No. 665,665. Patented Jan. 8, 1901.

L. H. SOLOMON.

GAS ENGINE.

(Application filed Oct. 8, 1898.)

(No Model.) 2 Sheets—Sheet 1.

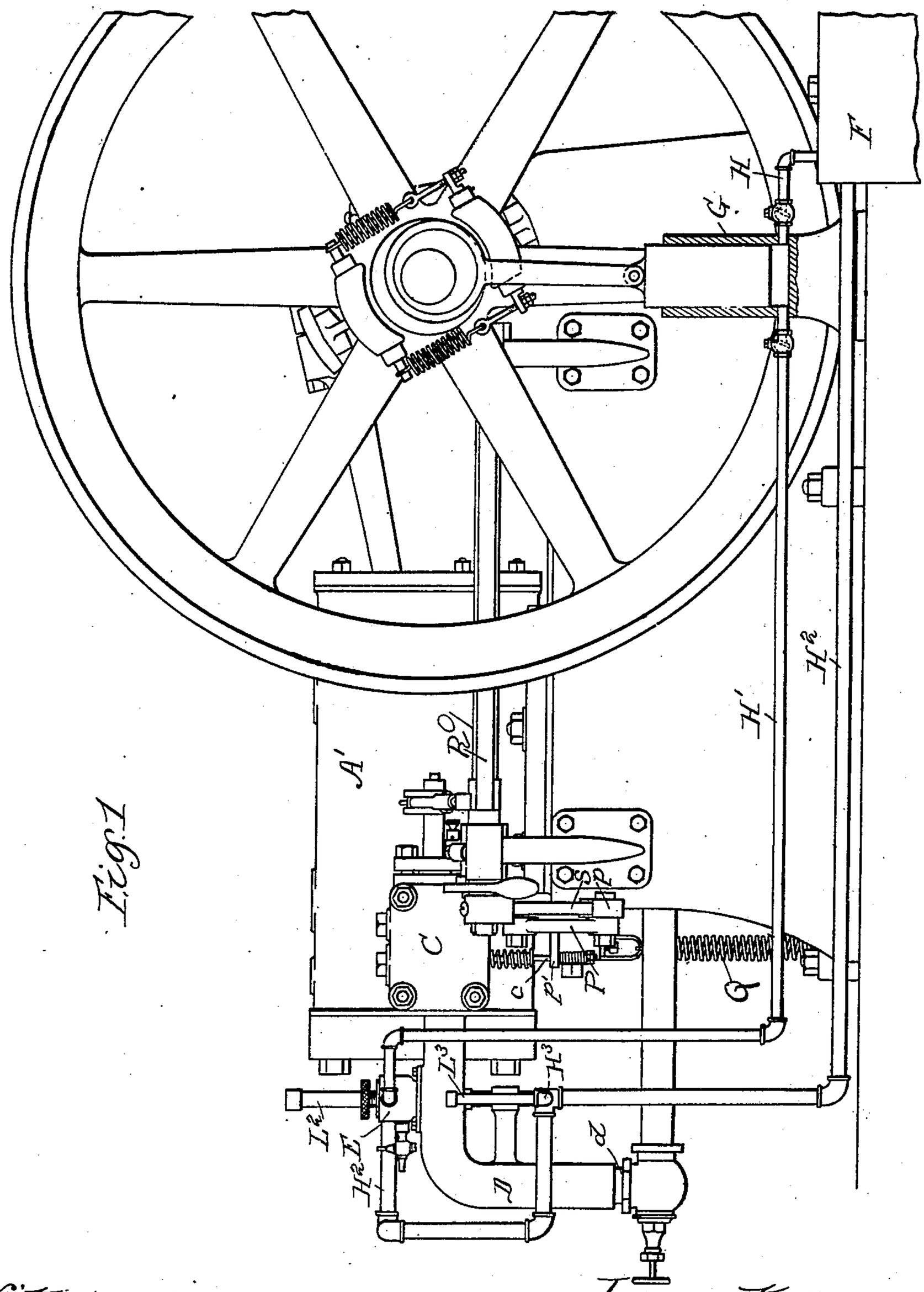

Fig. 1.

