No. 743,780. PATENTED NOV. 10, 1903.

H. F. WALLMANN.

MIXER FOR GAS ENGINES.

APPLICATION FILED MAR. 10, 1900.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1.

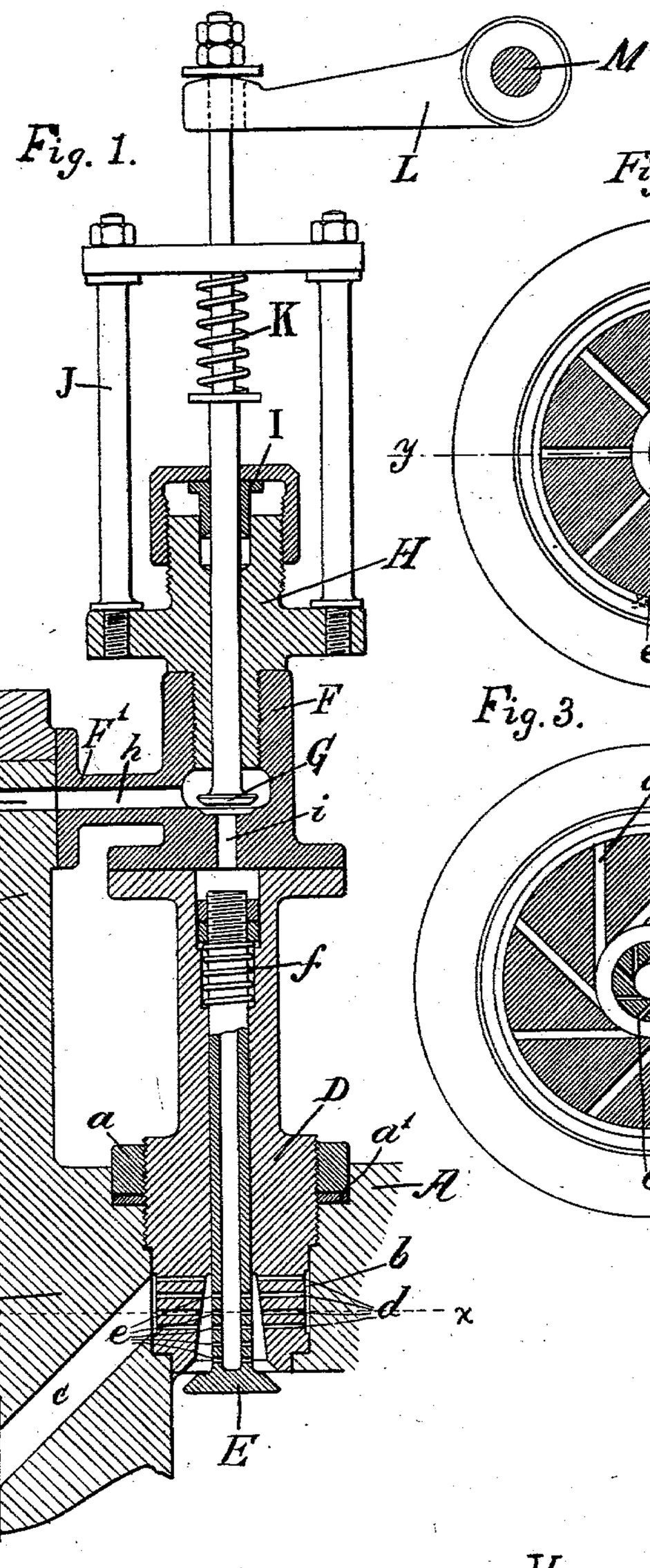


