(No Model.)

5 Sheets—Sheet 1.

L. H. NASH.

METHOD OF OPERATING EXPLOSIVE VAPOR ENGINES.

No. 334,041. Patented Jan. 12, 1886.

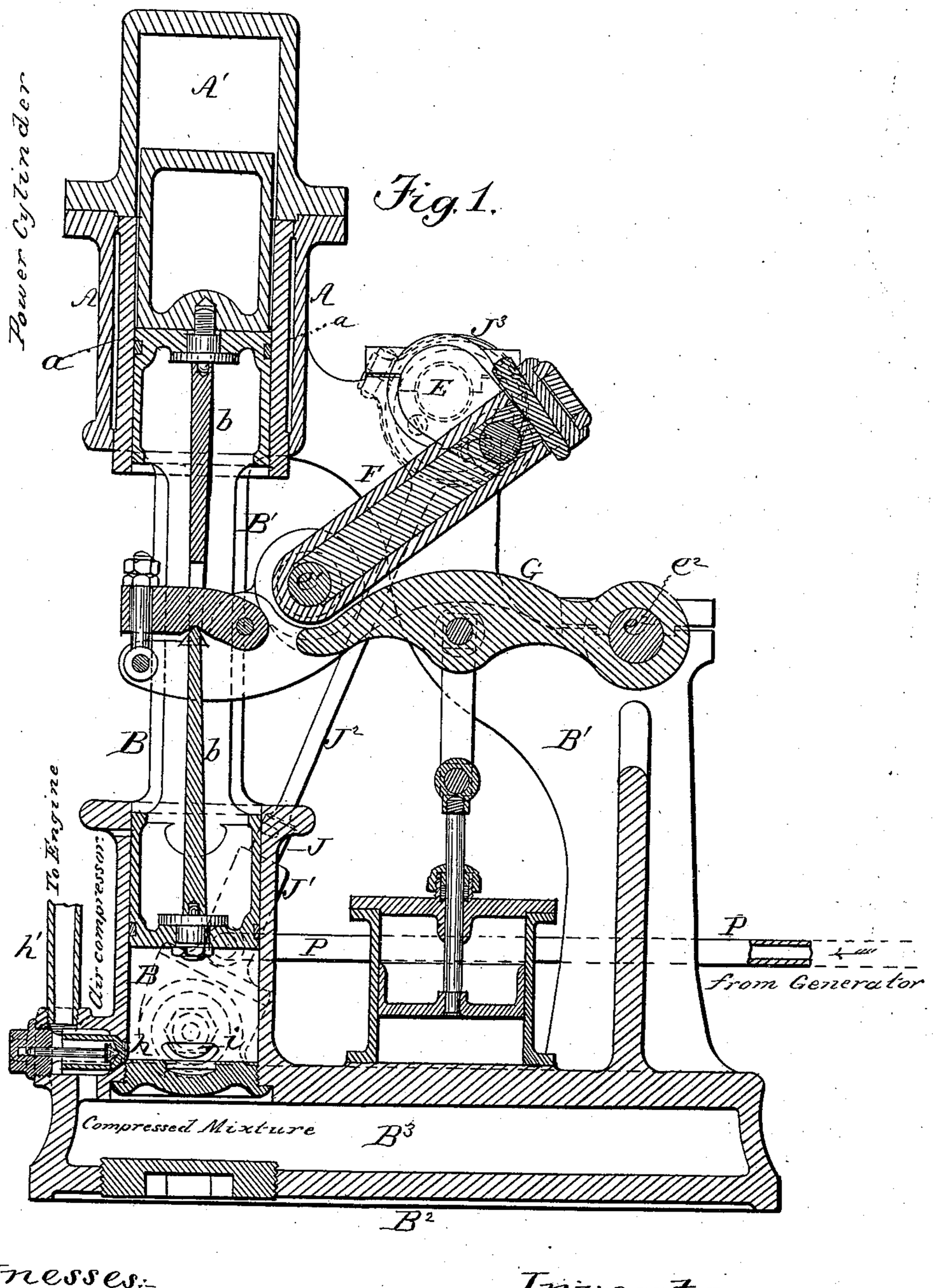

Fig. 1.

Witnesses:-
Bessie B. Johnson.
A. B. Rawlings

Inventor:-
Lewis Hallock Nash
by Johnson & Johnson
Attys.

(No Model.)

