(No Model.)

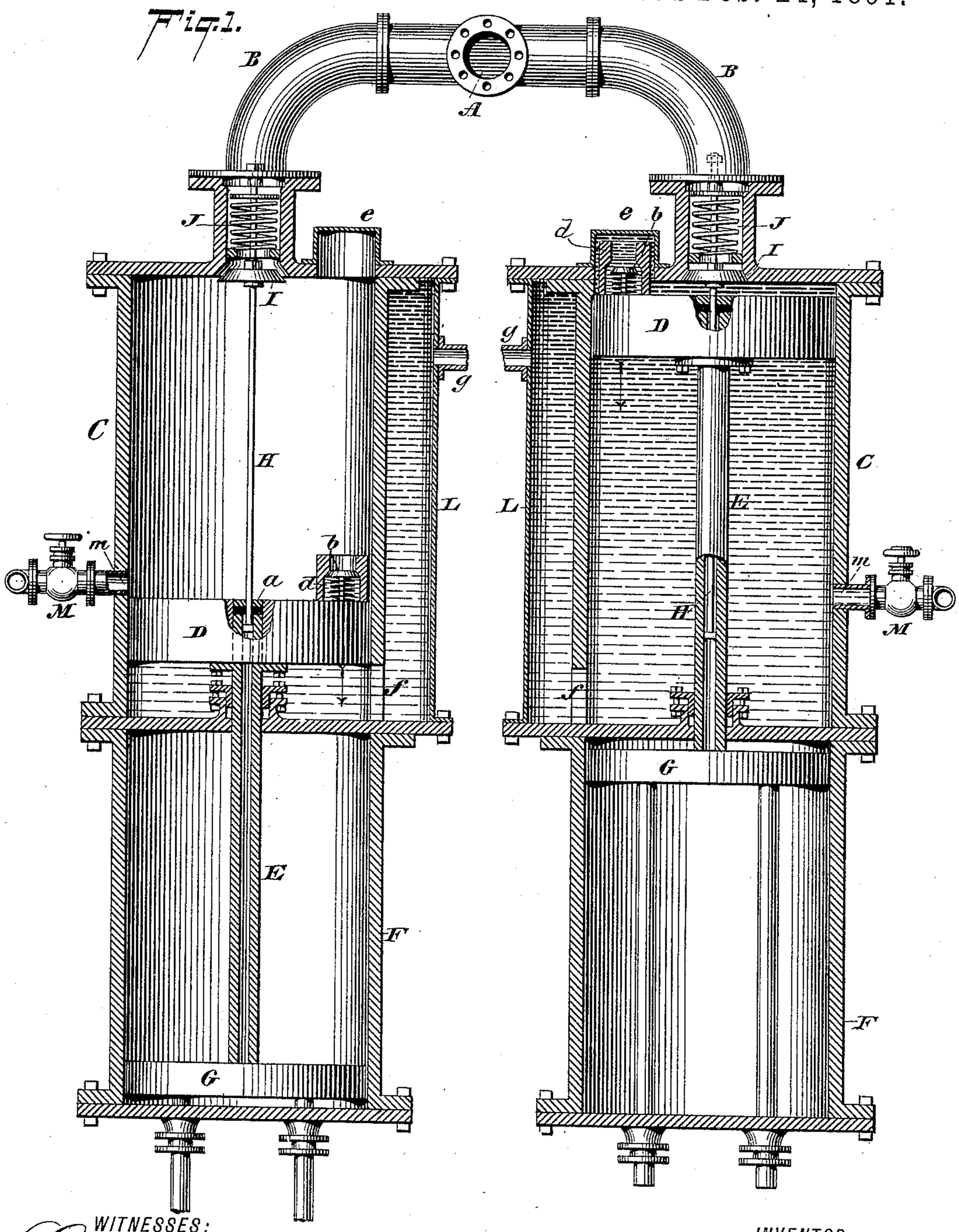
3 Sheets—Sheet 1.

A. BORNHOLDT.

VACUUM PUMP.

No. 446,960. Patented Feb. 24, 1891.

Fig. 1.



