(No Model.) 2 Sheets—Sheet 1.

W. H. SUMBLING.

VACUUM PUMP.

No. 560,240. Patented May 19, 1896.

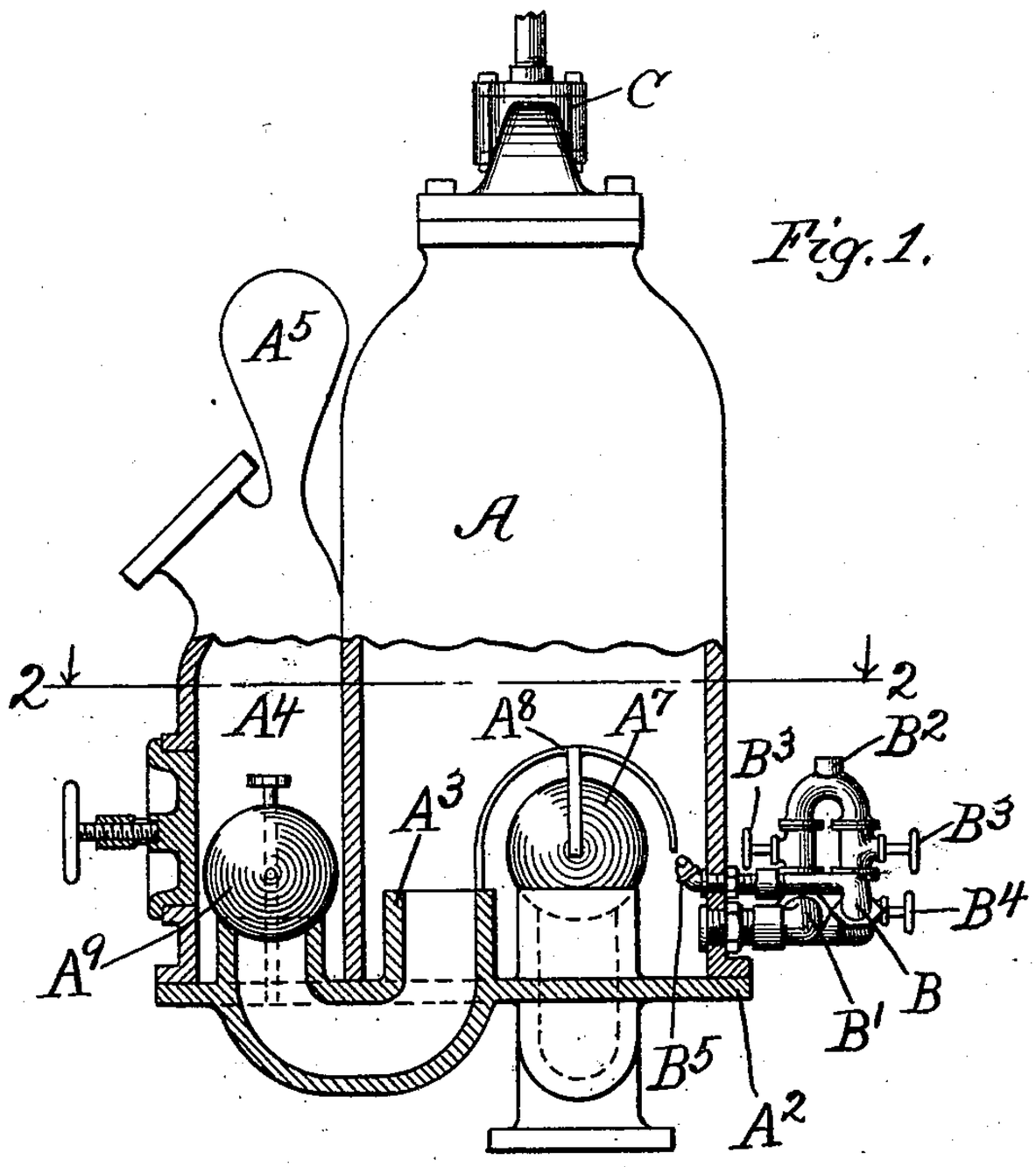


Fig. 1.