Fig. 2

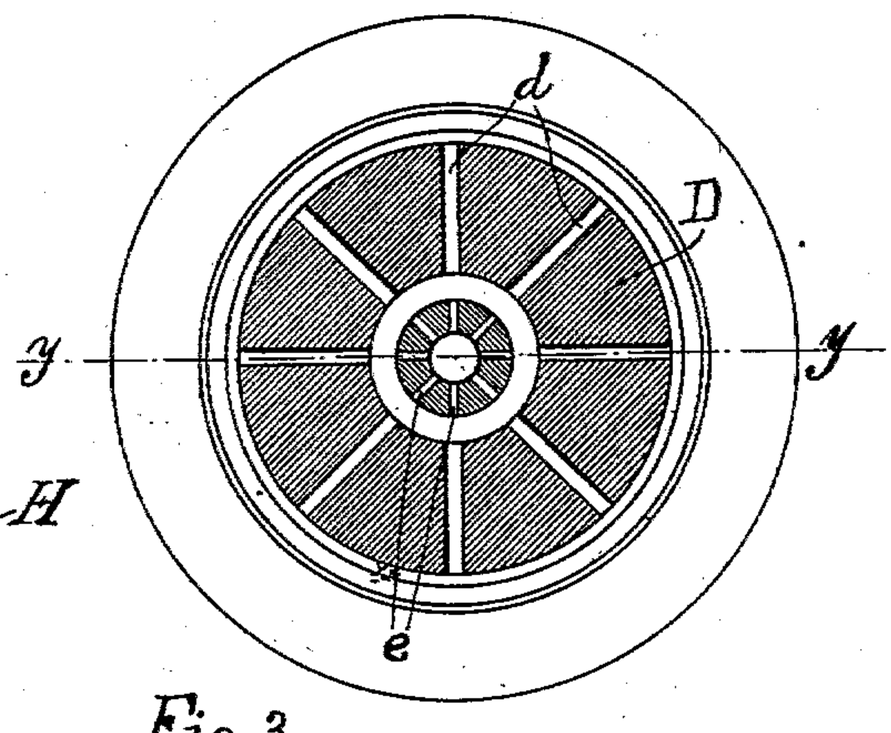
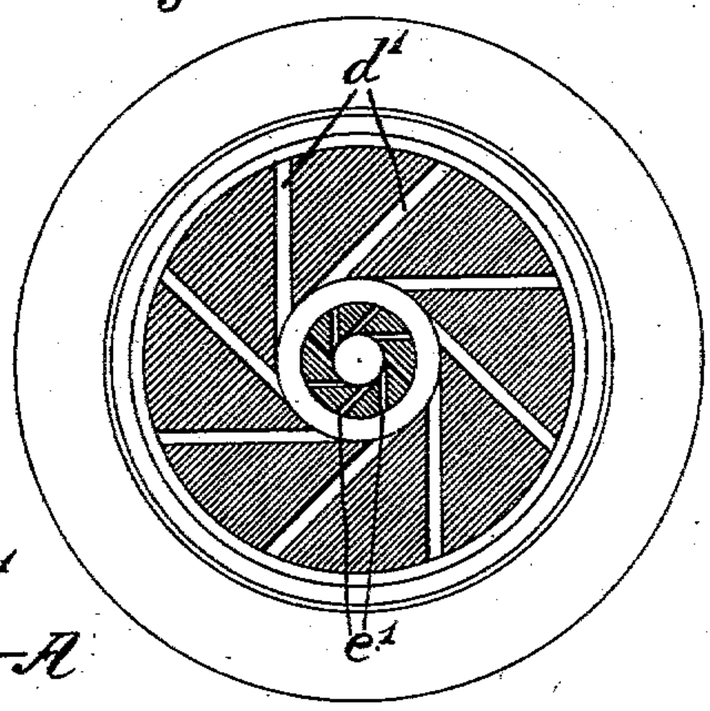


Fig. 3.



Witnesses

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NO MODEL. 3 SHEETS—SHEET 2.

