No Model.)

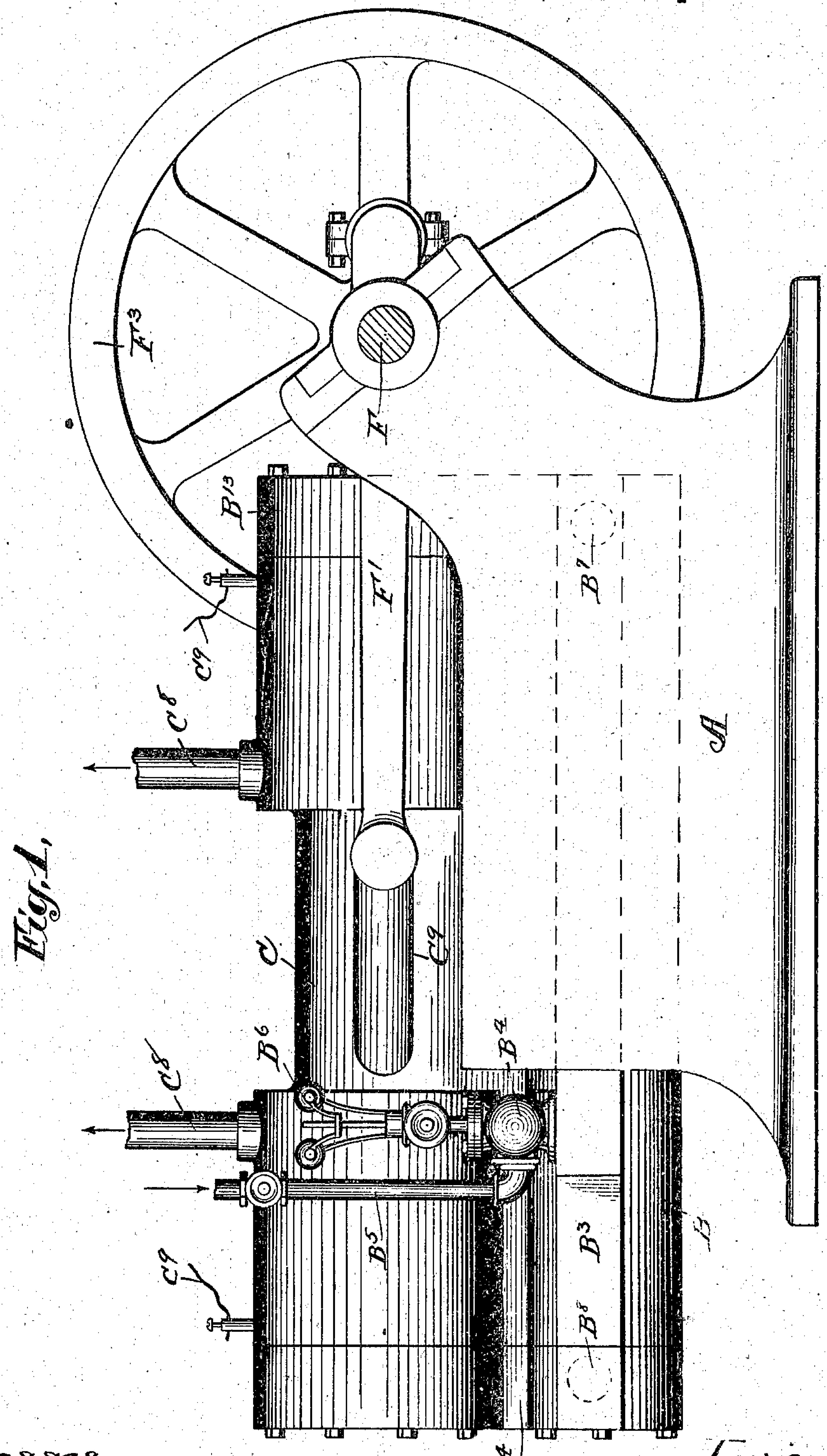
3 Sheets—Sheet 1.

J. M. WORTH.

GAS ENGINE.

No. 559,017.

Patented Apr. 28, 1896.



Witnesses.
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(No Model.) 3 Sheets—Sheet 2.