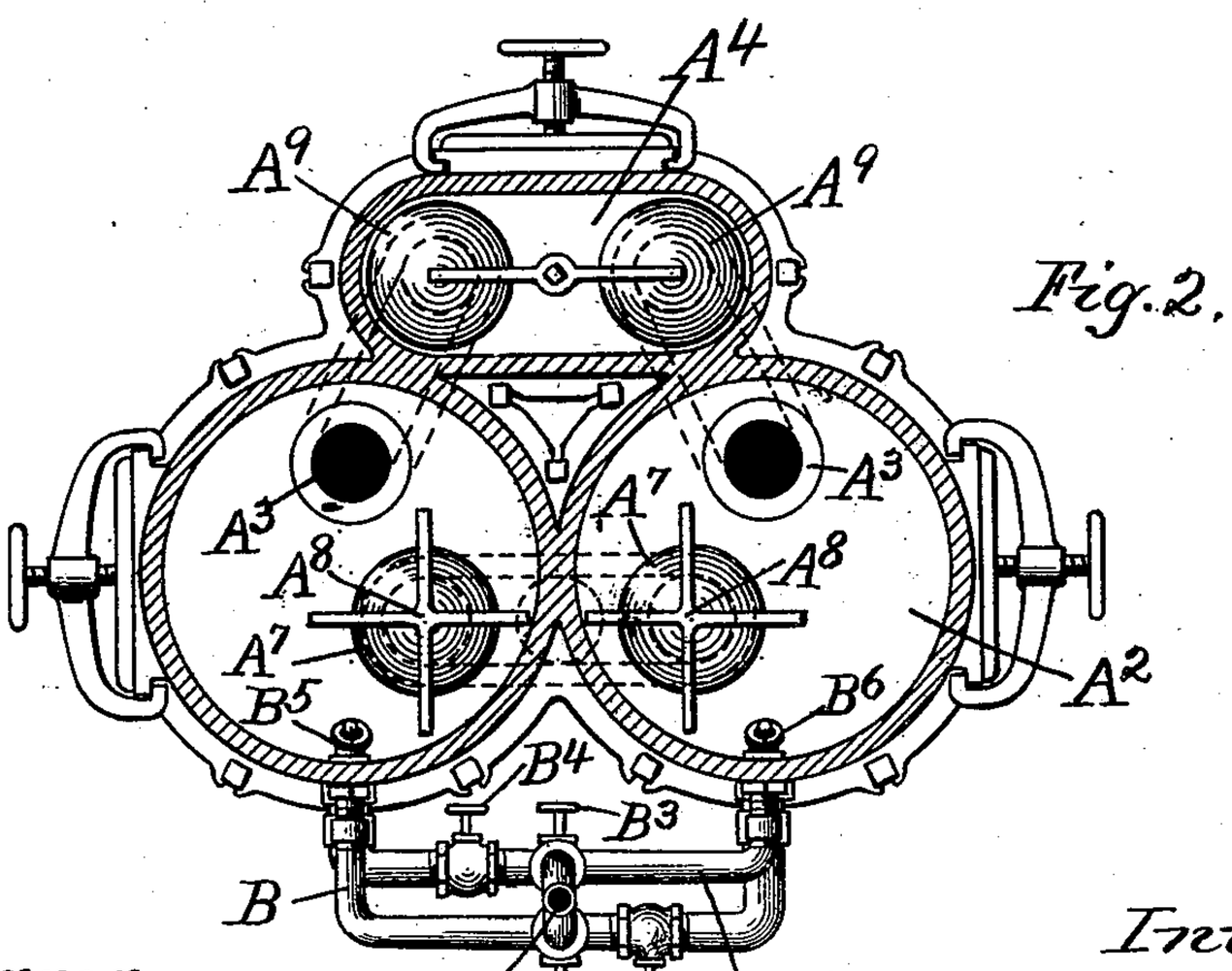


Fig. 2.

