

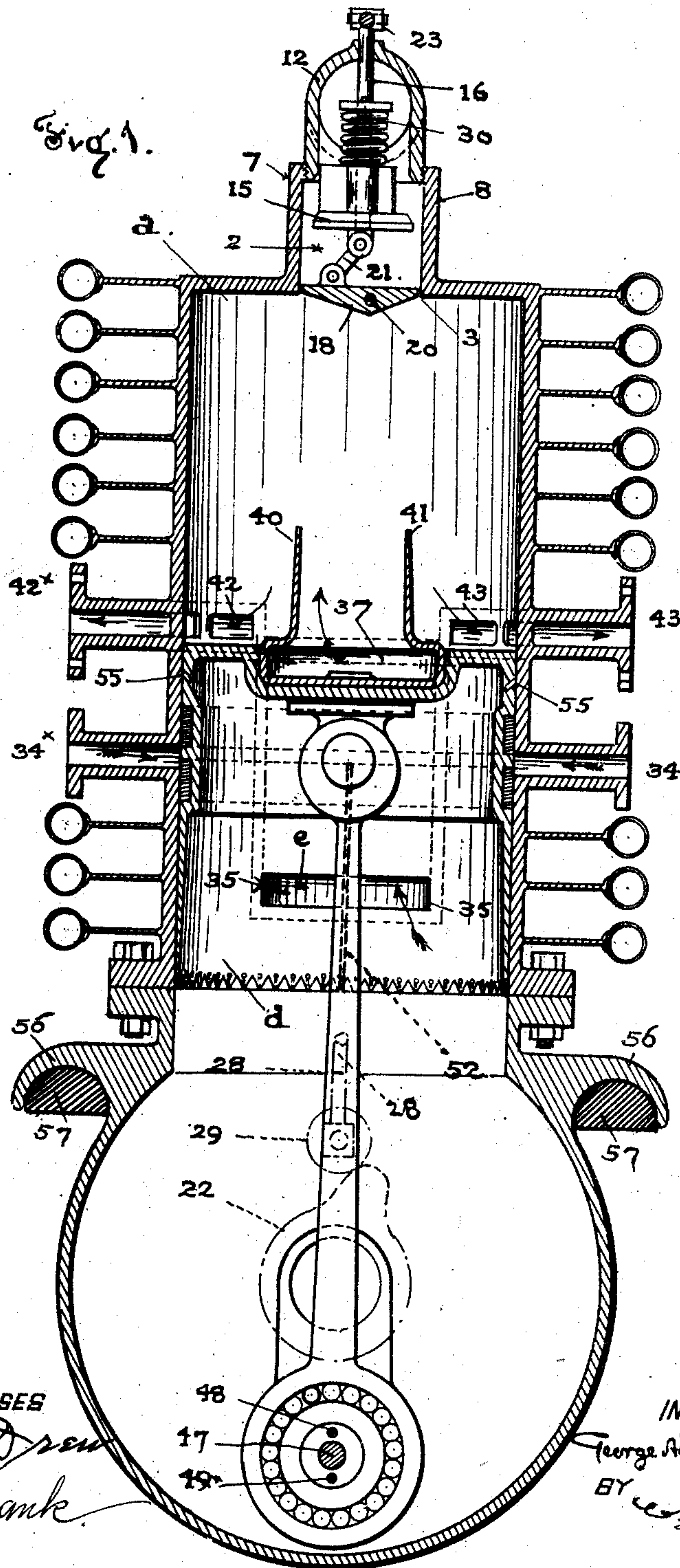
No. 883,511.

G. A. BEAUDET.
GAS ENGINE.

PATENTED MAR. 31, 1908.

APPLICATION FILED JULY 19, 1907.

