

2,315,946

4 Sheets-Sheet 1



BY *Augustus C. Durdin Jr*
Charles O. Sherway
his Atty

April 6, 1943.

A. C. DURDIN, JR

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VACUUM CONDENSATION PUMP

Filed April 7, 1941

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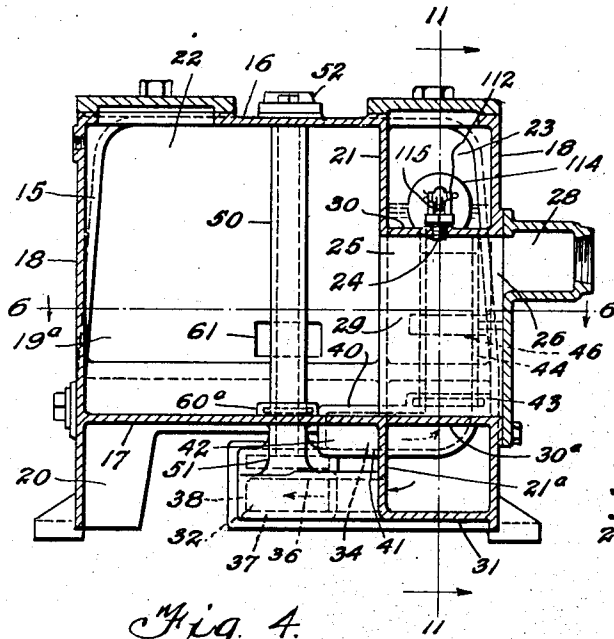


Fig. 4.

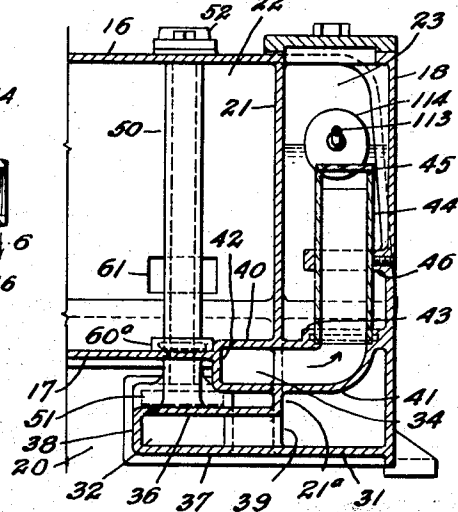


Fig. 5.

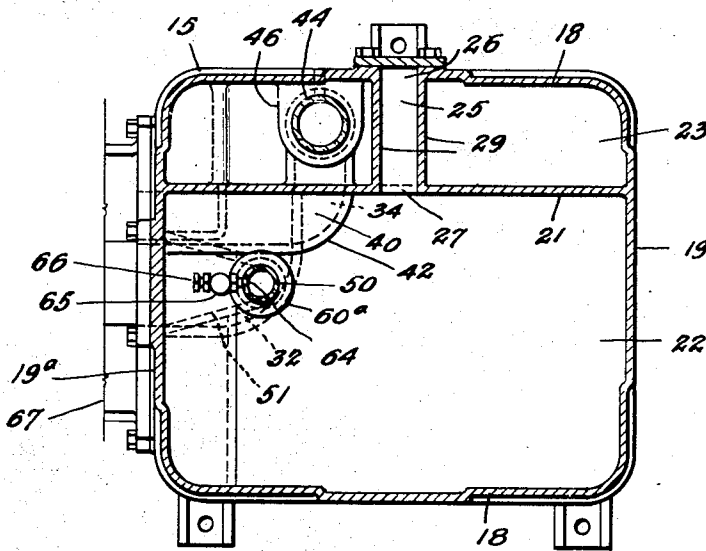


Fig. 6.

INVENTOR.
Augustus C. Durdin Jr.
BY Charles O. Sherway,
His Attorney

April 6, 1943.