Witnesses.
E. T. Wray.
J. H. Coulter.

Inventor.
William H. Sumbling
by Frederick W. Parker,
his Atty.

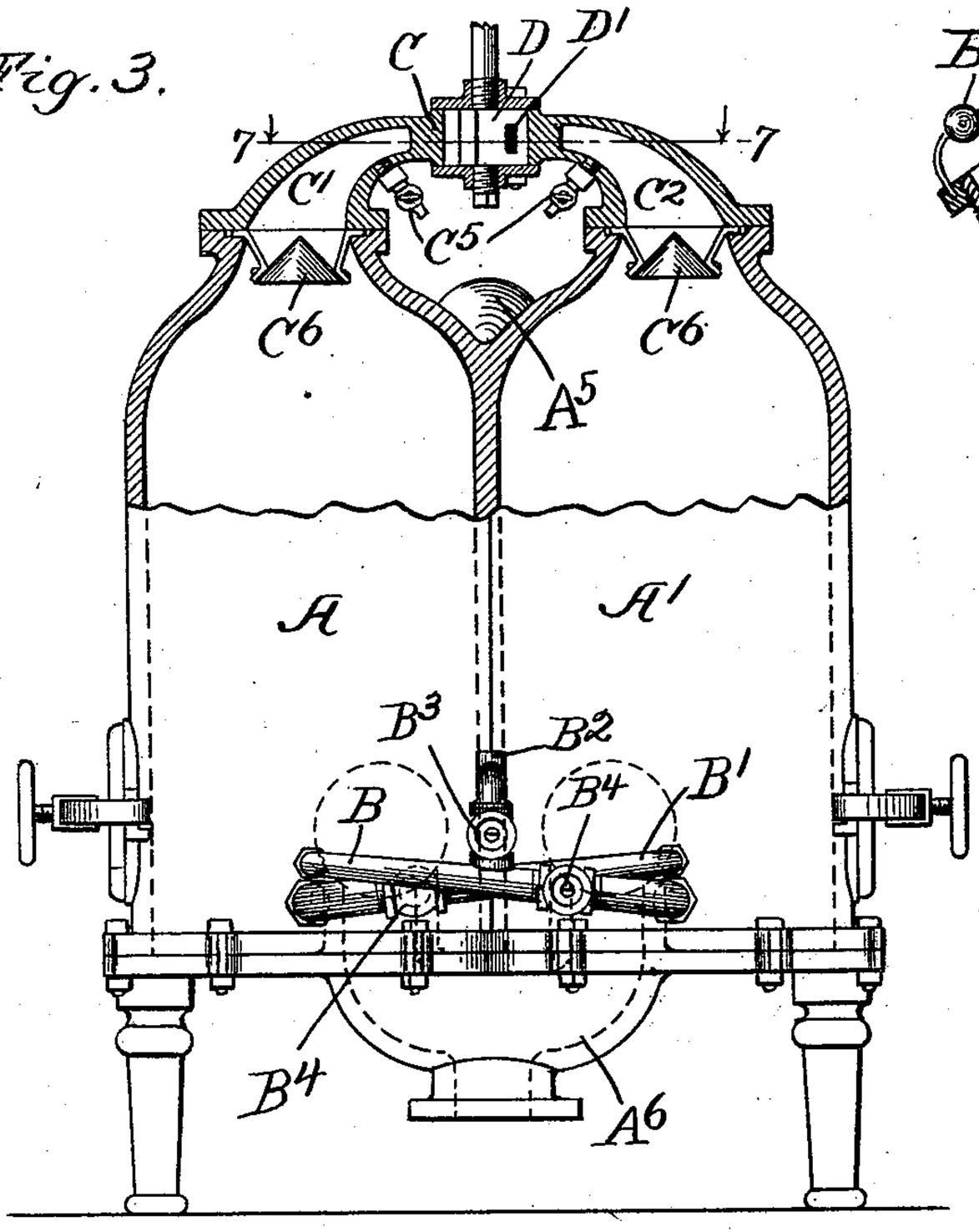
(No Model.) 2 Sheets—Sheet 2.

