E. F. McCARTHY.

COMBINED ASPIRATOR AND FORCE PUMP.

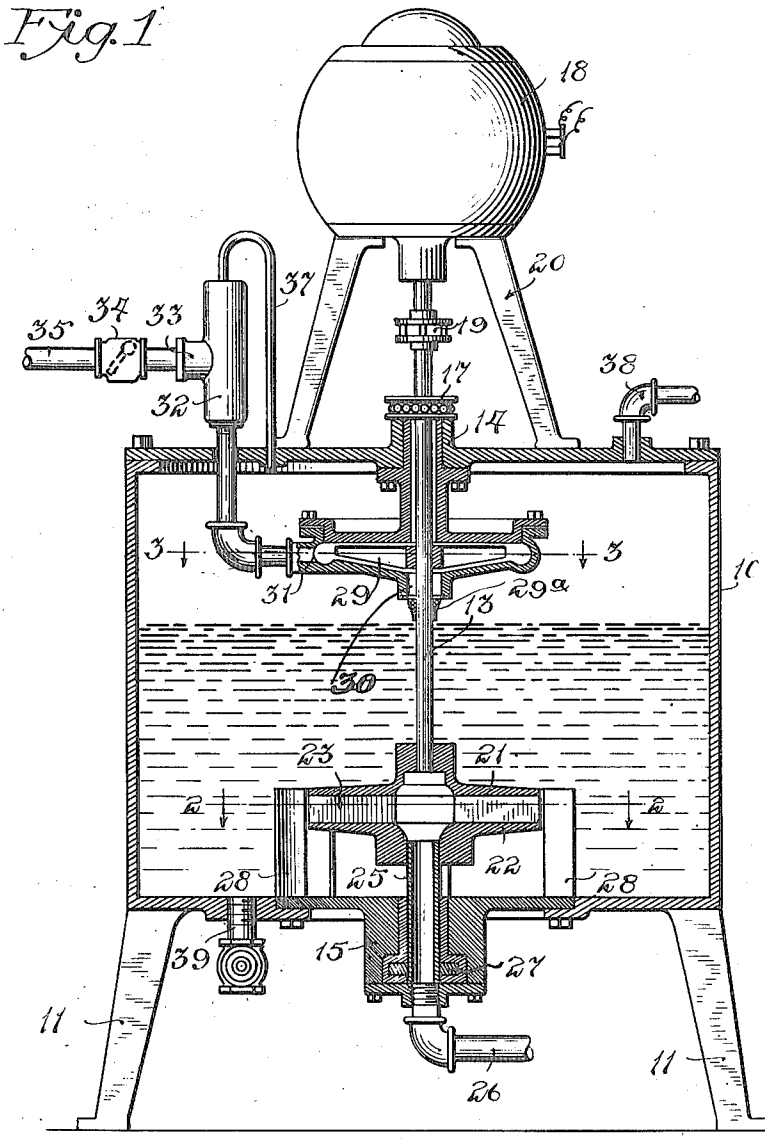
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1,264,315.

Patented Apr. 30, 1918.

3 SHEETS—SHEET 1.

Fig. 1



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3 SHEETS—SHEET 2.

Fig. 2

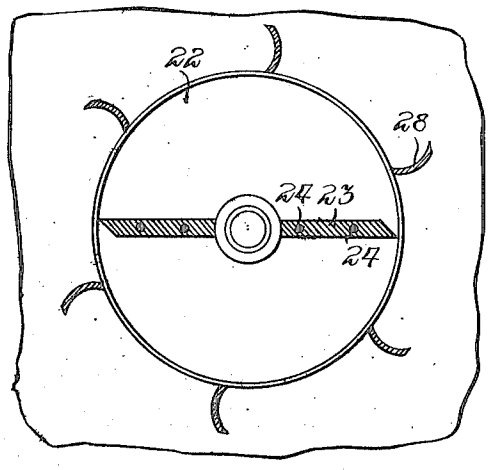


Fig. 3.

