No. 814,609. PATENTED MAR. 6, 1906.

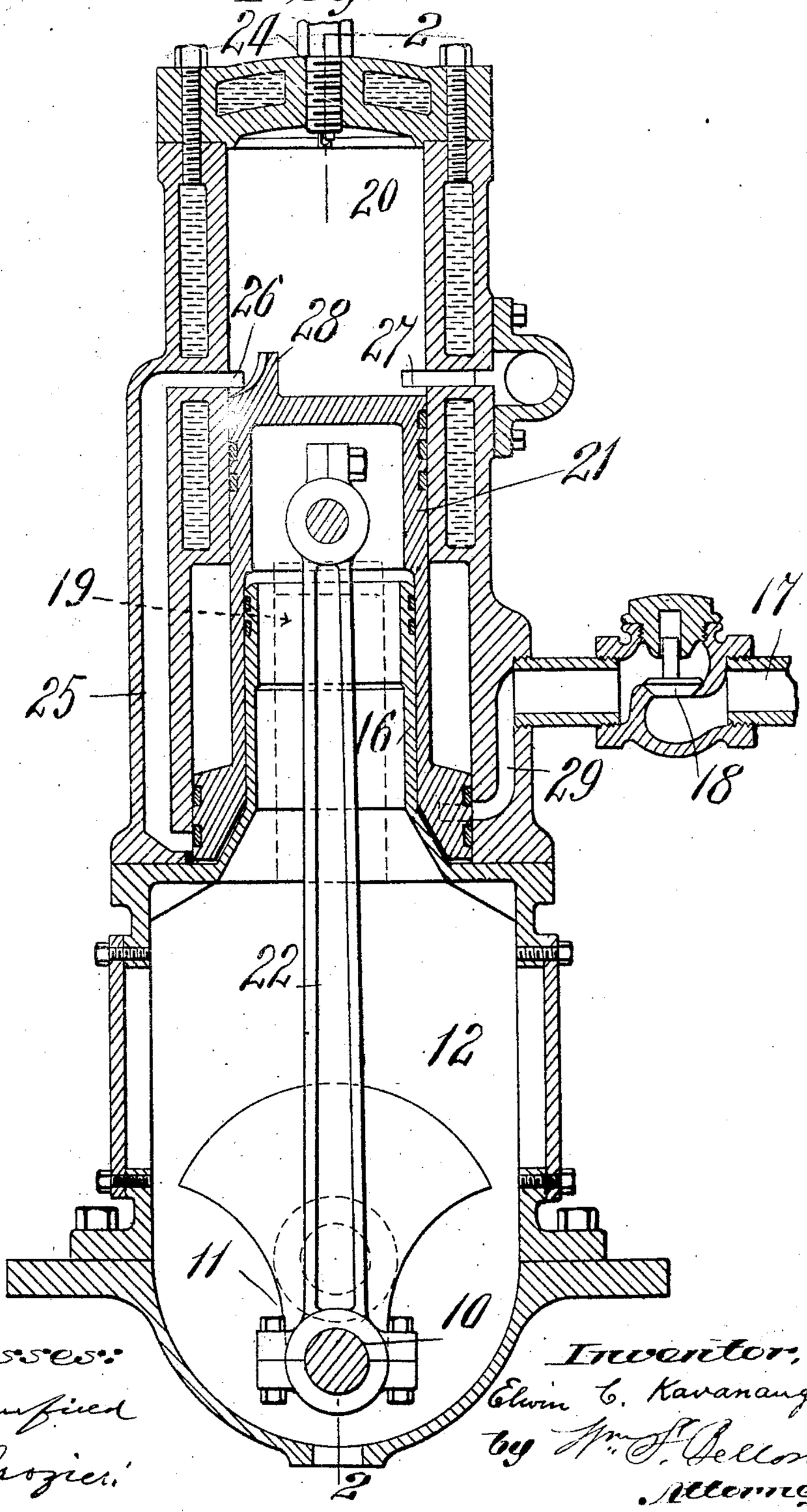
E. C. KAVANAUGH.

GAS ENGINE.