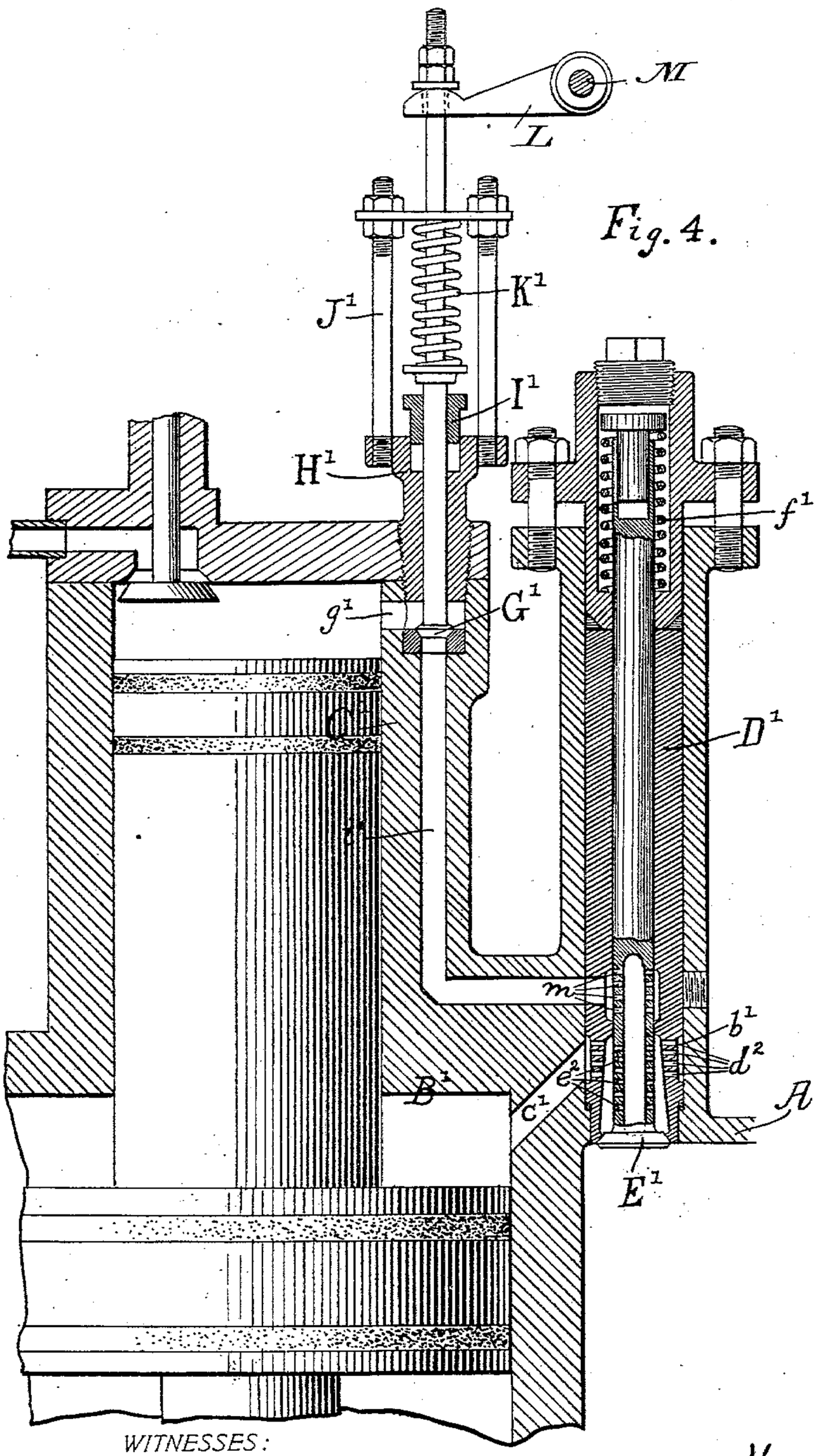

Fig. 4.

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APPLICATION FILED MAR. 10, 1900.

NO MODEL. 3 SHEETS—SHEET 3.