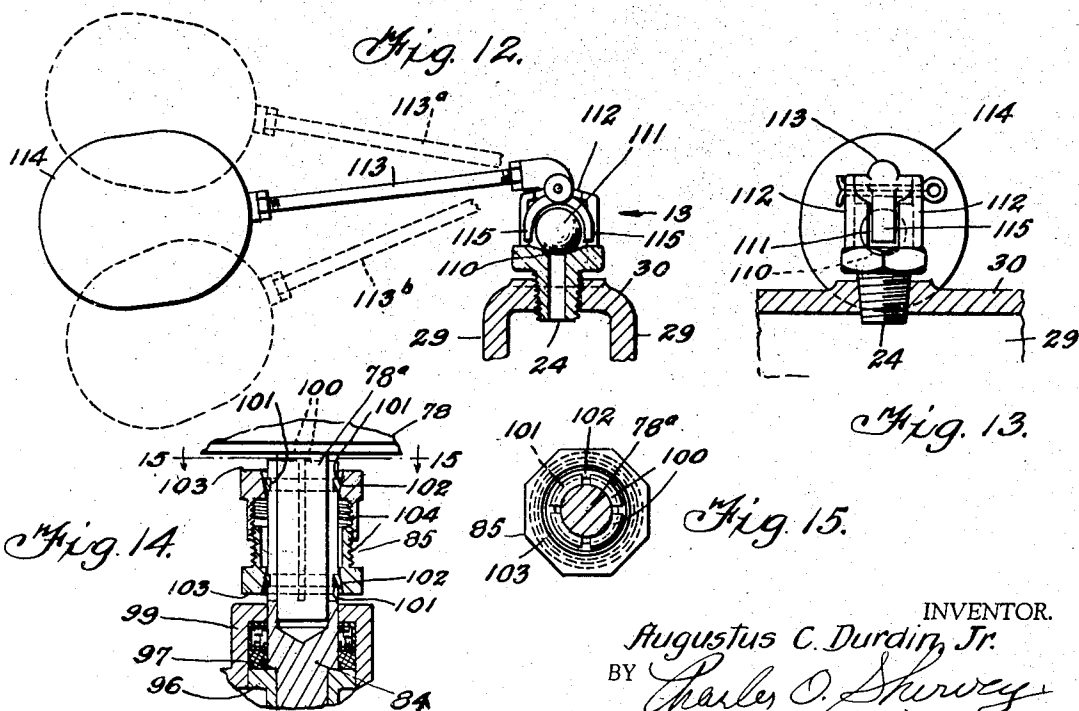
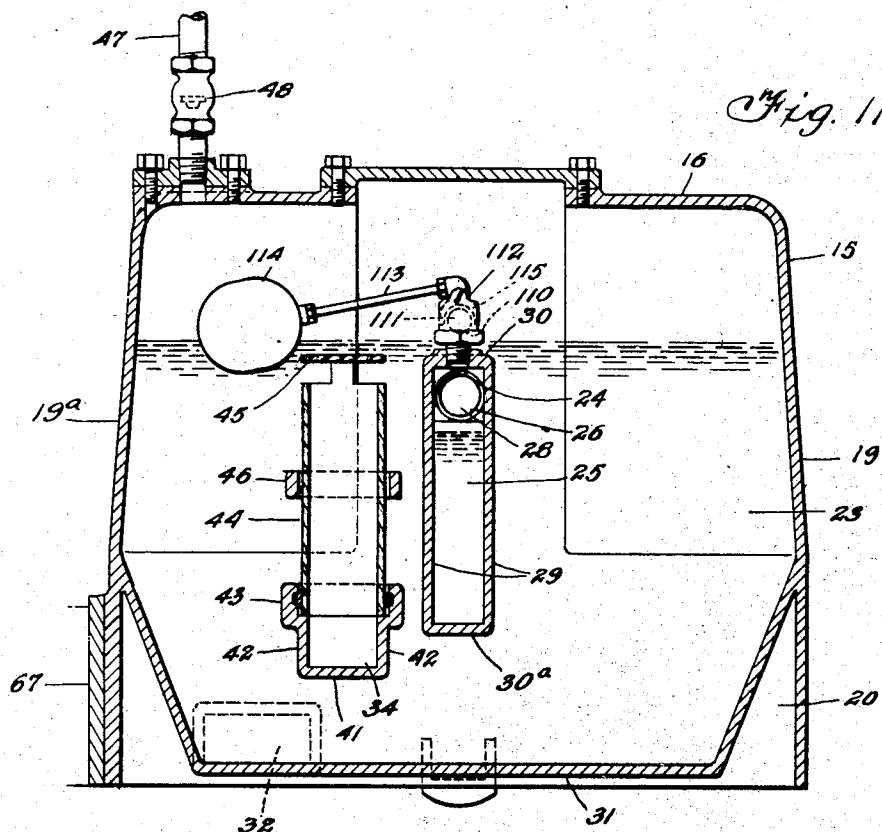
A. C. DURDIN, JR

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VACUUM CONDENSATION PUMP

Filed April 7, 1941

4 Sheets-Sheet 4



INVENTOR.
Augustus C. Durdin, Jr.
BY *Charles O. Shurway*
His Atty.

UNITED STATES PATENT OFFICE

2,315,946

VACUUM CONDENSATION PUMP

Augustus C. Durdin, Jr., Lincolnwood, Ill.

