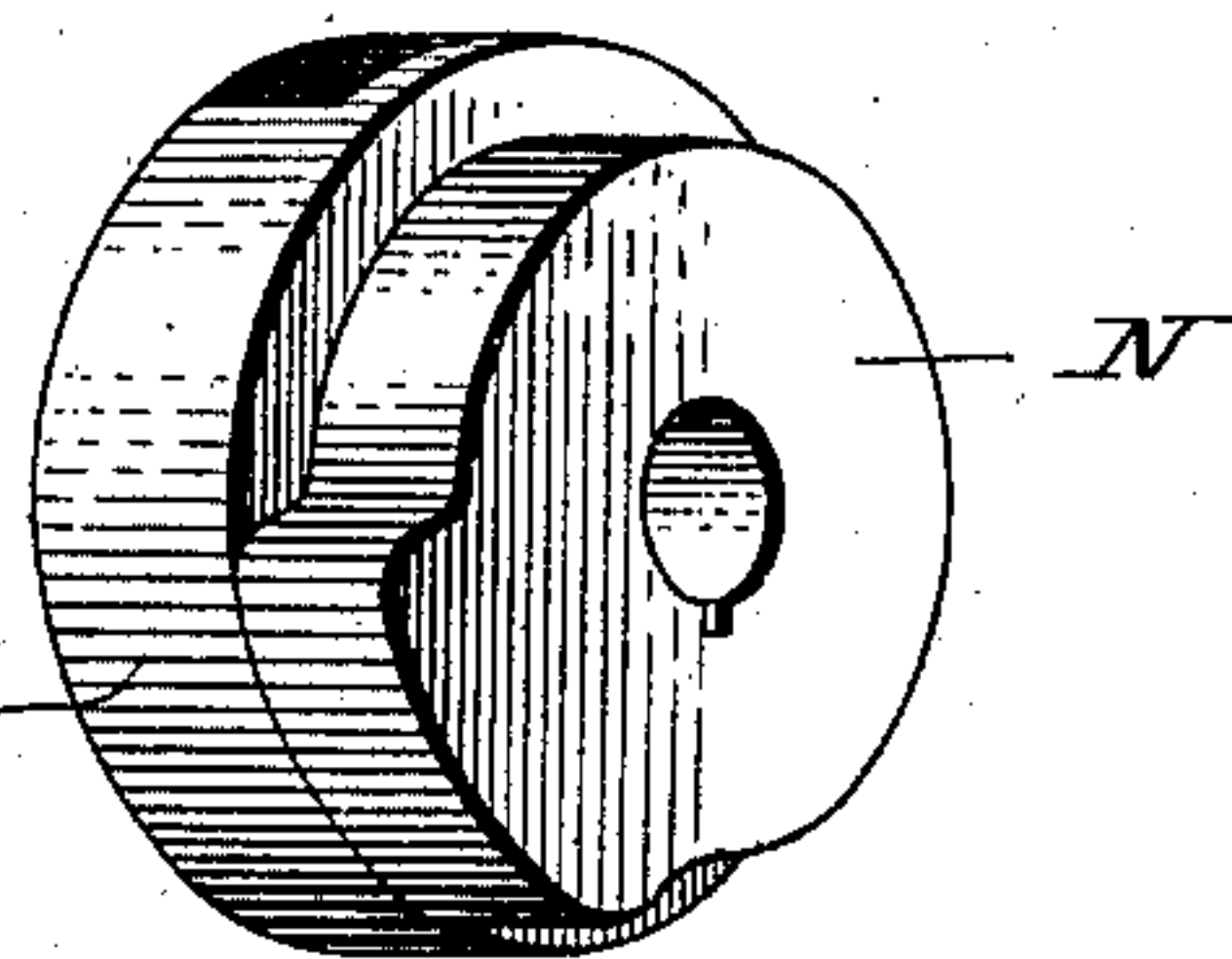


Fig. 3.

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UNITED STATES PATENT OFFICE.

RUSSELL A. FRISBIE, OF MIDDLETOWN, CONNECTICUT.

MULTIPLE-CYLINDER GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 656,539, dated August 21, 1900.

Application filed December 19, 1899. Serial No. 740,889. (No model.)

