C. S. BROWN.

METHOD AND MEANS FOR SEPARATING FLUIDS HAVING DIFFERENT CHARACTERISTICS.

APPLICATION FILED MAR. 23, 1908.

1,089,187. Patented Mar. 3, 1914.

Fig. 1

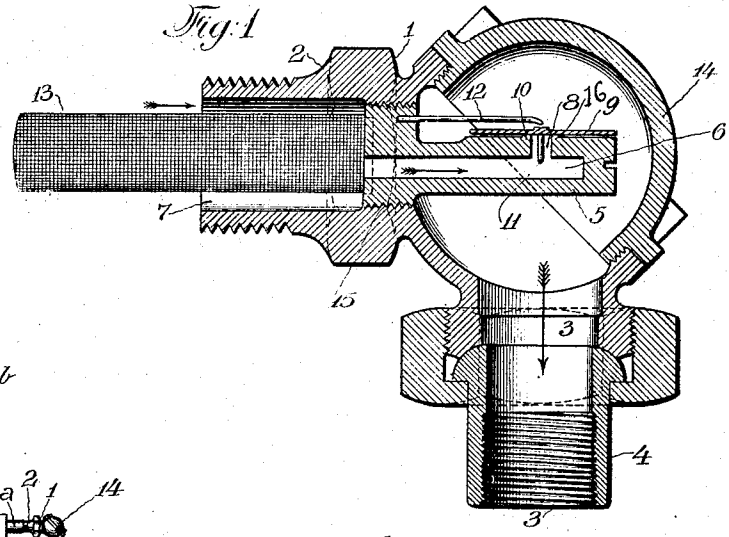


Fig. 8

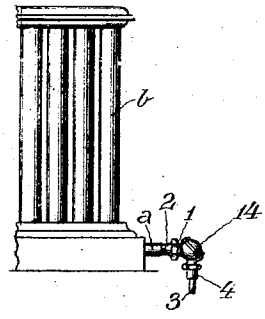


Fig. 2

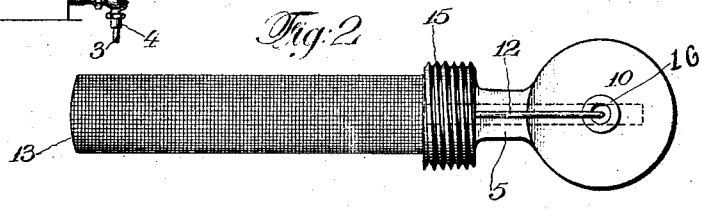


Fig. 3

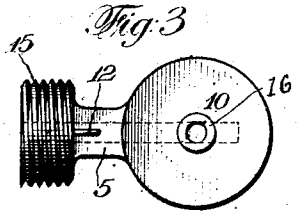


Fig. 4



Fig. 5

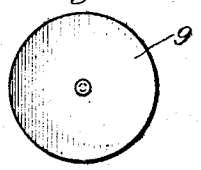


Fig. 6

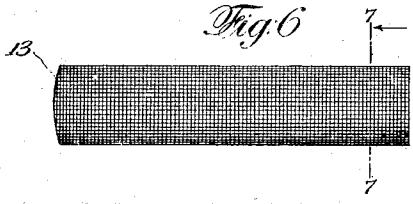


Fig. 7



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METHOD AND MEANS FOR SEPARATING FLUIDS HAVING DIFFERENT CHARACTERISTICS.

1,089,187. Specification of Letters Patent. Patented Mar. 3, 1914.

Application filed March 23, 1908. Serial No. 422,860.

To all whom it may concern:

Be it known that I, CHARLES S. BROWN, a citizen of the United States, and a resident of Nashville, county of Davidson, and State of Tennessee, have invented a new and useful Improved Method and Means for Separating Fluids Having Different Characteristics, of which the following is a specification.

The principal object of my invention is to mechanically separate fluids having different characteristics, and particularly to separate liquids and gases from vapors. By a gas, I mean an elastic fluid which is non-condensable at ordinary temperatures and pressures, such as air; by a vapor, I mean an elastic fluid which is condensable at ordinary temperatures, such as steam.