APPLICATION FILED MAY 17, 1904.

3 SHEETS—SHEET 1.

Fig. 1.



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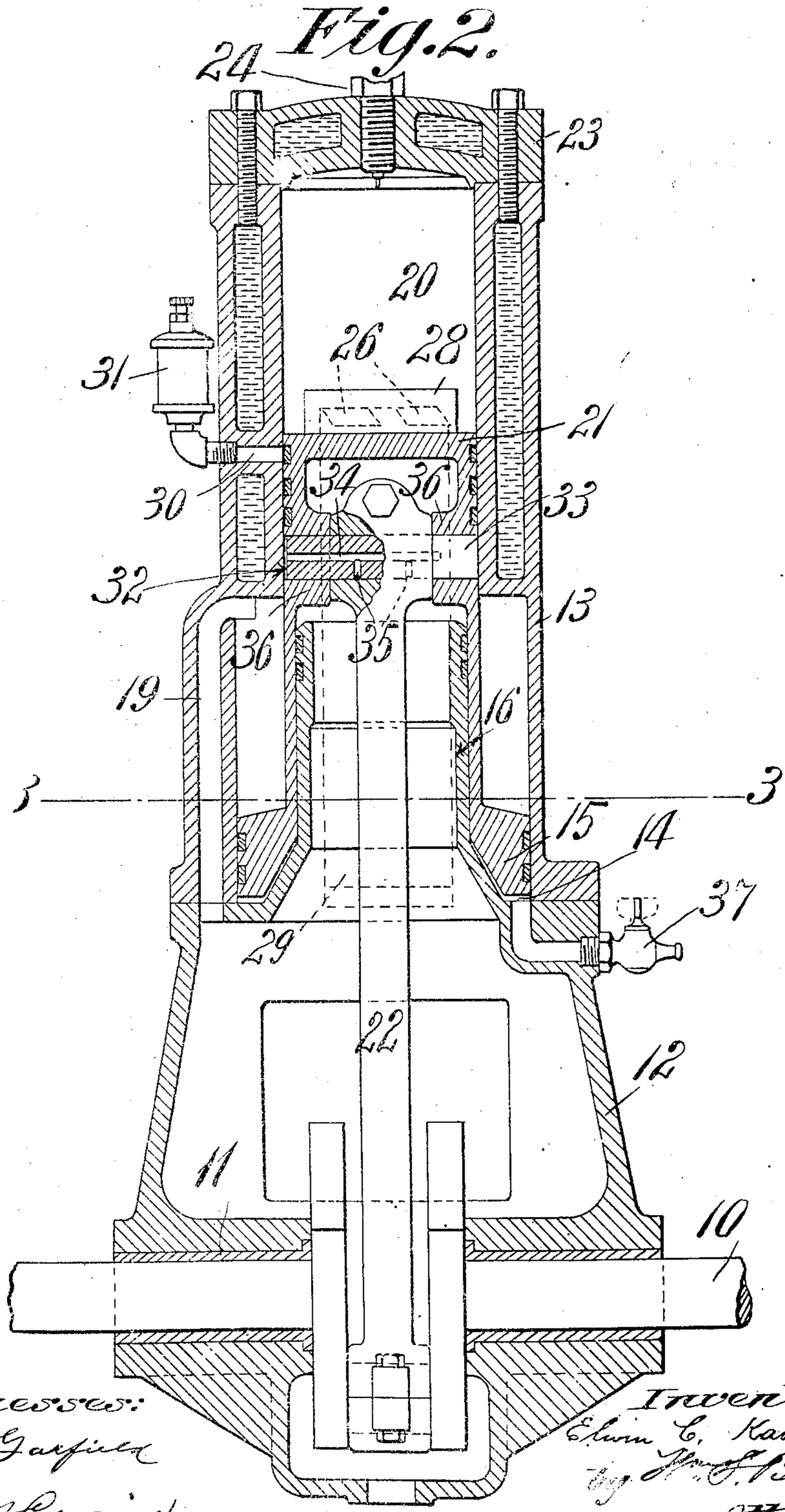
3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

Fig. 3.

