No. 811,990. PATENTED FEB. 6, 1906.

B. C. WOODFORD.

VACUUM BREAKER FOR CONDENSERS.

APPLICATION FILED FEB. 8, 1905.

Fig 1.

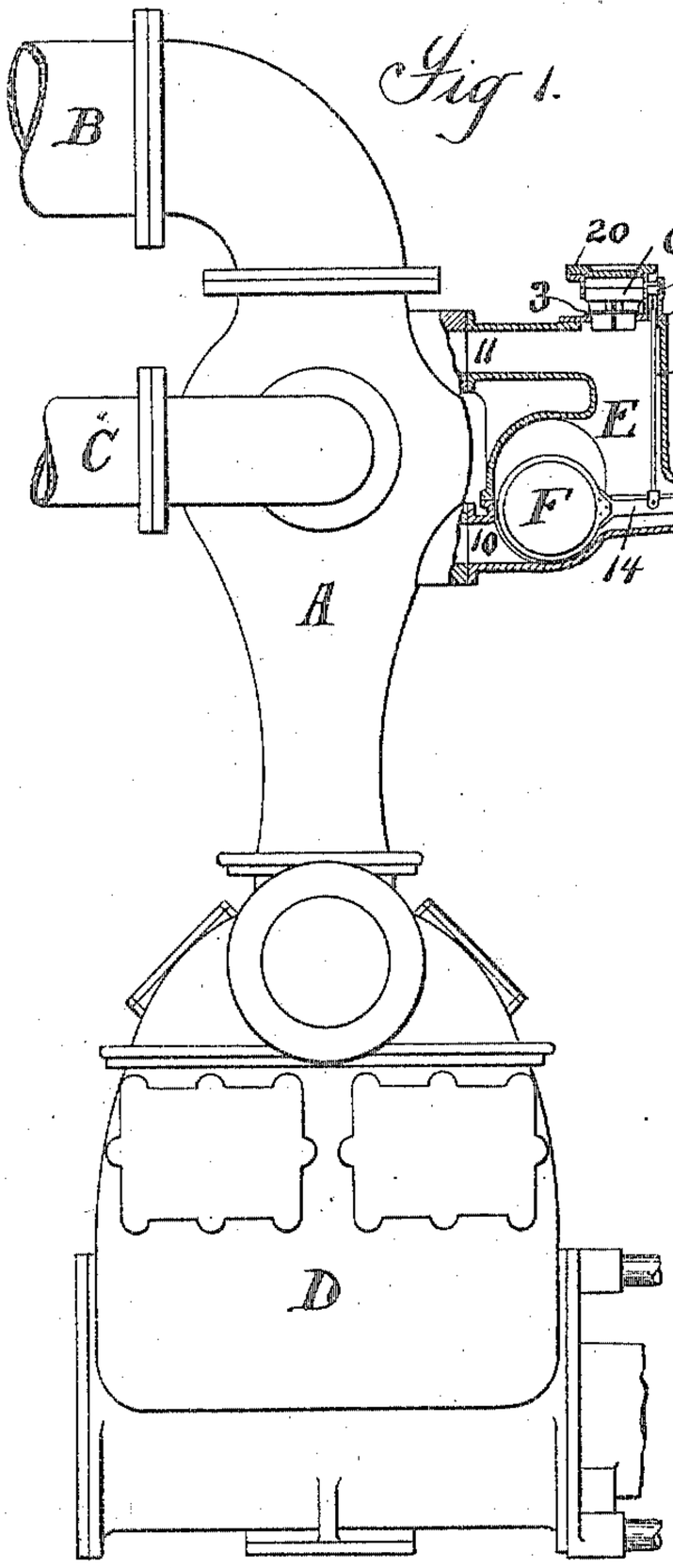


Fig 3.