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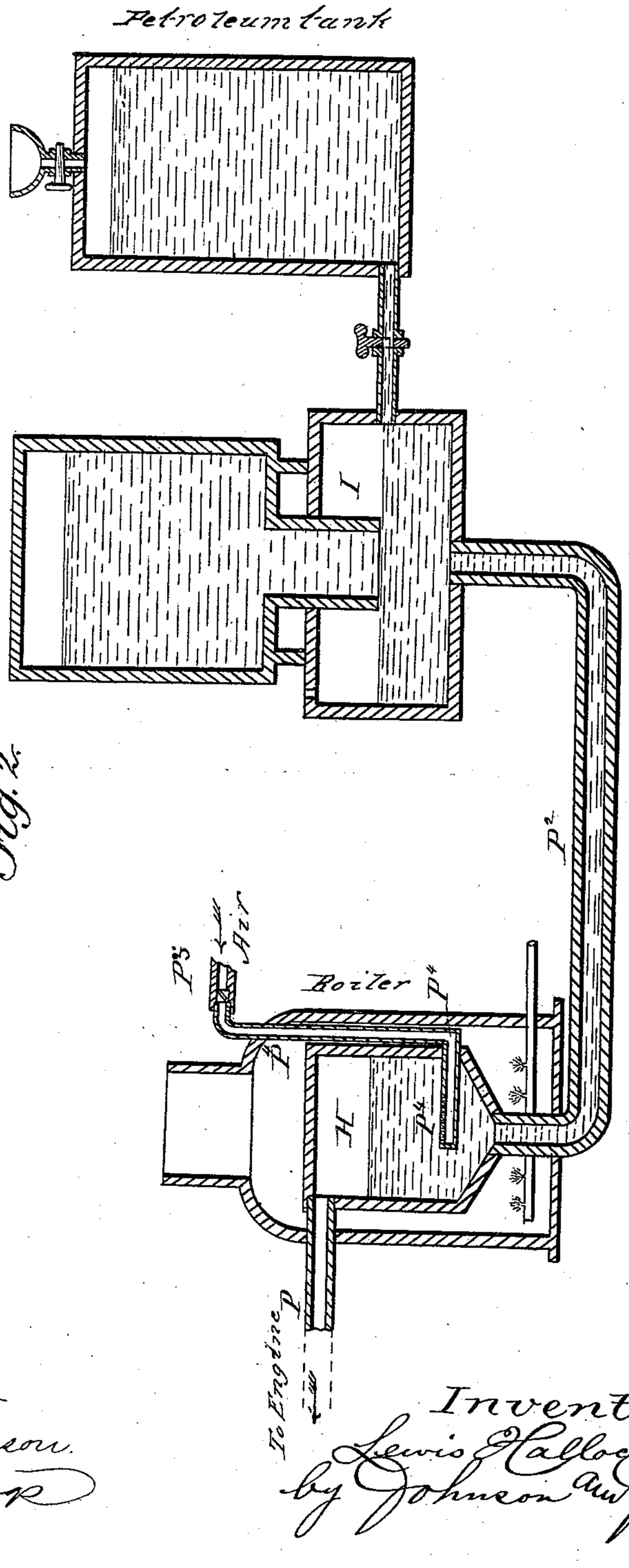

Fig. 2.

Witnesses:-
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(No Model.)