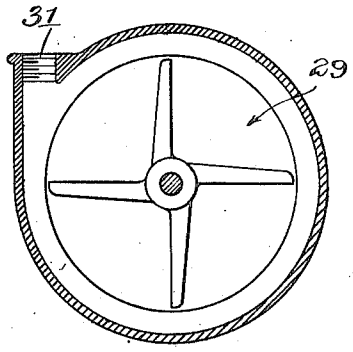
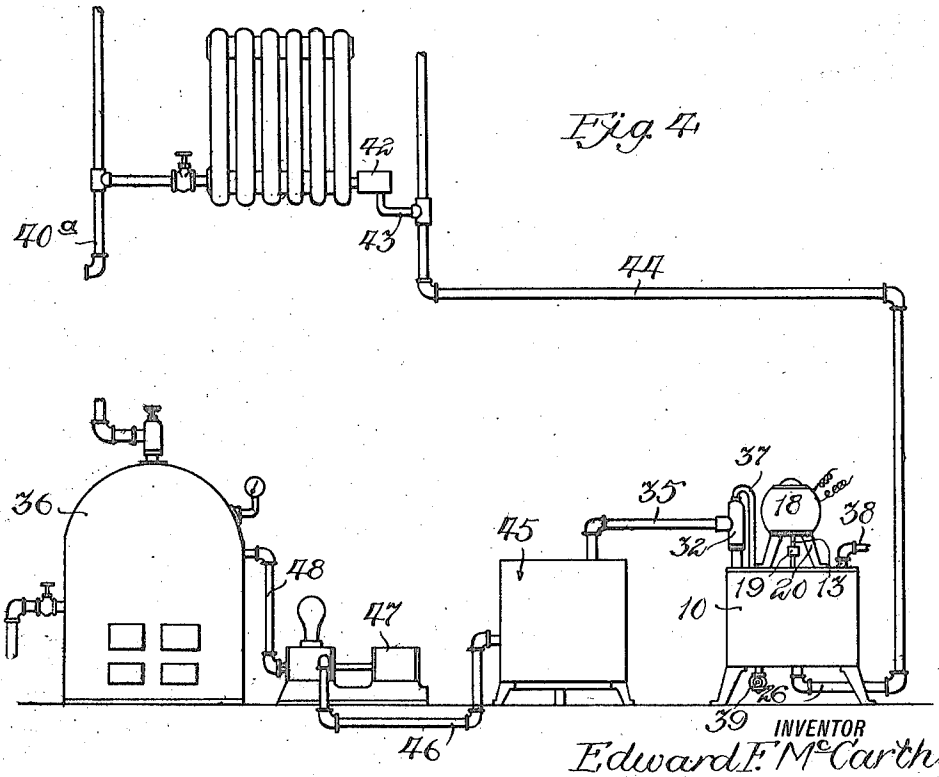


Fig. 4



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3 SHEETS—SHEET 3.