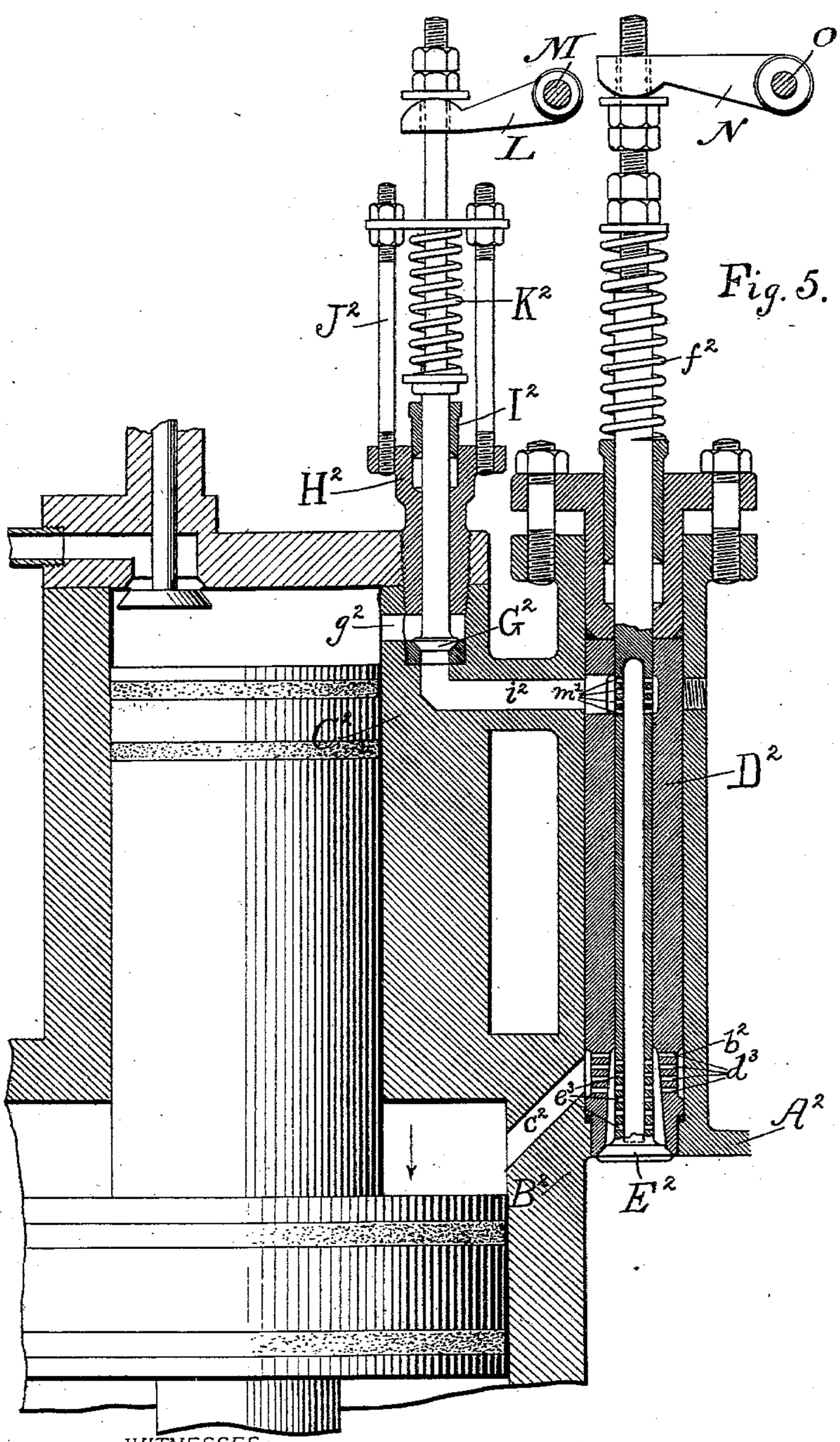

Fig. 5.

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No. 743,780. Patented November 10, 1903.

UNITED STATES PATENT OFFICE.