Application April 7, 1941, Serial No. 387,118

14 Claims. (Cl. 103—6)

This invention relates to vacuum condensation pumps such as are employed for creating vacuum in the return mains of steam heating systems and for collecting the water of condensation, vapors, air and non-condensable gasses therefrom and returning the water to the boiler or other desired place.

The invention has particular reference to that type of vacuum condensation pump which employs a water pump for discharging the water from a receiving chamber, and a vacuum pump, which employs water for its operation, for creating vacuum in the receiving chamber and obtaining its hurling water from a hurling water chamber.

One of the objects of this invention is to provide a valve controlled port between the receiving chamber and the hurling water chamber, controlled by the level of water in the hurling water chamber, to open the port and permit pressure in the two chambers to equalize, whereby to prevent hurling water from leaking too rapidly from the hurling water chamber through the pumps and into the receiving chamber, particularly when the pump is shut down at night and the boiler is shut down.

Another object is to provide pressure equalizing means between the receiving chamber and the hurling water chamber, whereby a sufficient head of hurling water is always maintained for the operation of the vacuum pump.

Another object is to provide a valve controlled port between the hurling water chamber and the receiving chamber, controlled by the level of the water in the hurling water chamber, for permitting water to flow from the hurling water chamber to the receiving chamber whenever the water in the hurling water chamber rises above a predetermined level.

Another object is to provide a make-up water inlet from the receiving chamber to the vacuum pump, whereby to replenish any loss of hurling water.

Another object is to provide a hurling water chamber, separate from the receiving chamber, arranged to hold a supply of hurling water and connected by conduits to the water inlet and discharge of the vacuum pump.

Another object is to provide a receiving chamber, which has its bottom disposed below the outlet to the water pump, with a make-up water inlet to an air conduit, which conveys the air and non-condensable gasses from the receiving chamber to the vacuum pump, which water inlet is always below the surface of the water in the

receiving chamber, and admits water to the air conduit after all of the water has escaped that can be siphoned out through the water outlet by reason of a drop in pressure in the boiler below that in the receiving chamber.

Another object is to provide a vacuum condensation pump in the form of a unit, composed of a minimum number of separate parts and capable of being easily and readily assembled.

With these and other objects and advantages in view, this invention consists in the several novel features of construction, arrangement and combination of parts hereinafter fully set forth and claimed.

The invention is clearly illustrated in the drawings accompanying this specification, in which:

Fig. 1 is a central longitudinal vertical section through a vacuum condensation pump, embodying one form of the present invention.

Fig. 2 is a horizontal section taken on the line 2—2 of Fig. 1.

Fig. 3 is an enlarged detail vertical longitudinal section taken through fragments of the tank and air conduit.

Fig. 4 is a vertical cross-section taken on the line 4—4 of Fig. 1.

Fig. 5 is a vertical cross-section taken on the line 5—5 of Fig. 1.

Fig. 6 is a horizontal section taken on the line 6—6 of Fig. 1.

Fig. 7 is an end elevation of the tank.

Fig. 8 is a horizontal section taken on the line 8—8 of Figs. 1 and 7.

Fig. 9 is a vertical cross-section taken on the line 9—9 of Figs. 1 and 10.

Fig. 10 is a horizontal section taken on the line 10—10 of Fig. 9.

Fig. 11 is a vertical longitudinal section taken on the line 11—11 of Fig. 4.

Fig. 12 is an enlarged detail side view of a float valve, which controls the port between the hurling water chamber and receiving chamber.

Fig. 13 is an end view of said valve looking in the direction of the arrow 13 in Fig. 12.

Fig. 14 is an enlarged detail vertical section through the shaft coupling between the motor shaft and impeller shaft, the line of section being indicated at 14—14 in Fig. 1.

Fig. 15 is a horizontal section taken on the line 15—15 of Fig. 14.

Referring to said drawings, which are merely illustrative of one embodiment of the invention, the reference character 15 designates a tank having a top wall 16, bottom wall 17, side walls

18, and end walls 19, 19^a. The side and end walls project down below the bottom 17 to provide a hollow base 20, upon which the entire structure is carried.

A vertical partition 21 divides the tank into a receiving chamber 22 and a hurling water chamber 23, which chambers are entirely separate from each other, although they are connected by a valve controlled port 24, through which water from the hurling water chamber may flow into the receiving chamber when the water level in the hurling water chamber rises above a predetermined level, and through which air may flow from the hurling water chamber into the receiving chamber whenever the water in the hurling water chamber falls below the said predetermined level. The purposes of the float controlled port are to prevent flooding of the hurling water chamber and to equalize the pressure in the two chambers under certain conditions that may arise, especially when the pump is shut down.