Fig. 5

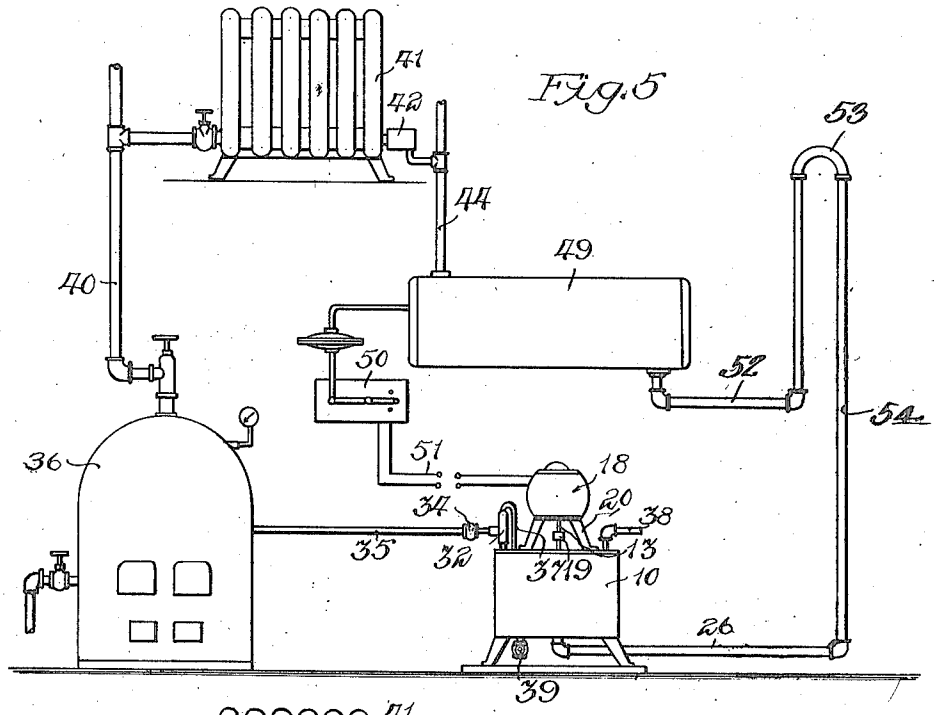
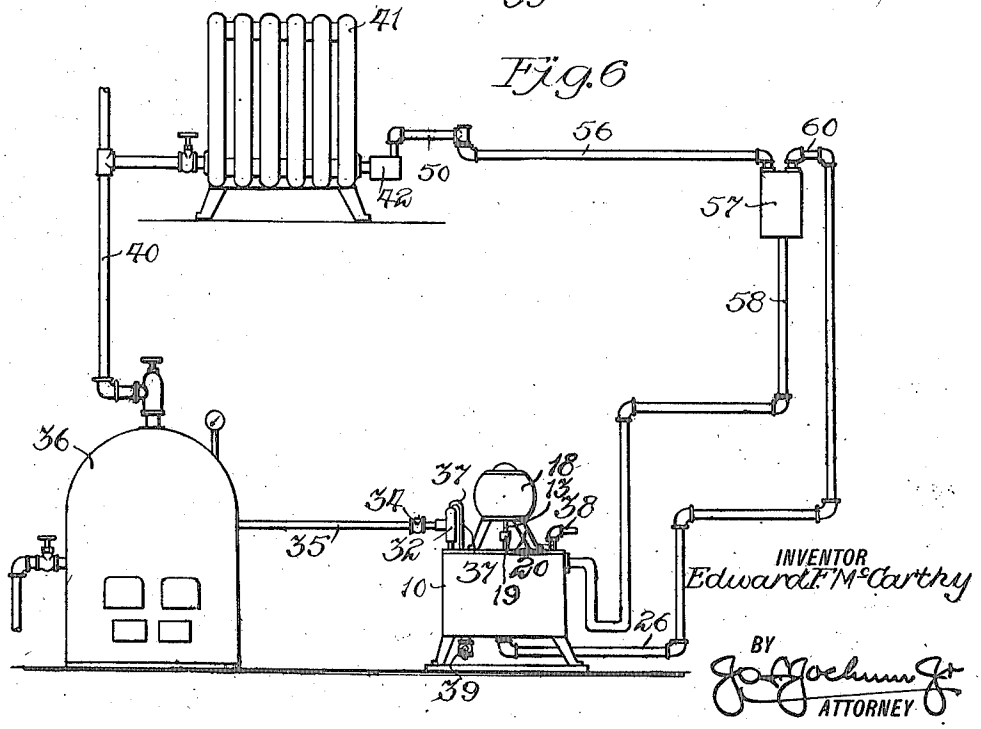


Fig. 6



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UNITED STATES PATENT OFFICE.

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COMBINED ASPIRATOR AND FORCE-PUMP.

1,264,315. Specification of Letters Patent. Patented Apr. 30, 1918.

Application filed March 22, 1917. Serial No. 156,628.

To all whom it may concern:

Be it known that I, EDWARD F. McCARTHY, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Combined Aspirators and Force-Pumps, of which the following is a specification.

This invention relates to improvements in a combined aspirator and force pump, adapted to produce and maintain a vacuum in a chamber or tube, by entrainment of the fluid therefrom, and to deliver the fluid to another chamber or receptacle in which the aspirator is arranged, and in which latter chamber is also arranged a force pump, by means of which pump the fluid is discharged from the receptacle.

A further object is to provide an improved apparatus of this character, which is particularly adapted, though not necessarily limited in its use with heating systems, whereby a suction or vacuum will be maintained in the system by means of liquid entrainment, and at the same time consumption of the liquid will be maintained at a minimum and waste of liquid will be avoided.

A further object is to provide an improved apparatus of this character having means whereby the pump will be automatically primed by the fluid entrained by the aspirator into the chamber, in which the aspirator and pump are located.

