

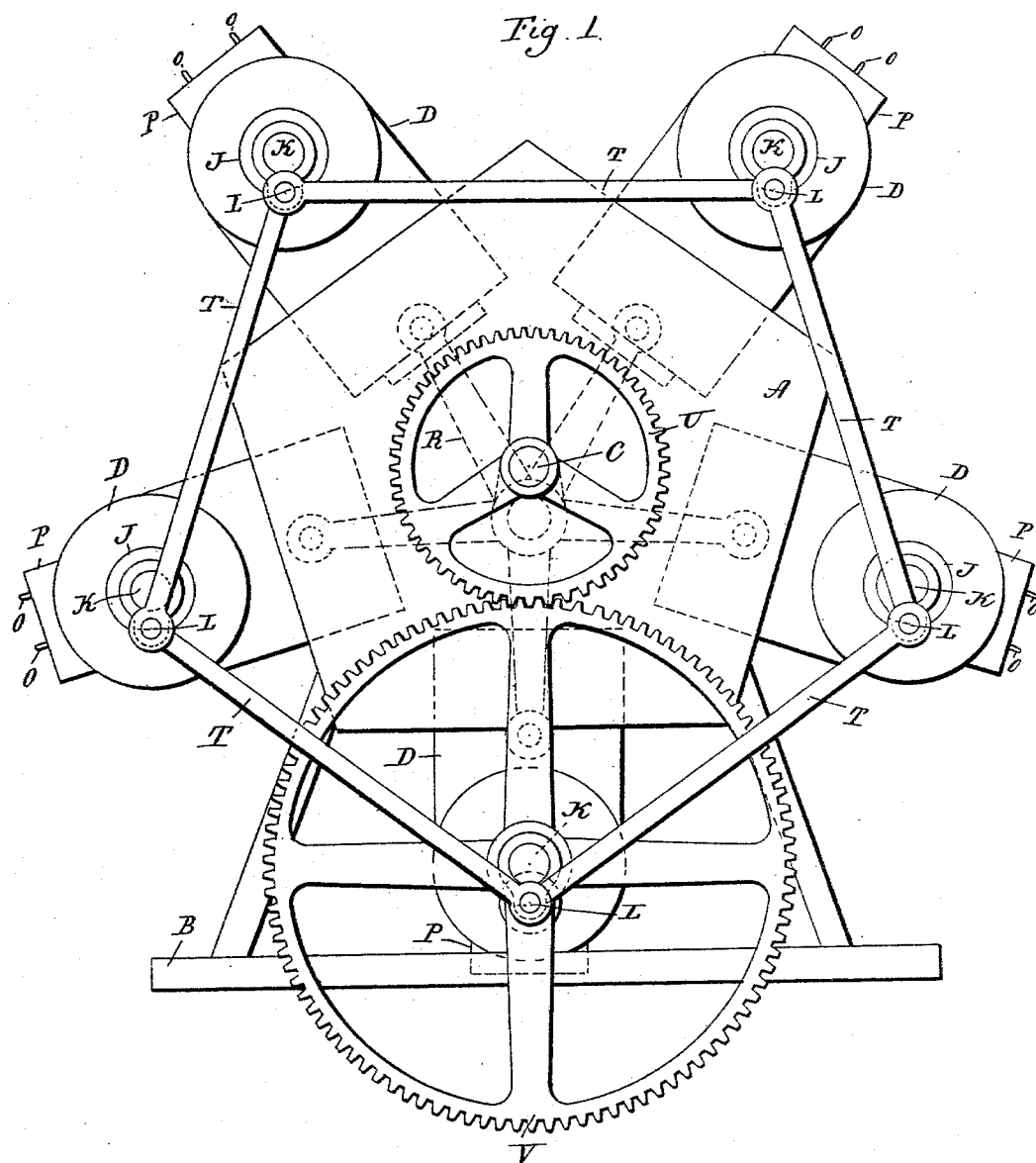
(No Model.)

3 Sheets—Sheet 1.

F. C. GRISWOLD.
GAS ENGINE.

No. 584,130.

Patented June 8, 1897.



Witnesses,
J. H. Shumway
Lillian D. Kelsey.