5 Sheets—Sheet 3.

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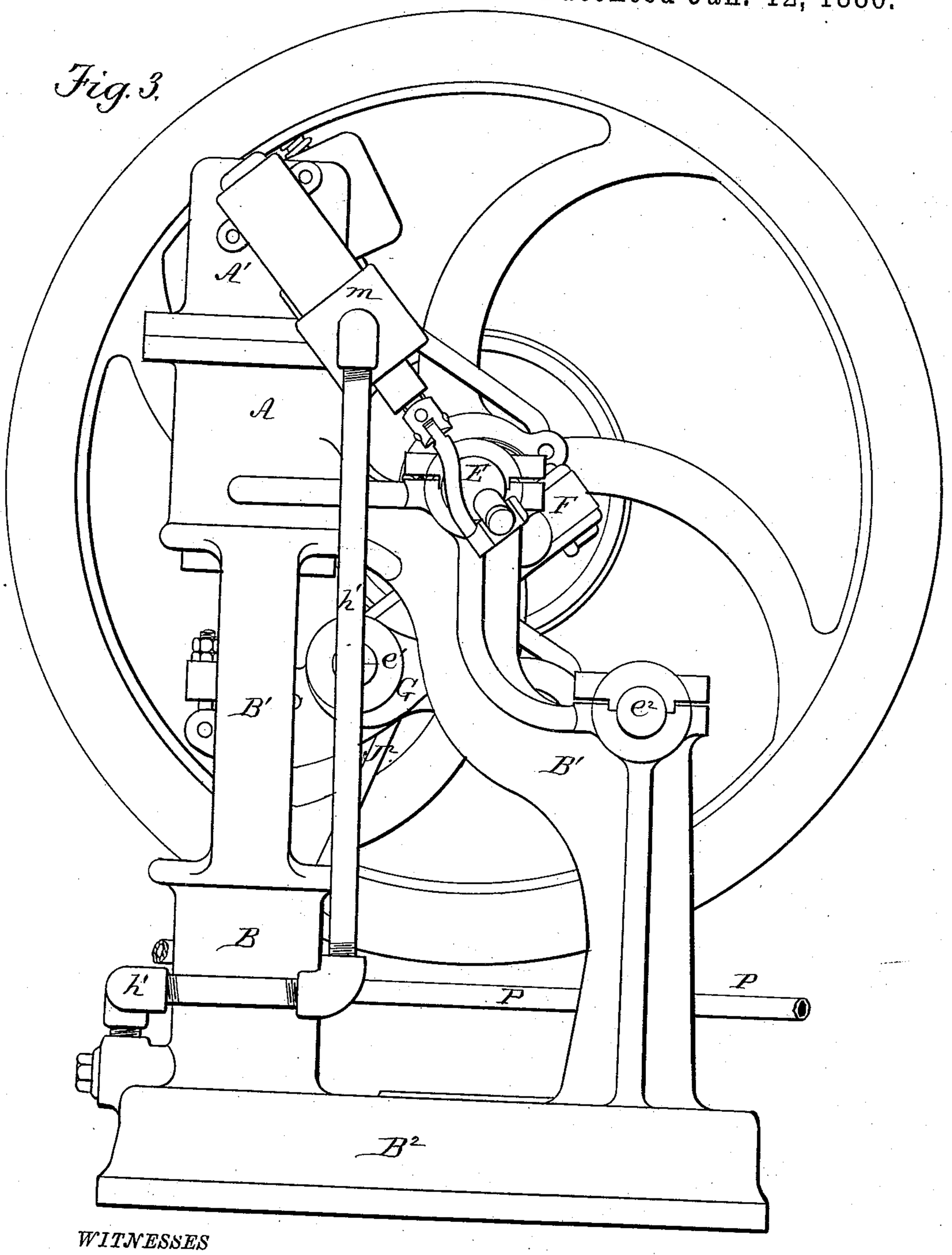
Fig. 3.



WITNESSES

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5 Sheets—Sheet 4.

L. H. NASH.

METHOD OF OPERATING EXPLOSIVE VAPOR ENGINES.

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Fig. 8.

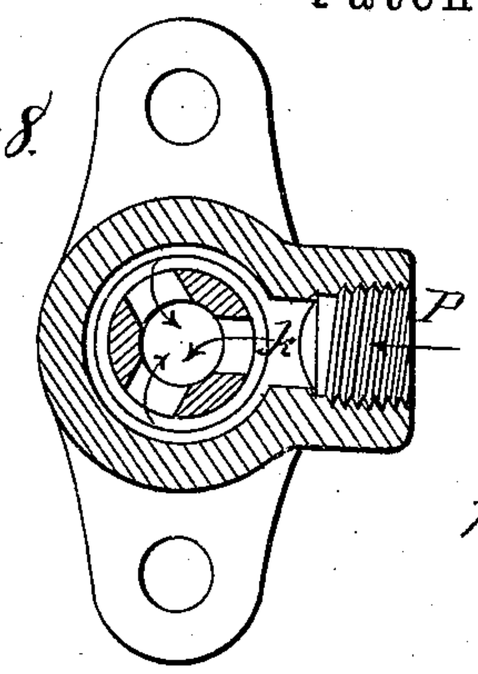


Fig. 5.

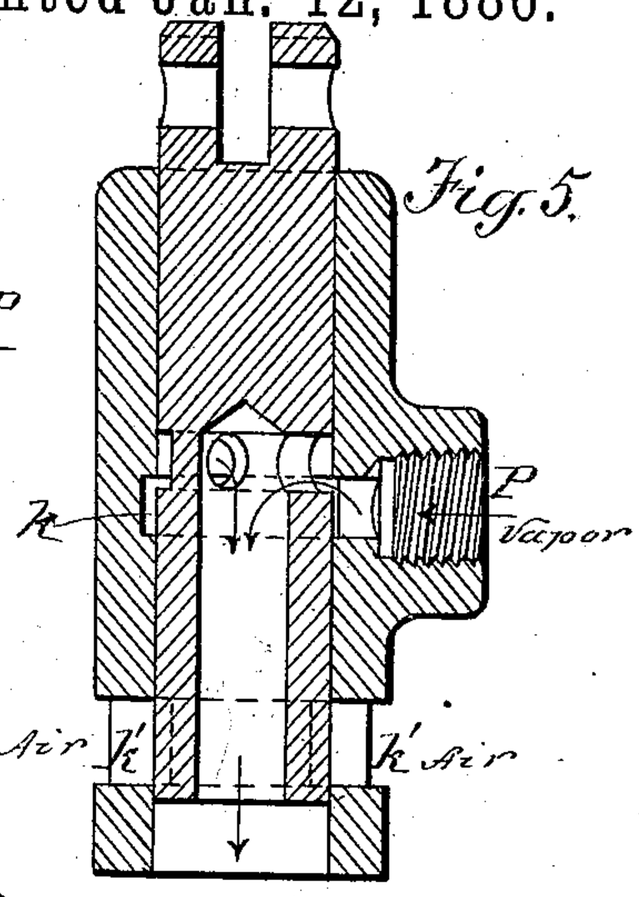


Fig. 6.