A further object is to provide a combined aspirator and pump of this character which will be of a unitary and compact structure.

A further object is to provide an improved apparatus of this character which will be simple, durable and cheap in construction, effective and efficient in operation and in which the use of floats, stuffing boxes, pistons, automatic valves and gearing will be dispensed with.

To the attainment of these ends and the accomplishment of other new and useful objects as will appear, the invention consists in the features of novelty in substantially the construction, combination and arrangement of the several parts hereinafter more fully described and claimed and shown in the accompanying drawings illustrating this invention and in which:

Figure 1 is a view partly in vertical section and partly in elevation of an improved apparatus of this character, constructed in accordance with the principles of this invention.

Fig. 2 is a horizontal sectional view taken on line 2—2, Fig. 1.

Fig. 3 is a horizontal sectional view taken on line 3—3, Fig. 1.

Fig. 4 is a diagrammatic view of one form of heating system to which this apparatus may be applied.

Fig. 5 is a diagrammatic view showing the apparatus used in connection with a return line vacuum heating system.

Fig. 6 is a diagrammatic view showing this improved apparatus applied to a system in which the air is separated from the liquid before the liquid enters the aspirator chamber, the aspirator handling only air, and the water being delivered to the chamber by gravity.

Referring more particularly to the drawings, the numeral 10 designates generally a chamber or receptacle which is supported in any suitable manner such as by means of legs 11, and arranged within the receptacle is an upright shaft 13 having a suitable bearing 14 at the top of the receptacle, and another suitable bearing 15 at the bottom thereof, and the shaft 13 is journaled in the bearing 14.

A thrust 17 is provided on the shaft 13 adjacent the bearing 14, and the end of the shaft projects beyond the thrust bearing and is connected with a motor 18 preferably of the electric type. Arranged within the shaft, and preferably between the motor and the thrust bearing 17, is a flexible coupling 19 which may be of any approved type. The motor is preferably supported above the receptacle 10, preferably by means of supports 20. Arranged within the receptacle and preferably at a point adjacent the bottom thereof, is an aspirator, or suction creating device. The aspirator comprises preferably spaced disks 21, 22 which are separated from each other by means of upright partitions 23 and the parts are secured together in any suitable manner such as by means of fastening devices 24. Two of these partitions 23 are preferably provided and are arranged diametrically opposite each other, and the aspirator is secured to the shaft 13 in any suitable manner so as to rotate therewith.

Depending from the member 22 of the aspirator is a tubular element 25, which ro-

tates in a suitable bearing and extends through the bottom of the chamber. A suitable packing 27 may be provided to form a fluid tight joint, and the pipe 26 constitutes an inlet to the receptacle or chamber 10, through which pipe the fluid is entrained by the aspirator. Arranged concentrically with the aspirator are upright members or baffles 28 which are provided for the purpose of breaking up or preventing the liquid from swirling in the chamber 10. Any number of these uprights or baffles 28 may be provided but in the drawing six are shown.

Arranged also within the chamber 10 and secured preferably to the shaft 13 is a force pump, designated generally by the reference numeral 29 (see particularly Fig. 3), and which force pump is preferably of the centrifugal type, having an inlet 30 over which a strainer 29[a] is arranged, and an outlet 31.

This pump 29 is preferably arranged at a point above the aspirator, so that the inlet of the pump will be above the normal level of the liquid in the chamber 10, but in such a position that as the liquid rises in the chamber 10, by the entrainment of liquid in the chamber by the aspirator, the inlet of the pump will be submerged and the pump will be automatically primed so that the operation of the pump will draw the liquid out of the chamber 10, and force the liquid through the outlet 31 of the pump into the chamber 32, and from the chamber 32 out of the outlet 33 thereof, through the check valve 34 to be discharged through the pipe 35 and preferably back to the boiler 36, as shown in Figs. 5 and 6.

Leading from the chamber 32 is a pipe 37 which preferably extends from the high point of the chamber and forms a communication between the chamber 32 and the chamber 10 so that when the centrifugal pump operates, any air which is forced by the pump through the outlet 31 and into the chamber 32 will escape through the pipe 37 and will not be forced through the system but will be discharged back into the chamber 10, and from which chamber any excess or accumulation of air will be discharged through the outlet 38 leading from the chamber 10. The chamber 10 may also be provided with an outlet 39 leading from the bottom thereof and by means of which outlet the chamber may be cleaned.