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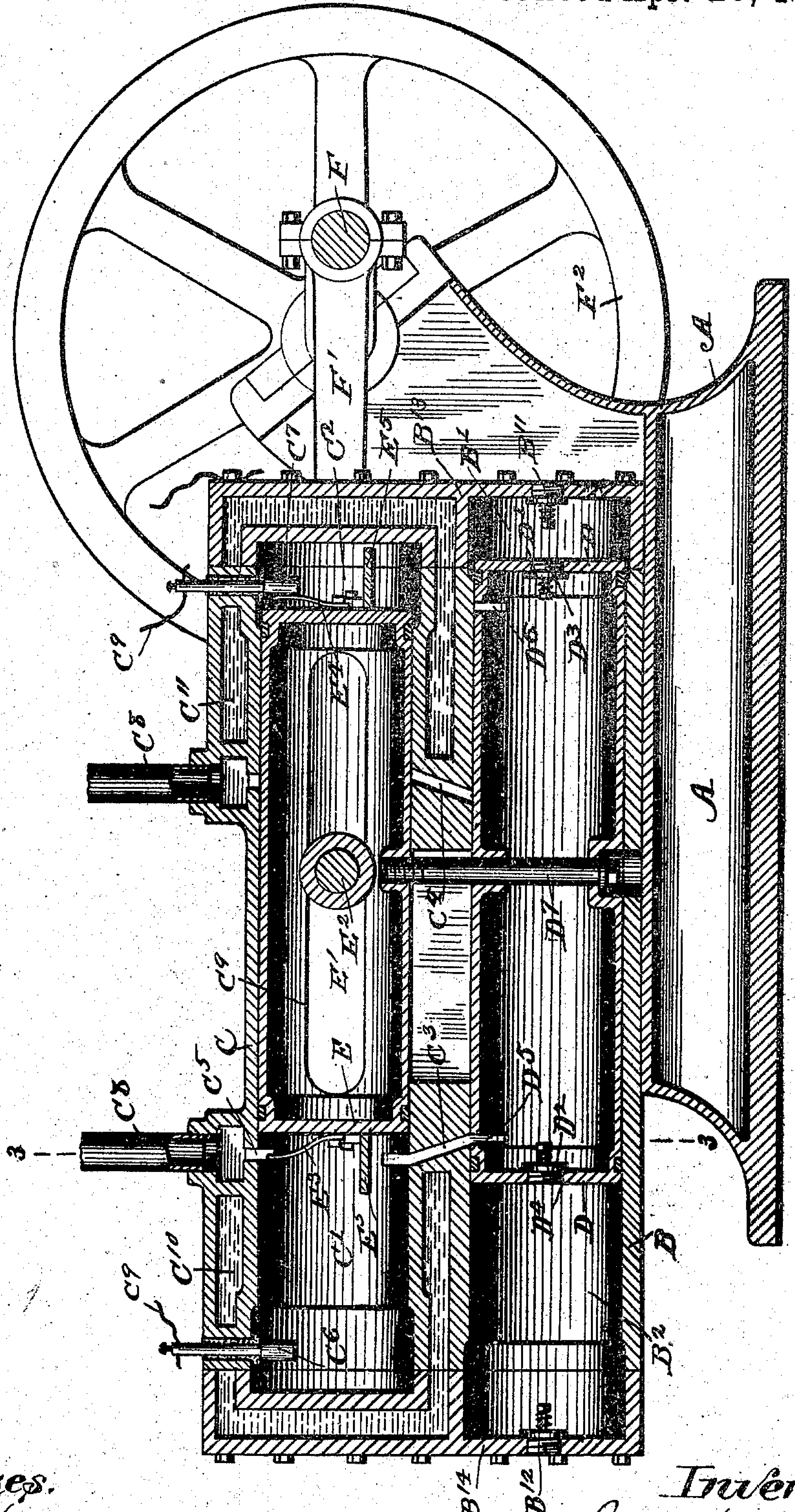
Fig. 2.



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3 Sheets—Sheet 3.

