C. H. DeLamater.

Steam Boiler Condenser.

No. 94,403. Patented Aug. 31, 1869.

Fig. 2.

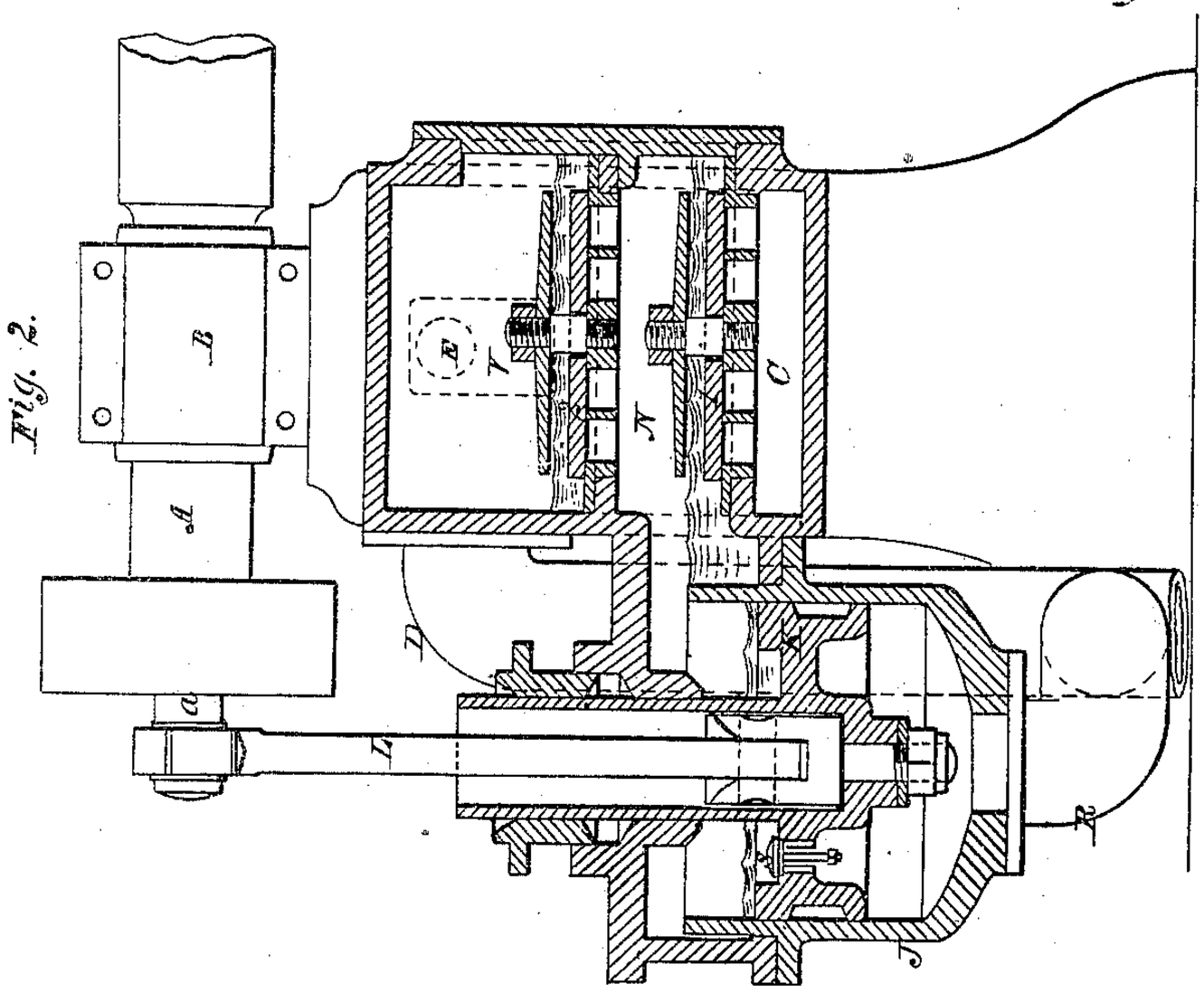
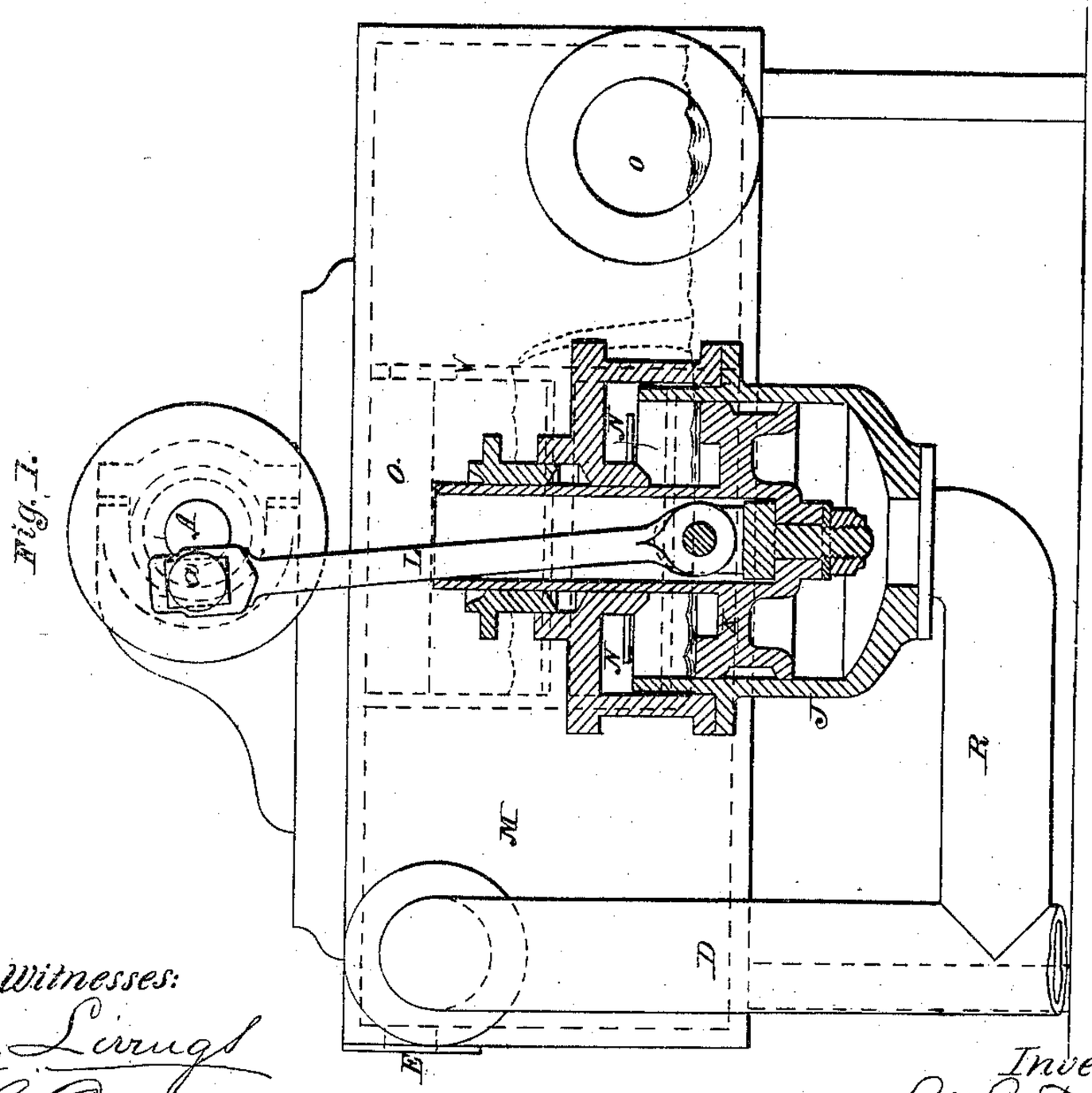