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Fig. 3.

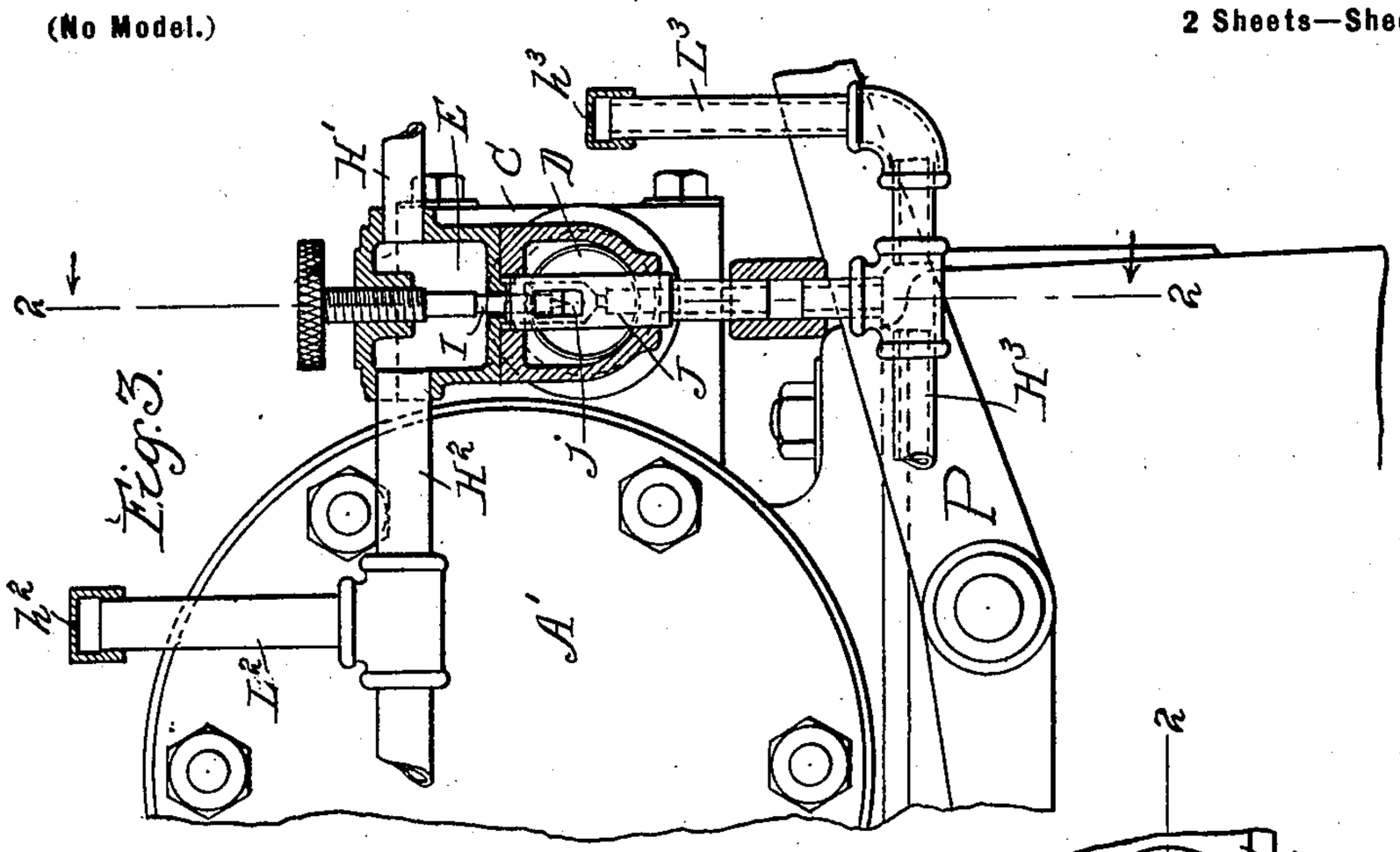


Fig. 4.