An inlet passage 25 connects the receiving chamber with the inlet opening 26 for the water of condensation, air and other non-condensable gases which are usually conveyed to the pump by the return mains and discharge into an inlet fitting 28, bolted or otherwise fastened to a side wall of the tank over the inlet opening 26. The inlet passage 25 is formed by two upright cross-walls 29, which extend up from the plane of the bottom wall 17 of the tank and are connected at their upper and lower ends by walls 30, 30^a. The walls, which define the inlet passage, join with the partition 21 and side wall 18 of the tank and the partition is formed with an opening 27 therein, which opens from the receiving chamber to the inlet passage.

The partition 21 extends below the bottom wall 17 as at 21^a, and joins with a bottom wall 31, which forms the bottom of the hurling water chamber and joins with the side wall 18 of the tank. From the above, it is apparent that the hurling water chamber is of greater depth than the receiving chamber.

Some vapor, which accumulates in the receiving chamber, is carried along with the air to the hereinafter described vacuum pump, and make-up water is drawn into the vacuum pump from the receiving chamber and is discharged into the hurling water chamber, where it accumulates. To prevent the water from flooding the hurling water chamber or being discharged through the hereinafter mentioned air vent pipe, the port 24 is provided with a float controlled valve which is here shown as comprising a valve seat 110, having a nipple threadedly secured in the top wall 30 of the inlet passage 25; a valve 111, preferably in the form of a ball, seats upon the valve seat and closes the opening therethrough, except when unseated. Fulcrumed upon upstanding ears 112 that rise from the valve seat, is a float lever 113 which has a ball float 114 on the end of one arm, and two fingers 115 on its other arm, which fingers straddle the ball and act to unseat it whenever the float lever is moved up or down from its normal position, which position is controlled by a predetermined level of the water in the hurling water chamber. The ears 112 are arranged on the sides of the ball and prevent it from escaping from its seat.

Fig. 12 illustrates in solid lines the position in which the float lever is held when the water level stands at its predetermined height; in the dotted lines 113^b the float lever reaches a high

water level, and in the dotted lines 113^b the position it occupies when the water level falls below the predetermined level. In either of the dotted line positions, one of the fingers 115 engages the ball 111 and unseats it. If the water has risen above the predetermined level, the float lever unseats the ball and permits water to flow from the hurling water chamber to the receiving chamber and if the water falls below the predetermined level, the other finger engages the ball, unseats it and permits air to flow from the hurling water chamber to the receiving chamber, thereby equalizing the pressure in the two chambers.

Leading from the hurling water chamber, is a water inlet conduit 32 for conducting hurling water to the water inlet of the vacuum pump 33, and leading from the discharge of said pump is a discharge conduit 34, which runs to the hurling water chamber. Conveniently these inlet and discharge conduits are cast as a part of the tank and open out through openings, disposed below the end wall 19^a of the tank.

The water inlet conduit 32 is formed by upper and lower walls 36, 37 and side walls 38, located in the interior of the base and forming an L shaped conduit that opens to the hurling water chamber through an opening 39 in the wall 21^a thereof. The discharge conduit 34 is located at a higher level than the inlet conduit and has top, bottom and side walls 40, 41, 42, that lead from the same end of the base as the conduit 32, to a convenient place in the hurling water chamber and terminate in a hub 43 in which is held the lower end of a vertical water and air discharge pipe 44, which extends up part way in the hurling water chamber and is provided with a splash plate 45, supported at a place slightly above the discharge end of the pipe. A bracket 46, which projects from a wall of the hurling water chamber, and surrounds the discharge pipe 44, forms a lateral support therefor. In the operation of the vacuum pump, it draws its hurling water from the hurling water chamber, through the water inlet conduit 32 and discharges it back to the hurling water chamber through the discharge conduit 34 and discharge pipe 44.

The vacuum pump exhaust air and other non-condensable gases from the receiving chamber, thereby creating a partial vacuum therein and discharges these gases through the discharge pipe 44 into the hurling water chamber, from which they escape through an air vent pipe 47, which has an outwardly opening check valve 48 therein and leads from the top wall of the hurling water chamber. It will be understood that the hurling water chamber remains at or above atmospheric pressure, whereas a partial vacuum is maintained in the receiving chamber to facilitate the return of water and non-condensable gases from the steam heating system with which the pump is used.

An upright air conduit 50 extends from the top to the bottom wall of the receiving chamber and is held in hubs 60, 60^a formed on said walls and sealed therein. Cast integrally with the bottom wall of the receiving chamber is an air conduit 51, which opens at one end to the bottom of the air conduit 50 and communicates with the air inlet of the vacuum pump. As shown, the air conduit 51 opens at its other end in the same vertical plane as the other hereinbefore mentioned conduits, where it joins with

the air inlet to the vacuum pump as will be presently described.