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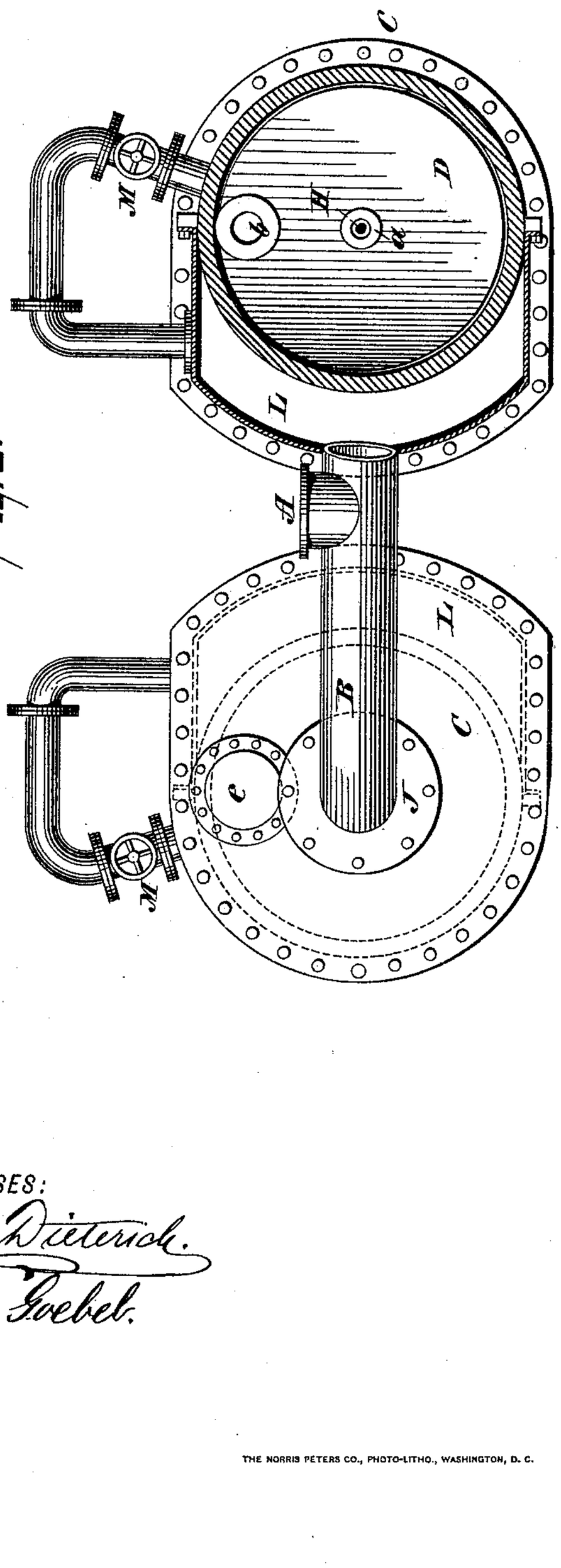
(No Model.) 3 Sheets—Sheet 2.

A. BORNHOLDT.

VACUUM PUMP.

No. 446,960. Patented Feb. 24, 1891.

Fig. 2.



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(No Model.) 3 Sheets—Sheet 3.

A. BORNHOLDT.

VACUUM PUMP.