W. H. SUMBLING.

VACUUM PUMP.

No. 560,240. Patented May 19, 1896.

Fig. 3.



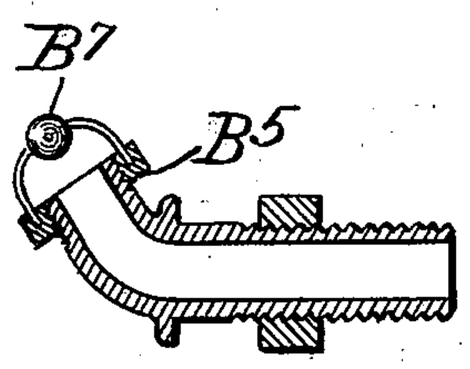


Fig. 4.

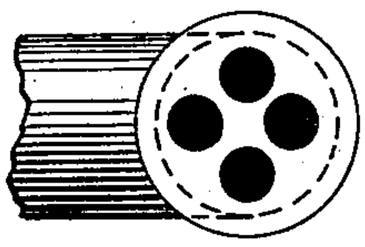


Fig. 5.

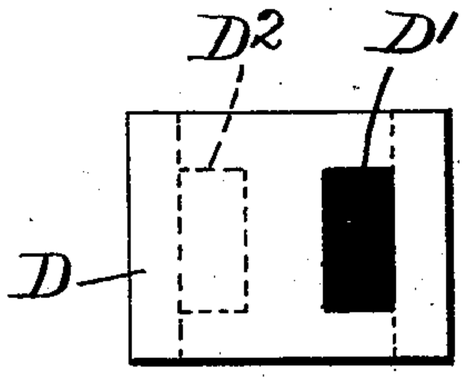


Fig. 6.

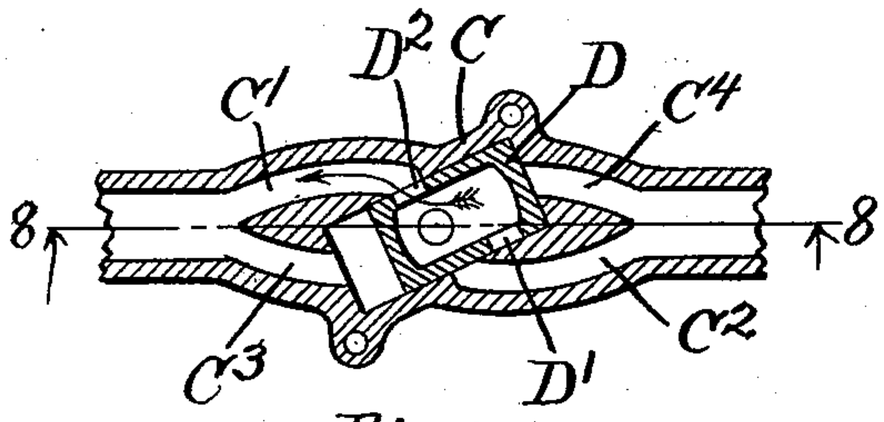


Fig. 7.

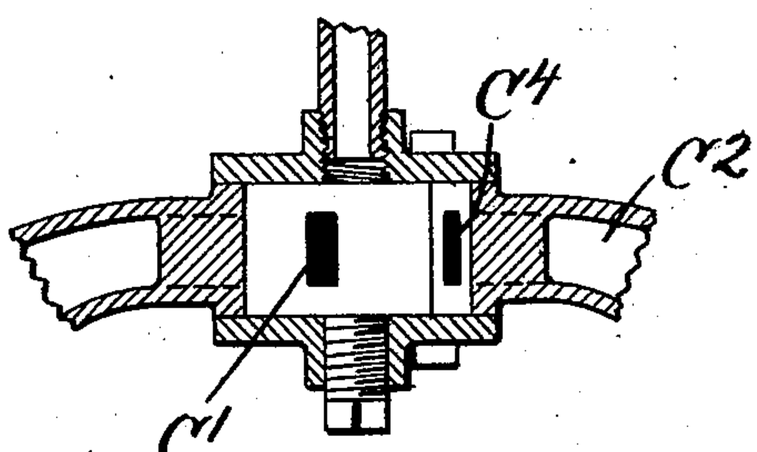


Fig. 8.