My invention is applicable to methods and apparatus for heating or refrigerating by the circulation of vapor, and is also applicable to other methods or apparatus in which a separation of fluids having different characteristics and particularly a separation of liquid from vapor or liquid and gas from vapor, is required.

My invention is particularly adapted for the separation of the water of condensation and the air from the steam in a steam heating system or other steam apparatus whereby the water and air are permitted to escape therefrom without substantial loss of steam.

My invention consists in the method and apparatus hereinafter described and set forth in the claims.

The accompanying drawings illustrate one form of device for carrying out my improved method, in which—

Figure 1 is a vertical section. Fig. 2 is a detail in plan, of the tube, base-plate and screen of the device shown in Fig. 1. Fig. 3 is a similar view of Fig. 2, but showing the screen removed. Fig. 4 is an edge view or elevation of the movable part or disk which coöperates with the base-plate. Fig. 5 is a plan view of the same. Fig. 6 is a side elevation in detail of the screen shown in Figs. 1 and 2. Fig. 7 is a transverse section of Fig. 6 on the line 7—7 looking in the direction of the arrow. Fig. 8 shows my device applied to the discharge end of a steam radiator.

Similar characters represent like parts in all the figures.

1 is a casing inclosing the operative parts of the device. 2 is an extension from said casing 1, screw-threaded for attachment to any apparatus in which it is desirable to separate liquids or gases from vapors or to separate fluids having different characteristics.

3 is the discharge opening which, in the device shown, includes a pipe 4 attached by an ordinary union nut.

Within the casing 1 is a tube 5, the passageway 6 of which is connected with the passage 7 in the extension 2. Extending from said passageway 6 into the casing 1, is an outlet 8. This outlet is surrounded by a base-plate or fixed part 10. When my complete invention is employed this base-plate is provided with a raised seat 16 immediately surrounding the outlet 8, as shown in Figs. 1, 2 and 3.

9 is a movable part shown in Figs. 1, 4 and 5 in the form of a disk, which is adapted to operate in connection with the base-plate or fixed part 10. It is obvious that the raised seat 16 may be placed upon the disk, if preferred, instead of upon the base-plate.

Any simple device may be used for preventing the movable part 9 from dropping off or getting out of place. In that form of the device shown in the drawing, the movable part is provided with a pin 11, extending into the outlet 8, and with a wire 12 extending over the movable part 9, for holding said part in place; the pin 11 may also serve to keep the outlet 8 clean and clear of dirt. In Fig. 3 the wire 12 is broken away so as to more clearly show the base-plate with its raised seat. This wire 12 constitutes means for limiting the distance to which the movable part 9 can move away from the plate 10 and thus prevents the part 9 from moving outside of the zone of influence or operation of the fluids tending to escape.

13 is a screen extending into the passage 7

and to the passageway 6 to prevent dirt being carried into the passageway 6.

In order to provide a simple and ready means for the changing or removal or renewal of the different parts of the device, the upper part of casing 1 is made in the form of a removable cap 14 secured to the lower part of the casing. The portion of the tube 5 that is nearest or adjacent to the passage 7, is attached by a screw thread 15 to the extension 2, and the screen 13, which is soldered or permanently fastened to the tube 5, extends into said passage 7. The above described construction will permit the device to be readily applied whenever it may be desired, and in any position, to any apparatus for which it may be intended; and it can readily be seen that the operative parts may be easily removed or replaced at a moment's notice.