Frederick C. Griswold
Inventor.
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Fig. 2

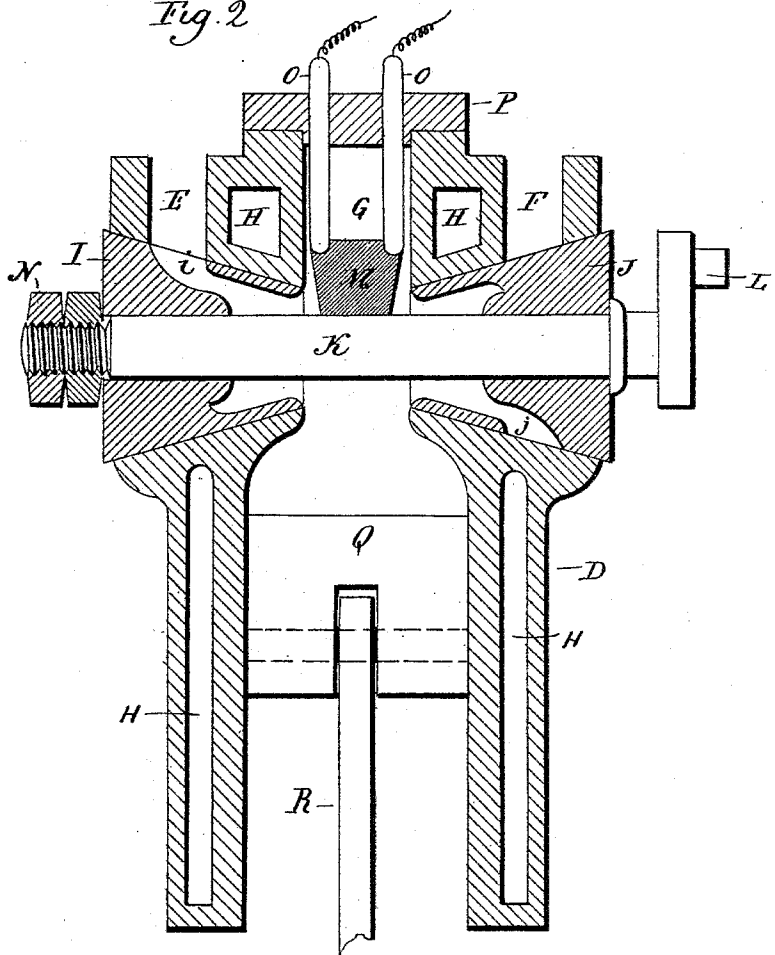
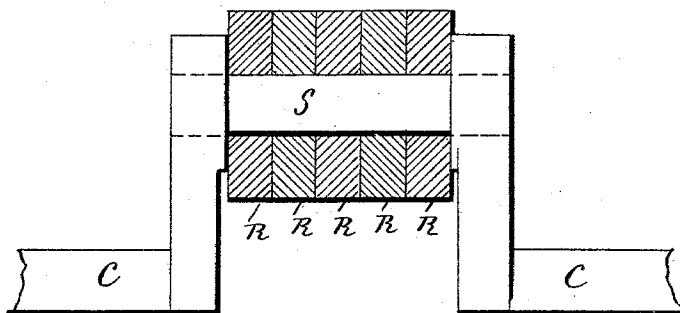


Fig. 3



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(No Model.)

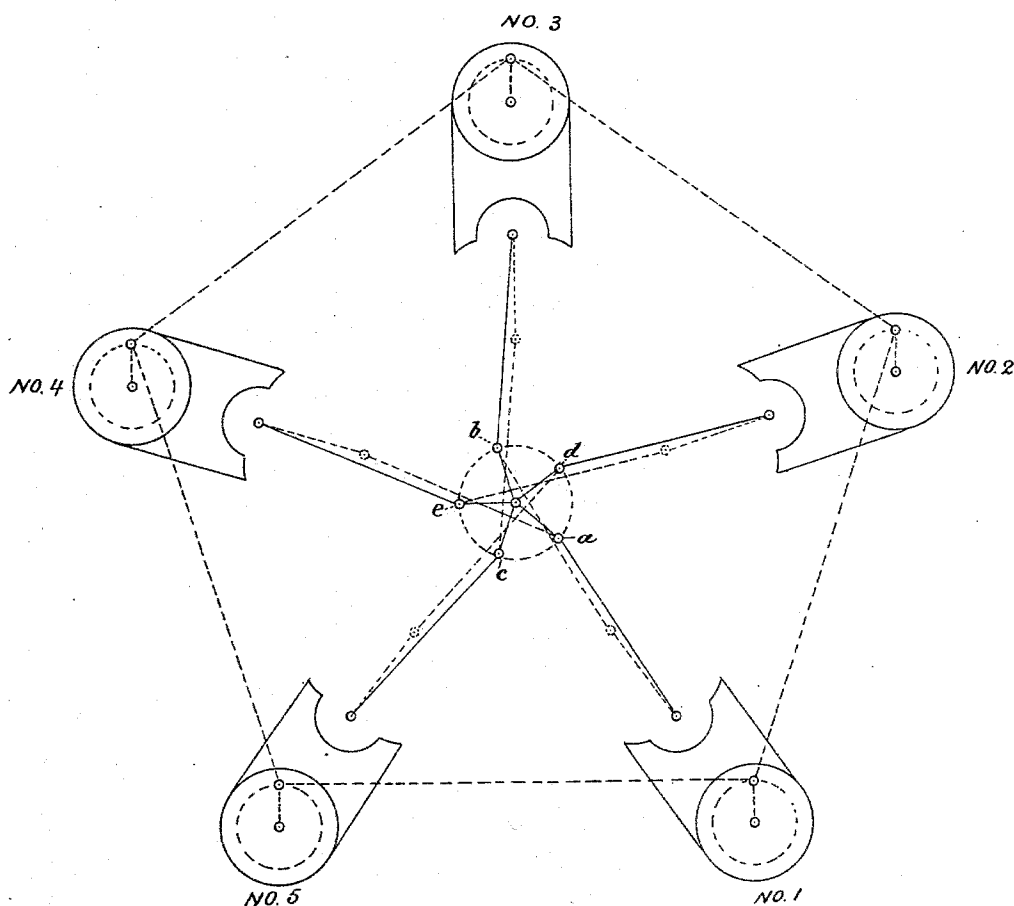
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Fig. 4