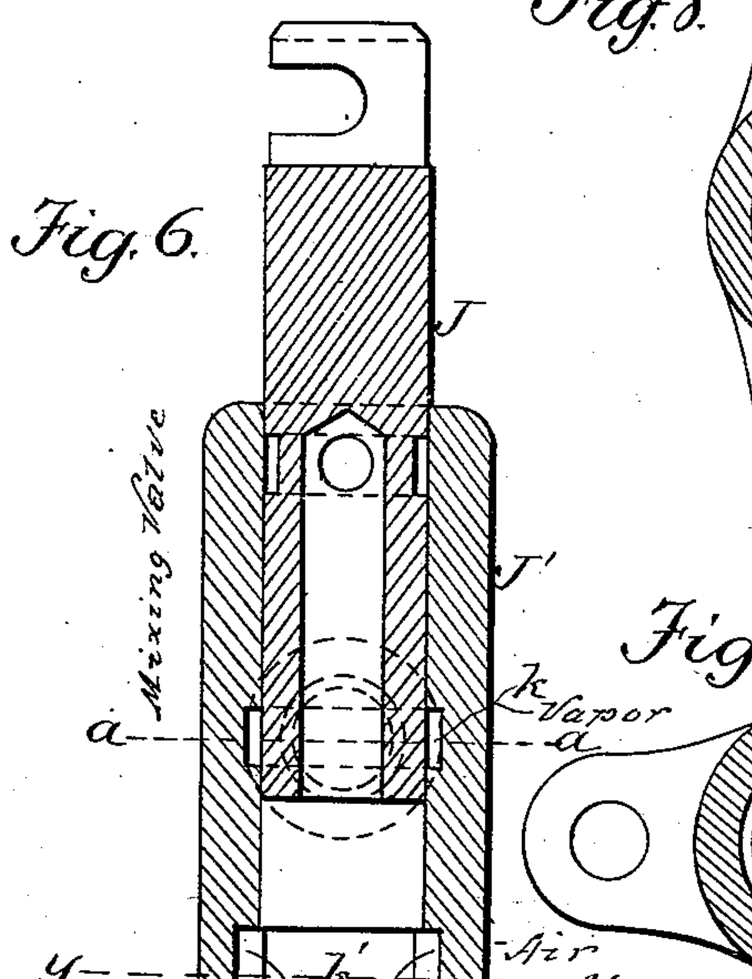
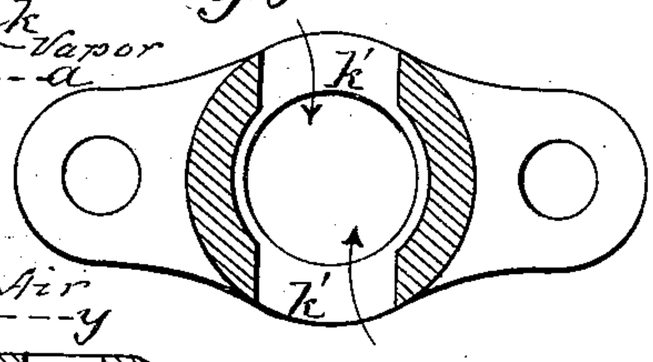


Fig. 7.