My invention is particularly adapted for use in a steam heating system for draining off the water of condensation, and also removing the air, while practically preventing the discharge or loss of steam. In such case the extension 2 is connected with the discharge pipe or opening of the heater or radiator or system, and the discharge opening of the device is connected with the main discharge pipe. Such a construction is illustrated in Fig. 8 wherein *a* is the outlet of the radiator *b*, and the extension 2 is connected with *a*, and the discharge opening 3 of the device is adapted to be connected with the main discharge pipe. When steam is supplied to the radiator, water will flow into the passage 7 in the direction of the arrow, see Fig. 1, and said water will pass freely through the screen 13 and the passageway 6 and outlet 8, and between the plate 10 and the disk 9, and then pass through the opening 3 to the discharge pipe. The space between the plate 10 and disk 9 constitutes a passage for the escape of fluids, the outlet 8 from the passageway 6 being an inlet to the passage between said plate and disk. Whatever air is in the radiator, or collects therein from time to time, will tend to flow to the valve and when it reaches the same will flow out through the passages 6 and 8 and through the passage between the disk and plate. As soon as the water and air have passed through the outlet 8, the steam or vapor will enter the passageway 6 from the passageway 7 through the screen 13, but will be held back and prevented from escaping in any substantial quantity by the movable part or disk 9, acting in conjunction with the base-plate 10. Steam under practical conditions always contains some air or gas, and as this fluid tends to flow from the outlet 8, the escaping portion of the fluid is forced to spread out in a thin film in the passage between the base plate 10 and the movable part 9, producing or maintaining a partial vacuum or decreased pressure between those parts, and tending to cause the part 9 to move toward the plate 10, or tending to hold it against said plate so as to practically prevent the flow of steam. When water again reaches the outlet 8, the water will cause the part 9 to move away from the base-plate 10 and thus permit the discharge of the water. When air flows to the outlet 8, it will also escape as already stated.

I have discovered that when liquids, gases and vapors, such as water, air and steam, are caused to flow through a device such as I have described herein, the water and the air will escape, while the steam will be substantially or practically prevented from escaping. I believe that this result is due to the fact that when the water or the air flows between the base-plate 10 and the movable part or disk 9, it does not cause such a reduction of pressure between these two parts as to make the disk 9 move toward the plate 10 close enough to prevent the discharge of the water or the air, and to the fact that when the fluid mixture of steam and air or gas tends to flow between these same parts, such a reduction of pressure between the plate and the disk will be produced or maintained that the disk will be held so close to the plate as to prevent the loss of any substantial amount of steam. It will be observed that this result is brought about by providing or employing a passage of rapidly increasing area and thereby varying the pressure in said passage according to the nature of the fluid flowing therethrough, and causing the passage to be controlled by said variation in pressure. The disk or movable part 9 is so arranged that it is adapted to be operated by the pressure in this passage of rapidly increasing area, so as to control said passage. The flow of each of these fluids through the said passage is more or less forcibly restrained according to its properties or characteristics, the variations of the restraining influence being due to the action of the respective fluids.

In the best form of my invention the fluids are caused to flow through a central orifice, and then through a passage extending radially from said orifice and thereby increasing rapidly in area. In this way the fluids are caused to spread out in a thin annular or radial film. The orifice is surrounded by a plate and, in the best form of the invention, a raised seat is provided surrounding the orifice, and a movable part is employed which is adapted to move toward or against the plate or seat and thereby to control or close the orifice. The areas of the orifice, the plate, the seat and the movable part should be so proportioned relatively to one another and to the pressure of the fluids to be separated, as to cause the movable part to be held away from the seat sufficiently to

permit the escape of such liquid or gas but not sufficiently to permit the escape of any substantial quantity of vapor.

In the separation of water from steam, I have discovered from experience that in some cases it is desirable to have a narrow, slightly raised seat, surrounding the outlet 8, such as shown at 16 in Figs. 1 and 2. This construction permits of a freer and more prompt discharge of water and a more prompt and positive movement of the disk toward the seat as soon as steam reaches the outlet. This is due to the fact that the passage between the disk and the plate increases in area very suddenly beyond the outer edge of the seat, and thereby permits the freer discharge of the water after it passes the seat, and also permits a greater velocity or expansion of the escaping portion of the fluid mixture of steam and air or gas, thereby causing a greater reduction of pressure between the disk and the plate, which causes the disk to be more forcibly pressed toward the plate.