Bolted or otherwise rigidly secured to the top wall of the receiving chamber over the open upper end of the air conduit 50, is a hollow cap 52, which provides a passageway leading from the upper end of the air conduit to a port 53 in said top wall, which port opens to the receiving chamber, whereby air, vapors, and non-condensable gases may be exhausted from the receiving chamber by the vacuum pump. The cap provides a casing for a check valve 54, desirably of the disc type, which is contained in a cage 55, seated in the port 53, and having a valve seat for the valve disc which closes an opening 56 in the cage. Other openings 57 in the wall of the cage above the valve disc, together with the opening 56 provide communication between the receiving chamber and air conduit when the valve is unseated. The cap is formed with a semi-circular bridge 58, which, together with the bottom face of the cap, bears upon a sealing ring 59 which is seated in an annular groove in the hub 60, and makes a tight joint between the air conduit, top wall, and cap. A sealing ring 59^a is seated in an annular groove in the hub 60^a and makes a tight joint between the lower end of the air conduit and bottom wall of the receiving chamber.

In the end wall of the receiving chamber and located above the bottom wall thereof, is a water discharge opening 61, which communicates with the suction inlet conduit 62 of the hereinafter described water pump 63, and located in a plane below the lower edge of the opening 61, is a make-up water inlet 64 in the air conduit, through which make-up water for the vacuum pump is drawn into the air conduit and conducted to the vacuum pump. A check valve 65, opening in a direction from the receiving chamber to the air conduit, is connected to the latter by a short nipple and an orifice nipple 66 is secured in the other open end of the check valve. Suction, created by the vacuum pump, draws water from the receiving chamber at a point below the outlet opening 61, through the air conduit to the vacuum pump and supplies the latter with make-up water to compensate for any difference in loss.

Bolted to or cast integrally with the end of the base containing the several conduits, hereinbefore referred to, is a hollow pump base 67, which as a preference is cast with a pump casing 68 for the vacuum pump 33 and with a hurling water inlet 69, a hurling water outlet 70, and an air inlet conduit 71, which are aligned with the conduits 32, 34 and 51, and are held in intimate contact therewith. Desirably, the abutting ends of the several conduits are formed with flanges around the openings to provide wide contacting surfaces between the aligned conduits.

Bolted to the top of the pump base, is a water pump casing member 72, which desirably is cast with the water suction inlet conduit 62, that extends to the wall 19^a of the receiving chamber and opens to the water discharge opening 61. The water suction inlet conduit 62 is formed with a bolting flange at its open end, bolted to the wall 19^a of the receiving chamber.

The pump casing member 72 is also cast with a water discharge outlet 74, which connects with the pipe connections to the boiler or other place where the water is to be discharged. Usually, a check valve 75 is contained in said pipe connections.

Rising from the pump casing member 72, are 75

upright supports 76, which join with a ring 77 at their upper ends that forms the support for an electric pump motor 78. The pump motor is of the vertical type and its shaft 78^a is coupled to the vertical shaft 84, for the impellers of the two pumps, by a novel shaft coupling as will be presently described.

The vacuum pump casing is formed with the usual volute chamber 79, in which is contained the impeller 80 of the vacuum pump, and in the pump casing member 72 is formed the usual volute chamber 81 for the impeller 82 of the water pump. Between the two volute chambers is a circular plate 83, which forms a common wall for volute chambers; the edge portion of the plate seats in grooves formed in the meeting faces of the pump base and water pump casing member. Both impellers are rigidly secured to the impeller shaft 84.

Any suitable vacuum pump, employing water for its operation, may be employed and the one shown and described in my prior Letters Patent, No. 1,664,249, dated March 27, 1928, is an example of such a pump, and reference may be had to said Letters Patent for a full description thereof.

Briefly, the vacuum pump casing below the impeller is bored as at 86, to receive the lower end of an upright cylindrical wall 87, which separates a centrally located water intake passage 88 from air intake passages 89. The water intake passage opens to the passageway in the water inlet conduit 69, and an annular inlet passage 92 formed between the casing wall and cylindrical wall connects the passage in the air inlet conduit 71 with the air intake passages 89.

The cylindrical wall 87 extends axially into the interior of the impeller to the top wall 90 thereof and is formed with water outlet openings 91, through which hurling water enters the passages between the vanes of the impeller 80. The air intake passages 89 conduct the air to the passages between the vanes. The openings 91 and air intake passages 89 are disposed circumferentially around the cylindrical wall in alternate arrangement.