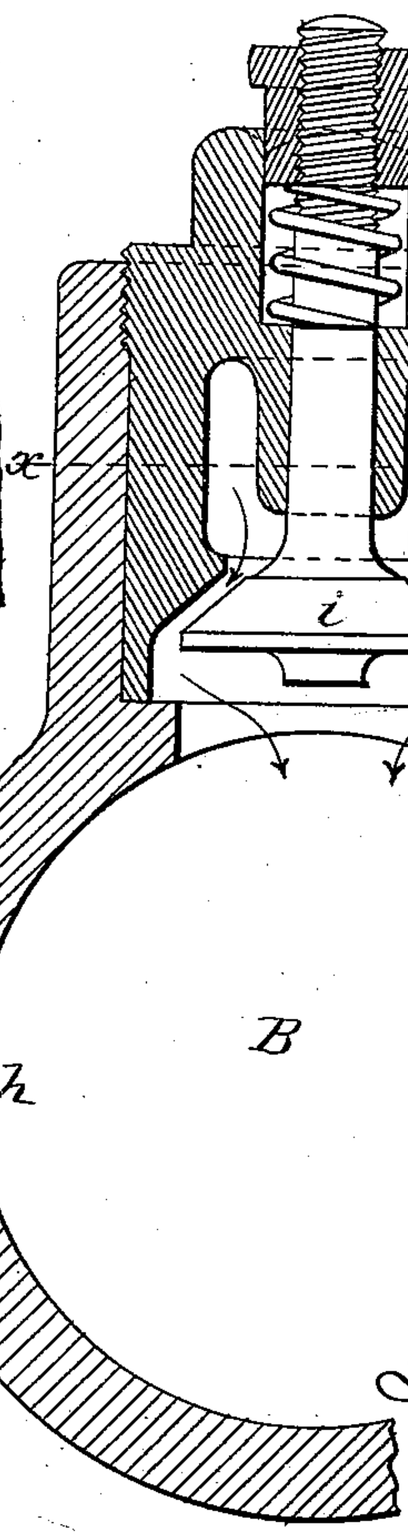
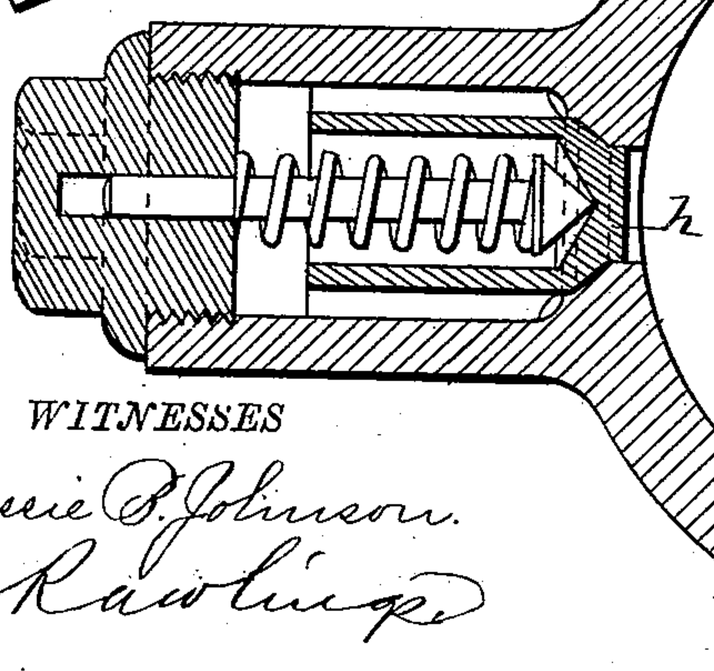


Fig. 4.



B

WITNESSES

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(No Model.) 5 Sheets—Sheet 5.

L. H. NASH.

METHOD OF OPERATING EXPLOSIVE VAPOR ENGINES.

No. 334,041. Patented Jan. 12, 1886.

Fig. 9.