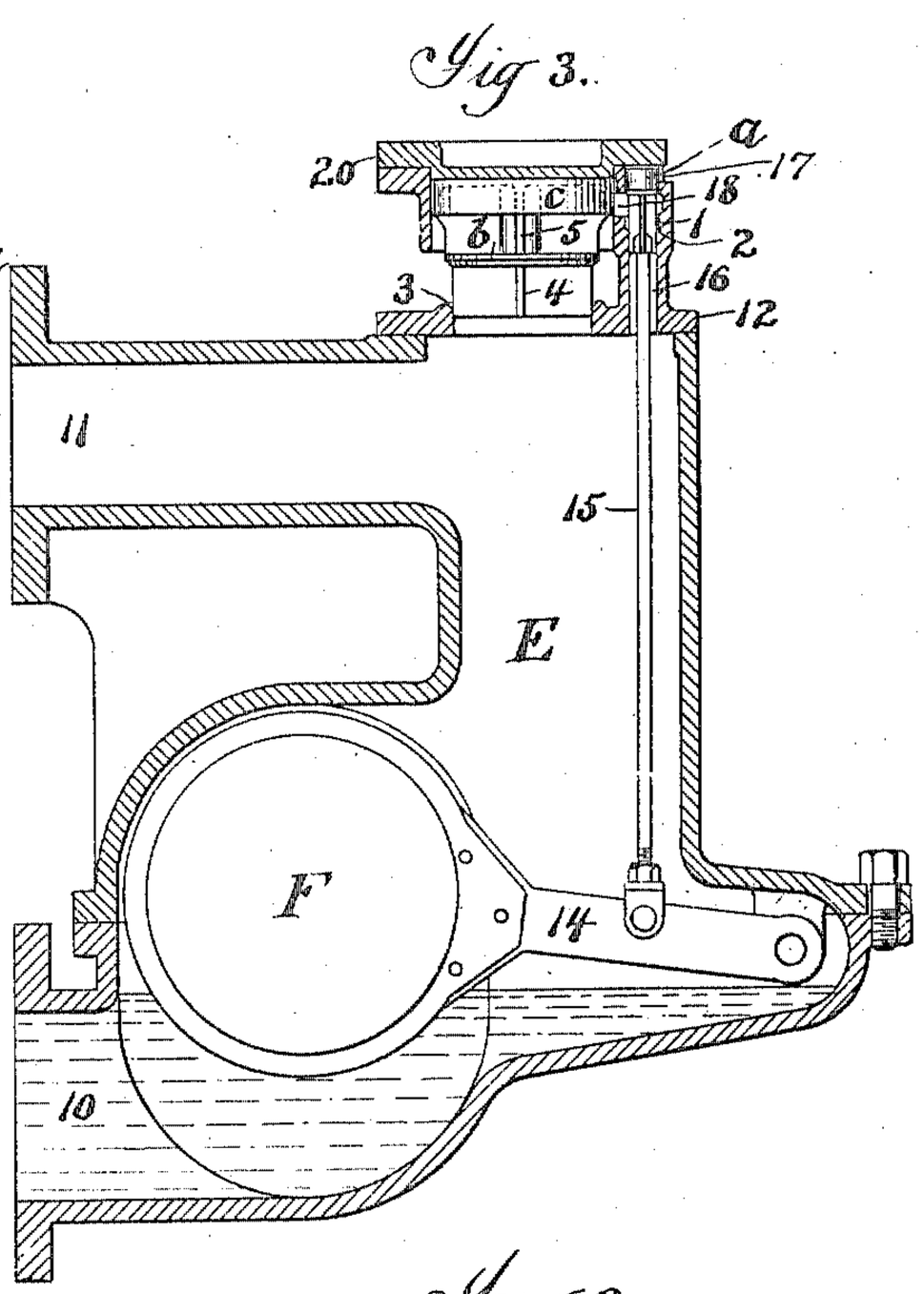


Fig 2.