To all whom it may concern:

Be it known that I, RUSSELL A. FRISBIE, a citizen of the United States, and a resident of Middletown, in the county of Middlesex and State of Connecticut, have invented an Improvement in Multiple-Cylinder Gas-Engines, of which the following is a specification.

This invention is an improvement in gas-engines, and relates more especially to that class which are employed as motors for bicycles and other light vehicles; and the object thereof is to provide a gas-engine of this character by which a cylinder having two apartments or piston-chambers is employed to give an explosion at each revolution of the crank-shaft, the parts being so constructed and arranged as to produce an engine that shall be compact and simple and in which a more even motion is imparted to the crank-shaft.

The invention contemplates the employment of a cylinder which is formed from a single casting to present two apartments or piston-chambers, so arranged that the pistons, which are connected to each other and to the piston-rod, may be acted upon alternately by the explosion of the charges, thereby to produce a succession of strokes and lessen the shock incident to each explosion, very noticeable in a single-cylinder engine.

The invention also embodies a peculiar construction of the cylinder which in connection with certain automatic devices will serve to cool that part forming the central explosion-chamber and prevent overheating of the same.

The invention also provides a peculiar arrangement of the devices which control the exhaust-valves in order that the said valves may be operated from a single cam, and the said devices, with the gas-inlet and igniting devices, may be all located on one side of the engine to form a more compact structure.

The following specification enters into a detail description of the construction and operation of my improved gas-engine, reference being had to the accompanying drawings and to letters thereon, which designate the different parts, and what I consider to be new in the construction and combination is more specifically set forth in the appended claims.

In the drawings, Figure 1 is a side elevation of a gas-engine constructed in accordance

with my invention, the upper part of one of the fly-wheels being broken away to show the controlling devices. Fig. 2 is a vertical sectional view. Fig. 3 is a detail perspective view illustrating the cam which operates the exhaust-valves and the disk controlling the igniting devices.

In carrying out my invention the cylinder, with the exception of the upper head B, is made of a single casting or in one piece, and said cylinder or casting is provided with a partition *a*, forming two compartments or piston-chambers A and A', and at one side of the cylinder is an integral projection *a'*, supporting the gas inlet and exhaust valves for the lower apartment or piston-chamber. To this end said projection presents a straight horizontal chamber *c*, communicating with the upper end of the lower apartment and internally threaded at its outer end to receive an igniting device, which is not shown, as any of the approved devices for the purpose may be used in connection with the engine. Communicating with the chamber *c* is a valve-casing D, forming the lower part of the projection *a'* of the casting or cylinder, and said casing contains the exhaust-valve D' and has a threaded outlet-opening *d*, to which an exhaust-pipe may be connected. The upper part of the projection *a'* is provided with a stepped opening, as shown, to receive the valve-casing E, which contains the inlet-valve E', the said casing being held in place by a bolt F, passed through a threaded opening in a lug *a''*, projecting from the cylinder.

The head B, which is separate from the cylinder and rests upon the same, is provided at one side with a projection *b*, similar to the projection *a'*, hereinbefore described, to provide a valve-casing G for the exhaust-valve G' and a valve-casing H for the inlet-valve H', said valves communicating with a chamber *i*, entering the upper compartment of the cylinder and threaded at its outer end to receive an igniting device. The cylinder is provided with the usual external webs *a'''*, horizontally disposed, and the head B is provided with webs *b'*, vertically disposed.

The cylinder is mounted upon a frame K and rigidly connected thereto by tie-bolts *k*. Within the frame K is journaled a crank-shaft L, which is connected by pitman-rod *l*