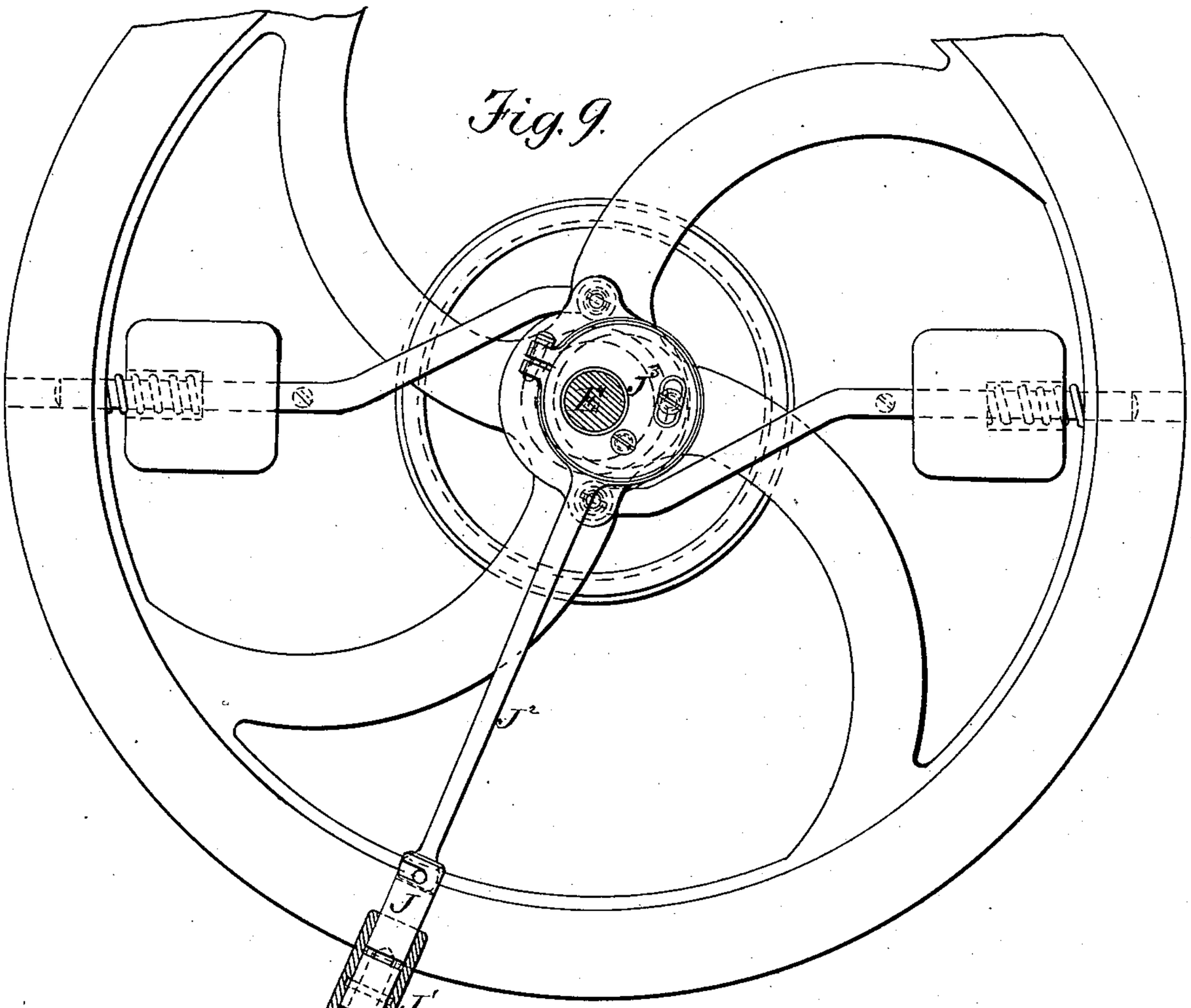
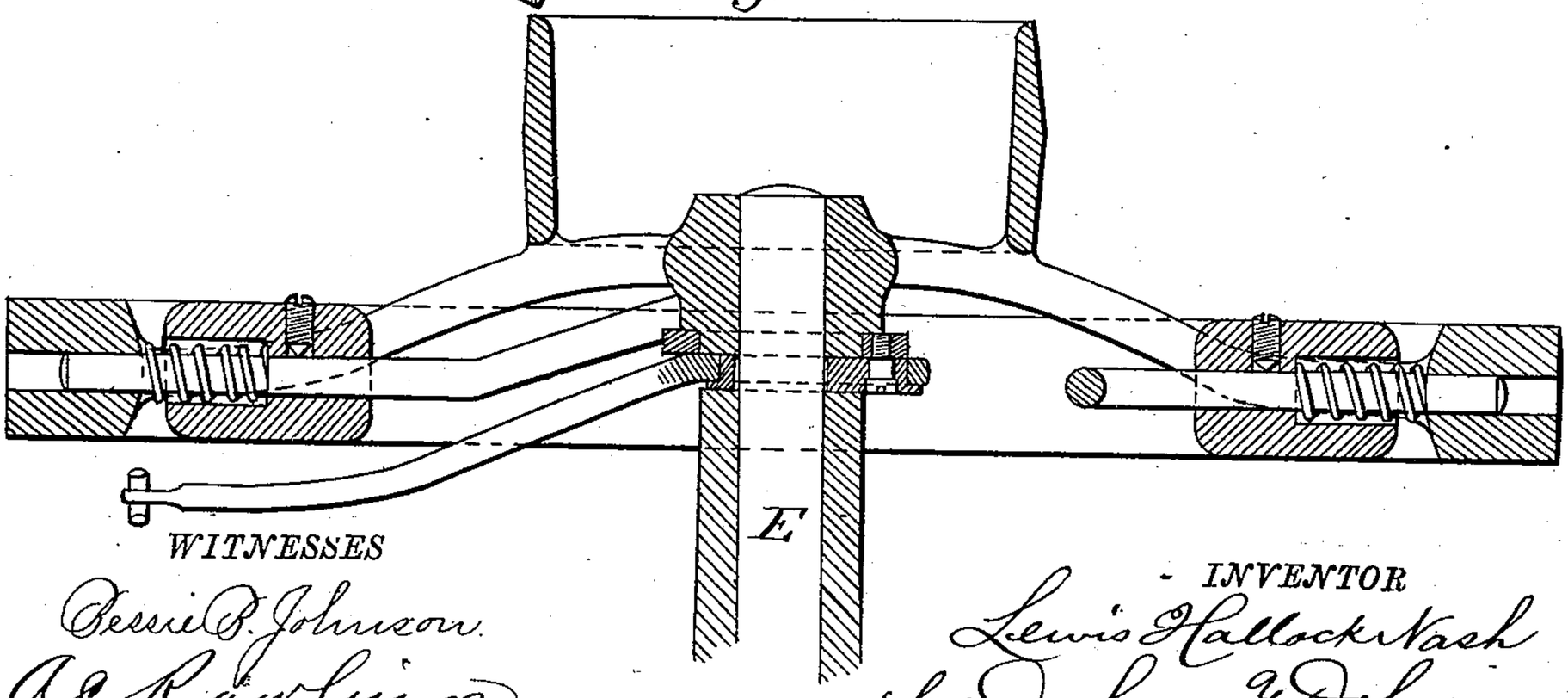


Fig. 10.