HENNING FRIEDRICH WALLMANN, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE WALLMANN ENGINE COMPANY, A CORPORATION OF ILLINOIS.

MIXER FOR GAS-ENGINES.

SPECIFICATION forming part of Letters Patent No. 743,780, dated November 10, 1903.

Application filed March 10, 1900. Serial No. 8,132. (No model.)

To all whom it may concern:

Be it known that I, HENNING FRIEDRICH WALLMANN, 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 Mixers for Gas-Engines, of which the following is a specification.

My invention relates to improvements in mixing devices for use in that class of engines in which the motive power is derived from the ignition and expansion of a combustible charge of mingled air and gas or oil-vapor. In that class of engines the efficiency is in no small measure dependent upon the thoroughness with which the components of the charge are commingled either before or after their admission to the combustion-cylinder and previous to their ignition therein. Where such commingling is but poorly or inadequately effected, the charge often misses fire, resulting in a waste of the fuel employed and in a loss to the engine's efficiency of the power represented by the unconsumed and wasted fuel, or if it ignites it burns poorly and unevenly and yields much less than the maximum efficiency of which it is capable when properly and thoroughly prepared.

The object of my present invention, therefore, has been to provide a mixing device which shall be simple in construction, automatic in its operation, and which shall effect a thorough commingling of the elements of the charge in a most efficient manner just prior to their admission to the combustion-cylinder.

To this end my invention consists in a mixing device for gas-engines embodying the principles of construction and operation substantially as hereinafter described and claimed and as illustrated in the accompanying drawings, in which—

Figure 1 is a central vertical section of a mixing device constructed in accordance with my invention. Fig. 2 is a horizontal section, enlarged, on line *x x* of Fig. 1. Fig. 3 is a horizontal section, similar to Fig. 2, of a modified arrangement of the fuel and air ducts; and Figs. 4 and 5 are modified forms of my invention.

Similar letters of reference refer to similar parts throughout the several views.

Referring first to the form of the invention shown in Figs. 1 and 2, A may represent a section, broken away, of the upper end or cylinder-head of the combustion-cylinder of a gas-engine. B may represent a section, broken away, through the cylinder-wall of an adjacent air-compressor, and C a similar section through the cylinder-wall of a fuel-pump.

D represents a valve-casing screwed into the cylinder-head A and suitably packed therein by a gasket *a* and packing-ring *a'*. Within the valve-casing D is an automatically-opening inlet-valve E, which has a long hollow stem guided in a vertical extension of the valve-casing, as shown. At its lower end this hollow stem of valve E is provided with a series of small radially-arranged lateral ports *e*, providing communication between said hollow valve-stem and the surrounding chamber of the valve-casing, and through the walls of the latter at its lower end are formed a similar series of radially-arranged lateral ports *d*, which provide communication between said chamber of the valve-casing and an annular chamber *b*, formed by a wide shallow groove sunk in the periphery of the valve-casing. Into this latter chamber opens the discharge-port *c* of the air-compressor. The upper end of the elongated hollow stem of valve E is provided with an adjustable closing-spring *f*, as shown.

The fuel-supply may be connected with the hollow stem of valve E in any desired or preferred manner; but in the construction shown, which is more particularly adapted for application to two-cycle engines in which both the air and fuel are ordinarily forced into the combustion-cylinder under pressure, the discharge-port *g* of the fuel-pump communicates with the casing F of a positively-actuated controlling-valve G. This valve-casing F is superimposed on the upper end of valve-casing D and may be secured to the fuel-pump cylinder by a lateral extension F', through which is formed a duct *h*, that connects the fuel-discharge port *g* with the chamber in valve-casing F. A short vertical duct

i, controlled by the valve G, connects the latter chamber with the upper end of valve-casing D and the hollow stem of valve E. The elongated stem of valve G has an extended bearing in a bearing-block H, which screws into and fills the upper end of valve-casing F, and at its upper end has a suitable stuffing-box I. Mounted on the bearing-block H is a yoke J, in which the valve-stem has an additional bearing and which also forms an abutment for the returning-spring K. The upper end of the valve-stem is engaged by a tappet L on a rock-shaft M, whereby the valve G may be lifted at the proper time and through the proper interval to permit the introduction of fuel.