3 SHEETS—SHEET 1.



WITNESSES

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L. M. Frank

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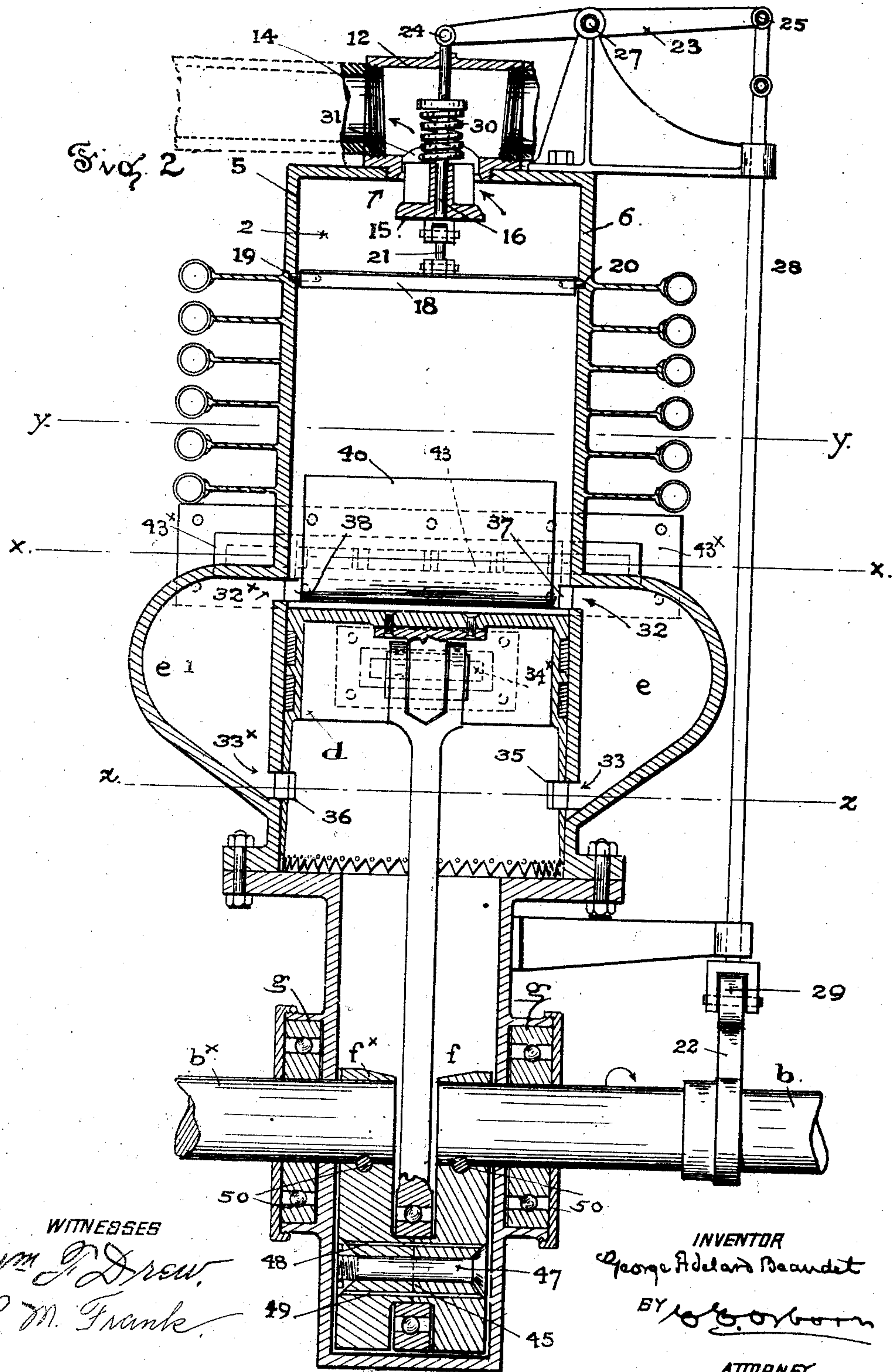
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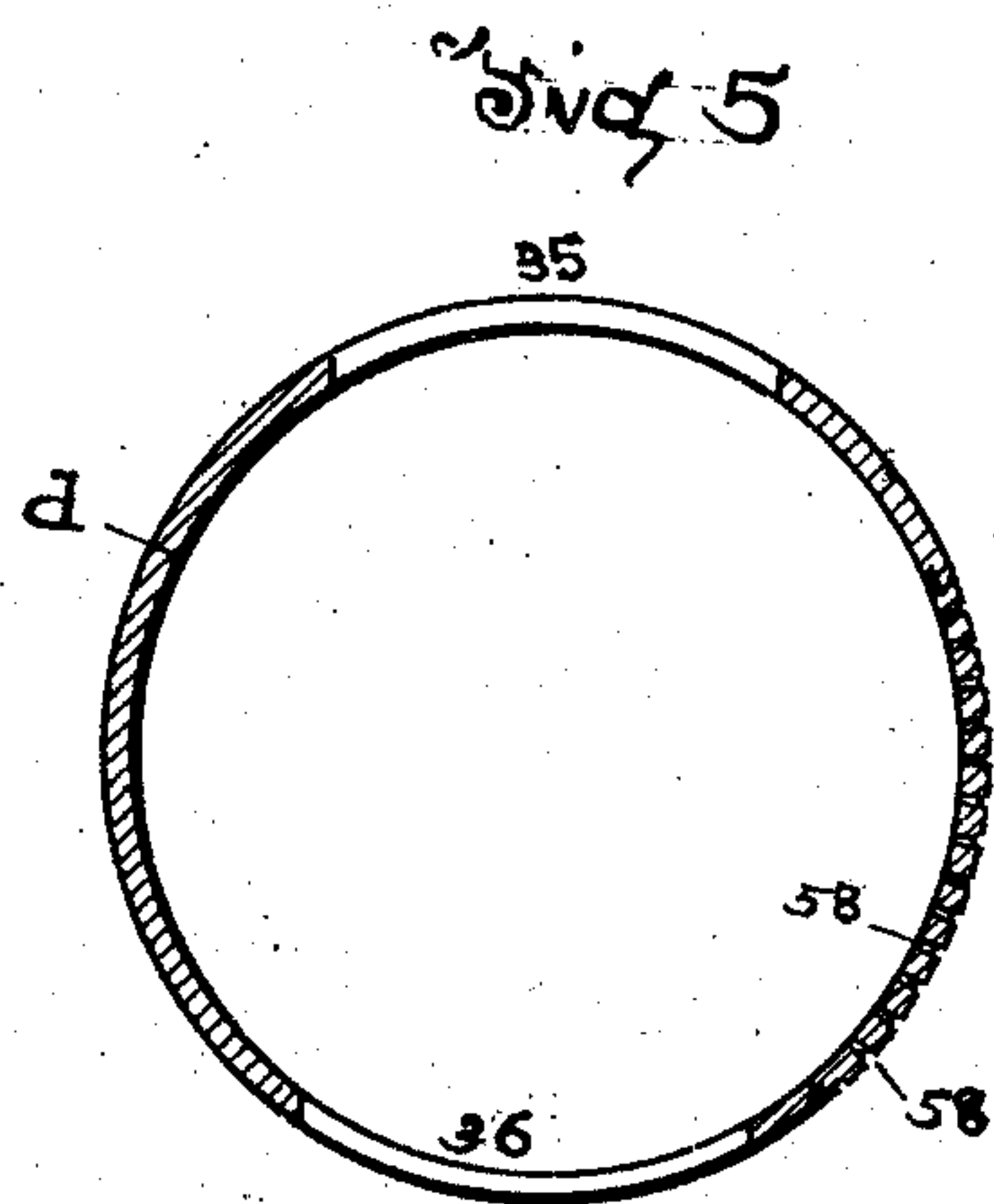
