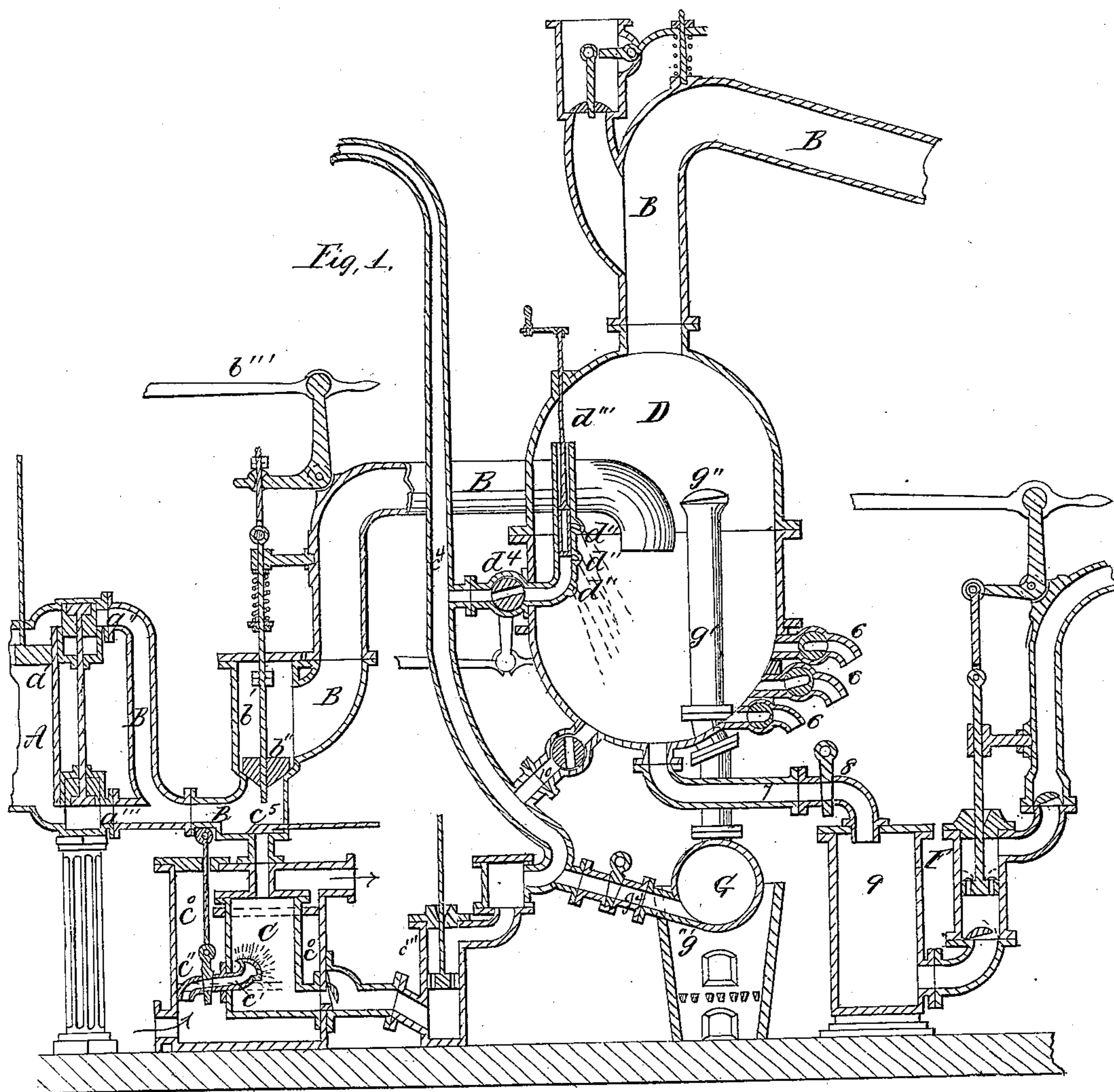


Sheet 1-3, Sheets.

