

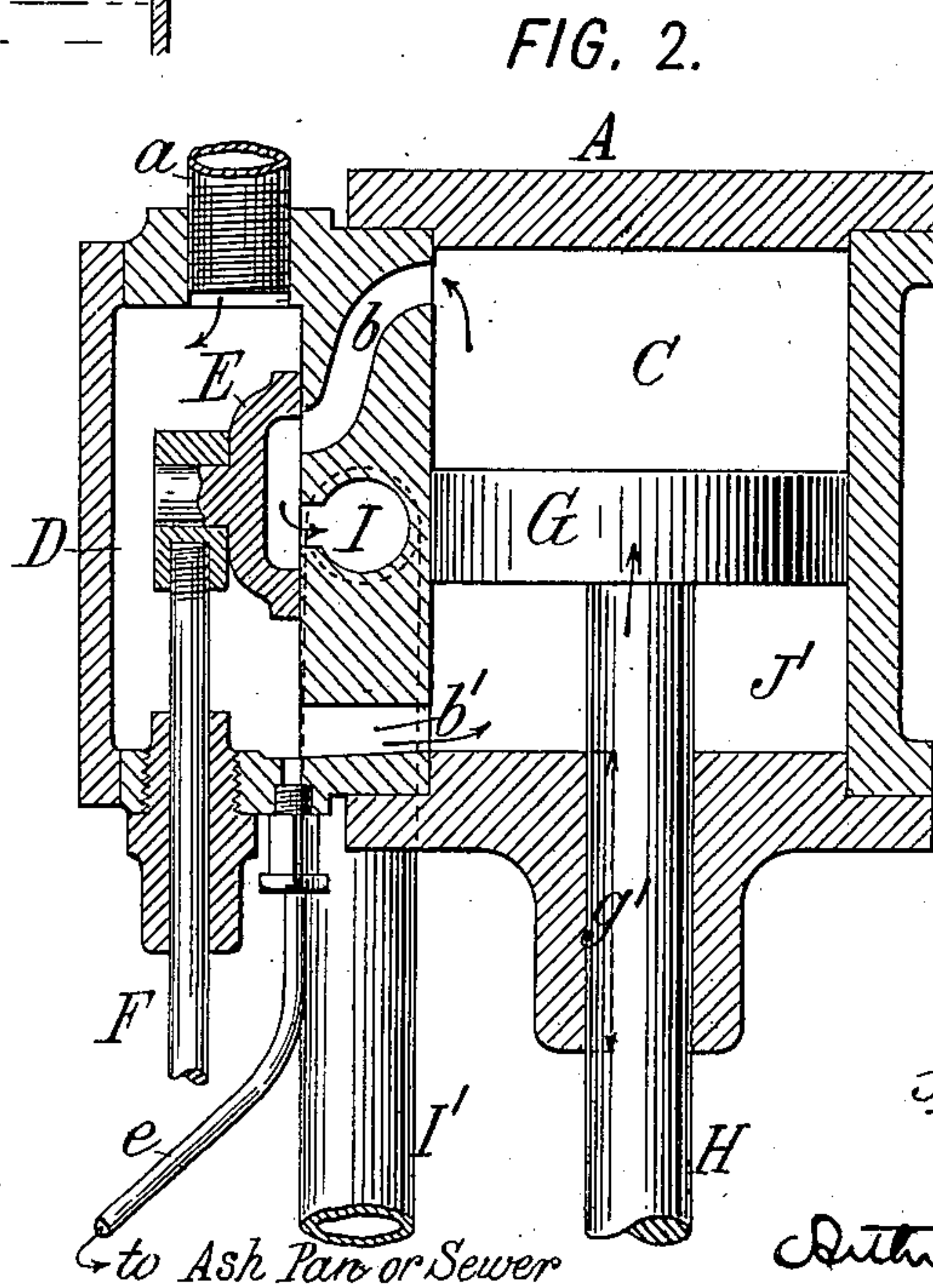