Witnesses.
E. T. Wray.
J. H. Cutler.

Inventor.
William H. Sumbling
by Lauch W. Parker,
his Att'y.

UNITED STATES PATENT OFFICE.

WILLIAM H. SUMBLING, OF CHICAGO, ILLINOIS.

VACUUM-PUMP.

SPECIFICATION forming part of Letters Patent No. 560,240, dated May 19, 1896.

Application filed January 8, 1895. Serial No. 534,168. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM H. SUMBLING, a subject of the Queen of Great Britain, residing at Chicago, in the county of Cook and State of Illinois, have invented certain Improvements in Vacuum-Pumps, of which the following is a specification.

My invention relates to steam vacuum-pumps, and has for its object to produce a new and improved steam vacuum-pump embodying certain useful and novel features described in the following specification, and set forth in the claims thereof.

My invention is illustrated in the accompanying drawings, wherein—

Figure 1 is an end elevation, in part section, of a pump embodying my invention. Fig. 2 is a cross-section on line 2 2 of Fig. 1. Fig. 3 is a side elevation with parts broken away. Figs. 4 and 5 are details of the condensing-jet nozzles. Fig. 6 is a side elevation of the steam-admission valve. Fig. 7 is a cross-section on line 7 7 of Fig. 3. Fig. 8 is a vertical section on line 8 8 of Fig. 7, with valve removed, showing steam-ports.

Like letters refer to like parts throughout the several figures.

The two cylinders A A′ of the pump may be of any ordinary construction. As shown in the drawings, they are cast in one piece and fastened to the common base A^2. The discharge-pipes A^3 A^3, communicating with both cylinders, are preferably constructed so that they project above the base-plate A^2, as shown. These pipes are preferably cast integral with said base. Said discharge-pipes communicate with the discharge-chamber A^4, which is provided with the air-chamber A^5, to secure a continuous discharge. The discharge-pipes project above the base A^2 of the pump, as shown, so that all of the water will not be forced out of the cylinder. The induction-pipe A^6 communicates with both cylinders, as shown, each opening being provided with a suitable check-valve. I have shown ordinary ball-valves A^7 A^7. Said valves are prevented from becoming unseated by the stops A^8 A^8. The ends of the discharge-pipes A^3 A^3, which open into the discharge-chamber are also provided with the check-valves A^9 A^9 which are prevented from being unseated by the stop A^{10}. The cylinders A A′ are connected by the pipes B B′, which communicate with each of the cylinders, and are small at one end and large at the other end, as shown. Said pipes are so arranged that the small end of one projects into one cylinder and the large end into the other cylinder. The large end of each pipe, instead of having one large opening, is provided with a number of small openings, (see Fig. 5,) which are preferably the same size as the opening at the smaller end of the pipe. By this arrangement no solid material can enter the large end of the pipe that is too big to pass out at the small end, and hence the pipe is prevented from becoming clogged.