*J. Houpt*  
*Steam Condenser.*

*N<sup>o</sup> 109,616.*

*Patented Nov 29, 1870.*



*Witnesses,*  
*Phos Morris*  
*Wm H Morison*

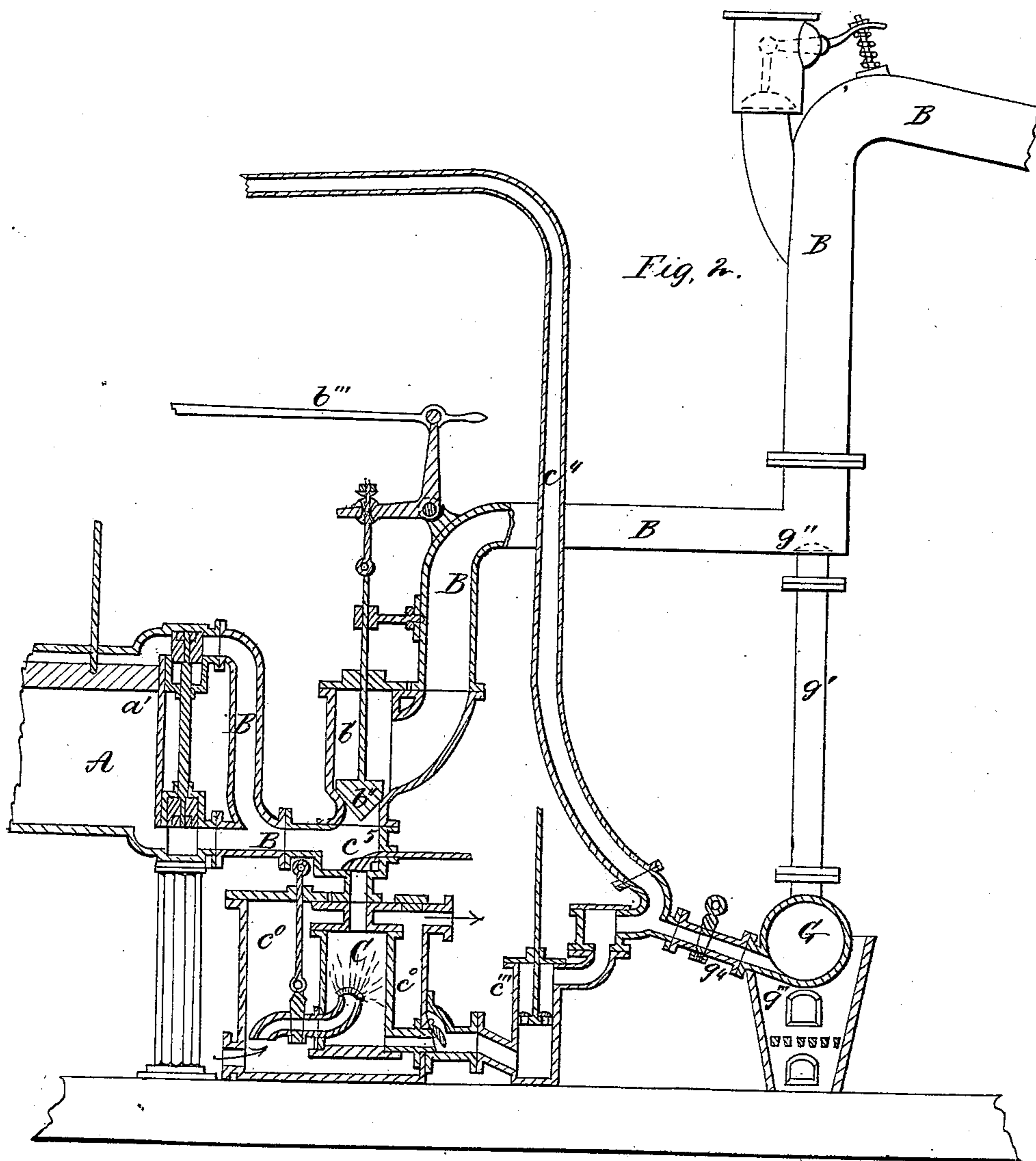
*Inventor,*  