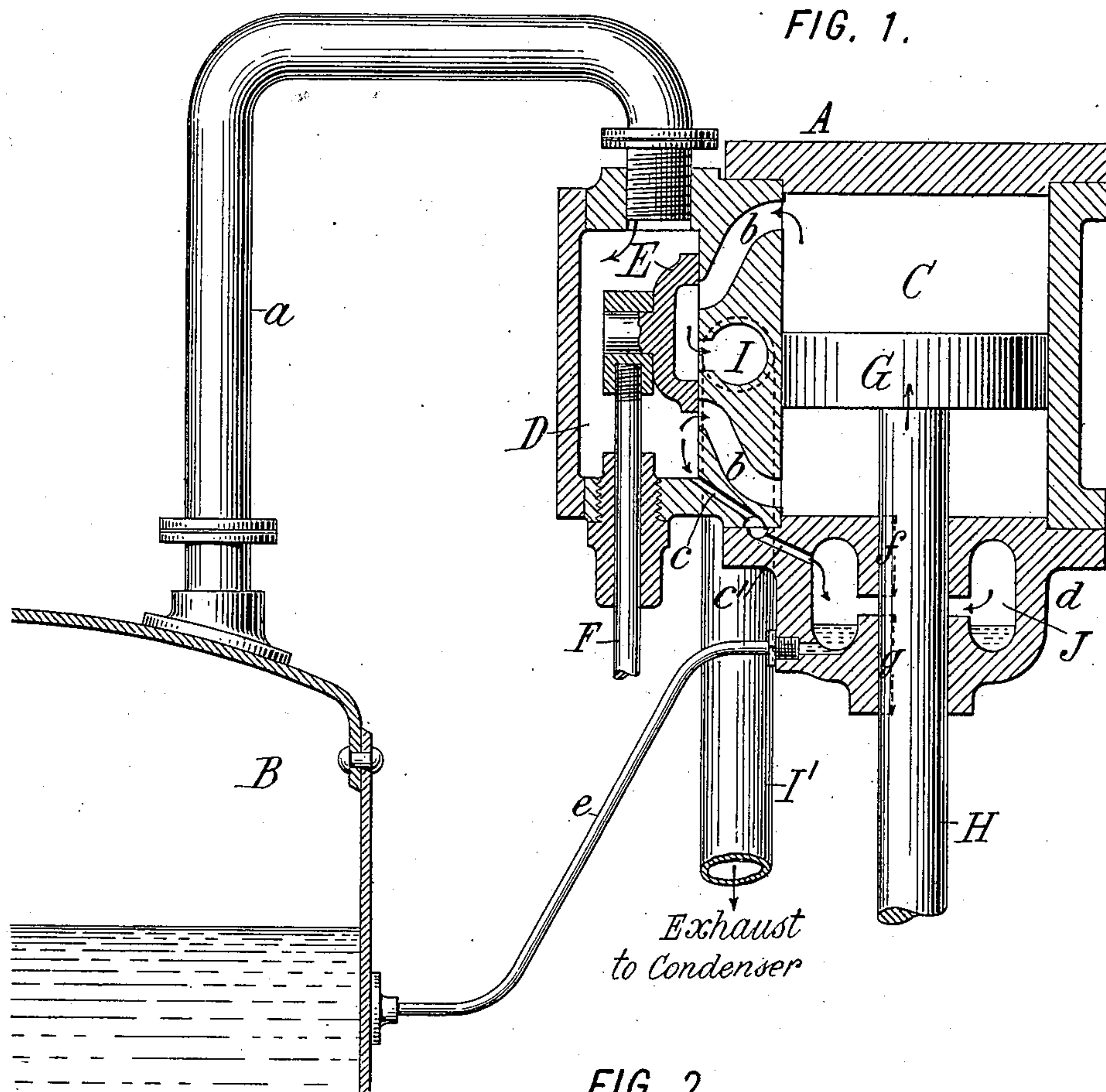
No. 639,744.