The cylindrical wall 87 seats upon an annular seat 93, formed in the bottom member of the vacuum pump casing wall and is held thereon by a bolt 94, which is threadedly secured in a boss formed on the bottom wall of the water inlet conduit 69. The cylindrical wall is formed with a spider 95 for receiving the upper end of the bolt.

The water pump impeller 82 is of conventional type employed in centrifugal water pumps, and is formed with a central eye, which opens from the water suction conduit 62.

Both impellers are formed with hubs 80^a, 82^a that surround the impeller shaft. The hub of the water pump impeller bears against a bushing 96, which bears against a shouldered part 97 of the impeller shaft and the end of the hub of the vacuum pump impeller is beveled and bears against a correspondingly beveled part of the bottom shroud of the water impeller, and nuts 98, threaded on the lower end of the impeller shaft, serve to secure the impellers together and upon the impeller shaft. A suitable stuffing box 99 is formed on the pump casing member 63 around the upper end of the impeller shaft.

The shaft coupling 85 is of novel construction. The motor shaft 78^a and impeller shaft 84 are telescoped as shown in Fig. 14, one of them being bored cut to receive the end portion of the other shaft and the wall of the bored shaft is formed with several slits that extend lengthwise thereof

to provide shaft gripping jaws 100, that surround the other shaft. Two circumferential grooves 101 are formed in the external faces of the shaft gripping jaws, in which are held split rings 102, the outer faces of which are oppositely tapered. Bearing against the tapered faces of the rings are collars 103, which are formed with tapered inner faces that correspond with the tapers of the tapered faces of the rings. The collars are provided with threaded connection for adjusting them toward and away from each other and as shown, they are formed with interengaging threaded sleeves 104; desirably, the collars are formed with hexagonal heads by means of which a wrench may be applied to them for tightening them upon the rings. When tightened up, the beveled faces of the collars crowd the rings against the shaft gripping jaws and therewith clamp the same upon the shaft.

As is well understood, the usual float and pressure switches (not shown) are provided for starting and stopping the pump motor, but as the construction and operation of these switches is well known, no detailed description of them is thought necessary to the understanding of the present invention. Sometimes the water accumulates to such an extent that the pumps are required to operate for a longer time than is necessary to bring the vacuum down to a normal low pressure. To prevent an excessive low pressure from being created in the system, a relief valve or vacuum breaker 105 is provided as is customary.

In operation under normal conditions with the motor running and the water, air, and non-condensable gases emptying into the receiving chamber, the water pump withdraws water from the receiving chamber and pumps it back to the boiler or other desired place and the vacuum pump builds up a partial vacuum in the receiving chamber and return mains. As has been explained, the vacuum pump receives its hurling water from the hurling water chamber and discharges it (together with air and other non-condensable gases which it exhausts from the receiving chamber through the air conduit) into the hurling water chamber, from which the air and non-condensable gases escape through the air vent pipe. Some make-up water for the vacuum pump is withdrawn from the receiving chamber through the water inlet port 64 and passes, along with the air flowing in the air conduit, to the vacuum pump and is discharged into the hurling water chamber, where it accumulates.

If the water in the hurling water chamber rises above the predetermined level therein, it lifts the float of the float valve, thereby swinging up the float lever and unseating the valve, permitting the excess water to drain into the receiving chamber until the level of the water in the hurling water chamber falls to the predetermined level.

The pumps continue to operate until the required low pressure is obtained in the receiving tank, and the water therein has been pumped out to a predetermined low level as limited by the float and pressure switches.

When the motor stops and the pumps are at rest, then with a partial vacuum in the receiving chamber and atmospheric pressure in the hurling water chamber, water may slowly leak from the hurling water chamber through the vacuum pump past the hub of the vacuum pump impeller into the volute chamber of the water pump and through the water pump impeller to the suction

inlet of the water pump and into the receiving chamber. However, when the level of the water in the hurling water chamber falls below its predetermined level, the float lowers, swings the float lever down and unseats the valve, permitting air from the hurling water chamber to flow into the receiving chamber until the pressure in both chambers is equalized, whereby the leakage of the water from the hurling water chamber through the pumps to the receiving chamber ceases when the water in both chambers reaches a common level. As a result, a sufficient head of water is preserved in the hurling water chamber to supply the vacuum pump with water for its operation.

At night, when the boiler is shut down, then in case the pressure therein falls below the low pressure in the receiving chamber, and may tend to syphon water out of the receiving chamber and hurling water chamber, then when the level of the water in the hurling water chamber lowers and unseats the float valve, air is admitted from the hurling water chamber to the receiving chamber, thereby equalizing the pressure in both chambers, and if the level of the water lowers to the suction outlet of the water pump, the vacuum will extend to the receiving chamber and hurling water chamber, thereby preventing more water from being syphoned out. As a result, there is always sufficient hurling water left to supply the vacuum pump for its operation when the apparatus is again started.