Fig. 1.



Witnesses:

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CORNELIUS H. DE LAMATER, OF NEW YORK, N. Y.

Letters Patent No. 94,403, *dated August* 31, 1869.

IMPROVED STEAM-ENGINE CONDENSING-APPARATUS.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, CORNELIUS H. DE LAMATER, of the city and county of New York, in the State of New York, have invented certain new and useful Improvements in Air-Pumps and Condensers for Low-Pressure Steam-Engines; and I do hereby declare that the following is a full and exact description thereof.

My invention consists in a novel arrangement and construction of an air-pump and condenser, adaptable to all varieties of condensing-engines, and having for its main object the production and maintenance of a more perfect vacuum than is attainable by the means in ordinary use, together with compactness of form, facility of construction, economy of material, and operative power, and accessibility to all the working-parts, as will be more fully explained by the annexed drawings and description, forming part of this specification.

In the construction of the arrangement shown in the annexed drawings, I use a rectangular hollow casting, which forms the foundation for the outer main pillow-block of the engine, and which is divided by suitable partitions across its length, into three nearly equal compartments, forming, respectively, the condenser proper, the valve-chamber, and the hot-well.

The air-pump is attached to the valve-chamber at one side of the main body of the casting, and in the middle of its length, fitting into a socket of suitable dimensions, and being secured by bolts and flanges, as seen in the drawing, referring to which—

Figure 1 is a vertical longitudinal section of the air-pump, and its connections, showing also a front elevation of the condenser-casting, the interior compartments of which are seen in dotted lines.

Figure 2 is a transverse section, taken vertically through the centre of air-pump valves and valve-chamber, showing the interior construction and arrangement of the various parts and passages. It also shows an elevation of the shaft, pillow-block, and crank, as arranged for operating the air-pump.

Like letters of reference indicate the same parts in both views.

A is the main shaft of the engine.

a a, the crank-pin, operating the air-pump by the connecting-rod L.

B is the pillow-block, resting on and attached to the condenser-casting, which forms its foundation.

J is the air-pump, which, though not essentially so, is in this case fitted with "trunk"-piston, K, to allow of being arranged to work nearer the main shaft A.