Patented Dec. 26, 1899.

F. M. LEAVITT.
ATMOSPHERIC STEAM ENGINE.

(Application filed Jan. 18, 1899.)

(No Model.)



WITNESSES:

Ired White
J. F. Wallace

INVENTOR:

Frank M. Leavitt,

By his Attorneys,

Arthur C. Orasea & Co.

UNITED STATES PATENT OFFICE.

FRANK M. LEAVITT, OF NEW YORK, N. Y., ASSIGNOR TO THE E. W. BLISS COMPANY, OF SAME PLACE.

ATMOSPHERIC STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 639,744, dated December 26, 1899.

Application filed January 18, 1899. Serial No. 702,498. (No model.)

To all whom it may concern:

Be it known that I, FRANK M. LEAVITT, a citizen of the United States, residing in the city of New York, borough of Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Atmospheric Steam-Engines, of which the following is a specification.

This invention relates to atmospheric or vacuum engines employed for small power purposes, such as pumping water for domestic establishments, &c., or for driving small light machinery. Engines for such purposes are commonly operated where there is no licensed engineer, and hence for safety it is desirable that the steam-pressure in the boiler be practically *nil* or only sufficient to cause a circulation of steam through the engine. Hence such engines are operated entirely, or practically so, by atmospheric pressure, due to the condensation of the steam admitted to the cylinder. In such engines the available pressure is necessarily low, the practical limit to the vacuum being in the neighborhood of thirteen pounds, while the initial steam-pressure rarely exceeds two or three pounds. One serious practical difficulty that has been encountered in the designing of engines of this class is the liability of the leakage of air into the cylinder by reason of the suction or vacuum that exists therein during the exhaust-stroke, such leakage occurring mainly around the piston-rod. It is impracticable to pass the piston-rod through a tight stuffing-box, because the frictional resistance thereby occasioned would seriously diminish the efficiency of an engine of this type. Hence resort has been had to cupped leather packings and other loose packings, which have only partially checked the inleaking of air. The objection to leakage of air is that it adds seriously to the service required of the air or vacuum pump. A leakage of steam or water would be practically unobjectionable because of the ease with which the steam can be condensed and the water of condensation pumped out as compared with the difficulty of pumping out air. My invention aims to overcome the leakage of air without involving the use of a tight packing, or, indeed, of any packing at all. This I accomplish by causing the piston-rod to work through an atmosphere of live steam direct from the boiler, the pressure

of which normally is slightly above that of the atmosphere, so that if any leakage occurs it will be of steam outward rather than of air inward, and if any leakage occurs into the exhaust it will be a leakage of steam or water instead of air.

My invention is shown in its preferred form as applied to a double-acting engine and is illustrated in Figure 1 of the accompanying drawings, which is a vertical mid-section through the engine-cylinder and valve-chest and through a fragment of the boiler. Fig. 2 is a similar section through the cylinder, showing a modified construction as applied to a single-acting engine.

In the drawings let A designate the engine, and B the boiler. Of the engine I have shown only the cylinder C, valve-chest D, slide-valve E, with its valve-rod F, and piston G, with its piston-rod H. The engine-shaft and its connections with the rods H and F being of any usual construction are not shown. Steam passes from boiler B by steam-supply pipe *a* into the valve-chest D, thence under control of the valve through ports into the opposite ends of the cylinder, and the exhaust from the cylinder passes into the usual exhaust-passage I and thence by pipe I' to the condenser and air-pump commonly employed with atmospheric or vacuum engines. In the double-acting engine shown in Fig. 1 the cylinder-ports *b b* are both under control of the valve E in the manner usual in double-acting engines. In the single-acting engine shown in Fig. 2 only the upper cylinder-port *b* is controlled by the valve, the lower port *b'* being always open.

I will now proceed to describe my invention with reference to Fig. 1. Around the piston-rod H and between the engine-cylinder and the outer air I arrange a live-steam chamber or space J, which surrounds the piston-rod, so as to bring live steam into contact with it. I provide for maintaining a constant or practically-uninterrupted supply of live steam into this space or chamber from the pump. To this end I may provide any suitable steam pipe or duct leading from the pump to this chamber; but preferably I connect this chamber in permanent manner with the valve-chest D, so that the live steam therefrom may flow into the chamber J. This is accomplished in Fig. 1 by means of a duct or passage *c*, formed