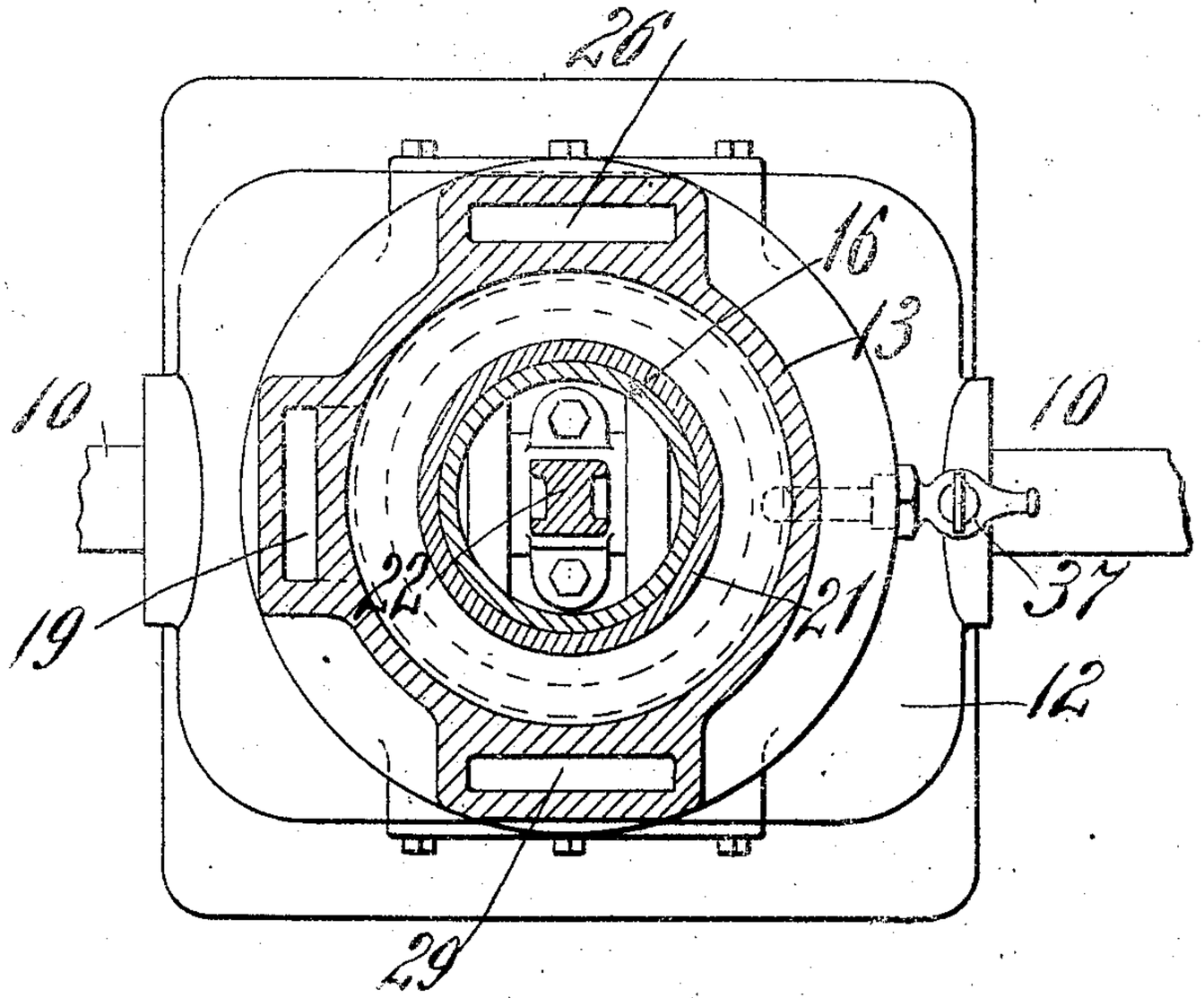