The pipes B B′ are both connected to the pipe B^2, but may be disconnected therefrom by closing the valves B^3 B^3. The pipes B B′ are provided with the valves B^4 B^4, by which the passage-ways between the cylinders A A′ may be closed. Said pipes may be connected to the cylinders in any convenient manner. As shown in the drawings, each pipe is provided with a collar, which bears against the inner surface of the cylinder and is threaded to receive a nut, which bears against the outside surface of the cylinder. Packing is placed between the collars and the surface of the cylinders and a perfectly tight joint can be secured by tightening the nuts. The smaller ends B^5 B^6 of the tubes are situated so that their mouths or openings are preferably a short distance above the top of the projecting part of the discharge-pipes A^3, and hence they will be uncovered just before the cylinders are emptied. Said smaller ends are the condensing-nozzles of the pump and are upturned, as shown. A ball B^7 is placed in the path of the jet of water and deflects or spreads said jet so that it will condense the steam in the cylinder more rapidly. Each cylinder is provided with a door, so that its interior may be inspected. The cylinders A A′ are connected to the valve-chest C, which contains the steam-admission valve D by the passage-ways C′ C^2. The valve-chest C is also connected with the passages C′ C^2 by the short passages C^3 C^4. (See Fig. 7.) The valve D consists of a hollow rectangular box open at the top and bottom and provided with the ports D′ D^2. Steam may be admitted to the valve-chest either above or below, as desired.

The valve D is loose in the valve-chest—*i. e.*, it is not fastened in any manner—and is free to move backward and forward. This arrangement secures a simple and perfectly balanced valve. The passages C′ C^2 are provided with the air-valves C^5 C^5. Said valves admit air into the cylinders when a vacuum is formed therein. Any desired form of check-valve may be used for the purpose. The passages C′ C^2 gradually increase in size from the valve-chest toward the cylinders and are provided at their lower ends with the cone-shaped deflectors C^6 C^6, which spread the steam over the entire area of the cylinders.

I have described these several parts in detail, but it is evident that they may be varied in form, construction, and arrangement without departing from the spirit of my invention, and I therefore do not wish to be limited to the exact construction shown.

I have shown the cylinders of the pump as connected by two pipes, but it is evident that one pipe alone may be used, if desired.

The use and operation of my invention are as follows:

Suppose that the water in the cylinder A has been forced out and the steam in such cylinder is being condensed by the jet of water flowing through the nozzle B^5. When the steam is condensed, it produces a vacuum in such cylinder and the valve A^7 is raised and the water is drawn up through the induction-pipe. When the vacuum is formed in such cylinder, the air-valve in the passage C′ is slightly opened and allows a small quantity of air to enter the cylinder. Said air-valve is regulated so that the quantity of air will be sufficient to prevent the water from flowing up the passage C′ and getting into the valve-chest. When the cylinder has become filled, the valve D is moved, as will be explained hereinafter, so as to allow the steam to enter said cylinder. The pressure of the steam forces the water out through the discharge-pipe, the steam being separated from the surface of the water by the air which entered through the air-valve described above. The pressure of the steam in the cylinder A also forces some of the water through the pipes B and B′ into the cylinder A′, which is being filled with water through the induction-pipe. The water passing from cylinder A to cylinder A′ through pipe B will be very small, while that passing through pipe B′ will be considerably larger on account of the large end of the pipe being connected with cylinder A and the small end with cylinder A′. When the cylinder A′ becomes filled, which happens before the water is all forced out of the cylinder A, the water forced through pipe B′ raises the pressure in cylinder A′, so that it will become greater than the atmospheric pressure and will approach the pressure in the cylinder A. When the water in the cylinder A reaches the level of the top of the discharge-pipe, the air that was between the water and the steam is forced out through the discharge-pipe and the steam comes directly in contact with the surface of the water. When this occurs, a partial vacuum is formed, and since the condensing-jet nozzle is located so that it will be just above the top of the discharge-pipe it will be in such vacuum and the pressure in the cylinder A′ will force the water through the pipe B. The water flowing from the nozzle passes up into the steam in cylinder A and rapidly condenses it. The steam now rushes with great velocity through the passage C′ and forms a partial vacuum in the short passage C^3, Fig. 7. This causes the pressure at the ends of the valve D to be unequal, and said valve will be moved so as to close the passage C′ and open the passage C^2. The steam will now be admitted into the cylinder A′, and the process described above will be repeated.