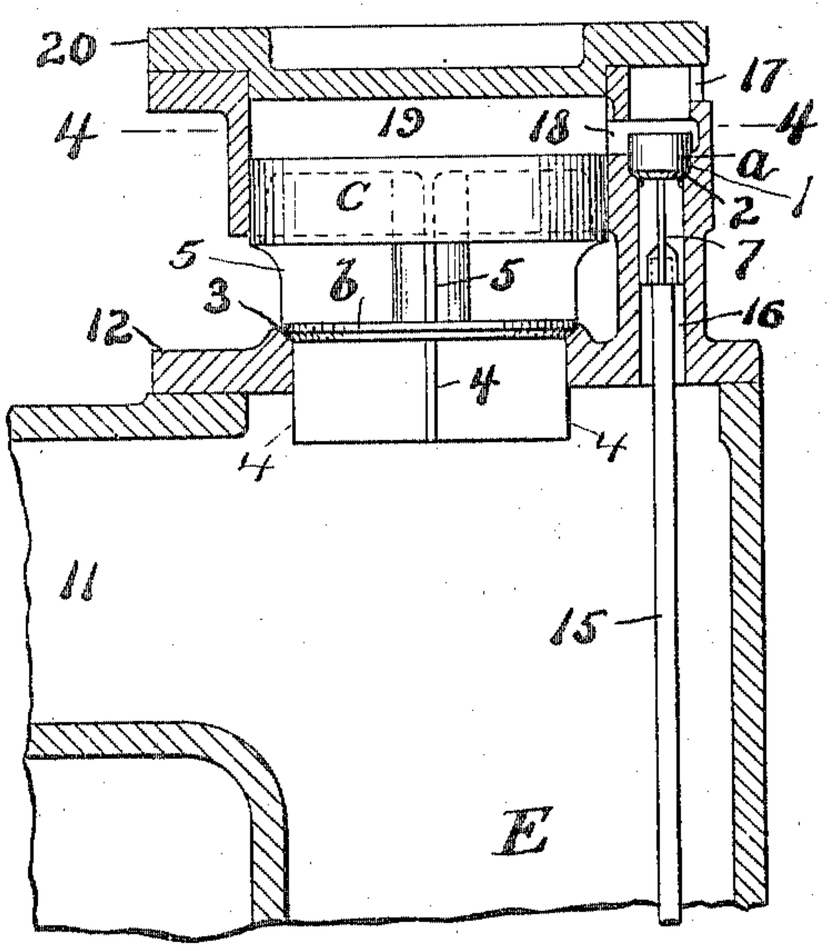
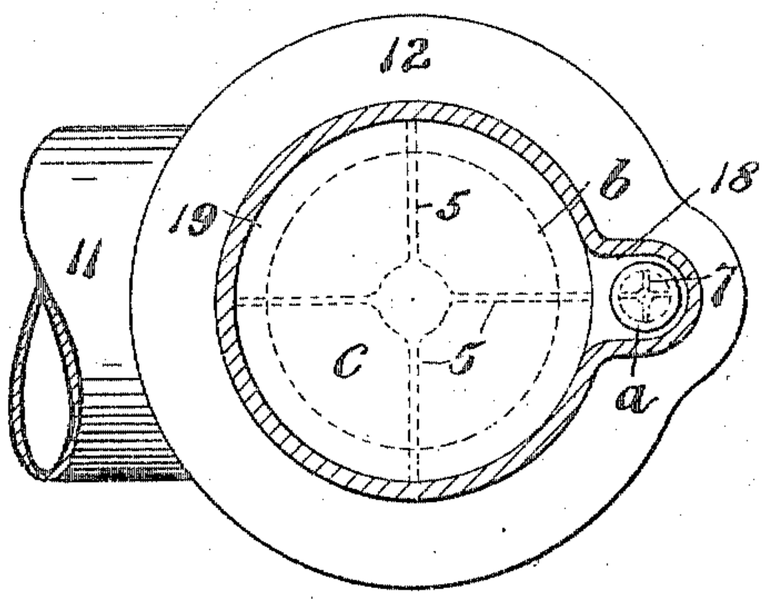


Fig 4.



Witnesses
J. R. Graves.
L. Adelmann.

Inventor
Bronson C. Woodford
By his Attorneys
Philip Sawyer Rice & Kennedy

UNITED STATES PATENT OFFICE.

BRONSON C. WOODFORD, OF NEW YORK, N. Y., ASSIGNOR TO INTERNATIONAL STEAM PUMP COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

VACUUM-BREAKER FOR CONDENSERS.

No. 811,990. Specification of Letters Patent. Patented Feb. 6, 1906.

Application filed February 8, 1905. Serial No. 244,712.

To all whom it may concern:

Be it known that I, BRONSON C. WOODFORD, a citizen of the United States, residing at New York city, county of Kings, and State of New York, have invented certain new and useful Improvements in Vacuum-Breakers for Condensers, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to that class of constructions known as "vacuum-breakers," which are used in injection and other condensers to prevent flooding of the condenser by the injection-water when the withdrawal of water from the condenser slackens or stops. In constructions of this class it is very important that the vacuum should be broken quickly when the water-level in the condenser rises too high; and the object of the present invention is to provide a construction by which the vacuum shall be broken by the opening of a valve of large effective area, so that a large volume of air shall be admitted immediately on opening the valve, and which valve shall be operated by pressure controlled by a small control-valve operated by the usual float, so that a light float pressure shall be sufficient to shift the control-valve while a much larger opening pressure on the vacuum-breaking valve is secured, thus avoiding any danger of the vacuum-breaker failing to work through sticking of the valves or otherwise.