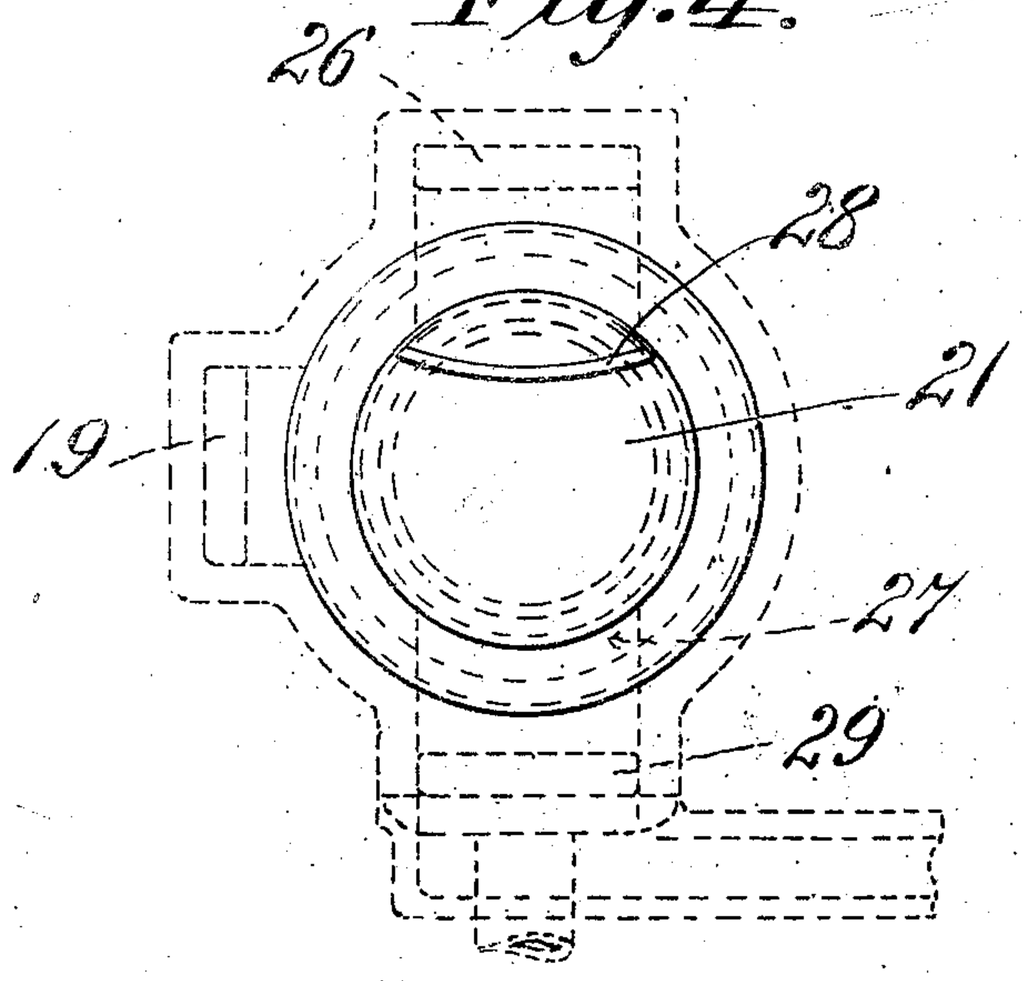