More or less variation of the exact details of construction is possible without departing from the spirit of this invention; I desire, therefore, not to limit myself to the exact form of the construction shown and described, but intend, in the following claims to point out all of the invention disclosed herein.

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

1. In a vacuum condensation pump, the combination of a tank having a receiving chamber and a hurling water chamber, the latter opening out to the atmosphere, water and air pumping means having their suction inlets in communication with the receiving chamber, the air pumping means employing water for its operation and having a water inlet and a discharge outlet in communication with said hurling water chamber and a float valve controlled port between the hurling water chamber and receiving chamber, the float of which is contained in the hurling water chamber and acts to open the valve when moved upwards or downwards from its normal position as governed by a predetermined water level in the hurling water chamber.

2. In a vacuum condensation pump, the combination with a receiving chamber and a hurling water chamber, having a port therebetween, said hurling water chamber opening out to the atmosphere, a water pump and a vacuum pump connected to the receiving chamber, said vacuum pump also having hurling water connections with the hurling water chamber, of a valve device controlling said port and comprising a valve seat and a float operated valve, the float of said valve being located in the hurling water chamber and being adapted to unseat the valve when moved upwards or downwards from a normal position as governed by a predetermined normal level of the water in the hurling water chamber.

3. In a vacuum condensation pump, the combination with a receiving chamber and a hurling water chamber, having a port therebetween, said

hurling water chamber opening out to the atmosphere, a water pump and a vacuum pump connected to the receiving chamber, said vacuum pump also having hurling water connections with the hurling water chamber, of a valve device controlling said port and comprising a valve seat, a valve adapted to seat on said valve seat, and a float lever and float for operating the valve, the float being located in the hurling water chamber and said float lever being constructed and arranged to unseat the valve when moved upwards or downwards from a normal position as governed by a predetermined normal level of the water in the hurling water chamber.

4. In a vacuum condensation pump, the combination with a receiving chamber and a hurling water chamber having a port therebetween, said hurling water chamber opening out to the atmosphere, a water pump and a vacuum pump connected to the receiving chamber, said vacuum pump also having hurling water connections with the hurling water chamber, of a valve device controlling said port and comprising a valve seat, a ball valve adapted to seat on said valve seat, and a float lever having a float on one arm and a pair of fingers on the other arm straddling said ball valve, said float lever being located in the hurling water chamber and arranged to unseat the ball valve when moved upwards or downwards from a normal position as governed by a predetermined normal level of the water in the hurling water chamber.

5. A vacuum condensation pump comprising in combination a receiving chamber and a hurling water chamber having a float valve controlled port therebetween, a water pump connected with said receiving chamber, a vacuum pump employing water for its operation, an air conduit leading from the upper end of the receiving chamber to the suction inlet of the vacuum pump, a make-up water inlet, opening to the air conduit at a place below the suction inlet to the water pump, a water inlet conduit leading from the hurling water chamber to the suction inlet of the vacuum pump and a discharge conduit leading from the discharge end of the vacuum pump to the hurling water chamber.

6. In a vacuum condensation pump, the combination of a receiving chamber and a hurling water chamber having a float valve controlled port therebetween of which the float is contained in the hurling water chamber and arranged to open the valve when moved upwards or downwards from a normal position as controlled by a predetermined water level in the hurling water chamber, water and air pumping means comprising a pump casing, a water pump impeller and a vacuum pump impeller in said casing and both mounted on a vertical motor driven impeller shaft, said casing having a water inlet for the water impeller connected with said receiving chamber, an air inlet in communication with the upper end of the receiving chamber and water inlet and discharge openings, respectively in communication with the hurling water chamber.

7. A vacuum pump comprising in combination a tank having a receiving chamber and a hurling water chamber, a hollow base supporting said tank, a pump base at one end of the tank base, a water pump and a vacuum pump associated with said pump base, the water pump having a suction inlet, opening to said receiving chamber and the vacuum pump having an air inlet, a water inlet, and a discharge outlet, all lead-

ing to the base, an air conduit leading from the upper end of the receiving chamber to the air inlet of the vacuum pump, and inlet and discharge conduits leading from the hurling water chamber through the hollow of the base to the end thereof which supports the pump base, said last mentioned conduits opening to the water inlet and discharge outlet respectively to the vacuum pump.