partly in the cylinder-casting and partly at c' in the cylinder-head casting d , the chamber J being preferably formed in such cylinder-head. The duct $c c'$ leads downwardly from the valve-chest, so as to drain off therefrom any condensation-water and lead it into the chamber J, and all condensation-water forming in the chamber J is drained off from the bottom thereof by a pipe e , which may lead to any suitable waste—as, for example, to the sewer or to the ash-pan of the boiler-furnace—or preferably in case the water-level of the boiler is lower than the chamber J, as is shown in Fig. 1, drains back into the boiler, as there shown. I prefer to form the cylinder-head d with a neck (indicated at f) surrounding the rod H between the chamber J and the interior of the cylinder and with a neck g between the chamber J and the outer air. The piston-rod H is made a close but free fit with the bore through the head in which it works, so that these necks closely but freely embrace the rod and constitute a substitute for a stuffing-box. Since the steam-pressure in the chamber J does not exceed approximately two to three pounds above atmospheric pressure, the packing thus afforded by the neck g is ample to prevent any serious degree of leakage of steam outwardly into the atmosphere. A greater degree of leakage can occur between the chamber J and the cylinder by reason of the fact that during the exhaust-stroke the difference between the pressure of the steam and the negative pressure of the vacuum may reach an approximate limit of, say, sixteen pounds per square inch; but this leakage, which practically is of slight extent, can occasion no appreciably disadvantageous results, because it is a leakage of steam into the cylinder instead of a leakage of air, and hence is readily disposed of by the action of the condenser and imposes no appreciably-increased service upon the air-pump. The live-steam chamber J which my invention provides thus serves to envelop the piston-rod between the cylinder and the outer air in an atmosphere of live steam which can leak inwardly into the cylinder in place of a leakage of air and may to some slight extent leak outwardly to the outer air, or which, at any rate, by reason of being at slightly higher pressure than the outer air, prevents any inflow of air. Thus the engine is effectually protected against any leakage of air into the exhaust.

As applied to a double-acting engine, as already described, the live-steam chamber J is necessarily distinct from the cylinder. In a single-acting engine, however—such, for example, as are applicable for deep-well pumping—the construction can be somewhat simplified, as shown in Fig. 2. In this case the lower end of the cylinder is connected permanently with the valve-chest D by means of the port or passage b' already described, which is not controlled by the valve. Hence there is a constant supply of live steam to the under side of the piston, the steam flowing back

and forth through the passage b' as the piston rises and falls. Hence the lower end of the cylinder constitutes a chamber (lettered J') which serves the same essential function as the chamber J already described, in that it prevents any inflow of air around the piston-rod through the neck g' , which corresponds to the neck g in Fig. 1. Any leakage occurring past the piston must in this case be a leakage of live steam from the chamber J' and cannot be a leakage of air, so that only steam can leak into the exhaust.

I claim as my invention the following-defined novel features, substantially as hereinbefore specified, namely:

1. An atmospheric steam-engine having in lieu of piston-rod packing a live-steam chamber surrounding the piston-rod between the piston and the outer air, and means for keeping said chamber filled with steam at not less than atmospheric pressure, whereby leakage of air into the cylinder around the rod by reason of the exhaust-vacuum is prevented.
2. An atmospheric steam-engine having a live-steam chamber surrounding the piston-rod between the piston and the outer air, and a duct communicating therewith from the source of steam, adapted to keep said chamber filled with steam at not less than atmospheric pressure, whereby leakage of air into the cylinder around the rod by reason of the exhaust-vacuum is prevented.
3. An atmospheric steam-engine having a live-steam chamber surrounding the piston-rod between the piston and the outer air, and a duct communicating therewith from the source of steam, adapted to keep said chamber filled with steam at not less than atmospheric pressure, and means for draining off the condensation-water therefrom.
4. A double-acting atmospheric steam-engine, having in lieu of piston-rod packing a live-steam chamber surrounding the piston-rod between the end of the cylinder and the outer air, and means for keeping said chamber filled with steam at not less than atmospheric pressure, whereby leakage of air into the cylinder around the rod by reason of the exhaust-vacuum is prevented.
5. A double-acting atmospheric steam-engine, having a live-steam chamber surrounding the piston-rod between the end of the cylinder and the outer air, and lower than the valve-chamber, a duct leading downward from the latter to said steam-chamber, for supplying steam to the latter and for draining condensation from the former, and a drainage-tube leading downward from said steam-chamber.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

FRANK M. LEAVITT.

Witnesses:

H. HUGHES,
J. A. SEITZ.