*John Houpt*

*J. Houyt.*  
*Steam Condenser.*

*Sheet 2-3, Sheets.*

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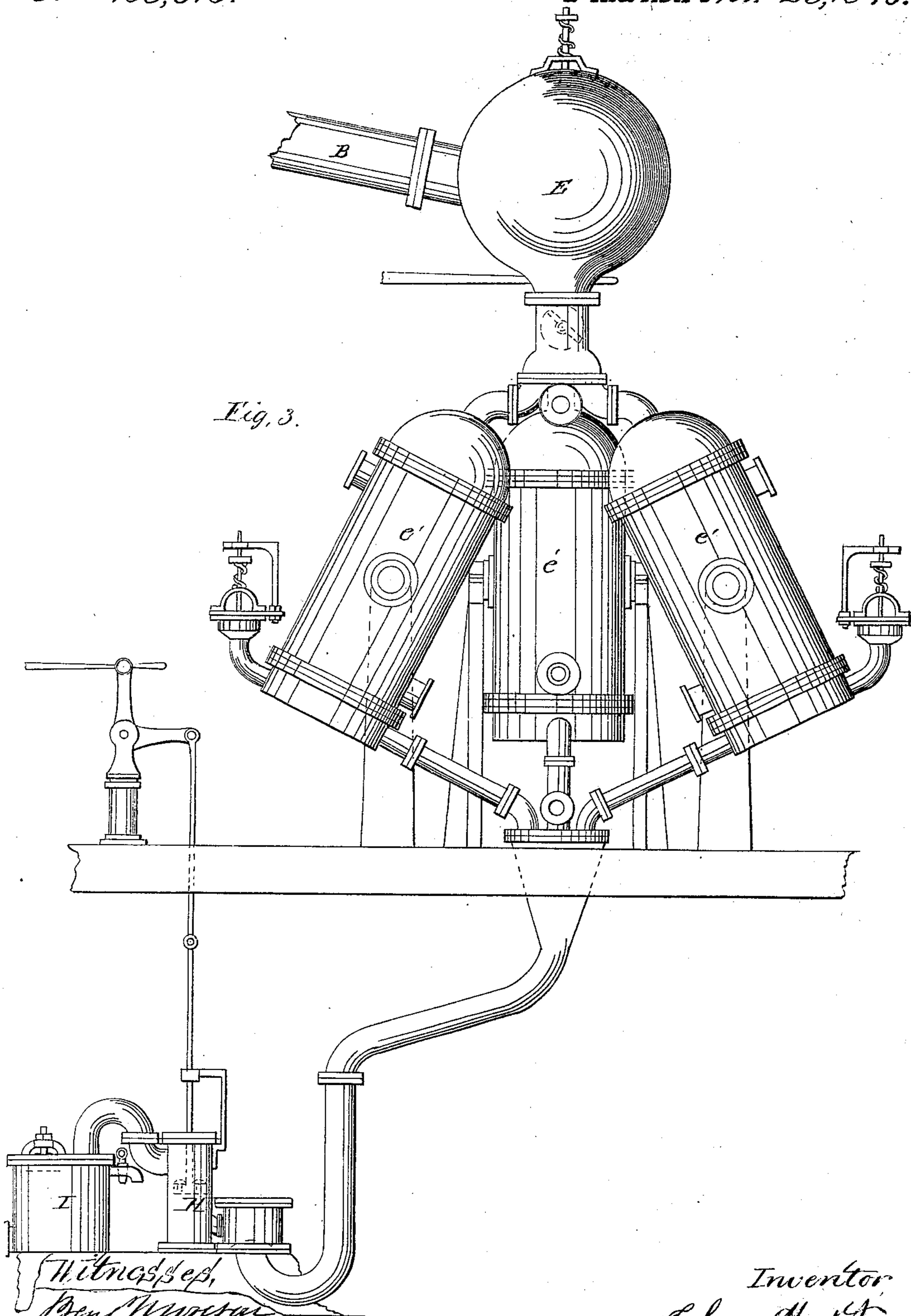
*J. Haupt.*