8. In a vacuum condensation pump, the combination of a tank having a receiving chamber and a hurling water chamber, a hollow base supporting said tank, said receiving chamber having a water discharge opening in one end wall disposed above its bottom, an air conduit leading from the upper end of the receiving chamber, through the hollow of the base, to one end thereof and said hurling water chamber having water inlet and discharge conduits leading therefrom through the hollow of the base to the same end as the air conduit leads, a pump base bolted to the end of the tank base containing the ends of said conduits, said pump base having a water pump and a vacuum pump carried thereby, the suction inlet of the water pump opening to the water discharge opening of the receiving chamber and the vacuum pump having an air inlet, opening to the air conduit and water inlet and discharge openings, opening respectively to the said water inlet and discharge conduits.

9. In a vacuum condensation pump, the combination of a receiving chamber and a hurling water chamber having a port therebetween, a water pump for discharging water from the receiving chamber, an air pump of the type employing water for its operation, having an air inlet, a water inlet, and a discharge outlet, said hurling water chamber having an air vent and having connections with the water inlet and the discharge outlet of the vacuum pump, an air conduit leading from the upper end of the receiving chamber to the air inlet of the vacuum pump, a float operated valve for controlling the port between the receiving chamber and hurling water chamber operating to close said port at a predetermined normal water level in the hurling water chamber and to open said port when the water level rises or falls below said predetermined level, whereby water drains from the hurling water chamber to the receiving chamber in a high position of the float and the pressure in the hurling water chamber and receiving chamber equalizes in a low position of the float.

10. The combination of a base portion formed with a hurling water discharge conduit, a receiving chamber and a hurling water chamber arranged side by side carried by said base portion with said inlet and discharge conduits leading from said hurling water chamber, a pump base mounted on said base portion and having a pump casing containing two volute chambers, a water impeller in one volute chamber and an air impeller in the other volute chamber, a motor driven shaft on which said impellers are mounted, said pump casing having a suction inlet opening for the water impeller, communicating with the receiving chamber, and said pump casing having an air inlet opening, communicating with the receiving chamber and having also a water inlet and a discharge outlet in communication respectively with said hurling water inlet conduit and said hurling water discharge conduit.

11. The combination of a tank having a re-

ceiving chamber, a water pump having a suction inlet, opening to said receiving chamber above its bottom, a vacuum pump employing water for its operation, an air conduit leading from the upper end of the receiving chamber to the air inlet of the vacuum pump, said air conduit having a water inlet orifice located below the inlet opening to the suction inlet of the water pump, through which make-up water for the vacuum pump is admitted to said vacuum pump from the receiving chamber.

12. A vacuum condensation pump comprising in combination a receiving chamber, a hurling water chamber, which opens out to the atmosphere, a water pump connected to the receiving chamber for withdrawing water therefrom, a vacuum pump which employs water for its operation, there being two air ports in the top wall of the receiving chamber, a chambered cap bolted to said top wall over said air ports with said air ports in communication with said chamber, a check valve in said chamber, opening away from the receiver, an air conduit leading from the other air port to the air intake of the vacuum pump, and water inlet and discharge conduits leading from the hurling water chamber to the water inlet and discharge outlets respectively of the vacuum pump.

13. A vacuum condensation pump comprising in combination a base, a tank formed integrally therewith and having a receiving chamber and a hurling water chamber disposed side by side, the latter of which opens out to the atmosphere, water and air pumping means carried by said base and comprising a pump casing disposed at one side of and bolted to said base, a water pump impeller and a vacuum pump impeller therein, a vertical motor driven impeller shaft upon which both of said impellers are mounted,

said pump casing having a water suction inlet, opening to the receiving chamber and said pump casing having an air inlet, a water inlet, and a discharge outlet, an air conduit leading from the upper end of the receiving chamber to said air inlet of the vacuum pump casing, and water inlet and discharge conduits connecting the hurling water chamber with the water inlet and discharge outlets respectively of the vacuum pump.

14. In a vacuum condensation pump, the combination of a base, a tank thereon having a partition dividing the same into a receiving chamber and a hurling water chamber, cross walls in the hurling water chamber providing a water and air inlet passage from a wall of the tank to the receiving chamber, there being a float valve controlled port in a wall of said inlet passage of which the float is contained in the hurling water chamber, said float acting to open the valve when moved upwards or downwards from a normal position as governed by a predetermined water level in the hurling water chamber, a water pump and a vacuum pump mounted on said base, the water pump having a suction inlet opening to the receiving chamber through an opening in a wall thereof, and said vacuum pump having an air inlet in communication with the upper end of the receiving chamber, said vacuum pump having also a water inlet and a discharge outlet, a water inlet conduit leading from the hurling water chamber to the water inlet of the vacuum pump, a discharge conduit leading from the discharge outlet of the vacuum pump and terminating in an upright discharge pipe in the hurling water chamber.

AUGUSTUS C. DURDIN, JR.