In the accompanying drawings I have shown the various parts of the device in such proportions as I have found to be well adapted to carry out the method herein described and to produce the results set forth. I have found that a device made in these proportions, when applied to the discharge end of a radiator, will permit the free escape of water of condensation and of air, but will prevent the escape of any substantial amount of steam, and that it will do so although the pressure of the steam in the radiator may be varied between wide limits. I have found that a device in these proportions will operate successfully with steam at a pressure in the radiator of anywhere between about three pounds below atmosphere, and about five pounds above atmosphere. In the device as illustrated in the drawings, the diameter of the orifice 8 is one-eighth of an inch. The raised seat around the orifice has a width of one-sixteenth of an inch. The diameter of the base-plate 10 and of the disk 9 is one inch. It will be seen that the plate and the disk are of much greater diameter than the outlet. The dimensions of these various parts may be varied within wide limits, according to the pressure to be employed in the apparatus with which the device is connected, and according to the character of the fluids to be separated thereby. It is essential, however, that the area of the orifice should be very small in comparison with the area of the disk and plate. While the relation between these two areas may be varied according to the nature of the fluids which are being separated, it is essential that the area of the plate and disk should be sufficiently great relative to the areas of the orifice to cause the disk to be moved away from the plate when one of the fluids is flowing through the orifice so as to permit that fluid to escape, but to cause the disk to be moved or held against the plate when the other fluid reaches the orifice so that the escape of the latter fluid is substantially prevented.

The use of the screen 13 prevents any dirt or scale which may accumulate in the radiator, from passing into the tube 5 or the outlet 8, or choking said passages.

The apparatus is very simple in construction and can be readily and economically made. The tube 5 and its connected parts, including the screen 13, can be readily fitted into any form of casing or apparatus, and be easily removed or renewed or cleaned.

I do not limit myself to the precise device herein described and shown for the carrying out of my method, as many changes may be made therein without departing from the spirit of my invention, or sacrificing its principal advantages.

What I claim as new, and desire to secure by Letters Patent, is:

1. The method of separating fluids having different characteristics, which consists in causing them to flow into a passage of increasing area, thereby producing a pressure in said passage according to the expansion or velocity of said fluids, and causing said passage to be controlled by the pressure therein, whereby one fluid is permitted to escape but the escape of another fluid is substantially prevented.

2. The method of separating fluids having different characteristics, which consists in causing them to flow through a central orifice, and then through a passage extending radially from said orifice and increasing rapidly in area, thereby varying the pressure in said passage and causing said variation in pressure to operate a movable device and thereby control said passage, whereby one or more fluids are permitted to escape but the escape of another fluid is substantially prevented.

3. The method of separating fluids having different characteristics, which consists in causing them to flow through an orifice, and then to spread out in a thin film so as to vary the pressure in said film, and thereby causing said variation in pressure to operate a movable device and thereby control said orifice whereby one or more fluids are permitted to escape but the escape of another fluid is substantially prevented.

4. The method of separating fluids having different characteristics, which consists in causing them to flow into a passage of increasing area, and causing the pressure in said passage to be varied by the different action of the respective fluids, and causing this variation of pressure to operate a movable part by such variation of pressure in

said passage so as to control the passage whereby one or more fluids are permitted to escape but the escape of another fluid is substantially prevented.

5. The method of separating fluids having different characteristics, which consists in causing them to flow in a passage of rapidly increasing area, thereby varying the pressure in said passage, and causing the variation in pressure to operate a movable part so as to control the passage, whereby one or more fluids are permitted to escape but the escape of another fluid is substantially prevented.

6. The method of separating fluids having different characteristics, which consists in causing them to flow through a central orifice, and then through a passage extending radially from said orifice and increasing rapidly in area, thereby varying the pressure in said passage, and causing the variation in pressure to operate a movable part so as to control the passage, whereby one of the fluids will be expanded in said passage so as to reduce the pressure and cause the passage to be substantially closed, while another fluid will increase the pressure in said passage and thereby open the passage, and permit the escape of said fluid.

7. The method of separating fluids having different characteristics, which consists in causing the fluids to flow through an orifice, and then between a surrounding plate and a movable part adapted to move toward or against the plate and to control or close the orifice, the areas of the orifice, plate and movable part, being so proportioned relatively to one another, as to cause the movable part to be held away from the plate when one fluid is flowing between the movable part and plate, and to cause the movable part to be moved toward the plate when another fluid tends to flow between said parts.