This air-pump piston, whether of the "trunk" construction or otherwise, is, to all intents, a solid "plunger" or "piston," in its mode of action. It is not intended to pump the injection and condensed vapors through it, as in the usual construction of air-pump buckets, as it is provided with only one small valve opening upward, as seen at *s*, fig. 2, the precise use of which will be given below. The size of the valve *s* is not essential, however, and it will answer equally well if made of considerable dimensions.

M, to the left of fig. 1, is the condenser proper, or condensing-chamber. It is a rectangular space, the whole width of the casting, and extending about one-third of its length, as before stated. It communicates with the valve-chamber O by a shallow passage, *c*, at the bottom, and below the lowest valve, commonly known as the foot-valve, as seen at C, and receives the exhaust and injection-pipes D and E, near its upper portion.

The valve-chamber O occupies the central position in the condenser-casting. In it are fitted the inlet (1) and outlet (2) valves, or foot-valve and delivery-valve, as sometimes called. These valves are directly over each other, the space N between them being in communication with the upper and open end of the air-pump. These valves are here shown as constructed of rubber, and with the usual "grates" and "guards."

The valve-chamber O communicates with the condenser, below the lower valve, with the air-pump, by the space N between the valves, and finally with the hot well above the upper valve, by the passage or opening V.

I prefer to construct the air-pump J with a close bottom, below the piston K, but I can, and may occasionally, use the pipe R, to form a communication with the condenser from the space below the air-pump piston K, in special cases explained below.

Having described the construction of my improved "air-pump and condenser," I will explain its operation.

Steam, being admitted to the condensing-chamber M by the exhaust-pipe D, will be met and condensed by the jet of cold water, entering by the injection-nozzle E. The water of condensation and injection falling to the bottom of the condensing-chamber M, will flow through the passage *c*, entering the valve-chamber O, below the lower valve 1.

The air-pump piston K, being set in motion downward, will expel the air beneath it through the small valve *s*, (the bottom of the air-pump being closed, it has no other outlet,) and on its return stroke upward, will drive the air through the upper valve 2, and, at the same time, will produce a vacuum, more or less perfect, below the air-pump piston. The next stroke downward will produce a vacuum above the air-pump piston, and in the space N between the valves, inducing the water in the condensing-chamber to flow through the passage *c* and the lower valve 1, into the open end of the air-pump, by the space N. The succeeding stroke upward will completely fill with water the space N, and expel through the upper valve 2 the air and uncondensed vapor, before discharging any

water. In the mean time, a small amount of water having leaked past the air-pump piston into the vacuous space beneath it, will, as the air-pump piston again nears the bottom, fill all the vacant space included in the clearance between the piston and the bottom of the air-pump, all the included air and the surplus water finding vent through the small valve *s*, when the lowest point of the stroke is reached.

It will readily be seen, that when in operation the air-pump piston is at all times covered with water, by the water from the space N flowing back into the air-pump at each down stroke, and as all the space below the piston of the air-pump, when at the bottom, is filled with the same inelastic fluid, the up stroke must produce below the piston the most perfect vacuum consistent with the temperature of the water, and as the space above the piston, up to and over the outlet-valve, is full of dense water at the termination of the up stroke, the same perfect vacuum obtained below the piston, by submerged space development in dense water, is, by the same means and under like conditions, obtained above the piston in the space N, and consequently in the condensing-chamber, when the piston moves downward.

It will also be seen, that as the upper edge of the air-pump stands above the lower valve 1, a stratum of water is always retained over and interposed between this valve and any vapors which might collect or be present in the space N.

The upper valve 2 is also constantly covered with water, as there is a dam provided for this purpose by a part of the partition V, at the lower part of the opening into the hot-well, being raised above the valve 2, so as always to retain water over it.

It will thus be readily understood that the upper and lower valves, and also the air-pump piston are at all times perfectly water-packed, as a stratum of water is always over them; and, as the pressure on the valves and on the air-pump piston is downward, it will also be seen that as all the air and vapor is expelled before the water, no elastic vapors can remain or collect in the air-pump or valve-chamber between the valves, to diminish the vacuum by their expansive action.

No shock to the air-pump piston occurs in expelling the surplus water from beneath the air-pump piston, through the small valve *s*, as the quantity of water to be expelled is very small, being only the amount leaking at each stroke, and its expulsion takes place only at the very end of the stroke, when the piston is coming to a state of rest, and consequently moving slow.

The pipe R, establishing a connection between the under side of the air-pump piston and the condenser, is intended for use occasionally. When the air-pump piston is very leaky, or in case the valve *s* by any means gets fast, or becomes inoperative, its use merely establishes the same vacuum on the lower side of the air-pump piston as that obtained in the condensing-chamber, but the vacuum obtained by this means is not so perfect as by the mode of operation first described. Any water accumulating in the pipe R is carried up by the current of steam flowing through the pipe D, and thus transferred into the condenser.

Having described the construction and operation of my improvements, I will state what I claim as new, and desire to secure by Letters Patent, as follows:

The construction and arrangement of the valves 1 and 2, in relation to the piston K, condenser M, hot-well O, and chamber N, as herein set forth.

In testimony whereof, I have hereunto set my name, in presence of two subscribing witnesses.

CORNELIUS H. DE LAMATER.

Witnesses:

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A. K. RIDER.