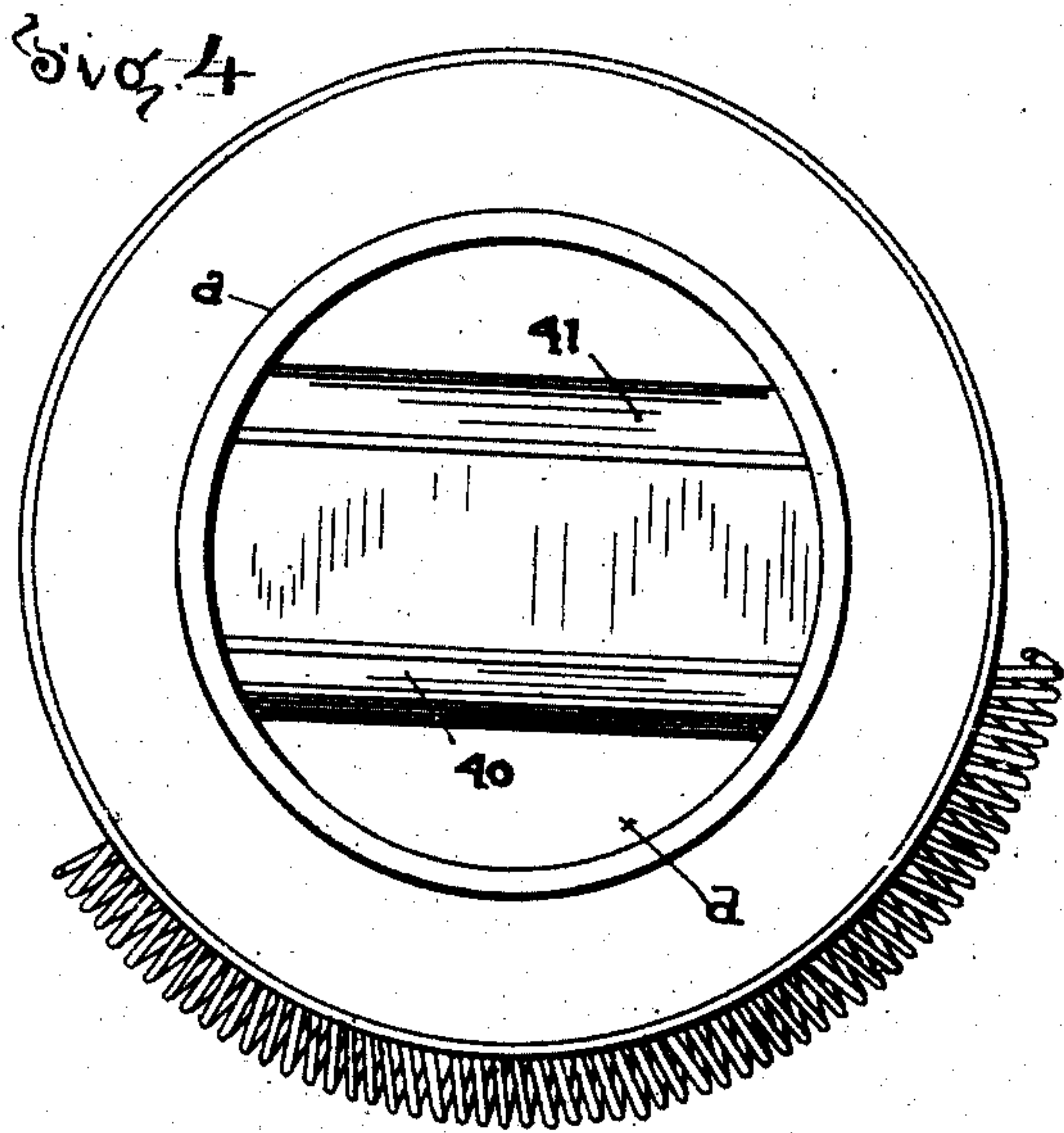
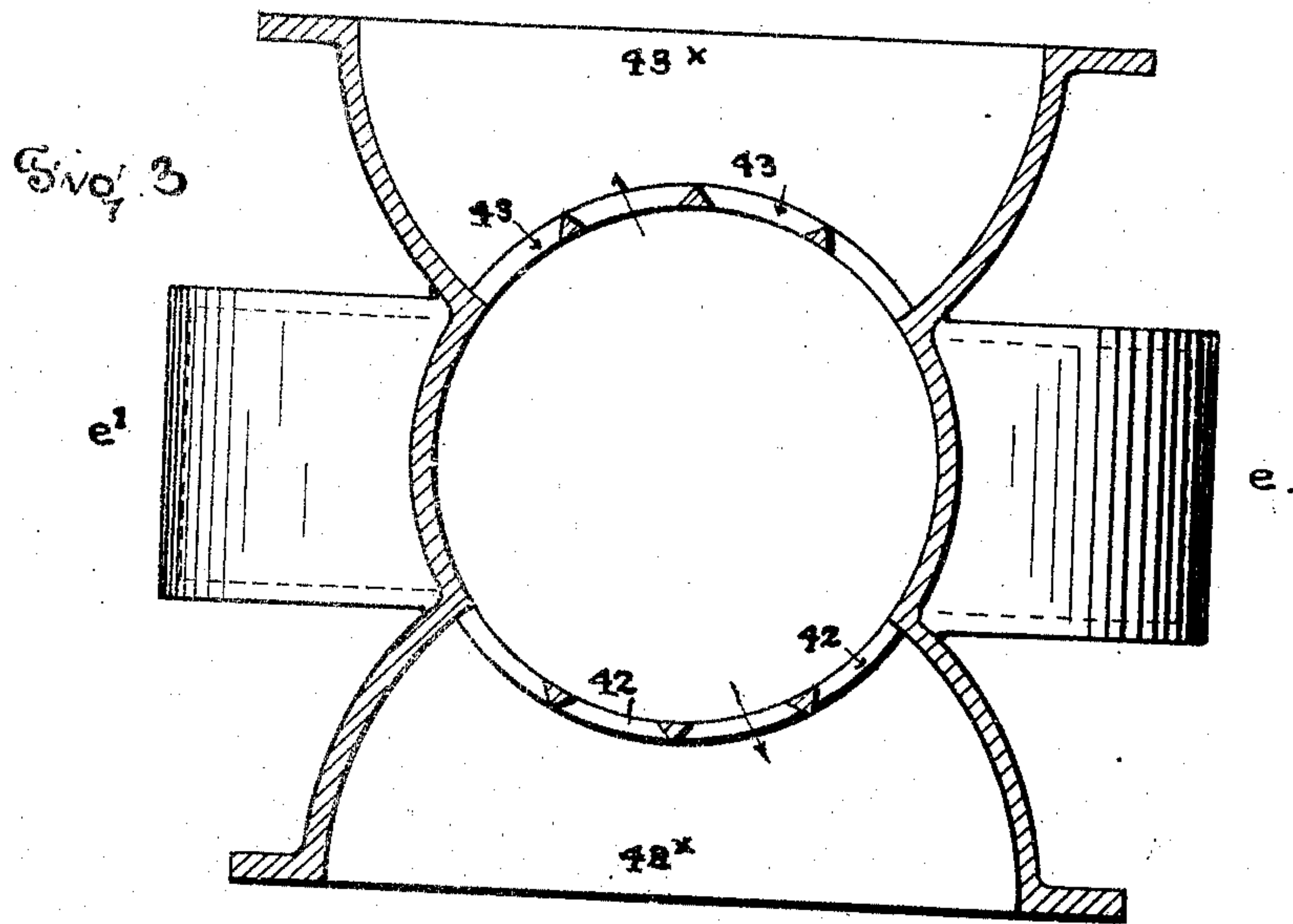
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WITNESSES