8. The method of separating fluids having different characteristics which consists in causing them to flow through an orifice, and then between a surrounding plate and a movable part adapted to move toward or against the plate to control or close the orifice, one of said parts being provided with a raised seat surrounding said orifice, the areas of the orifice, seat, plate and movable part being so proportioned relatively to one another, as to cause the movable part to be held away from the plate when one fluid is flowing between the movable part and the plate, and to cause the movable part to be moved toward the plate when another fluid tends to flow between said parts.

9. The method of separating water or air from steam, which consists in causing the water or air and steam to flow into a passage of increasing area, and causing the pressure in said passage to operate a movable part so as to control the passage, whereby when the steam reaches the said passage the pressure therein will cause the movable part to substantially close the passage against the steam.

10. The method of separating water or air from steam, which consists in causing the water or air and steam to flow through a central orifice, and then through or into a passage extending radially from said orifice and increasing rapidly in area, and causing the pressure in said passage to operate a movable part so as to control the passage, whereby the water or air will escape through said passage, but, when the steam reaches said passage, the pressure therein will cause the movable part to substantially close the passage against the steam.

11. The method of separating water or air from steam, which consists in causing the water or air and steam to flow through a central orifice, and then causing the water or air to spread out in a thin radial film between a surrounding plate and a movable disk adapted to move toward the plate whereby the water or air will flow between said plate and disk and escape, and causing sufficient steam to flow between said plate and disk to reduce the pressure between the same and to thereby cause said disk to be held so close to the plate as to substantially prevent the escape of steam.

12. The improved means for separating fluids having different characteristics which consists of the combination of a device for holding or supplying said fluids provided with a small outlet for said fluids, a plate surrounding said outlet, a movable part adapted to move toward or away from said plate, and forming between it and said plate a narrow passage, the area of the movable part and plate being so much greater than the area of the outlet that the pressure between said movable part and the plate will be varied according to the nature of the fluid in said passage, and the movable part will be moved away from said plate by one fluid so as to permit that fluid to escape, but will be held substantially against said plate by another fluid so as to prevent any substantial amount of that fluid from escaping.

13. The improved means for separating fluids having different characteristics which consists of the combination of a device for holding or supplying said fluids provided with a small outlet for said fluids, a plate surrounding said outlet, a movable part adapted to move toward or away from said plate, and forming between it and said plate a narrow passage, one of said parts being provided with a raised seat surrounding the outlet, the area of the movable part and plate being so much greater than the area of the outlet that the pressure between said movable part and the plate will be varied

according to the nature of the fluid in said passage, and the movable part will be moved away from said plate by one fluid so as to permit that fluid to escape, but will be held substantially against said plate by another fluid so as to prevent any substantial amount of that fluid from escaping.

14. The improved means for separating fluids having different characteristics which consists of the combination of a device for holding or supplying said fluids provided with a small outlet for said fluids, a plate surrounding said outlet of much greater diameter than the outlet, a movable disk of much greater diameter than the outlet adapted to move toward or away from said plate so as to control said outlet, and forming between it and said plate, when open, a narrow annular passage, the area of the disk and plate being so much greater than the area of the outlet that the pressure between said disk and plate will be varied according to the nature of the fluid in said passage, and the disk will be moved away from said plate by one fluid so as to permit that fluid to escape, but will be held substantially against said plate by another fluid so as to prevent any substantial amount of that fluid from escaping.

15. The improved means for separating fluids having different characteristics which consists of the tube 5, having the passageway 6 provided with the outlet 8, the disk 9 adapted to control said outlet and the plate 10, the area of the disk and plate being so much greater than the area of the outlet 8 that the pressure between the disk and plate will be varied according to the nature of the fluid between said disk and plate, and the disk will be moved away from said plate by one fluid so as to permit that fluid to escape, but will be held substantially against said plate by another fluid so as to prevent any substantial amount of that fluid from escaping, substantially as set forth.