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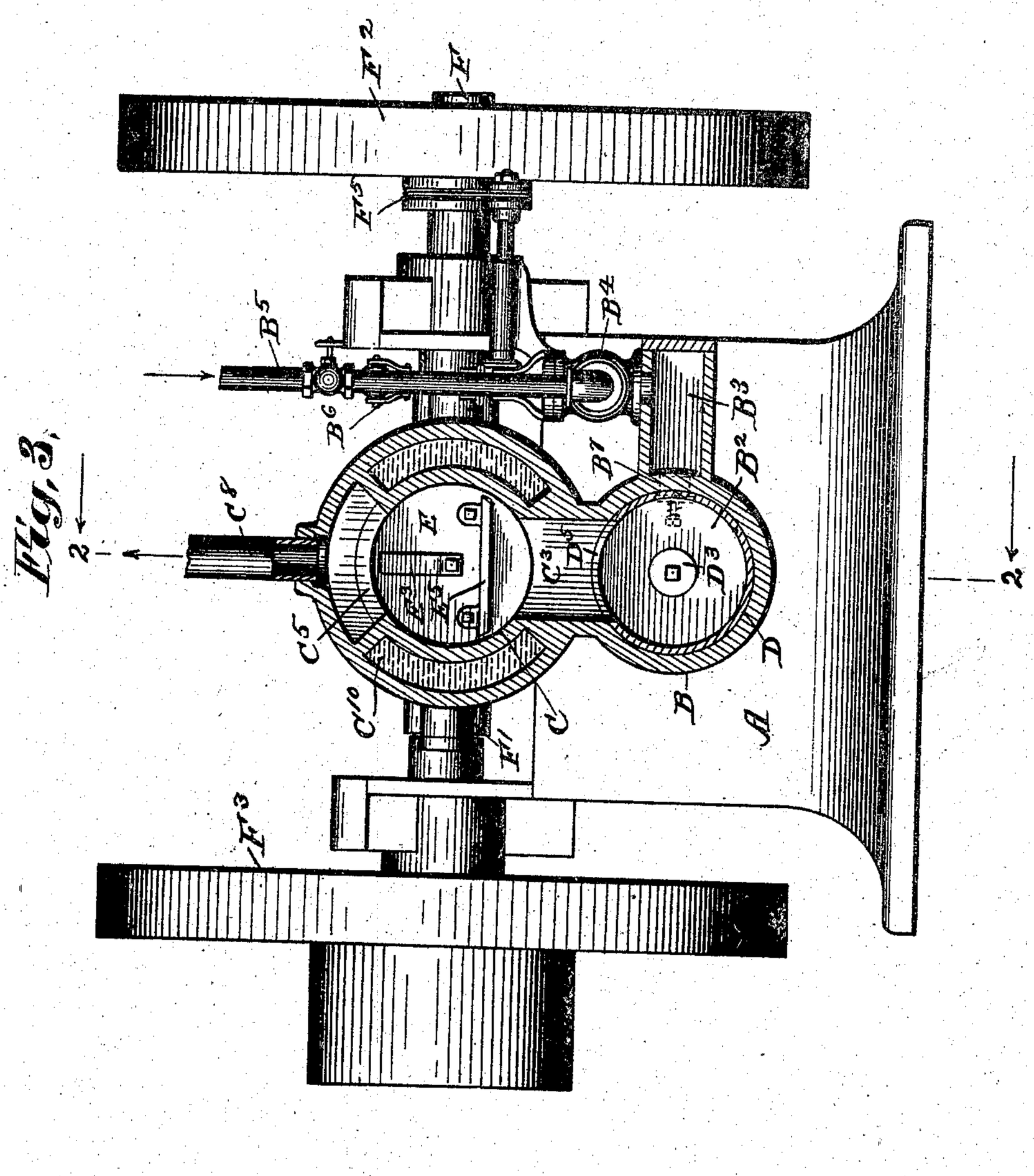

Witnesses:
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Inventor:
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By S. H. Brainard
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UNITED STATES PATENT OFFICE.

JAMES M. WORTH, OF CHICAGO, ILLINOIS.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 559,017, dated April 28, 1896.

Application filed January 4, 1895. Serial No. 533,854. (No model.)

To all whom it may concern:

Be it known that I, JAMES M. WORTH, a citizen of the United States, residing at Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Gas-Engines; and I declare the following to be a full, clear, and concise description of the same, reference being had to the accompanying specification and drawings.

My purpose is to produce a gas-engine wherein an explosion takes place at each end of the working cylinder at every complete cycle of motion, procuring thereby practically the same result as obtained in the use of a single-cylinder steam-engine. I have designed to use either generated gas or gasolene as the source of energy.

Referring to the drawings, Figure 1 is the side of one side elevation on an engine embodying my invention. Fig. 2 is a central vertical section of same, taken lengthwise of the cylinder and on the line 2 2 of Fig. 3. Fig 3 is a transverse sectional view on the line 3 3 of Fig. 2.

Similar letters refer to like parts throughout the specification and drawings.

Suitably mounted on the base A of the engine are the parallel cylinders B C. The interior of the cylinder B is divided by the piston D into two carbureting-chambers B′ B². The interior of the cylinder C is divided by the piston E into two combustion-chambers C′ C². The cylinder B has cast upon one side a parallel gas-chamber B³, said chamber communicating with the gas supply through the throttle-valve B⁴ and pipe B⁵. The throttle-valve is controlled by an ordinary ball-governor B⁶. The gas-chamber B³ communicates with the chambers B′ B² of the cylinder B through the puppet-valves B⁷ B⁸, placed in the openings B⁹ B¹⁰.