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GEORGE ADELARD BEAUDET, OF SAN FRANCISCO, CALIFORNIA.

GAS-ENGINE.

No. 883,511.

Specification of Letters Patent.

Patented March 31, 1908.

Application filed July 19, 1907. Serial No. 384,581.

To all whom it may concern:

Be it known that I, GEORGE ADELARD BEAUDET, a citizen of the United States, resident of the city and county of San Francisco and State of California, have invented new and useful Improvements in Gas-Engines, of which the following is a specification.

This invention relates to improvements made in two-cycle gas engines or motors, of the type or description that are employed at the present time for automobiles, and for other purposes where a high speed motor is required.

The invention has for its objects chiefly to simplify the construction of the parts and mechanism that control and regulate the admission of the gas to the combustion-chamber; to secure a practically complete and a rapid discharge of the waste products from the combustion-chamber and cylinder space after every explosion; and to obtain the full effect of the charge directly against the piston and in the direction of its movement at the time of explosion.

Another object of the invention is to provide a case or chamber of novel construction to contain and inclose the crank; the same being formed in one piece without joints other than that which joins or unites the cylinder-body to the case; whereby the dangers arising from leaks at the joints are avoided and the case is readily detached to give access to the cylinder and inclosed parts for cleaning or repairs.

These and other objects I attain in and by the construction and combination of parts illustrated in the accompanying drawings, and as explained at length in the following specification, wherein my said invention is described in detail with reference to the said drawings and in connection with other well-known parts, and is afterward pointed out in the claims at the end of this specification.

The said drawings represent the principal parts of the cylinder and piston, and the crank-shaft and connections of a gas-engine embodying my said invention; the other parts necessary to produce the complete engine or motor but forming no part of this invention, as, for example, the gas-supply pipes connecting the inlet-ports in the cylinder with the source of supply, and the exhaust conductors for carrying off the waste-products after every explosion; the means whereby the motion of the crank-shaft is ap-

plied to the part or machine to be driven; and the frame to support the engine being omitted from the several figures.

Figure 1 of the drawing is a vertical section taken diametrically through the cylinder, the piston and the crank-case of an engine of my invention, the section being taken in a plane at right angles to the crank-shaft. Fig. 2 is a similar section, taken in a plane parallel with the crank-shaft. Fig. 3 is a horizontal section, taken transversely through Fig. 2, on the line $x-x$. Fig. 4 is a similar section taken through $y-y$, Fig. 2. Fig. 5 is a similar section taken on the line $z-z$, Fig. 2.

One feature of the present invention comprises an explosion-chamber 2 situated on the head of the cylinder a outside of, but connecting directly with, the cylinder-space above the piston through a long and relatively narrow opening 3. Such opening is the full size of the cylinder-space diametrically in one direction; but in the direction at right angles thereto, or widthwise, it is of smaller dimensions, as from one side-wall 7, to the opposite side-wall 8 of the chamber 2. The end-walls 5-6 of the chamber 2 are a continuation of the perpendicular sides of the cylinder-body, so that the inclosed space extends diametrically across the top of the cylinder from one side to the other. This chamber 2 inclosed between these walls 5-6, 7-8, communicates directly with the cylinder-space through the narrow opening 3 in the bottom, and it has direct connection also with an exhaust through an opening in the top in which is fixed a T-coupling or union 12, for connecting and leading to an exhaust-pipe or conductor, as 14, from one side or the other. Such exhaust outlet is provided with a downwardly opening valve 15 fixed on the bottom of an upright stem 16, to the upper end of which is connected a valve-operating means actuated from the engine-shaft.