In Fig. 4 of the drawings, the apparatus is shown as applied to the exhaust of a high pressure steam plant and 40[a] designates the connection with the exhaust. From the radiator 41, the fluid passes through a thermostatic trap 42, which may be of any well known construction, and which trap is connected by means of the communication 43 with the return pipe 44. The latter is in turn connected with the pipe 26 leading into the bottom of the chamber 10, and through which pipes 26, 44, the fluid is entrained into the chamber 10 by the action of the aspirator.

The centrifugal pump 29 operates to discharge the liquid from the chamber 10 through the pipe 35 into a feed water heater 45, which latter may be open or closed. From this feed water heater 45 the liquid is drawn through the pipe 46 by means of the pump 47 and discharged back into the boiler 36 through the pipe 48.

The apparatus is shown in Fig. 5 in connection with a return line vacuum heating system, the steam being supplied from the high pressure boiler 36, through the pipe 40 to the radiator 41. In this system there is employed an expansion tank 49, with which the return pipe 44 leading from the thermostatic trap is connected. An automatic electric vacuum switch 50, of the ordinarv type, is controlled from the tank 49, and the switch 50 controls the circuit 51 of the motor 18.

Leading from the tank 49 is a pipe 52 which is provided with a water seal loop 53, and which loop is arranged at such an elevation with respect to the tank 49, as to prevent any air from passing into the expansion tank through the pump, and also to prevent liquid from the chamber from being drawn into the tank 49 through the pipe 26 and between which pipe 26 and the loop 53, a connection 54 is provided.

In Fig. 6 the apparatus is shown in connection with another form of system wherein the air from the system is separated from the liquid before the liquid enters the chamber 10, so that the aspirator will handle only air, the liquid being delivered to the chamber 10 by gravity, and which liquid is discharged by the centrifugal pump 29 back to the boiler 36. In this form of invention, the air is discharged from the radiator 41 through a suitable pipe to the return pipe 56, which latter discharges into an expansion tank 57 leading from the bottom of which tank is a pipe 58 that discharges into the chamber 10, preferably adjacent the top thereof, and through which pipe the liquid will flow by gravity from the tank 57 into the chamber.

The air entering the expansion tank 57 with the liquid is separated from the liquid and will flow out of the pipe 60, which leads from the tank 57, and this pipe 60 is connected with the pipe 26 which leads into the botttom of the chamber 10 and through which pipe 26 the aspirator will entrain the air from the tank 57.

The tank 57 is located at such a height with respect to the chamber 10, so that the air in the chamber 10 cannot break through the wall of water in the pipes 58, which would destroy the vacuum in the tank 57.

In the operation of this improved apparatus, the aspirator or suction creating device is submerged in the liquid and revolved at a suitable speed, thereby creating a suction due to the tangential mingling of the liquid and air between the vertical partitions 23, which divide the circumferential submerged space with intervals therebetween. The whirling motion thus created, prevents the liquid penetrating far into the circumferential space, as the liquid after flowing inward due to the partial vacuum created in the circumferential space and the natural pressure of the liquid behind each partition, the liquid is immediately caught by the following partition and thrown outward.

In practice there is a constant inward and outward flow of liquid in the space between the periphery of the disks or in the outer spaces between the additional partitions. The action is enhanced by the breaking up of the liquid into sprays as it flows through the peripheral spaces and the entraining action of the liquid is effective to produce a vacuum up to approximately 25″ mercury, the intensity of the vacuum being determined by the velocity of revolution or the depth to which the circular disks are submerged.

The centrifugal pump being disposed above the aspirator will be primed by the liquid in the chamber 10 when the liquid therein rises sufficiently, and the liquid is then thrown out or discharged from the pump through the outlet 31, and this operation will be continued until the level of the liquid in the chamber 10 is below the inlet opening to the pump. The pump will again operate when the liquid rises sufficiently to cover the inlet opening.

This improved apparatus does not consume any of the liquid or waste any of the same and when the operation thereof is once started, very little attention is necessary as the operation is entirely automatic.