to a piston L^1 , reciprocating in the lower compartment or piston-chamber A, and said piston is connected by means of a rod l' to a piston L^2 , which reciprocates in the upper compartment of the cylinder. Where the rod l' passes through the partition between the compartments of the cylinder a thimble or bushing a^4 surrounds the same. Upon the crank-shaft is a pinion M, in mesh with a gear-wheel M' on a shaft m , also supported in the frame K, and upon the outer end of said shaft is a cam N and disk O, the cam serving to operate the exhaust-valves, while the disk controls the operation of the igniting devices. To this end the stem d' of the lower exhaust-valve bears directly upon the upper periphery of the cam, while the upper exhaust-valve is actuated by a push-rod P and interposed rock-lever Q, the latter being fulcrumed upon a pin carried by the frame K and having its opposite ends in engagement with the cam and push-rod, respectively. Both valves are held normally upon their seats by helical springs, which encircle the rods d' and P, and the push-rod P is bent, as shown, to escape the parts carrying the gas inlet and outlet valves and igniting devices for the lower piston-chamber. It will be noted that the rock-lever which operates the push-rod that actuates the exhaust-valve of the upper compartment of the cylinder bears against the lower periphery of the cam, while the rod that actuates the exhaust-valve of the lower compartment bears upon the upper part of said cam, and therefore the projection of the cam operates said valves alternately and at regular intervals, the gearing between the crank-shaft and cam being such as to exhaust the piston-chambers at the proper time. The operation of the gas-inlet valves is the same as in other types of engines or motors of this class, the gas being drawn into the compartments upon each downstroke of the pistons following that imparted to said pistons by the explosions in the compartments or piston-chambers, and after the gas is compressed upon the upstroke is ignited by the igniting devices not shown.

In explosive engines the head or upper part of the piston-chambers is quickly heated by the explosions of the gases in actuating the piston, and as these explosions occur very frequently some device is necessary to prevent overheating of the heads. Where the head is exposed—as, for instance, the head B—the same is cooled by the outside air and the cooling is facilitated by the webs b' ; but in the case of an unexposed head, as that of the lower piston-chamber of an engine or motor constructed as herein shown and described, means are required for keeping up a circulation of air above said head. To the accomplishment of this the upper compartment and piston therein are utilized for drawing in fresh air above the head of the lower compartment and expelling it, and in connection therewith are used opposing valves R and S, the air being

drawn in through valves S and expelled through valves R, forming a continuous circulation of air while the engine is in operation. A circuitous passage is given to the fresh air on its way to the lower part of the upper piston-chamber by causing said air to pass through openings s in the webs a^3 , which extend around the explosion-chamber of the lower compartment of the cylinder, the webs being closed at their outer ends by a ring or band T. It is obvious, however, that unobstructed openings could be left at the lower end of the upper compartment or piston-chamber, forming both inlet and outlet for the air; but it is believed that the arrangement shown herein and just described will more effectively cool the head of the lower compartment of the cylinder.

From the foregoing description, in connection with the accompanying drawings, the operation of my improved gas engine or motor for vehicles will be readily understood, for upon the downstroke of the piston in the lower compartment of the cylinder—resulting from an explosion of gas in said compartment above the piston—the corresponding movement imparted to the upper piston through the connecting-rod will cause said piston to draw a supply of gas into the upper compartment by way of the valve H' , and this gas is compressed upon the upstroke of the piston, and simultaneously the lower compartment is exhausted. The explosion then occurs in the upper compartment of the cylinder, and the lower compartment takes in a supply of gas. It will thus be seen that the pistons are operated alternately and that by providing two compartments or piston-chambers, arranged on a line with each other, and connecting the pistons to each other an explosion is had at each revolution of the crank-shaft, giving a succession of strokes that will impart a very even motion to the crank-shaft, and consequently produce greater power than could be generated by a single-cylinder engine of this type.

The peculiar construction of the cylinder and arrangement of the operating devices provides a very simple and compact engine or motor peculiarly adapted as a motor for bicycles and other light vehicles.

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

1. In an engine of the character described, the combination, of a cylinder formed of a single casting with a single partition presenting two compartments or piston-chambers located on a line with each other, said partition forming the head of the lower compartment, inlet and exhaust valves for the compartments, pistons located in the compartments and connected to each other and to the crank-shaft, the cylinder having openings leading into the lower part of the upper compartment above the partition or head, and opposing valves located in said openings, sub-

stantially as shown and for the purpose set forth.

2. In an engine of the character described, the combination, of a cylinder formed of a
5 single casting and presenting two compartments or piston-chambers located on a line with each other, inlet and exhaust valves for the compartments, pistons located in the compartments or chambers and connected to each
10 other, lateral webs formed on the cylinder, valved outlet-openings leading from the lower

end of the upper compartment, valved inlet-openings also leading into the lower end of said upper compartment, a band around the outer ends of the webs, and openings leading 15 through the webs to the valved inlet-openings, substantially as shown and for the purpose set forth.

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Witnesses:

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