The outlet in the bottom of the chamber 2 communicating with the cylinder-space above the piston, is controlled by an upwardly-acting gate comprising a plate 18 of the proper size to close the opening when turned in a horizontal position—such plate being mounted on pivots 19-20 will stand in a perpendicular plane and open the chamber 2 when turned up vertically; or it will shut off communication between the cylinder-space and the chamber 2 when turned down horizontally—it being understood that

the position of the cylinder is generally upright. By connecting the gate 18 with the exhaust outlet valve 15, by means of a link 21, as shown in Figs. 1 and 2 the same means that acts on the exhaust-valve 15 will act on the gate 18 in such manner that when one is opened the other will be closed. In the means illustrated in the drawings, the outlet-valves are operated through the medium of a face-cam 22 fast on the crank-shaft $b-b^x$; a rocking-lever 23 attached at one end 24 to the stem 16 of the valve, and at the end 25 on the opposite side of the pivot 27 having attached to it a lifting-rod 28, on the foot of which is a roller 29 resting on the cam 22. A coiled-spring 30 interposed between a fixed collar 31 on the valve-stem and a stationary-guide fixed in the valve-opening, insures a close and even seating of the valve, by reason of the spring being placed around the valve-stem and arranged to press upward against the collar.

The outlet valve and the gate are so timed in their movements with respect to the strokes of the piston d that the outlet valve is opened, and the chamber 2 is cut off from communication with the cylinder space between such chamber and the piston, before the ports are uncovered to admit the gas to the said part of the cylinder; and their positions are not reversed, that is to say, the outlet valve closed and the gate opened, until the said ports have been closed by the movement of the piston on its up stroke. The parts remain in the last described position until after the explosion takes place, which occurs at the moment the crank passes the center.

The arrangement of the admission-ports 32—33 in the side-walls of the cylinder provides for controlling and regulating the admission of the gas in proper quantities or charges entirely by the movements of the piston, thereby dispensing with valves and more or less complicated valve-mechanism; and in this feature of my invention provision is made also for taking in and maintaining a body of gas in the lower part of the cylinder and in the crank-case, which is made to form an extension or continuation of the cylinder-space below the piston. This gas-holding space, which is designed to hold in reserve a much greater quantity of gas than is required for the charge, is further increased in dimension by the chambers $e-e^1$ on the sides of the cylinder-body covering the admission-ports, and those ports 32—32 x , 33—33 x are so arranged as to admit the gas into the cylinder-space both above and also below the piston. The positions of these ports are represented in Figs. 1 and 2.

The admission-ports 32—32 x , and 34—34 x provide for a full admission of gas to the cylinder-space in every charging period under all conditions of speed; and also insure

the proper quantity of gas for a fresh charge and to expel the burned gases remaining in the space above the piston after the explosion, and particularly when the engine is traveling at high speed.

As the piston in this engine forms the valve or controlling means for the admission-ports, it is provided with openings 35—36 in the sides below the piston-head, and also with openings 37—38 higher up, the latter being about on a level with the top of the piston-head.

The upper openings 36—37 in the piston are closed in on the sides by wings or standing-plates 40—41 fixed across the top of the piston-head, and extending perpendicularly upward in such position that the space inclosed between them is about the same width as the explosion-chamber 2 at the top of the cylinder. The function of these "wings" is to prevent the charge of gas at the moment of its admission to the cylinder-space above the piston—as it enters through the passages $e-e^1$ and ports 32—32 x —, from spreading laterally and mixing with the waste-products that may remain in the lower part of the cylinder-space after the explosion. These "wings" act, therefore, to direct the bulk of the entering charge of gas upwards towards the top of the cylinder ahead of the piston, and to shut in or confine such charge of gas, or the bulk of it that it will pass into and be compressed within the chamber 2 by the up-stroke of the piston. The length of such up-stroke is so regulated that the head of the piston will be brought almost up to the head of the cylinder at the end of its stroke, and only sufficient room will exist for clearance. Every charge of gas taken in, is thus compressed and fired within the explosion-chamber.

Among the novel features of this invention the direct exhaust from the chamber 2 provided through the outlet 12, in addition to the exhaust-ports 42—43 lower down, is an important part of the invention, in that the same effect a complete and a rapid discharge and clearing out of the waste-products from the upper end of the cylinder-space where the charge is fired, and also a direct outlet from the lower part of the cylinder-space into which the dead gases or a portion of the waste-products is drawn by the descending piston after every explosion. The chamber 2 is a compression-chamber and an explosion-chamber for the fresh charge of gas; or it is an exhaust-chamber for the waste-products after the explosion, according as communication is established with the cylinder-space by opening the gate 18 and closing the valve 15, or as the chamber is shut off from the cylinder-space and opened to the exhaust. But while the main-exhaust is cut off from the cylinder-space after every explosion before the fresh charge of gas is ad-

mitted to the cylinder, the supplementing-exhaust outlets 42—43 being situated in the lower part of the cylinder are so arranged as to be uncovered during the moment that the charge of gas begins to pass into the cylinder above the piston, and thereby afford a ready outlet for the dead gases in the lower part of the cylinder.