A detailed description of a construction embodying the invention as applied in its preferred form to a condenser of a common type will now be given in connection with the accompanying drawings, forming a part of this specification, and the features forming the invention will then be specifically pointed out in the claims.

In the drawings, Figure 1 is a diagrammatic elevation of a combined condenser and vacuum-pump of a common type provided with my vacuum-breaker and showing the position of the parts with the vacuum-breaking valve closed, as in the normal operation of the condenser. Fig. 2 is an enlarged detail of the valve portion of Fig. 1. Fig. 3 is an enlarged section of the vacuum-breaker similar to Fig. 1, but showing the position of the parts with the vacuum-breaking valve opened to break the vacuum. Fig. 4 is a detail cross-section on the line 4 of Fig. 2.

Referring to said drawings, A is the condensing-chamber, B the exhaust-steam pipe, C is the injection-water pipe, and D the pump, of which only the plunger end is shown, all of which parts may be of any suitable construction and are shown as of a common form.

Referring now to the vacuum-breaker, on one side of the condensing-chamber A and connected thereto by pipes 10 11, as shown, or it may be by a single continuous opening, is a suitable casing or float-tank E, entered near the bottom by the pipe 10 and having an opening at the top which is closed by a plate or cap 12, which cap carries the valve devices. Within the tank E is a float F, carried by lever 14, shown as pivoted on a bracket and connected by link 15 to the control-valve *a*, so as to move this valve up and down as the float rises and falls. This control-valve *a* has the usual guiding-ribs 7 on its stem and moves in a passage 16, formed in an upward extension of the cap 12 and controls this passage 16, which communicates with the space inside the tank E, passage 17, communicating with the atmosphere, and passage 18, communicating with chamber 19, which is the pressure-chamber for the piston on the main valve, as described hereinafter. Extending below the passage 18 the upper end of the passage 16 is enlarged somewhat to receive the piston *a*, as shown at 1, and at the bottom of this enlargement is formed a seat 2 for the valve *a*.

The main or vacuum-breaking valve *b* seats upon a valve-seat 3, formed on the top of the plate or cap 12, and is shown as provided with the usual guiding-ribs 4, by which the valve is guided in the plate 12. This valve *b* is connected by ribs 5 to a piston *c* moving in pressure-chamber 19, formed in the upward extension of the plate or cap 12, this pressure-chamber being preferably closed, as shown, by a removable cap 20, so that the valve *b* and piston *c* may readily be removed. The space between the valve *b* and piston *c* is open to the atmosphere, so that the lower side of the piston *c* is exposed to atmospheric pressure. This atmospheric pressure acts, therefore, on the top of the valve *b* and the under

side of the piston *c;* but the area of the under surface of the piston *c* is larger than that of the top of the valve *b*, so that this excess of pressure on the under side of the piston *c* will raise the piston *c* and valve *b*, when the chamber 19 above the piston is opened to the tank E and condensing-chamber. The area of the upper surface of the piston *c* is larger than that of the under surface, so that when the valve *b* is open and exposed to atmospheric pressure on opposite sides admission of atmospheric pressure to the chamber 19 will overcome the upward pressure on the under side of the piston *c* and close the valve.

In the normal position of the parts the valve *a* is in the position shown in Figs. 1 and 2, in which the passage 16 from the float-tank E is closed and the chamber 19 connected with the atmosphere through openings 17 18 above the piston *a*. When the valve *a* is raised into the position shown in Fig. 3 by the rising of the float F, the passage 17 from the atmosphere is closed and the chamber 19 connected with the tank E through passages 16 18.