16. The improved means for separating fluids having different characteristics which consists of the tube 5 provided with the outlet 8, the disk 9 adapted to control said outlet, the plate 10, and means to prevent the disk 9 from moving outside of the zone of influence of said fluids, the area of the disk and plate being so much greater than the area of the outlet 8 that the pressure between the disk and plate will be varied according to the nature of the fluid between said disk and plate, and the disk will be moved away from said plate by one fluid so as to permit that fluid to escape, but will be held substantially against said plate by another fluid so as to prevent any substantial amount of that fluid from escaping, substantially as set forth.

17. The improved means for separating fluids having different characteristics which consists of the tube 5, having the passageway 6 provided with the outlet 8, the disk 9 adapted to control said outlet, the pin 11, and the plate 10, the area of the disk and plate being so much greater than the area of the outlet 8 that the pressure between the disk and plate will be varied according to the nature of the fluid between said disk and plate, and the disk will be moved away from said plate by one fluid so as to permit that fluid to escape, but will be held substantially against said plate by another fluid so as to prevent any substantial amount of that fluid from escaping, substantially as set forth.

18. The improved means for separating fluids having different characteristics which consists of the tube 5, having the passageway 6 provided with the outlet 8, the disk 9 adapted to control said outlet, the pin 11, the plate 10, and the holder 12, the area of the disk and plate being so much greater than the area of the outlet 8 that the pressure between the disk and plate will be varied according to the nature of the fluid between said disk and plate, and the disk will be moved away from said plate by one fluid so as to permit that fluid to escape, but will be held substantially against said plate by another fluid so as to prevent any substantial amount of that fluid from escaping, substantially as set forth.

19. The improved means for separating the water and air from the steam in a steam apparatus which consists of a suitable device adapted to be attached to said apparatus having the outlet 8, the disk 9 adapted to control said outlet and the plate 10, the area of the disk and plate being so much greater than the area of the outlet 8 that the pressure between the disk and plate will be varied according to the nature of the fluid between said disk and plate, and the disk will be moved away from said plate by the water and the air so as to permit the water and the air to escape, but will be held substantially against said plate by the steam so as to prevent any substantial amount of steam from escaping.

20. The improved means for separating the water and air from the steam in a steam apparatus which consists of the tube 5, having the passageway 6 provided with the outlet 8, the screen 13, the disk 9 adapted to control said outlet, the plate 10, means for holding the disk in place, and a suitable casing to hold said parts, the area of the disk and plate being so much greater than the area of the outlet 8 that the pressure between the disk and plate will be varied according to the nature of the fluid between said disk and plate, and the disk will be moved away from said plate by the water and the air so as to permit the water and

the air to escape, but will be held substantially against said plate by the steam so as to prevent any substantial amount of steam from escaping.

21. In a steam heating system, the combination with a radiator or heater, provided with a small outlet and with a discharge passage for the discharge of water or air having an increasing area leading from said outlet, and a movable part adapted to be moved by variations in pressure in said passage so as to control the passage, the area of the movable part being so much greater than the area of the outlet that the pressure in the discharge passage will be varied according to the nature of the fluid in said passage, and the movable part will open said passage so as to permit the escape of water or air, but will close said passage so as to prevent any substantial amount of steam from escaping.

22. In a steam heating system, the combination with a radiator or heater, provided with a small outlet for the discharge of water and air, of a plate surrounding said outlet, a movable part forming between it and said plate a narrow passage, and adapted to be moved toward or away from said plate by variations in pressure in said passage, the area of the movable part and plate being so much greater than the area of the outlet that the pressure between said movable part and plate will be varied according to the nature of the fluid in said passage, and the movable part will be moved away from said plate so as to permit the air and water to escape through said passage, but will be held substantially against said plate by the steam so as to prevent any substantial amount of steam from escaping.

23. In a steam heating system, the combination with a radiator or heater, provided with a small outlet for the discharge of water and air, of a plate surrounding said outlet of much greater diameter than the outlet, a movable disk of much greater diameter than the outlet adapted to move toward or away from said plate so as to control said outlet, and forming between it and said plate, when open, a narrow annular passage, the area of the disk and plate being so much greater than the area of the outlet that the pressure between said disk and plate will be varied according to the nature of the fluid in said passage, and the disk will be moved away from said plate by the air and the water so as to permit the air and the water to escape, but will be held substantially against said plate by the steam so as to prevent any substantial amount of steam from escaping.