Ample outlet and discharge for the waste-products from the lower part of the cylinder-space as well as from the upper part are afforded by providing two sets of exhaust-ports 42—43, one diametrically opposite to the other. A rapid charging of this cylinder is also provided by the arrangement of the chambers *e, e'* on opposite sides of the cylinder, as well as by connecting the crank-case with such supply-chambers and with the cylinder-space through the passages and ports, as herein before described.

The crank shaft is represented as being formed of two sections *b, b'* suitably mounted in the crank case, and carrying at their inner ends the crank arms *f, f'*. These arms are suitably united, as by means of a connecting bolt 47, which passes through abutting bosses, carried by the crank arms and constituting the wrist pin with which is connected one end of the piston rod. This crank has the advantage of being easily set and secured in place on the shaft-sections *b—b'* through the open top of the crank-case *c* before the latter is set and bolted in place on the cylinder. In that operation the two crank-members are placed in position and the piston-rod is attached by placing the bosses together after inserting them through the eye on the end of the piston-rod, and then inserting the bolts and locking-pins as before described; this being done before the crank is dropped into the crank-case *c* from above. Then the eyes or the crank-members are brought in line with the bearings on the sides of the crank-case, and the ends of the shaft sections *b—b'* are inserted from opposite sides and secured in the crank-members by driving in the pins or keys 50. Finally the top-flange on the crank-case is set against the bottom flange on the cylinder-body, and the two are secured together by the bolts, after the piston has been set into the cylinder through the open lower end.

In the general construction of the cylinder-body and the crank-case in this engine the admission-ports and the exhaust-ports are arranged and disposed with a view to allow two or more engines to be set closely together and connected with a common supply-conductor and a common exhaust-conductor.

The main exhaust-outlet on the top is therefore provided with screw-threaded coupling sockets on opposite sides, and the supplementary exhaust 43—43' below are so placed as to be conveniently connected with

exhaust-pipes extending horizontally along the frame or truck on opposite sides of the cylinders; each cylinder being suspended between the carrying-rods or bars 57 of the truck by the yokes 56 on the crank-case.

What I claim and desire to secure by Letters Patent, is:—

1. In a gas engine, the combination of a cylinder having an exploding-chamber communicating with the cylinder-space through a valve-controlled opening, means operating to open the exploding-chamber to the cylinder-space when the cylinder is taking in gas and to shut off communication of said chamber with the cylinder-space after the explosion of the charge, a valve-controlled exhaust-outlet leading from the exploding-chamber, means operating to open the said chamber to the exhaust when said chamber is closed to the cylinder-space, and to close it to the exhaust when the cylinder-space is in communication with the said chamber, and a supplemental exhaust-outlet leading from the lower part of the cylinder-space and arranged to open said space to the exhaust when the piston is at the end of its stroke after an explosion.

2. In a gas engine, an explosion-chamber in communication with the cylinder-space in front of the piston through a valve-controlled opening in the head of the cylinder, and having an exhaust-outlet; a controlling-valve to said outlet; means actuated from the engine-shaft operating said valves to simultaneously open one valve and close the other; and a supplemental exhaust leading out from the lower part of the cylinder-space, and so arranged with relation to the portion of the cylinder-space traversed by the piston as to be uncovered by the piston at the end of the stroke and to be closed in the upstroke of the piston before compression of the fresh charge of gas takes place.

3. In a gas engine, the combination of a cylinder having an exploding-chamber in communication with the cylinder-space in front of the piston through a valve-controlled opening; a valve controlled exhaust-outlet leading out from said exploding-chamber; valve-operating means connected with said valves and adapted to simultaneously open one valve and close the other, whereby the exhaust-outlet is closed when communication is opened between the exploding-chamber and the cylinder-space, or the exploding-chamber is cut off from the cylinder-space when the said chamber is opened to the exhaust; a piston having deflecting-plates on the piston-head and gas-inlet apertures in the sides below the head, said apertures being arranged to deliver the gas for the charge within the space inclosed by the deflecting-plates.