The operation of the device as thus far described is as follows: Where the mixer is employed on a two-cycle engine, in which both the air and the gas or oil-vapor are forced into the combustion-cylinder under pressure, the opening of the fuel-controlling valve G will be so timed as to admit the fuel from port *g* at the same or substantially the same pressure as that of the air arriving through port *c*. The fuel entering by way of ducts *h i* and the hollow elongated stem of valve E rushes in fine streams and in a finely-divided condition through the small radial ports *e* in the lower end of the valve-stem. At the same time the air entering by way of port *c* and annular chamber *b* rushes in a similar finely-divided condition, but in the opposite direction, through the small radial ports *d* in the lower end of the valve-casing D. The opposing streams of gas and air thus meet in the chamber of the casing D and becoming thoroughly commingled therein by their pressure open the inlet-valve E and pass into the combustion-cylinder in the best condition for effective combustion and expansion.

Where my improved mixer is applied to the ordinary "Otto" or four-cycle type of engine, the operation will be substantially as hereinabove described, except that the air and fuel meet and mingle at atmospheric pressure and are drawn into the combustion-cylinder by the suction of the piston.

Fig. 3 illustrates a modification in the manner of forming the lateral ports in the valve-stem and valve-casing, by the employment of which the most effective mixing of the components of the charge is secured. In this case the lateral ports *d'* and *e'* instead of being arranged radially to the inner surfaces of the valve-casing and the hollow valve-stem, respectively, as in Figs. 1 and 2, are arranged tangentially to said surfaces, as shown in Fig. 3. The result of this arrangement is obvious. The air enters the valve-chamber in such a way as to cause it to whirl rapidly in one direction therein, while the gas or fuel enters the same chamber in such a way as to make it also whirl rapidly therein, but in the opposite direction to the air. The result is a most thorough intermingling of the components of the charge prior to their admission to the combustion-cylinder.

Fig. 4 illustrates a slight modification of the mixer. In this modification, as well as in another subsequently described, I have designated all parts which are similar to corresponding parts in Figs. 1 and 2 by the same reference-letters with increased exponents in order to avoid unnecessary length of description. Here the mixing-valve E' instead of being located directly beneath and in vertical alinement with the controlling-valve G' is located to one side thereof, as shown, and its stem is hollowed through only a portion of its length, and the fuel-duct *i'* communicates with the hollow stem of the valve E' laterally through lateral ports *m* near its lower end instead of longitudinally through its open upper end. This arrangement effects a quicker automatic closing of the valve E' because of the upward pressure on the interior of the valve-stem.

The form shown in Fig. 5 is similar to that last described, except that the valve-stem is hollowed through a greater portion of its length, and the lateral communication of the fuel-duct i^2 with the hollow stem of the valve E^2 is at a greater distance from the valve, and the valve-stem is extended through its casing and provided with a strong returning-spring f^2, this valve being designed to be positively opened at and during the proper period by some valve-actuating means connected with a moving part of the engine.

My present invention has been designed for use more particularly in connection with internal-combustion engines of the type shown in my copending applications, Serial No. 735,301, filed October 30, 1899; Serial No. 739,962, filed December 11, 1899; Serial No. 740,719, filed December 18, 1899, and Serial No. 3,841, filed February 3, 1900; but its use is by no means limited to engines of that type. As an effective mixing device it is capable of general application, with little or no modification, to any or all types of gas-engines.

I do not limit myself to the precise details of construction shown and described. It is obvious, for instance, that the air might be introduced through the hollow valve-stem and the gas or fuel through the lateral ports in the valve-casing, if preferred, without departing from the spirit of my invention.