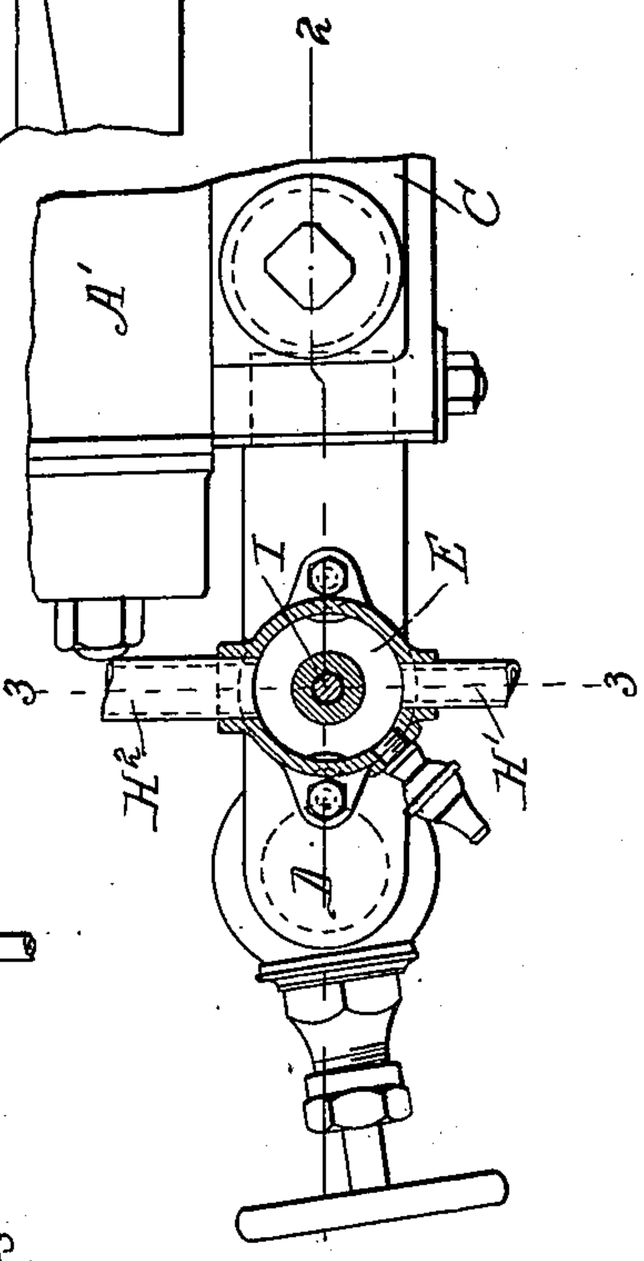
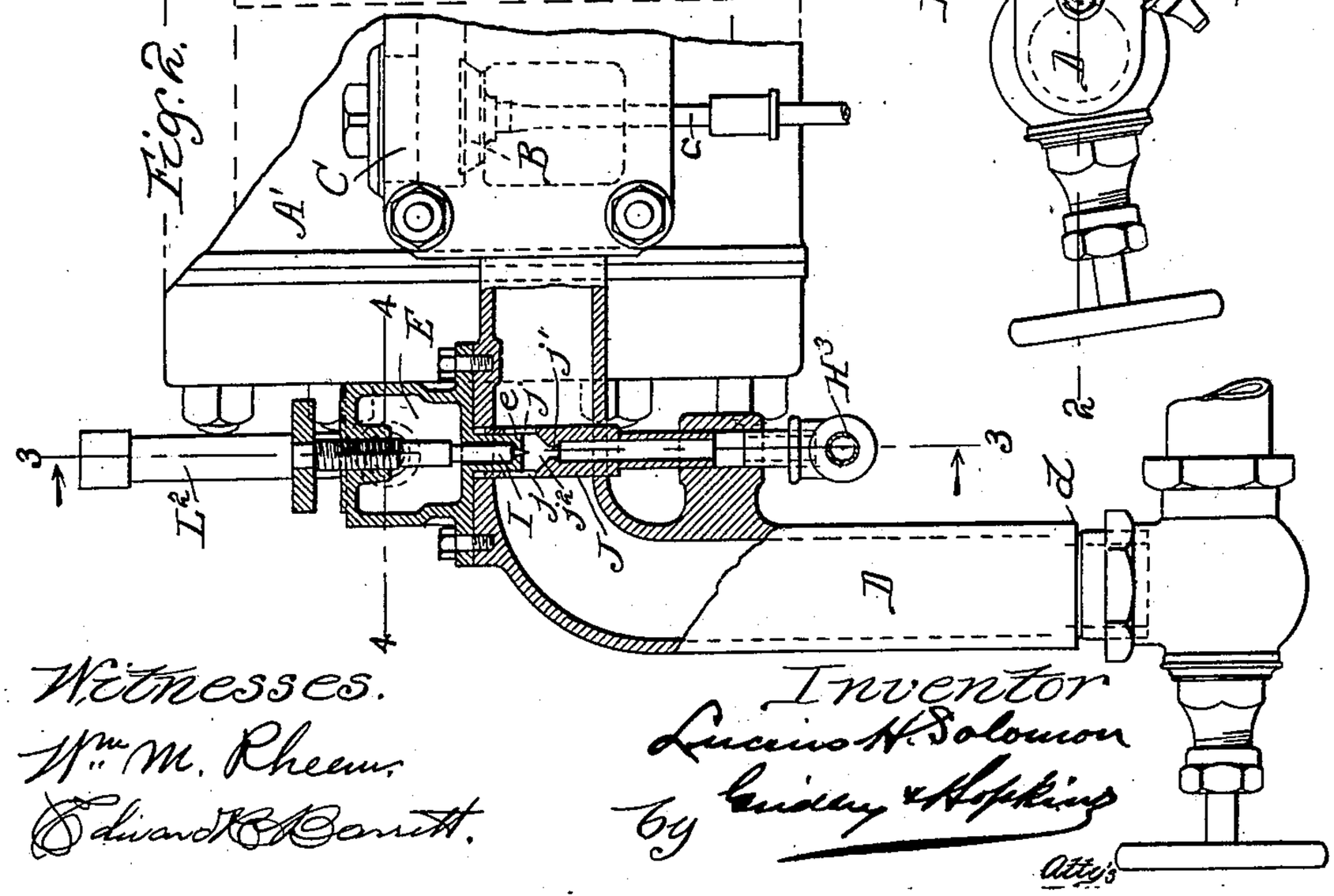