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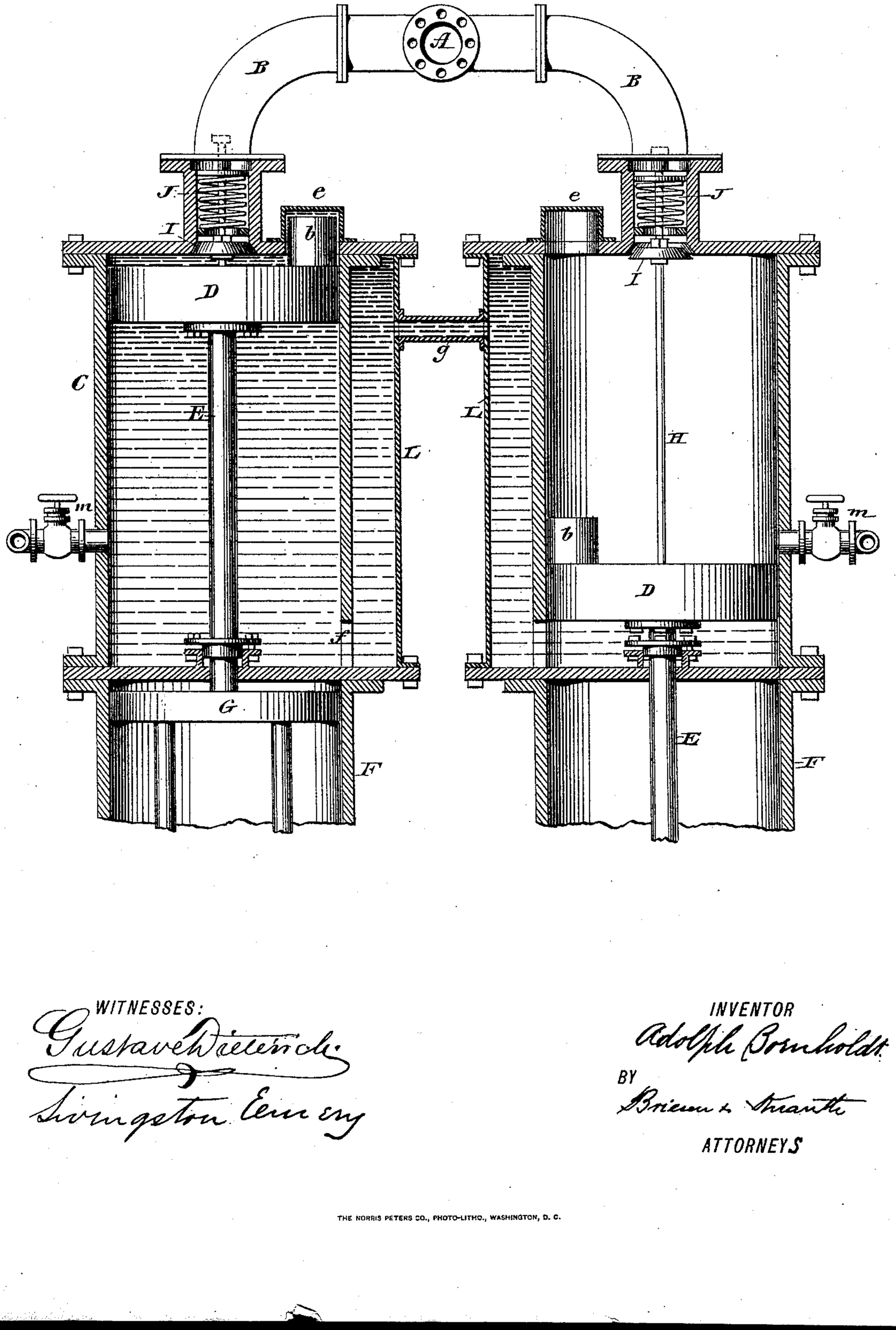
Fig. 3.



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UNITED STATES PATENT OFFICE.

ADOLPH BORNHOLDT, OF BROOKLYN, NEW YORK, ASSIGNOR OF ONE-THIRD TO JOSEPH GLATZ, OF SAME PLACE.

VACUUM-PUMP.

SPECIFICATION forming part of Letters Patent No. 446,960, dated February 24, 1891.

Application filed March 18, 1890. Serial No. 344,282. (No model.)

To all whom it may concern:

Be it known that I, ADOLPH BORNHOLDT, a resident of Brooklyn, Kings county, and State of New York, have invented an Improved Vacuum-Pump, of which the following is a specification, reference being had to the accompanying drawings, forming part of same, wherein—

Figure 1 is a vertical central section of my improved vacuum-pump. Fig. 2 is a top view, partly in section, of the same. Fig. 3 is a partial vertical section showing the reservoirs L connected together.

This invention relates to a vacuum-pump and condenser combined, serving to draw vapors from any suitable source into a vacuum which is created by the pump to condense these vapors and to mingle the products of condensation with water, from which the same may afterward be conveniently removed; and the invention consists more particularly in the employment within each pump-chamber of a reciprocating piston combined with a valve mechanism for closing the passage to the vapor-chambers whenever the piston approaches said passage and for opening the same whenever the piston recedes therefrom, and with valve mechanism also for throwing the products of condensation into a column of water which always follows one side of the piston, as hereinafter more fully described.

In the accompanying drawings two vacuum-pumps of my improved construction are represented, both being joined to the vapor-supply pipe A by branch pipes B B; but I desire it to be understood that I am not limited to the conjoint use of two pump-cylinders of my new construction, as one alone may in many instances be profitably employed, or more than two in connection. I will therefore describe but one of these cylinders.