The operation of the construction will be understood from a brief description. The steam entering the chamber A through the exhaust-steam pipe B is condensed by the cold injection-water entering through the pipe C and preferably sprayed into the steam, as usual in such condensers, and the discharge-water is withdrawn from the condensing-chamber A and delivered by the pump D, so as to preserve the vacuum. The level of the water in the lower part of the condensing-chamber and the pipe connecting it with the pump is constantly fluctuating, and if the pump slows down or stops the water may rise high enough in the condensing-chamber to submerge pipe C and even overflow the elbow of the pipe B at the top of the condenser. This flooding of the condenser is prevented by breaking the vacuum by opening valve *b*, and thus admitting air under atmospheric pressure to the condenser through tank E and pipe 11, thus stopping the inflow of injection-water through the pipe C, which opening of the valve *b* is secured as follows: Before the water reaches the lower edge of the injection-pipe C it reaches the pipe 10 and lower portion of the tank E and with the ample connection of pipe 10 the water-levels in the tank and condensing-chamber will rise nearly together, thus raising the float F and through lever 14 and link 15 raising the control-valve *a* from the position shown in Figs. 1 and 2 to that shown in Fig. 3, thus closing chamber 19 to the atmosphere and opening it to the tank E. This results in reducing the pressure above the piston *c* to condenser vacuum-pressure, and the excess of atmospheric pressure on the under side of the piston *c* then raises the piston quickly and opens the valve *b* for the admission of air to the condenser-chamber through pipe 11, thus breaking the vacuum and stopping the inflow of injection-water through the pipe C. When the level of the water in the condenser falls again, the water falls in the tank E and the lowering of float F moves the control-valve *a* downward to the normal position shown in Figs. 1 and 2, this downward movement of the valve *a* closing passage 16 and connecting the chamber 19 to the atmosphere through passages 17 18. The valve *a* closes passage 16 before it opens passage 17 to passage 18, so that no air will pass from the atmosphere through passage 16 into the tank E. The pressure above piston *c* thus being increased to atmospheric pressure, the piston *c* is moved downward, closing the valve *b*, and the vacuum is again formed in the condensing-chamber for the normal operation of the condenser.

It will be seen that in the construction shown the valve *b* may be quite large, so as to secure the admission of a large volume of air with a small opening of the valve, and thus assure a quick breaking of the vacuum. This use of a large effective valve area is made possible by the use of the control-valve, as the large valve *b* is not lifted against atmospheric pressure by the float, but actuated by the pressure on the piston *c*. The valve operated by the float, therefore, may be quite small, so that light pressure and a small float will raise it, and all danger of the float failing to open the valve on account of sticking, which has existed in previous vacuum-breakers, is avoided.

The invention has been illustrated as applied to a common type of condenser and vacuum-pump; but it will be understood that it is applicable also to other forms of condensers and in other condensing systems than those in which the vacuum is maintained by direct connection of the condensing-chamber to a vacuum-pump, as shown, and the invention obviously may be used in all classes of condensers in which it is desirable to break the vacuum in case the water rises too high in the condenser.

What I claim is—

1. The combination with a condenser, of a vacuum-breaker having an air-inlet valve exposed to atmospheric pressure on its outer side, a valve-actuating piston, a control-valve and passages for varying the pressure on said piston to open and close the air-inlet valve, and a float and connections for actuating said control-valve to secure the opening of the air-inlet valve when the liquid in the condenser reaches a certain level.

2. The combination with a condenser, of a vacuum-breaker having the inlet-valve exposed to atmospheric pressure on its outer side, a piston connected to said valve and exposed to atmospheric pressure tending to open the valve, a control-valve and passages for connecting the opposite side of the piston with the atmosphere or condensing-chamber,

and a float and connections for actuating said control-valve.

3. In a condenser vacuum-breaker, the combination with the air-inlet valve *b*, of piston *c* connected to the valve *b*, said valve and piston being exposed to atmospheric pressure on their adjacent sides, pressure-chamber 19 on the opposite side of said piston, passages for connecting said chamber 19 with the atmosphere or the condenser, and a float-actuated control-valve *a* controlling said passages, substantially as described.

4. In a condenser vacuum-breaker, the combination with the air-inlet valve *b*, of piston *c* connected to the valve *b*, said valve and piston being exposed to atmospheric pressure on their adjacent sides, pressure-chamber 19 on the opposite side of said piston, passages 16, 17, 18 for connecting said pressure-chamber with the atmosphere or the condenser, control-valve *a* controlling said passages, float F, and link 15 connecting said float to control-valve *a* for actuating said control-valve.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

BRONSON C. WOODFORD.

Witnesses:
C. J. Sawyer,
T. F. Kehoe.