Fig. 4.



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UNITED STATES PATENT OFFICE.

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GAS-ENGINE.

No. 814,609. Specification of Letters Patent. Patented March 6, 1906.

Application filed May 17, 1904. Serial No. 208,400.

To all whom it may concern:

Be it known that I, ELWIN C. KAVANAUGH, a citizen of the United States of America, and a resident of Holyoke, in the county of Hampden and State of Massachusetts, have invented certain new and useful Improvements in Gas-Engines, of which the following is a full, clear, and exact description.

This invention relates to explosive-engines of the "two-cycle" type; and it has for one of its objects the provision of a machine of this character in which an impulse is imparted to the piston at each rotation of the crank-shaft.

My invention has, furthermore, for its object the provision of a pair of connected cylinders and pistons simultaneously operable therein, one of said cylinders constituting a compression-chamber which is in communication with the other cylinder constituting the acting or explosion chamber.

My invention has, furthermore, for its object the provision of such a device in which the area of the compression-piston is greater than that of the working piston, so as to insure a comparatively large supply and subsequent high compression of the live gas preparatory to its delivery into the working cylinder.

Further objects of my invention will be attained by the peculiar organization and operation of the working piston which serves to close the port leading from the compression-cylinder into the working cylinder during the active stroke of the working piston, as will be hereinafter described, and particularly pointed out in the claims.

In the accompanying drawings, in which similar characters denote similar parts, Figure 1 is a vertical central section of a gas-engine embodying my invention. Fig. 2 is a similar section taken in a plane at right angles relative to that of Fig. 1. Fig. 3 shows a horizontal section on line 3 3, Fig. 2; and Fig. 4 represents a top view of the piston, the engine-casing being illustrated by dotted lines.

Briefly stated, my invention comprises an engine in which the upward stroke of the piston results in simultaneously drawing in a charge of live gas into the compression-chamber and compressing a charge in the working cylinder, whereupon near the completion of this piston movement the compressed charge in the working cylinder is fired and the piston moves downward to rotate the crank-shaft and at the same time to compress the charge of live gas in the compression-chamber. As the piston approaches the end of its downward stroke the exhaust-port is uncovered and the compressed charge of live gas is permitted to enter the working cylinder and to drive out the products of combustion therefrom.

In the drawings I have shown a water-cooled engine comprising a crank-shaft 10, journaled in bearings 11 of a crank-case 12. Secured at the top of this case is the cylinder-casing 13, which in the present instance comprises a compression chamber or cylinder 14, in which a piston 15 is mounted for reciprocation.

Referring to Fig. 1, it will be seen that the crank-case 12 has a cylindrical dome 16, the outer surface of which contacts with the inner surface of the piston 15, so that the compression-chamber is in reality annular in form.

Live gas is supplied through a pipe 17, and as the piston 15 rises the gas is sucked past the check-valve 18 and into the chamber 14, while any pressure in the cylinder above the piston 15 may be relieved by an air-passage 19, connecting the upper end of the cylinder 16 with the interior of the crank-case 12.

Disposed above the compression-chamber 14 and in axial alinement therewith is the working cylinder or explosive-chamber 20, smaller in area than the chamber 14 and containing a piston 21, movable with the piston 15 and connected by a pitman 22 with the crank-shaft 10. The top of the explosion-cylinder 20 is closed by a cap 23, provided with a sparking plug 24 of usual construction. The lower end of the compression-chamber 14 is connected with the explosion-chamber 20 by a gas-conduit 25, terminating in a port 26 in constant communication with the chamber 14 and which is open into said chamber 20 when the piston 21 is at the end of its downstroke, but is closed thereby during the initial upward movement thereof.

Disposed opposite the inlet-port 26 is an exhaust-port 27, through which the products of combustion resulting from the explosion of gas in the working cylinder may be discharged, both ports 26 and 27 being substantially in horizontal alinement, so that the movement of the piston 21 will result in either opening or closing both of said ports simultaneously.

Inasmuch as under the conditions above

described the incoming gas may find a direct outlet through the exhaust-port 27, I deem it expedient to provide means whereby the flow of the charge of gas entering the explosion-cylinder shall be directed into the "dead" or remote part of said cylinder, said means consisting, substantially, of a deflector 28, secured to or forming a part of the piston 21 and so constituted that the entering gas will be forced toward the top and near the wall of the cylinder 20, thus forcing the used gas out through the exhaust-port 27. When now the pistons rise, both ports 26 and 27 will be simultaneously closed and fresh gas will subsequently be sucked in by the piston 15 through a conduit 29, while the live gas in the cylinder 20 will be compressed by the piston 21. As the pistons reach the end of their upward stroke the charge in the cylinder is fired to give an impulse to piston 21, the downward movement of which will result in causing the piston 15 to compress the fresh gas contained in the compression-chamber 14 and in conduits 25 and 29 as far as the check-valve 18 until the piston 15 has moved far enough to shut off the conduit 29, when the compression-space will consist only of the chamber 14 below the piston 15 and the conduit 25. Hence the gas is compressed under high tension, so that when the pistons have descended sufficiently to open the ports 26 27 said compressed gas enters the working cylinder 20 under high initial velocity, which causes a rapid exhaust of used gas through the port 27 and insures a thorough scouring of the working cylinder. Furthermore, on account of the larger area of the compression-cylinder the quantity of live gas passing through the port 26 is ample to leave a full charge in the working cylinder 20.