Fig. 2.



Witnesses.
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UNITED STATES PATENT OFFICE.

LUCIUS H. SOLOMON, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE WEBSTER MANUFACTURING COMPANY, OF SAME PLACE.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 665,665, dated January 8, 1901.

Application filed October 8, 1898. Serial No. 693,038. (No model.)

To all whom it may concern:

Be it known that I, LUCIUS H. SOLOMON, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Gas-Engines, of which the following is a specification.

The present invention relates to that class of engines which in operating vaporize a liquid hydrocarbon and mix with the vapor thus produced a suitable quantity of air to form an explosive mixture; and the object of the invention is to provide improved means for forming this mixture.

The invention consists in the features of novelty that are hereinafter described, and shown in the accompanying drawings, which are made a part of this specification, and in which—

Figure 1 is an elevation of a gas-engine embodying the invention. Fig. 2 is an enlarged vertical section of a portion thereof on the line 2 2, Figs. 3 and 4. Fig. 3 is an enlarged vertical section of a portion thereof on the line 3 3, Figs. 2 and 4. Fig. 4 is an enlarged horizontal section of a portion thereof on the line 4 4, Fig. 2.

A represents the piston; A′, the cylinder; B, the valve for controlling the inlet-port thereof; C, the chest containing the valve, and D a passage communicating at one end with the valve-chest and having its other end open for the admission of air. This air-passage may terminate in direct communication with the external atmosphere, as shown at *d* in Fig. 2; but where petroleum or heavy oil is used I prefer to continue it to a point below the cylinder, which is inclosed by the engine-bed, as shown in Fig. 1, as the air at this point is hot and the heat will aid vaporization.