WITNESSES

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UNITED STATES PATENT OFFICE.

LEWIS HALLOCK NASH, OF BROOKLYN, ASSIGNOR TO THE NATIONAL METER COMPANY, OF NEW YORK, N. Y.

METHOD OF OPERATING EXPLOSIVE-VAPOR ENGINES.

SPECIFICATION forming part of Letters Patent No. 334,041, dated January 12, 1886.

Application filed September 5, 1885. Serial No. 176,224. (No model.)

To all whom it may concern:

Be it known that I, LEWIS HALLOCK NASH, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented new and useful Improvements in Methods of Operating Explosive-Vapor Engines, of which the following is a specification.

My invention is directed to an improved method of operating explosive-vapor engines in which the vapor is produced from liquid fuel.

My improved method consists in utilizing the suction of a compression-pump to draw therein a determined or regulated portion of the air-charge from the open air through a receptacle containing a volatile fuel, whereby to absorb vapor from the liquid fuel to form the combustible constituent of the charge.

In a patent granted to me under date December 4, 1883, No. 289,693, I have shown and described a method of operating a gas-engine by liquid fuel contained in a vessel, through which a portion of the air-charge is forced after it has been compressed in a compression-chamber, and which method cannot be used with every type of gas-engine, while my present method admits of a more extended application to engines of different types.

Referring to the accompanying drawings, Figure 1 represents a vertical section of gas-engine having a pump for compressing the charge, which is connected with the vapor-producer shown in Fig. 2, which is a vertical section of the vapor-producer and its liquid-fuel feeder. Fig. 3 represents in elevation the engine shown in Fig. 1, showing the valve connecting pipes and the valve-operating connections. Fig. 4 shows a horizontal section of the air-compression cylinder, taken through its inlet and outlet valves. Fig. 5 represents a longitudinal section of the valve which regulates the supply of the vapor of the engine, the valve being in position to admit the vapor-charge into the compression-pump. Fig. 6 represents a section of the valve, taken on line *x x* of Fig. 4, at right angles to the section shown in Fig. 5, showing the valve in position taking in air and its relation to the compression inlet-valve. Fig. 7 shows a cross-section taken through the air-inlet port *k'* of the valve-case on *y y* of Fig. 6. Fig. 8 shows a similar section taken through the vapor-inlet port *k* on line *a a* of Fig. 6. Fig. 9 represents the fly-wheel-governor device in elevation and its connection with the vapor-supply valve, and Fig. 10 a cross-section of the same.

The power-cylinder A is single-acting and placed vertically over and in line with the air-compressor B, and is provided with a separate cap forming combustion-chamber A' and a space, *a*, forming a cooling-jacket. The air-compression cylinder is connected to the power-cylinder by an open frame, B', which also supports the bearings of the crank-shaft E, and a pivoted rocker-arm, G, which is connected with and transmits the motion of the double-ended piston. The operating parts are supported upon a bed-plate, B^2, which has formed within it a storage-reservoir, B^3, for the compressed mixture. The double-ended piston works within the power-cylinder and within the compression-cylinder, and is connected between these cylinders to the rocker-arm G by means of separate connecting-rods *b*, having abutting bearings upon the pistons and upon the non-pivoted end of the rocker-arm, which extends for this purpose through an opening in the trunk of the double-ended piston, as shown in Fig. 1. The rocker-arm G has a pivot-bearing, e^2, upon the frame and carries a pin, *e'*, forming a connection for the crank-connecting rod F. The compressor-pump is provided with suitable inlet and outlet valves, as shown in Fig. 4. The inlet-valve *i*, which is an ordinary check-valve, and is connected with a mixing-valve, J, as seen in Fig. 6, is connected with the vapor-producer and controls the supply of air and vapor to the compressor. The mixing-valve case J' has an air-inlet port, *k'*, and a port, *k*, which, by the pipe P, communicates with the vapor-producer B, as seen in Figs. 1 and 2. The mixing-valve is a plunger-valve, J, and controls both the air and the vapor inlet ports, as seen in Figs. 5, 6, 7, and 8, and is connected by the rod J^2 with an eccentric, J^3, on the crank-shaft E, operated by the governor in a manner to control the proportions of air and vapor to the compressor. The outlet-valve *h* is a check-valve, and com-

municates with the engine-supply valve M by the pipe h', as seen in Figs. 1 and 3.