The generic feature of my invention is the introduction of the components of the charge in a finely-divided state in opposite directions into the valve-chamber through a series of small lateral ports formed through the valve-stem and through the walls of its surrounding casing, whereby the charge is thoroughly mixed just prior to its admission to the combustion-cylinder.

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

1. In a mixer for gas-engines, in combina-

tion an inlet-valve having a hollow stem and a series of lateral ports formed through said stem, a valve-casing surrounding said valve and its stem and having a similar series of lateral ports formed therethrough, and means for causing the flow of the components of a combustible charge simultaneously in opposite directions through said lateral ports in the valve-stem and valve-casing respectively, substantially as described.

2. In a mixer for gas-engines, in combination an inlet-valve having an elongated hollow stem and a series of lateral ports formed through said stem at or near its lower end, a valve-casing in its upper portion forming a guide and support for said hollow valve-stem and having a similar series of lateral ports formed through it at its lower end, and means for causing the flow of the components of a combustible charge simultaneously in opposite directions through said lateral ports in the valve-stem and valve-casing respectively, substantially as described.

3. In a mixer for gas-engines, in combination an inlet-valve having a hollow stem and a series of lateral ports formed through said stem, a valve-casing surrounding said valve and its stem and having a similar series of lateral ports formed therethrough, means for supplying gas or fuel to the engine through said hollow valve-stem and its lateral ports, and means for supplying air to the engine through said lateral ports in the valve-casing simultaneously with the gas-supply, substantially as set forth.

4. In a mixer for gas-engines, in combination an inlet-valve having a hollow stem and a series of lateral ports formed through said stem, a valve-casing surrounding said valve and its stem and having a similar series of lateral ports formed therethrough, means for supplying compressed air to the engine through said lateral ports in the valve-casing, and means for supplying compressed gas or fuel to the engine through said hollow valve-stem and its lateral ports during the compressed-air supply, substantially as and for the purpose described.

5. In a mixer for gas-engines, in combination an inlet-valve having an elongated stem which is hollow through a portion of its length, said stem having two series of lateral ports formed therethrough, one adjacent the valve and the other adjacent the upper end of the hollowed portion, a valve-casing surrounding said valve and its stem, and having a similar series of lateral ports formed therethrough opposite said first-named series of ports in the valve-stem, means for supplying compressed air to the engine through said lateral ports in the valve-casing, and means for supplying compressed gas or fuel to the engine through said hollow valve-stem, said gas or fuel entering the valve-stem through the upper or inner series of ports therein and leaving it through the lower or outer series, where it meets and mixes with the compressed air supplied through the ported valve-casing, substantially as and for the purpose set forth.

6. In a mixer for gas-engines, in combination an inlet-valve having an elongated stem which is hollow through a portion of its length, said stem having two series of lateral ports formed therethrough, one adjacent the valve and the other adjacent the upper end of the hollowed portion, a valve-casing surrounding said valve and its stem, and having a similar series of lateral ports formed therethrough opposite said first-named series of ports in the valve-stem, means for supplying compressed air to the engine through said lateral ports in the valve-casing, means for supplying compressed gas or fuel to the engine through said hollow valve-stem, and a positively-actuated valve controlling a duct leading from the gas or fuel supply to the upper or inner series of ports in the valve-stem, substantially as and for the purpose set forth.

7. In a mixer for gas-engines, in combination an inlet-valve having a hollow stem and a series of tangentially-arranged lateral ports formed through said stem, a valve-casing surrounding said valve and its stem and having a similar series of tangentially-arranged lateral ports formed therethrough, and means for causing the flow of the components of a combustible charge simultaneously in opposite directions through said tangentially-arranged lateral ports in the valve-stem and valve-casing respectively.

In testimony that I claim the foregoing as my invention I have hereunto signed my name in the presence of two witnesses.

HENNING FRIEDRICH WALLMANN.

Witnesses:
SAMUEL N. POND,
ALFRED F. TOMPKINS.