4. In a gas engine, the combination of a cylinder having an exploding-chamber on

the head in communication with the cylinder-space in front of the piston through a contracted opening of a length approximately equal to the diameter of the cylinder in one direction, but of relatively narrow width transversely; an exhaust-outlet in said exploding-chamber; a pivoted gate adapted to close or open communication between the exploding-chamber and the cylinder-space, according to the position given to the gate; a supplementary exhaust-outlet from the lower part of the cylinder-space adapted to be uncovered when the piston is at the lowest point of the stroke; gas-inlet ports in the sides of the cylinder so arranged as to be opened and closed to admit and cut off the gas at the end of the down-stroke and the beginning of the upstroke of the piston; and means actuated from the piston actuated shaft for simultaneously operating the gate and the exhaust-valve of the exploding-chamber.

5. In a gas engine, the combination, with the cylinder, of the exploding-chamber communicating with the cylinder-space above the piston through a relatively narrow opening; an exhaust-outlet from the exploding-chamber; a piston having gas-inlet ports through which gas is admitted from the cylinder-space below the piston into the cylinder-space above it; the deflecting plates on the piston-head adapted to confine the incoming gas and direct the bulk thereof into the exploding-chamber in the ascending stroke of the piston; and means operating the controlling-valves between the exploding-chamber and the cylinder-space and between the said chamber and the exhaust-outlet, whereby the said chamber constitutes a compressing and exploding-chamber when it is opened to the cylinder-space below, or an exhaust-chamber when it is opened to the exhaust outlet.

6. In a gas-engine, the combination of the cylinder; the exploding-chamber communicating with the cylinder-space through a relatively narrow opening in the bottom of said chamber; the exhaust-outlet in the top of the chamber; a downwardly-acting valve fitted to seat therein; a pivoted gate in the bottom of the chamber; a link connecting the said gate and the exhaust-valve; and means for simultaneously operating said gate and valve from the movements of the piston-actuated shaft to close one when the other is opened.

7. In a gas-engine, a cylinder having an exploding-chamber communicating with the cylinder-space in front of the piston through an opening in the cylinder-head; a gate adapted to close said opening; an exhaust-outlet from said chamber having a controlling valve; means connecting said gate and valve whereby one will be opened as the other is being closed; and means for operating the ex-

haust-valve from the movements of the engine-shaft, to close the exhaust-outlet in the exploding-chamber and establish communication between the said chamber and the gas-containing space of the cylinder in the compressing stroke of the piston, and to open the said exhaust-outlet and close the exploding-chamber to the cylinder in the return-stroke of the piston.

8. In a gas-engine, a cylinder having gas-containing compartments situated on opposite sides of the cylinder, ports in the cylinder-body through which said compartments are in communication with the cylinder-space; a crank-case removably secured to the lower end of the cylinder, and adapted to wholly contain and inclose the crank, the space within the said case forming a gas-containing compartment in direct communication with the cylinder-space; in combination with a tubular piston comprising a closed head and a cylindrical body having admission-ports in the sides below the head so arranged as to register with the ports in the cylinder-body when the piston is at that point in its stroke where the charge of gas is to be admitted, and an exhaust-outlet from the cylinder-space through the sides of the cylinder, adapted to be uncovered by the piston in the descending stroke, and to be covered in the contrary movement of the piston, the said exhaust-outlet being so arranged with relation to the admission-ports that the exhaust will be uncovered during the first admission of the charge of gas into the cylinder-space for clearing out the dead gas, but will be covered by the piston in advance of the complete closing of the admission-ports.

9. In a gas-engine, a cylinder having gas-containing compartments on the sides, an open lower end provided with a flange, and a removable crank-case having a cylindrical top, detachably united to the bottom of the cylinder by a flange, and a flattened body adapted to contain and wholly inclose the crank, the space within said case being in direct communication with the gas-containing compartments through the cylinder-space, and adapted in connection with said compartments to hold a body of gas in excess of the quantity required for the charge, admission-ports in the cylinder-body opening into said gas-holding space, and a tubular piston having a closed head, and provided with apertures in its sides below the head adapted to register with the admission-ports at the end of the descending-stroke; the said admission being arranged to be uncovered and thereby admit gas into the space inclosed by the crank-case in the ascending stroke of the piston.

10. In a gas engine, the combination of a cylinder having an exploding chamber communicating with the cylinder space, a valve or gate controlling the opening between the

said chamber and cylinder space, a valve-controlled exhaust connection leading from the exploding chamber, means arranged to control the said valve to open the exploding
5 chamber to the cylinder space while the charge is being compressed and when the explosion takes place, and at the same time to close the said exhaust connection, and to operate the valve to close the communication

between the exploding chamber and the 10 cylinder space, and to open the exhaust, after the explosion of a charge, and a supplemental exhaust for the said cylinder-space.

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Witnesses:

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