In view of the peculiar construction of the cylinder-casing especial care must be exercised to provide for proper lubrication of the operating parts, and the system shown in the drawings possesses meritorious features.

Penetrating the water-jacket of the explosion-cylinder 20 beyond the open-piston travel and at a point below the upper face of the piston 21 when in its lowermost position is a duct 30, receiving a supply of oil from a cup 31 and lubricating the piston 21. The oil will spread over the surface of this piston and also work its way into a recess 32, formed by shortening the pitman-pin 33, which may be provided with a longitudinal channel 34, from which branches 35 may lead to the pin-surface. The pin 33 is preferably stationary in lugs 36 of the piston 21, and the lubricant will spread from the joint between the lugs 36 and the head of pitman 22, finding its way toward the interior surface of the piston 21, thus lubricating this contact-surface with the exterior surface of the dome 16. All surplus of oil will thence gravitate into the bottom of the chamber 14 and may be drawn off by a petcock 37. The lubricant applied to the surface of the piston 21 will also gravitate to the piston 15 and settle in the chamber 14, as will be readily understood.

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

1. In a gas-engine, the combination with a cylinder having the cylinder-chamber formed with portions of different diameters, and a piston working therein and formed with a flange or enlargement corresponding to the cylinder portion of the larger diameter, a gas-supply inlet entering one end of the larger cylinder portion, a conduit leading from the lower end portion of the larger cylinder portion into the smaller cylinder portion, and an air-relief leading from a portion of the larger cylinder-chamber, above the piston enlargement downwardly to communication with the crank-inclosing portion of the engine-casing.

2. In a gas-engine, a crank-casing formed with a cylindrical dome, a cylinder secured to said casing, said cylinder comprising a working cylinder, and a compression-cylinder into the latter of which said dome extends whereby said cylinder is made annular in form, a working piston in the first-mentioned cylinder and an annular piston in the compression-cylinder, said annular piston being formed integral with the working piston, a gas-inlet to the compression-cylinder, a port by which the compressed charge passes from the compression-cylinder to the working cylinder, the outlet of said port being so located as to be closed by the working piston except when the latter is at the end of its working stroke, and an exhaust-port for the working cylinder disposed in alinement with the discharge-opening of said first-named port, the arrangement being such that the charge is compressed in the compression-cylinder during the outward stroke of the working piston, and delivered to the working cylinder at the end of said stroke.

3. In a gas-engine, a crank-casing having an opening in the wall thereof formed with a cylindrical dome, a cylinder secured to said casing, said cylinder comprising a working cylinder, and a compression-cylinder into the latter of which said dome extends whereby said cylinder is made annular in form, the dome forming the inner wall thereof, a hollow piston surrounding said dome and in sliding contact therewith, said piston formed at one end to constitute the piston for the working cylinder and at its opposite end to provide an annular piston for the compression-cylinder, a gas-inlet to the compression-cylinder, a port by which the compressed charge passes from the compression-cylinder to the working cylinder, the outlet of said port being so located as to be closed by the working piston except when the latter is at the end of its working stroke, an exhaust-port for the

working cylinder disposed in alinement with the discharge-opening of said first-named port, the arrangement being such that the charge is compressed in the compression-cylinder during the outward stroke of the working piston, and delivered to the working cylinder at the end of the said stroke, and an air-relief pass communicating with the upper portion of the compression-cylinder and opening into the crank-chamber.

Signed by me at Springfield, Massachusetts, in presence of two subscribing witnesses.

ELWIN C. KAVANAUGH.

Witnesses:

WM. S. BELLOWS.

A. V. LEAHY