The carbureting-chambers B′ B² communicate with the atmosphere through the puppet-valves B¹¹ B¹² in the cylinder-heads B¹³ B¹⁴, said puppet-valves being adapted to open to allow air to enter the carbureting-chamber and to close to prevent the carbureted air from escaping into the atmosphere when compressed by the piston D.

Communicating between the cylinder B and the cylinder C are passages or ports C³ C⁴. The chambers C′ C² of the cylinder C are provided with exhaust-ports C⁵ C⁶, communicating with the atmosphere through the exhaust-pipes C⁸.

The piston D is hollow and communicates with the carbureting-chambers B′ B² through the puppet-valves D′ D², placed in the openings D³ D⁴. The piston D is also provided with transverse slots D⁵ D⁶, adapted to register at either limit of the piston-stroke with the passages C³ C⁴.

The piston E is secured to the piston D by means of a suitable connection D⁷. The piston E is also hollow, the interior of same communicating with the external atmosphere through the slots E′ in the sides thereof, corresponding to the slots C⁹ in the sides of cylinder C. The piston E is connected with the crank-shaft F by means of the driving-arms F′, said driving-arms having outside connection to the wrist-pin E² of the piston E. The head of the piston E is provided with spring-electrodes E³ E⁴, adapted to contact with the insulated electrodes C⁶ C⁷, secured in the cylinder C.

The insulated electrodes C⁶ C⁷ and the spring-electrodes E³ E⁴ are connected by the conductors C⁹ to an electric circuit or galvanic battery. (Not herein shown.) Also secured upon the heads of the piston E are the deflectors E⁵. Mounted upon the shaft F are the fly-wheels F² F³ and the driving-pulley or belt-wheel F⁴. The hub of the fly-wheel F² has a groove cut therein to receive the governor-belt F⁵.

The action of my engine will be described as it operates when generated gas is used as the source of energy.

It will be seen that as the piston D, placed in the cylinder B, moves to the left a certain amount of gas will be drawn into the chamber B′ from the gas-chamber B³ through the puppet-valve B⁷. At the same time a certain amount of air will be drawn into the chamber B′ through the valve B¹¹, placed in the right cylinder-head B¹³. The return of the gas and air thus admitted is prevented by the puppet-valves B⁷ B¹¹. As the piston starts on its return stroke the carbureted air will be compressed in the chamber B′, the puppet-valve D′ will be open, and the carbureted air will pass into the hollow piston D, where it

will remain under slight compression until the opening of slot D^5 coincides with the port or passage C^3, when the gas will pass into the chamber C′ of the cylinder C, strike the deflector E^5, secured upon the head of the piston E, and fill the chamber C′. The piston E on its return stroke toward the left will cut off the port or passage C^3 and exhaust-port C^5 and compress the carbureted air within the chamber C′. As the piston E nears the limit of its stroke the spring-electrode E^3 will contact with the insulated electrode C^6, secured in the cylinder C. Shortly after the piston E starts on its return toward the right the contact of the electrodes E^3 C^6 will be broken and a spark produced that will ignite the gas and cause an explosion which will force the piston to the extreme limit of its travel toward the right, uncover the exhaust-port, and allow the expanded gas to escape to the atmosphere through the exhaust-port C^5 and exhaust-pipe C^7. The action is the same in the chambers B^2 C^2 as in B′ C′, an explosion taking place in each combustion-chamber at every reciprocation of the pistons D E. The piston D is rigidly connected to the piston E by means substantially as shown in Fig. 2. This connection insures a corresponding stroke to the two pistons. The cylinder C is provided with longitudinal slots C^9 to allow the crank-arm connection and wrist-pin to pass to and fro. These slots also allow air to pass into the piston through the corresponding slots E′ in the sides thereof, thus aiding in reducing the temperature due to the heat caused by the explosions. The combustion-chambers C′ C^2 are surrounded by water-jackets C^{10} C^{11}, connected with a water supply. (Not herein shown.) This circulation of water tends to reduce the temperature due to the above-stated cause.

Having thus described my invention, what I wish to secure by Letters Patent is—

A gas-engine, having in combination a double-acting compression-cylinder, a double-acting hollow piston having puppet-valve in either head thereof and transverse slots in the upper face thereof, said piston adapted to reciprocate in said cylinder, a double-acting combustion-cylinder having suitable inlet-ports and exhaust-ports, and a double-acting working piston adapted to reciprocate in said combustion-cylinder, said piston having outside connections with the crank-shaft, all substantially as shown.

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

JAMES M. WORTH.

Witnesses:
GEO. P. MCINTYRE,
S. W. BRAINARD.