The governor device is carried by the fly-wheel, and consists of weights carried by rods supported in the fly-wheel rim, and which are connected to a yoke having a bearing upon the hub of the fly-wheel and adapted to oscillate when moved by the rods.

The governor device operates the eccentric in such a manner as to increase or decrease the length of the travel of the plunger-valve; but as this special form of governor constitutes no part of my present invention it is not deemed necessary to particularly describe it as any suitable form of governor will answer which is adapted to control the relative proportion of air which is drawn through the vapor-producer.

The vapor-generator H is connected by the pipe P^2, with a reservoir, I, containing the volatile oil, in such manner as to maintain the supply in the generator. The vapor-supply pipe P is connected to the generator above the level of the volatile fuel, and an air-supplying pipe, P^4, leads into the vapor-generator and terminates in jet-openings, so as to discharge the air into the body of the volatile fuel, so that it will absorb sufficient of the vapor to render it combustible.

When the liquid fuel is of such a nature as not to volatilize readily, then the producer may be heated by gas-jets, as shown, or by any suitable means. When gasoline or similar liquid is used, then heat is not necessary for evaporation.

The vapor-producer may be of any suitable construction and placed upon or independent of the engine and any desired distance therefrom.

The air-suction pipe P^4 is provided with a suitable check-valve, P^2, opening inward, to prevent the escape of vapor through said pipe.

In the operation of the engine the air is drawn by the suction of the compressor into the vapor-producer in regular proportions through the body of the liquid, as stated, and the operation of regulating the relative quantity of the vapor and air drawn into the compressor and supplying the charges to the engine is as follows, viz: The engine being in motion, and the compressor taking in the charges through the check-valve i from the mixing-valve, the eccentric so controls the mixing-valve that for a portion of the time, corresponding to a definite movement of the stroke of the piston, said valve is in position (shown in Figs. 5 and 8) taking in the supply through the port k and pipe P from the producer. During this time the said valve closes the outside air-port, k', as shown in said figure. When the piston has completed this part of its stroke, the mixing-valve closes port k and opens port k', admitting air only through the remainder of the stroke of the piston, as seen in Fig. 6, thereby completing the charge in the compressor during the forward stroke of the compressor-piston. On the back-stroke of the compressor-piston the charge is compressed and forced out through the check-valve into the reservoir.

The quantity of fuel-laden air which is drawn into the compressor-cylinder is regulated by the governor, which operates the mixing-valve, so as to cause it to maintain the port k open during a longer or shorter period of the stroke of the compressor-piston, and thus admit a greater or less quantity of the fuel-laden air as more or less power is required of the engine. In this operation the distinctive feature of my improvement is in causing a portion of the air-charge supplying the engine to be drawn through the liquid fuel as a separate division of the charge and the other portion of the air mixed with it to complete the charge for the engine.

I have shown and described an engine operating to compress its charge in a separate air-compression cylinder; but I can apply my improvement to engines in which the charge is compressed within the power-cylinder or admitted without compression. In either of these cases the air-supply pipe would be supplied from two sources, one connecting with the vapor-generator and the other open to the air.

A very important advantage of drawing the fuel-laden part of the air through the volatile liquid, instead of forcing it through, is that in the latter case there is more or less pressure in the fuel-containing vessel, and necessarily great strength is required in its construction to sustain such pressure, and careful work is required in the pipe-connections to prevent leakage. In sucking the air through the vessel there is no pressure therein, and if there should be leakage in the pipe such leakage will only be the drawing of air into the flow, and the vessel can be heated without danger of explosion, and it can be placed away from the engine out in the yard.

I claim—

1. The method herein described of operating explosive-vapor engines by means of liquid fuel, which consists in drawing a portion of the air-supply for the charge through a volatile fuel, regulating the quantity of such constituent so drawn in by a governor, and completing the charge by drawing into it a separate supply of air.

2. The method herein described of operating explosive-vapor engines by means of liquid, which consists in drawing a portion of the charge through a volatile liquid fuel into a chamber and admixing with it another portion of air to complete the charge and compressing the mixture before its ignition.

3. The method herein described of operating explosive-vapor engines by means of liquid fuel, which consists in utilizing the suction of a compression-pump to draw therein a portion of the air through a volatile liquid fuel, and

forcing it therefrom with another portion of air to form the combustible mixture.

4. The method herein described of operating explosive-vapor engines by means of liquid fuel, which consists in drawing a portion of the air-charge through a heated volatile fuel to evaporate it, conveying it into a compressor, mixing it therein with another portion of the air-charge, compressing the same, and regulating the supply of the fuel-laden air from the said heater by the controlling action of a governor.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

LEWIS HALLOCK NASH.

Witnesses:
A. E. H. JOHNSON,
J. W. HAMILTON JOHNSON.