*Sheet 3-3, Sheets.*

*Steam Condenser.*

*N<sup>o</sup> 109,616.*

*Patented Nov 29, 1870.*



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# United States Patent Office.

JOHN HOUP, OF SPRINGTOWN, PENNSYLVANIA.

Letters Patent No. 109,616, dated November 29, 1870.

## IMPROVEMENT IN STEAM-GENERATORS.

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

I, JOHN HOUP, of Springtown, in the county of Bucks and State of Pennsylvania, have invented certain further Improvements in Condensers for Marine-Engines, of which the following is a specification.

### *Nature and Objects of the Invention.*

My present improvements relate, generally, to the employment of a plurality of condensers for a single steam-cylinder described in Letters Patent granted to me on the 18th day of May, 1869, but, more especially, to certain improvements in condensers for which Letters Patent were granted to me on the 19th day of April, 1870, and to certain further improvements in condensers for marine-engines described in an application filed by me in the United States Patent Office March 24th, 1870.

The first part of my present invention relates to the construction of a comparatively small primary jet condenser and an air-pump attached, to operate together in combination with a valve, and with a steam-passage-way, which communicates with both exhausts of the steam-cylinder of an engine and with a tertiary conductor in such a manner as to allow only a small remnant of the exhaust steam coming from the said cylinder to be condensed by a jet-spray of sea-water, in the said primary condenser, to produce the required vacuum before the piston, immediately after the first puff or main portion of the said exhaust-steam has been discharged through the said valve and passage-way toward the tertiary condenser for the production of fresh water for the steam-generators of the engine; the object of this part of my invention being to provide for the passage of the main portion of the escape-steam toward the tertiary condenser, to more effectually prevent any saline vapor which may arise from the condensing water of the jet-spray in the said primary from reaching the tertiary condenser, and also for the purpose of furnishing the water of condensation for the steam-generators of a higher degree of temperature than can be furnished by the ordinary condensers which are intended to produce a vacuum.

The second part of my present invention relates to the construction and arrangement of a secondary chamber or evaporator, in combination with the escape-steam passage-way which leads from the exhausts of the steam-cylinder to the tertiary condenser, and with the hot-water discharge-pipe of the primary condenser, the object of this part of my invention being to produce an additional amount of vapor free from any salines, to compensate for the loss of that portion which is condensed by the saline jet-spray in the primary condenser.

The third part of my invention relates to the combination, with the exhaust-steam passage-way, of a

supplementary furnace and boiler or steam-generator in such a manner that aqueous vapor, free from any salines, may be furnished thereby to the said steam passage-way when necessary, the object of this part of my invention being to afford a more simple and inexpensive means of making up for the loss of the fresh-water vapor condensed in the primary condenser.

### *Description of the Drawing.*

Figure 1 is a vertical section representing the steam-cylinder of an engine with its exhausts in communication with the steam passage-way, primary jet-condenser, and the secondary chamber or evaporator, with their respective attachments, arranged substantially in the same vertical plane for the purpose of better illustration.

Figure 2 is a like section of the same parts, modified so as to operate without the secondary chamber or evaporator.

Figure 3 is a side elevation of the tertiary condenser, with its fresh-water reservoir and air-pump attached.