The oil to be vaporized is introduced into this air-passage continuously and at a uniform rate. A portion of the stream of oil is exposed to the direct action of air traversing the passage under the influence of the induction-stroke of the piston with the result that the exposed portion of the stream of oil will be cut off by the air and carried into the cylinder, this exposed portion of the stream of oil being the only body of oil that can be drawn upon for supplying the cylinder. Preferably the oil traverses the air-passage in a direction at right angles to that in which the air traverses it. This is best accomplished by leading the oil through a duct which extends vertically through the air-passage and supplying this duct with oil from a source the head of which is kept uniform, so that the oil will always flow at the same rate. The exposed portion of the stream of oil is preferably very short and is not varied during the operation of the engine, my aim being to provide for each and every charge of the engine a never-varying quantity of oil, the quantity provided being exactly the quantity necessary for the charge. All of this may be accomplished by the following means:

E is a chamber forming a part of a circulating system which in addition to said chamber comprises a main oil-reservoir F, a pump G, actuated by the engine, a pipe H, leading from the reservoir to the pump, a pipe H′, leading from the pump to the chamber E, and an overflow-pipe H^2, leading from the upper portion of the chamber E back to the reservoir, so that no part of the overflow from this chamber E enters the air-inlet passage. By this means the chamber E is kept filled with oil to the level of its overflow-opening. At bottom the chamber E has an extension *e*, which extends downward through an opening in the upper part of the wall of the air-passage D and terminates above the center of said passage. In its lower end it has a contracted orifice, and this orifice is controlled by a valve I. A sleeve J passes through an opening in the bottom wall of the air-passage D and at its upper part surrounds the extension *e*, the sleeve and extension being portions of the oil-duct. The oil-duct is provided with a short well-defined breach, through which a short well-defined portion of the stream is exposed to the action of the air passing through the air-passage, said breach being invariable during the operation of the engine. This breach may be made by providing the sleeve at diametrically opposite points with lateral openings *j*, extending both above and below the lower end of the extension *e*, said openings forming, in fact and in effect, a port which is transverse to the oil-duct and paral-

lel with the air-passage and the course of the air which passes through it. Upon opposite sides of the breach thus formed the walls of the oil-duct completely protect the stream of oil from the action of the air passing through the air-passage. Below the breach the oil-duct has a contracted throat j', and above this throat it has a well j^2 for conducting oil which falls into it to the throat j', whence it escapes into the lower part of the sleeve, which latter is in communication at its lower end with an overflow-pipe H^3, communicating with the overflow-pipe H^2. By these means a stream (the term "stream" being intended to comprehend a succession of drops) of oil uniform and invariable in all respects is caused to flow constantly into the transverse breach of the oil-duct. When the piston makes its induction-stroke, if the speed of the engine is not above normal the induction-valve B opens and a current of air is drawn through the passage D. A portion of this current of air enters the transverse breach of the oil-duct and impinges against the short exposed portion of the stream of oil, whereby so much of the stream as is exposed at the breach is cut off and carried into the cylinder, those portions of the stream that are upon opposite sides of the breach being protected from the action of the air by the walls of the duct. When the piston completes its induction-stroke and at all other times when there is no current of air traversing the air-passage, the oil will flow in a continuous stream past the breach; but the entire stream will find its way to the overflow-pipe H^3 and thence to H^2 and back to the reservoir.

At the outset the quantity of oil flowing through the duct of the mixer is regulated by the valve I, and the quantity of air admitted to the exposed portion of the stream of oil may be regulated by adjusting the size of the breach, and this may be done by adjusting the parts *e* and J relatively to each other. To this end the sleeve J may have a snug fit upon the extension *e* and also in the opening in the lower side of the air-passage D, through which it passes, the fit being such that by the aid of proper tools the sleeve J may be moved up or down, as may be necessary, in order to adjust the size of the breach of the oil-duct, it being the intention that when this adjustment is once accomplished before the engine leaves the shop it will not be necessary to thereafter change it. In other words, the breach is not varied during the running of the engine. It will be seen upon reference to the drawings that the breach of the oil-duct is very short as compared with the air-passage D. In practice the length of this breach varies from three-eighths of an inch for a two-and-one-half-horse-power engine to three-fourths of an inch for a twenty-horse-power engine. With such a breach the entire length of the exposed portion of the stream of oil will be cut off by the air and carried into the cylinder at each inspiration of the engine, and this is so whether the engine is running at high speed or at low speed. This has the advantage of supplying the cylinder with absolutely the same quantity of oil at every inspiration, and this is possible only when the breach is so short that even when the engine is running at high speed the stream of oil will have time to traverse the entire length of the breach and re-form its exposed portion between successive inspirations and when the length of the breach is not varied during the running of the engine.