It will be seen that by this arrangement the pump is made self-acting. The pressure in the discharging-cylinder acts through the pipes B B′ to increase the pressure in the receiving-cylinder, so that the pressure in the latter cylinder will be sufficient to force the water out of the condensing-nozzle of the discharging-cylinder when all of the water has been discharged from such cylinder. The stream of water from such nozzle instantly condenses the steam in said cylinder, and the valve D is moved, so as to allow the steam to enter the other cylinder. By making the pipes B B′ small at one end and large at the other I get a more powerful condensing-jet than if the pipes were made of the same diameter throughout.

It will be noticed that the steam-admission valve of this pump consists simply of a hollow rectangular box and is in no way connected with the valve-chest. Said valve is simply inserted in the valve-chest, and since it is a perfectly-balanced valve, due to the fact that the top and bottom are removed and the steam is admitted into its interior, the only wear will be that due to its own weight. Since the valve is very light, it will be seen that the wear will be very small, and hence waste of steam on account of leakage will be reduced to a minimum.

Steam-admission valves on vacuum-pumps as now constructed cause a great waste of steam on account of their not being perfectly balanced. When the water in the discharging-cylinder has all been forced out, the steam in the passage leading from the valve to the cylinder must reach a high velocity to move the valve, and since all steam that passes into the discharging-cylinder at this time is wasted it will be readily seen that the quicker the valve responds to the change of pressure due to this rush of steam the smaller the amount of steam wasted. The simplicity and the perfectly-balanced nature of my valve causes it to readily respond to such change of pressure, and a great saving of steam necessarily results.

When the pump is used to pump material containing a large amount of solid matter, it may be desirable to have the condensing-jet come from some outside source. This may be done by connecting the source of supply with the pipe B^2 and opening the valves B^3 B^3 and closing the valves B^4 B^4.

It may also be desirable to provide the condensing-jet nozzles with an ordinary check-valve.

I claim—

1. A steam vacuum-pump comprising two cylinders connected together by two pipes, one end of each forming a condensing-jet, means by which each pipe may be connected to an external source of water supply and a series of valves by which the connection of each pipe with one of the cylinders may be closed whereby the water for the condensing-jets may be taken from the cylinders of the pump or from an external source as desired.

2. A steam vacuum-pump comprising two cylinders having discharge-pipes projecting above the base thereof, a steam-admission valve, air-valves located between said cylinders and said steam-admission valve, a condensing-nozzle for each cylinder located substantially on a level with the mouth of said discharge-pipes and connected with the other cylinder, whereby when the discharging-cylinder becomes empty the pressure in the receiving-cylinder will act to operate the condensing-nozzle, substantially as described.

3. A steam vacuum-pump comprising cylinders connected together by pipes each increasing in diameter from one end to the other, the larger ends provided with a number of openings of substantially the same size as the openings at the smaller ends so that solid material passing into either end will readily pass out the other, the smaller ends of said pipes opening into different cylinders, means by which each pipe may be connected to an external source of water supply, and a series of valves by which the connection of each pipe with one of the cylinders may be closed, whereby the water for the condensing-jets may be taken from the cylinders of the pump or from an external source as desired.

4. A reciprocating admission-valve for steam vacuum-pumps, consisting of a hollow rectangular box with top and bottom removed so that when in action in the pump the steam is admitted into the interior, said valve being provided with side openings for the exit of the steam, a valve-chest containing said valve, and a series of passages associated with said valve-chest and valve, said passages so shaped and positioned that the steam acts to move said valve independent of exterior mechanism.

5. The combination with a steam vacuum-pump of a rectangular valve-chest, a hollow rectangular valve with top and bottom removed loose within said valve-chest so as to be free to reciprocate therein, said valve provided with side openings adapted to alternately register with corresponding openings in the valve-chest which connect with the passages that lead to the cylinders in the pump, said passages provided with short branch passages that connect with the ends of the steam-chest, the whole so constructed that the valve is moved by the steam independent of external mechanism.

Chicago, Illinois, December 31, 1894.

WILLIAM H. SUMBLING.

Witnesses:

DONALD M. CARTER,

J. H. COULTER.