The vacuum-pump cylinder is shown at C and contains a piston D, whose stem E extends into a steam-cylinder F, within which it carries a piston or plunger G. Steam is supplied to the cylinder F on opposite sides of the plunger G alternately in the well-known manner, the devices for introducing it not being represented in the drawings. The effect of the alternate admission of steam to the upper and lower part of the steam-cylinder F is to lower and then raise the plunger G, and thereby to lower and to raise the plunger D within the vacuum-pump. The plunger D is perforated, and with it the stem E is likewise perforated for the purpose of admitting within the tubular cavity thus formed a stem H of a valve I, which valve is placed below the entrance of the vapor-supply pipe B to the cylinder C. A spring J may be placed above the valve I, as shown; but in lieu of this spring an equivalent weight may be employed. The stem H where it enters the tubular passage of the plunger D is embraced frictionally by a washer *a*, which has for its object to normally retain the valve I in the position which corresponds to the motion of the plunger D—that is, when the plunger D moves upward this frictional grasp will cause the valve I to move upward too until it finds resistance on its seat, thus closing all communication with the pipe B, whereas when the plunger D moves downward this frictional contact with the stem H will cause it to draw the valve I away from its seat and thereby establish communication between the vapor-pipe B and the cylinder C. The plunger D carries also a check-valve *b*, which opens downwardly and which closes upwardly under the influence of a suitable spring or otherwise against its seat. By preference this check-valve *b* is contained within an upward extension *d* of the plunger D, as shown, and in case this upward extension is employed the upper head of the cylinder C has a corresponding upwardly-extending chamber *e*, into which the extension *d* can enter, as on the right-hand side of Fig. 1, when the plunger D is raised. Below the lowermost position of the plunger D is a water-supply passage *f* in the wall of the cylinder C, which communicates with a water-reservoir L. This water-reservoir I prefer to place alongside each pump-cylinder, as clearly appears from Figs. 1 and 2 of the drawings; but it may be placed at a distance therefrom whenever desired, and when I say "water-reservoir" I mean either water or any analogous liquid which will answer the purpose of receiving the products of condensation and of cooling the walls

of the vacuum-cylinder, another object of the water being to make air-tight connections wherever its column contacts the movable parts of the machine. Directly above the lowermost position of the plunger D is a jet-supply pipe M, through which a jet of water or analogous liquid may be sprayed into the cylinder C when the plunger D is down.

Having now described the construction of my new pump, I will proceed to describe its operation: Supposing the plunger D of the vacuum-pump to be in the lowermost position shown on the left-hand side of Fig. 1. In this position the valve I is open, and vapors are free to enter from the pipes A B into the vacuum-cylinder C. The valve *b* is closed, so that these vapors cannot escape from the cylinder C, and the aperture *m* being open to admit a small spray or stream of liquid into the cylinder C, sufficient simply to cover the plunger D and prevent leakage of air from around the same, which it continues to do during the subsequent ascent of the plunger D. Steam is now admitted beneath the piston G and the plunger D thereby lifted. As soon as it begins to lift it causes the valve I to be closed, and is now dealing with the confined column of vapors which had previously been admitted to the cylinder C. This column of vapors the plunger D as it continues to rise compresses, no escape for the same being provided for until the compression has reached such a degree that under its influence the check-valve *b* is opened, when during the continued ascent of the plunger D these vapors will be forced into the column of water beneath the plunger D until finally the plunger D is in the most elevated position shown on the right-hand side of Fig. 1, when there will be no more vapors, or practically none, left above the plunger D, all having been discharged into the water, which, during the ascent of the plunger D, was caused to follow it from the reservoir L through the aperture *f*. Having now attained the most elevated position, the plunger D is next moved downward by causing steam to be admitted to the upper part of the steam-cylinder F. As soon as the downward motion is started the valve I is immediately opened and fresh vapors are admitted into the vacuum-chamber which otherwise would be created by the descent of the plunger, and the descent of the plunger further serves to force the water beneath through the aperture *f* back into the reservoir L, and thence out through a suitable conduit *g*, until finally the lowermost position of the plunger D (shown on the left-hand side of Fig. 1) has been again attained. Where there are two vacuum-pumps connected for conjoint operation, as shown in the drawings, the two reservoirs L may be directly connected together, as shown in Fig. 3, so that as each piston descends the water or other liquid is forced from the corresponding reservoir L into the other reservoir through pipe *g*. The products of condensation can be separated from the liquid that is discharged from the reservoir L or directly within the reservoir L, if desired, by any well-known means, according to the character of these products in each instance.

Having now described my invention, what I claim is—

1. The combination of the vacuum-cylinder provided with an induction-valve, the piston connected with the stem of said valve so as to operate the same positively, said piston being provided with a discharge-valve, and the water-reservoir communicating with said cylinder on the side of the piston opposite to the induction-valve, substantially as described.

2. The vacuum-cylinder having an induction-valve and reciprocating piston connected with said valve and provided with a discharge-valve, in combination with the water-reservoir communicating with the cylinder near the end opposite to the induction-valve, and with the spray-supply pipe located at a point above the piston when the latter is in its lowest position, substantially as described.

3. The vacuum-cylinder C, having induction-valve I, valve-stem H, and jet-pipe *m*, combined with the piston D, having discharge-valve *b*, said piston being frictionally connected with the stem H of the valve I, which is opened and closed by said stem, and with means, such as the spring J, for reseating valve I when the piston passes the mouth of jet-pipe *m*, substantially as described.

ADOLPH BORNHOLDT.

Witnesses:
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