In order to facilitate the flow of oil through the overflow-pipes, their interiors are kept at atmospheric pressure, and this is done by providing them with vents h^2 and h^3, that are open to the atmosphere, and in order to prevent the escape of oil through these vents they are located above the highest level to which it is possible for the oil to flow and in risers L^2 L^3, that communicate with the pipes H^2 and H^3, respectively.

With a mixer in which the oil is at all times exposed to the air in the air-passage when the engine governs it is necessary to keep the induction-port closed and to open some other port (preferably the exhaust-port) for the admission of a non-explosive fluid to the cylinder in order to prevent the formation of a vacuum. This may be done by many of the well-known valve-gears, one of which is shown in the drawings. Briefly described, it consists of a shaft O, which derives its rotation from the main shaft of the engine and carries a cam arranged in operative relation to the end of a lever P, which is fulcrumed to the engine-bed, as shown more clearly in Fig. 3. On the exhaust side of the engine the lever P is connected with the stem of the exhaust-valve, so that when the cam comes in contact with the end of the lever on the induction side of the engine it will depress it and throw the other end of the lever up, thus opening the exhaust-valve, a spring Q being provided for the purpose of closing said valve. When the speed of the engine exceeds normal, the governor-balls will move and in doing so partially rotate a rock-shaft R, which carries an arm S, so disposed that its end may be moved into position to engage a roller *p*, carried by the lever P, and when in such engagement hold the lever P in the position to which it is moved by the cam on the shaft O, thus holding the exhaust-valve open and permitting the induction-valve to remain closed during the induction-stroke. In order to guard against the accidental opening of the induction-valve when the exhaust-valve is thus held open, the lever P is provided also with a lug p', through which the stem *c* of the induction-valve passes, a spring being interposed between said lug and a part carried by the valve-stem *c* for the purpose of exerting a downward pressure upon the valve-stem and holding the valve seated.

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

1. In a gas-engine, the combination with the cylinder, the piston and an air-passage through which air is drawn into the cylinder by the action of the piston, of an oil-duct, and means for causing a uniform stream of oil to flow constantly therethrough, said duct being provided with a breach opposite which a portion of the stream of oil is at all times exposed to the direct action of the air in the air-passage, whereby at each inspiration of the engine the air traversing said passage takes up the oil exposed at the breach, and only the oil so exposed, the breach being of such length that it exposes the exact quantity of oil necessary for a single charge, substantially as set forth.

2. In a gas-engine, the combination with the cylinder, the piston and an air-passage through which air is drawn into the cylinder by the action of the piston, of an oil-duct, and means for causing a uniform stream of oil to flow constantly therethrough, said duct having a portion provided with a breach opposite which a portion of the stream of oil is at all times exposed to the direct action of the air in the air-passage, whereby at each inspiration of the engine the air traversing said passage takes up the oil exposed at the breach, and only the oil so exposed, the portion of the duct having the breach being so disposed that the exposed portion of the stream of oil travels in a direction which is transverse to the direction of the current of air passing through the duct, and said breach being of such length that it exposes the exact quantity of oil necessary for a single charge, substantially as set forth.

3. In a gas-engine, the combination with the cylinder, the piston and the air-passage through which air is drawn into the cylinder by the action of the piston, of an oil-duct, and means for causing a uniform stream of oil to flow constantly therethrough, said duct having, within the air-passage, a portion which is transverse to the current of air passing through the passage, and which is provided with a breach opposite which a portion of the stream of oil is at all times exposed to the direct action of the air in the passage, whereby at each inspiration of the engine the air traversing said passage takes up the oil exposed at the breach, and only the oil so exposed, the breach being of such length that it exposes the exact quantity of oil necessary for a single charge, substantially as set forth.