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UNITED STATES PATENT OFFICE.

FREDERICK C. GRISWOLD, OF PORT JEFFERSON, NEW YORK, ASSIGNOR OF
ONE-HALF TO MARTIN L. CHAMBERS, OF SAME PLACE.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 584,130, dated June 8, 1897.

Application filed November 25, 1896. Serial No. 613,367. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK C. GRISWOLD, of Port Jefferson, in the county of Suffolk and State of New York, have invented a new Improvement in Gas-Engines; and I do hereby declare the following, when taken in connection with the accompanying drawings and the letters of reference marked thereon, to be a full, clear, and exact description of the same, and which said drawings constitute part of this specification, and represent, in—

Figure 1, an end view of an engine constructed in accordance with my invention; Fig. 2, a sectional view of one of the cylinders enlarged; Fig. 3, a side view of the central portion of the crank-shaft, showing its crank and connecting-rods mounted thereon; Fig. 4, a diagram illustrating the operation of the engine.

This invention relates to an improvement in gas-engines, the object being to increase the power of such engines and to so distribute the power as to act upon the crank-shaft at different points in its revolution, so that practically a continuous power is exerted thereon; and it consists in arranging a plurality of cylinders and connecting-pistons therefrom to the crank-shaft and so timing the explosion of gas in the cylinder as to exert their power at different points in the revolution of the crank-shaft and once in each cylinder during two revolutions of the crank-shaft, and in certain details of construction, as will be hereinafter described, and particularly recited in the claims.

Preferably and as herein shown I employ a pentagonal casing A, suitably supported upon a base E, through which casing a crank-shaft C extends, and in each side of and opening into the casing is a cylinder D. Each cylinder, as shown in Fig. 2, is formed with an inlet-port E, an exhaust-port F, gas-chamber G, and cooling-water spaces H, all substantially in the usual manner. Entered into tapered openings in one side of the cylinder is a hollow tapered valve I, and into a corresponding opening in the opposite side is a hollow tapered valve J, said valves being keyed to a valve-shaft K, which has a valve-crank L at one end and receives nuts N at the opposite end, by which the valves are crowded into their seats. The said valve I is formed

with a port *i* and the valve J with a port *j*, opening on opposite sides of the valve-shaft, so that when the port *i* registers with the opening E the valve J closes the exhaust-opening F, and when the valve I closes the opening E the port *j* registers with the exhaust-port F. Secured to the shaft K is an exploder-plate M, which projects into the gas-chamber G, and depending into the gas-chamber G, into the path of the exploder-plate, are firing-pins O, supported by a firing-pin cap P, which closes the gas-chamber G, and from these pins wires extend to an electric battery. (Not shown.) Within the cylinder is a piston Q, connected by a connecting-rod R with the crank S of the crank-shaft C. The valve-cranks L are connected by valve-crank-connecting rods or links T.

To operate the valve-cranks, I couple to one of the valve-cranks, and preferably the lower one L', a gear-wheel V, which meshes with a gear-wheel U on the crank-shaft C, the diameter of the wheel U being one-half that of the wheel V, so that the crank-shaft may make two revolutions while causing the valve-cranks to make one revolution.