24. In a steam heating system, the combination with a radiator or heater, of the tube 5, having the passageway 6, and the outlet 8, the disk 9, adapted to control said outlet and to be operated by variations of pressure between the disk and the plate 10, and the plate 10, the area of the disk and plate being so much greater than the area of the outlet that the pressure between said disk and plate will be varied according to the nature of the fluid between said disk and plate, and the disk will be moved away from said plate by the air and water so as to permit the air and water to escape, but will be held substantially against said plate by the steam so as to prevent any substantial amount of steam from escaping, substantially as set forth.

25. In a steam heating system, the combination with a radiator or heater, of the tube 5, having the passageway 6, and the outlet 8, the disk 9 adapted to control said outlet and to be operated by variations of pressure between the disk and the plate 10, the plate 10, and the raised seat 16, the area of the disk and plate being so much greater than the area of the outlet that the pressure between said disk and plate will be varied according to the nature of the fluid between said disk and plate, and the disk will be moved away from said plate by the air and water so as to permit the air and water to escape, but will be held substantially against said plate by the steam so as to prevent any substantial amount of steam from escaping, substantially as set forth.

26. In a steam heating system, the combination with a radiator or heater of the tube 5, having the passageway 6, and the outlet 8, the disk 9 adapted to control said outlet and to be operated by variations of pressure between the disk and the plate 10, the plate 10, and means for holding the disk in place, the area of the disk and plate being so much greater than the area of the outlet that the pressure between said disk and plate will be varied according to the nature of the fluid between said disk and plate, and the disk will be moved away from said plate by the air and water so as to permit the air and water to escape, but will be held substantially against said plate by the steam so as to prevent any substantial amount of steam from escaping, substantially as set forth.

27. In a steam heating system, the combination with a radiator or heater of the tube 5, having the passageway 6, and the outlet 8, the disk 9 adapted to control said outlet and to be operated by variations of pressure between the disk and the plate 10, the plate 10, the pin 11, and the holder 12, the area of the disk and plate being so much greater than the area of the outlet that the pressure between said disk and plate will be varied according to the nature of the fluid between said disk and plate, and the disk will be moved away from said plate by the air and water so as to permit the air

and water to escape, but will be held substantially against said plate by the steam so as to prevent any substantial amount of steam from escaping, substantially as set forth.

28. The improved means for separating fluids having different characteristics which consists of the tube 5, having the passageway 6, and the outlet 8, the disk 9 adapted to control said outlet, the plate 10, and the raised seat 16, the area of the disk and plate being so much greater than the area of the outlet that the pressure between said disk and plate will be varied according to the nature of the fluid between said disk and plate, and the disk will be moved away from said plate by one fluid so as to permit that fluid to escape, but will be held substantially against said plate by another fluid so as to prevent any substantial amount of that fluid from escaping, substantially as set forth.

29. In a steam heating system, the combination with a radiator or heater of the tube 5, having the passageway 6 provided with the outlet 8, the disk 9 adapted to control said outlet and to be operated by variations of pressure between the disk and the plate 10, the plate 10, and the screen 13, the area of the disk and plate being so much greater than the area of the outlet that the pressure between said disk and plate will be varied according to the nature of the fluid between said disk and plate, and the disk will be moved away from said plate by the air and water so as to permit the air and water to escape, but will be held substantially against said plate by the steam so as to prevent any substantial amount of steam from escaping, substantially as set forth.

30. In a steam heating system, the combination with a radiator or heater provided with a small outlet for the discharge of water and air, of a plate surrounding said outlet, a movable disk adapted to move toward or away from said plate so as to control said outlet, the area of the disk and plate being so much greater than the area of the outlet that the pressure between said disk and plate will be varied according to the nature of the fluid between said disk and plate, and the disk will thereby be moved away from said plate when air or water flow between the same so as to permit air and water to escape, but will be drawn toward said plate when steam tends to flow between the disk and the plate so as to substantially check the escape of steam.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

CHARLES S. BROWN

Witnesses:
FRANK W. CHAPPELL,
JOHN H. LAWRENCE.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."