4. In a gas-engine, the combination with the cylinder, the piston and an air-passage having a portion through which air travels horizontally on its way to the cylinder under the action of the piston, of an oil-duct, and means for causing a uniform stream of oil to flow constantly therethrough, said duct being provided, within the aforesaid portion of the air-passage, with a vertical portion having a breach opposite which a portion of the stream of oil is at all times exposed to the direct action of the air in the air-passage, whereby at each inspiration of the engine the air traversing said passage takes up the oil exposed at the breach, and only the oil so exposed, the breach being of such length that it exposes the exact quantity of oil necessary for a single charge, substantially as set forth.

5. In a gas-engine, the combination with the cylinder, the piston and an air-passage having a horizontal portion through which air travels horizontally on its way to the cylinder under the action of the piston, of an oil-duct having within the horizontal portion of the air-passage a vertical portion provided with a breach, and means for causing a uniform stream of oil to flow constantly through said vertical portion of the oil-duct in a downward direction, whereby a portion of the stream of oil is at all times exposed to the direct action of the air in the air-passage, and whereby at each inspiration of the engine the air traversing said passage takes up the oil exposed at the breach, and only the oil so exposed, the breach being of such length that it exposes the exact quantity of oil necessary for a single charge, substantially as set forth.

6. In a gas-engine, the combination with the cylinder, the piston and an air-passage through which air is drawn into the cylinder by the action of the piston, of an oil-duct having within the air-passage a vertical portion provided with a breach, and means for causing a uniform stream of oil to flow constantly therethrough in a downward direction, whereby at each inspiration of the engine the air traversing said passage takes up the oil exposed at the breach, and only the oil so exposed, the oil-duct being provided below the breach with a contracted throat and below said throat with an enlarged portion, the portion of the duct below said contracted throat serving as an overflow-pipe for surplus oil, substantially as set forth.

7. In a gas-engine, the combination with the cylinder, the piston and the air-passage, of an oil-duct passing transversely through said passage so that the air traversing the passage passes by the duct, and means for causing a uniform stream of oil to flow constantly therethrough, said duct having a short well-defined breach, consisting of a port which is transverse to the duct and parallel with the air-passage, through which a short well-defined portion of the stream of oil is exposed and through which a portion of the air may pass, whereby at each inspiration of the engine that portion and only that portion of the stream of oil that is opposite the breach is cut off by the air, substantially as set forth.

8. In a gas-engine, the combination with the cylinder, the piston and the air-passage, of an oil-duct passing vertically through said passage, and means for causing a uniform stream of oil to flow downward therethrough constantly, said duct having within the air-

passage a well-defined breach shorter than the diameter of the air-passage through which a short well-defined portion of the stream of oil is exposed and through which a portion of the air passes and impinges directly against the exposed portion of the stream of oil, the oil-duct having below said breach a contracted throat and below this an enlarged overflow-pipe, whereby at each inspiration of the engine that portion of the stream of oil that is exposed at the breach is cut off by the air, substantially as set forth.

9. In a gas-engine, the combination with a mixer, of an oil-circulating system comprising a reservoir, a pipe leading therefrom, a pump incorporated in said pipe, a chamber into which the pipe discharges, means for conducting oil from said chamber to the mixer, and an overflow-pipe returning from said chamber to the reservoir, said overflow-pipe being provided with a vent open to the atmosphere, substantially as set forth.

10. In a gas-engine, the combination with a mixer, of an oil-circulating system comprising a reservoir, a pipe leading therefrom to the mixer, means for causing oil to flow constantly through said pipe to the mixer, and an overflow-pipe returning from the mixer to the reservoir, said overflow-pipe being provided with a vent open to the atmosphere, substantially as set forth.

11. A mixer for gas-engines having an overflow-pipe provided with a riser, and a vent in said riser above the high level of the liquid in said pipe, substantially as set forth.

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Witnesses:
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