The operation within each cylinder is as follows: When the piston Q is ready to descend, the port I registers with the inlet E, so as to allow gas to enter the chamber G. As the piston completes its downward movement the valve I closes the port E, and upon the return stroke of the piston the gas within the chamber is compressed. Just as the piston reaches its up position the exploder-plate N comes in contact with the firing-pins O, completing the electric circuit, creating a spark which ignites the gas within the chamber and forces the piston Q downward. When it reaches its down position for the second time, the valve-shaft in constantly revolving is turned, so that the port *j* of the valve J registers with the exhaust-opening F, and upon the return of the piston the products of combustion are forced outward through the opening F, and just as it reaches this last position the opening F is closed and the opening E opened. It will thus be seen that the piston operates once by the explosion of gas and once under the action of the crank-shaft. The five cylinders are so connected and timed to operate alternately, as illustrated in the

diagrammatic view Fig. 4. Thus the explosion in cylinder No. 1 turns the crank-shaft from *a* to *b*, and when just beyond the center the gas in cylinder No. 3 is exploded, which forces the crank-shaft to *c*, or just beyond the central line from cylinder No. 5, when the explosion therein forces the crank-shaft to *d*, just beyond the line from cylinder No. 2. An explosion in cylinder No. 2 forces the crank-shaft from *d* to *e*, when the explosion in cylinder No. 4 returns the crank-shaft from *e* to *a*. Thus the five explosions have caused the crank-shaft to make two revolutions, and hence the piston in each cylinder has made two complete movements, as before described, one under direct action from the explosion of the gas and the other under the action of explosion in the other cylinder. The power is thus distributed throughout the rotation of the crank-shaft, and by thus alternating the operations in the cylinders sufficient time is gained to properly fill with and compress gas in each cylinder before explosion, and causes a constant pressure upon the crank-shaft. While I prefer to explode the gas in the chamber by means of the exploder-plate and electric fire-points, it may be exploded in the manner usually employed in gas-engines. In order that the connecting-rods may extend into direct connection with the crank S of the crank-shaft, it will be necessary to arrange the cylinders in different planes.

If desired, the casing may be filled or nearly filled with oil or other lubricating material, so that the piston will work freely, the oil displaced by the downward movement of one piston replacing the space left by the upward movement of the other piston.

I am aware that engines having a plurality of cylinders, with pistons arranged to operate at different points during the revolution of the crank-shaft, have been used, and therefore do not wish to be understood as claiming such as my invention; but,

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

1. In a gas-engine the combination with a casing and a crank-shaft mounted therein of an odd number of cylinders arranged concentric to said shaft, pistons in said cylinders connected to the crank-shaft by connecting-rods each cylinder formed with a gas-chamber and inlet and outlet openings, valves adapted to open and close said openings and connected by a shaft having a crank extending beyond one side of the cylinder, said valve-cranks connected together by links so as to be uniformly turned, the valves on said shaft being so timed that explosion occurs in alternate cylinders and connections between the crank-shaft and valve-cranks, whereby the valve-cranks make one-half as many revolutions as the crank-shaft, substantially as described.

2. In a gas-engine the combination with a frame supporting a crank-shaft of five cylinders arranged concentric to said shaft and a piston in each cylinder, connecting-rods connecting said pistons with the said crank-shaft, each cylinder formed with a gas-chamber and inlet and outlet openings, valves adapted to open and close said openings and connected by a shaft having a crank extending beyond one side of the cylinder, said valve-cranks connected together by links so as to be uniformly turned, the valves on said shafts being so timed that explosions occur in alternate cylinders and connections between the crank-shaft and one of the valve-cranks whereby the valve-cranks make one-half as many revolutions as the crank-shaft, substantially as described.

3. In a gas-engine, the combination with a pentagonal closed casing supporting a crank-shaft of five cylinders arranged concentric to said shaft and pistons in each cylinder, and a connecting-rod connecting said pistons with said crank-shaft, each cylinder formed with a gas-chamber and inlet and outlet openings, valves adapted to open and close said openings and connected by a shaft having a crank extending beyond one side of the cylinder, said valve-cranks connected by links so as to be uniformly turned, the valves on said shafts being so timed that explosion occurs in alternate cylinders, and a gear-wheel on said crank-shaft meshing with a gear-wheel on one of the valve-shafts, the wheel on the crank-shaft being of one-half the diameter of the wheel on the valve-shaft, substantially as described.

4. In a gas-engine the combination with a casing and a crank-shaft mounted therein of a plurality of cylinders arranged concentric to said shaft, pistons in said cylinders connected with the crank-shaft by connecting-rods; each cylinder formed with a gas-chamber and inlet and outlet opening valves adapted to open and close said openings, and connected by a shaft having a crank extending beyond one side of the cylinder, said valve-cranks connected altogether by links so as to be uniformly turned, the valves on said shafts being so arranged that explosion occurs in alternate cylinders, electrically-connected firing-pins within said gas-chamber and explosion-plates carried by said valve-shafts and adapted to be brought into contact with said firing-pins and connections between the crank-shaft and links, whereby the valve-cranks make half as many revolutions as the crank-shaft, substantially as described.

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

FREDERICK C. GRISWOLD.

Witnesses:

FRED. C. EARLE,

LILLIAN D. KELSEY.