### *General Description.*

A represents the steam-cylinder of a marine-engine, *a'* its piston, and *a'' a'''* its exhausts, in communication with the steam passage-way B, the primary jet-condenser C, the secondary chamber or evaporator D, and the head or drum E of the tertiary condenser.

In the passage-way B, near its junction with the two exhausts, *a'' a'''*, of the cylinder A, a valve-chamber, *b'*, is made, in which a spindle-valve, *b''*, is fitted to be opened upward and closed downward by a positive motion derived through a connecting-rod, *b'''*, from any suitable moving part of the engine, so as to alternately open and close the passage-way B at a point directly above the primary condenser C.

The primary condenser C is surrounded by a case containing cold sea-water, *c'*, and has a jet-spray pipe, *c''*, for the discharge of cold sea-water from the surrounding case into the condenser in a steady spray, regulated by an adjustable stop-cock, *c'''*, and has also communicating with its lower end an air-pump, *c''''*, operated in a positive manner by any suitable moving part of the engine, so as to draw out and force overboard, through a pipe, *c'''''*, the air and the water of condensation deposited in the said condenser.

The upper end of the condenser C communicates with the passage-way B at a point directly below the valve *b''*, and has at this part a slide-valve *c<sup>5</sup>*, operated in a positive manner by any suitable moving part of the engine in such a manner as to be closed when the valve *b''* opens, and open immediately after

the said valve *b*" closes, and so that when the exhaust-valve of either end of the steam-cylinder *A* begins to open then the valve *b*" opens and lets the first or main portion of the escaping high steam pass upward through the way *B* toward the head *E* of the tertiary condenser and then closing, the valve *c*<sup>5</sup> immediately after opens and lets the remaining small portion of steam pass down into the condenser *C*, (which, being surrounded by cold water *c*<sup>6</sup> passing through the casing,) when it is immediately condensed by the spray *c*<sup>7</sup> of cold sea-water, and the required vacuum thus produced before the returning piston, which, having nearly returned, the valve *c*<sup>5</sup> closes and the air and the warm water of condensation are drawn out of the condenser *C* and forced overboard through the pipe *c*<sup>4</sup> by the air-pump *c*<sup>3</sup>.

The evaporating or secondary chamber *D* is a capacious oval-shaped vessel supported in a comparatively elevated position, and into this the steam passage-way *B* opens, (see fig. 1.)

The said chamber *D* has a bent pipe, *d*', within it, which is constructed with a series of very minute jet-spray openings, *d*" *d*", controllable by a hand-screw stem, *d*<sup>3</sup>, fitted with a stopper at its lower end, so that either one, two, or all of said jet-openings may be stopped or opened at pleasure, and this bent pipe *d*' communicates with the pipe *c*<sup>4</sup> and is fitted with a valve, *d*<sup>4</sup>, operated in a positive manner by any suitable moving part of the engine, so as to let warm water pass periodically from the pipe *c*<sup>4</sup> into the chamber *D*, the object being to produce an additional supply of fresh-water vapor by the evaporating effect of the high steam from the steam-passage way *B* upon the saline water from the spray-jets *d*" *d*", to compensate for the loss occasioned by the condensation of the steam in the primary condenser *C*.

The lower end of this chamber *D* is provided with a series of try-cocks, 6 6 6, by which the height of the water therein may be readily ascertained, and also with an evacuating-pipe, 7, fitted with a stop-cock, 8, and opening into a chamber, 9, which communicates with a force-pump, *F*, whereby the water in the said chamber *D* can be drawn out and forced overboard when necessary.

For the purpose of affording a ready means for washing out any saline deposits which may in time accumulate on the bottom of the said evaporating-chamber *D*, an inlet pipe, 10, fitted with a stop-cock, is fixed to communicate with the said bottom and the warm-water pipe *c*<sup>4</sup>; and for the purpose of affording a ready means of warming up the evaporator *D* before starting the engine, and also of increasing the quantity of fresh-water vapor, should there not be a sufficiency provided by the action of the steam upon the spray-water in the said evaporating-chamber *D*, a supplementary evaporator is provided, consisting of a boiler, *G*, fitted with a steam-pipe, *g*', which passes vertically up through the bottom of *D* and opens into the upper end of the same, a gravitating-valve *g*" being applied over the open end of the said pipe.

The said boiler is supported and heated by a small special furnace, *g*<sup>3</sup>, and receives its supply of water from the warm-water pipe *c*<sup>4</sup>, through a communicating-pipe, *g*<sup>4</sup>, which is provided with a stop-cock.

As the supplementary boiler *G* will probably be sufficient to furnish the required amount of fresh-water vapor to compensate in the greater number of marine-engines for that lost in the primary condenser, the evaporating-chamber *D* may, in such cases, be dispensed with entirely, and the boiler *G* relied upon to make up the deficient amount of vapor, by modifying the steam-passage-way *B* and opening the valved end of the pipe *g*' of the boiler *G* directly into the said pipe

or steam-passage-way *B*, as represented in fig. 2. This modification has the advantage also of being much less costly in construction.

The tertiary condenser, (see fig. 3,) consists of a series of inclined condensing-cases *c*<sup>1</sup> *e*<sup>1</sup>, constructed and operating in connection with a reservoir for the water produced, in the manner described in my application filed in the Patent Office on the 24th day of March, 1870, as before stated; but in my present invention I apply an air-pump, *H*, so arranged and operated between the condenser and the reservoir *I* as to produce a sufficient vacuum in the condensers to facilitate the escape steam through the steam-passage-way *B* into the said tertiary condenser without any more expenditure of power in working the said air-pump *H* than will be sufficient to produce the said partial vacuum, and without straining the sliding joints, as aforesaid.

In the operation of my present invention it will be understood that, as there is but a small remnant of the exhaust-steam to be condensed in the primary condenser *C*, the temperature therein can be more quickly reduced, and to a lower degree and therefore a more sudden and better vacuum be produced and maintained in front of the piston than heretofore.

It will also be understood that, as the main portion of the exhaust-steam passes into the tertiary condenser, only the small remnant condensed in the primary has to be provided in order to keep up the full supply of fresh water for the steam-generators, and that therefore the mode of producing this deficiency by means of the evaporating-chamber *D* and the supplementary boiler *G*, as represented in fig. 1, or by means of the boiler *G* alone, as represented in fig. 2, will be sufficient to produce more vapor than will be required.

Although it is believed that the vapor produced by the action of the high steam upon the very minute spray-jets of the saline water coming from the pipe *c*<sup>4</sup> will be free from any saline matter, still I prefer the modification shown in fig. 2, first, because the vapor generator or boiler *G* is much more distant, and therefore the vapor will the more certainly be free from any salines by the time it reaches the outlet-valve *g*" in the top of the pipe *g*', and second, because it is much less costly of construction.

The partial vacuum produced in the tertiary condenser by means of the air-pump *H* it will be evident must facilitate the passage of the steam and vapor through the steam-passage-way *B* into the condenser by releasing the latter of a part of the air that may be contained therein.

#### Claims.

I claim as my invention—

1. The primary condenser *C* and air-pump *c*<sup>3</sup>, in combination with the valve *b*" and steam-passage-way *B*, the said parts being constructed and arranged to operate substantially as and for the purposes hereinbefore set forth.

2. The secondary chamber or evaporator *D*, in combination with the escape-steam passage-way *B* and the hot-water discharge-pipe *c*<sup>4</sup>, the said parts being constructed and arranged to operate substantially as and for the purpose hereinbefore set forth.

3. The supplementary boiler *G*, furnace *g*<sup>3</sup>, and pipe *g*', in combination with the escape steam-passage-way *B*, when arranged substantially as shown in fig. 2, for the purpose hereinbefore specified.

JOHN HOUP.

Witnesses:

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WM. H. MORISON.