Furthermore this improved apparatus when used in conjunction with heating systems, operates as an air eliminator, a strainer to prevent sediment from passing back to the boiler, a combined vacuum and pressure pump and a condenser for condensing the steam and thereby prevents any of the steam from escaping to the atmosphere.

This improved apparatus also operates as a medium for condensing liquids in the practice of distillation, whereby a partial vacuum may be maintained in a receptacle containing the liquid to be distilled, thereby causing the liquid to boil at a lower temperature than under ordinary atmospheric conditions, and then drawing the vapor into the chamber 10, containing the same liquid as contained in the boiling receptacle, and which chamber contains the suction producer and centrifugal pump, and then discharging the liquid from the chamber by the centrifugal pump.

While the preferred form of the invention is herein shown and described, it is to be understood that many changes may be made in the details of construction and in the combination and arrangement of the several parts without departing from the spirit of the invention and it is therefore desired, that the drawings herewith submitted, are to be considered as being merely diagrammatic.

What is claimed as new is:

1. The combination of a chamber containing liquid, a rotary suction producing device submerged in the liquid within the chamber, a rotary pump also arranged in the same chamber, a suction tube through which fluid is drawn into the chamber by the suction creating device, an outlet through which liquid is discharged from the chamber by the pump, and means for operating the said suction creating device and pump.

2. The combination of a chamber containing liquid, a rotary suction producing device submerged in the liquid within the chamber, a rotary pump also arranged in the same chamber, a suction tube through which fluid is drawn into the chamber by the suction creating device, an outlet through which liquid is discharged from the chamber by the pump, means for operating said suction creating device and pump, and means for maintaining the liquid relatively at rest when the suction creating device is actuated.

3. The combination of a chamber containing liquid, an operating shaft in the chamber, means for rotating the shaft, a submerged suction creating device connected with the shaft, a centrifugal pump within the same chamber, and also connected with the shaft, an outlet from the chamber through which the liquid is forced by the pump, and an inlet to the chamber and through which inlet fluid is drawn into the chamber through the instrumentality of the suction creating device.

4. The combination of a chamber containing liquid, an operating shaft in the chamber, means for rotating the shaft, a submerged suction creating device connected with the shaft, a centrifugal pump within the same chamber and also connected with the shaft, an outlet from the chamber through which the liquid is forced by the pump, and an inlet to the chamber and through which inlet fluid is drawn into the chamber through the instrumentality of the suction creating device, said pump being spaced from the suction creating device and adapted to be automatically primed by the rising of the liquid in the said chamber.

5. The combination of a chamber containing liquid, a submerged suction creating device within the chamber, said suction creating device embodying two or more axially separated plates having circular peripheries, one or more rotative partitions in the space between said plates, a suction tube communicating with the said space whereby the rotation of the said suction creating device will cause the liquid to flow inward behind one of the said partitions and to be thrown outward by a tangential action of the following partition to entrain the air in the said suction tube to create a partial vacuum in said tube, a rotary discharge pump in the same chamber for the liquid therein, and a discharge outlet leading from the chamber, for the liquid.

6. The combination of a chamber containing liquid, a submerged suction creating device within the chamber, said suction creating device embodying two or more axially separated plates having circular peripheries, one or more rotative partitions in the space between said plates, a suction tube communicating with the said space whereby the rotation of the said suction creating device will cause the liquid to flow inward behind one of the said partitions and to be thrown outward by a tangential action of the following partition to entrain the air in the said suction tube to create a partial vacuum in said tube, a rotary discharge pump in the chamber for the liquid therein, a discharge outlet leading from the chamber, for the liquid, and means common to the suction creating device and the said pump for actuating them.

7. The combination of a chamber containing liquid, a submerged suction creating device within the chamber, said suction creating device embodying two or more axially separated plates having circular peripheries, one or more rotative partitions in the space between said plates, a suction tube communicating with the said space whereby the rotation of the said suction creating device will cause the liquid to flow inward behind one of the said partitions and to be thrown outward by a tangential action of the following partition to entrain the air in the said suction tube to create a partial vacuum in said tube, a rotary discharge pump in the chamber for the liquid therein, a discharge outlet leading from the chamber, for the liquid, and an air eliminator connected with the said discharge outlet.

8. The combination of a chamber containing liquid, a rotary suction producing device submerged in the liquid within the chamber, a rotary pump arranged in the same chamber, a suction tube through which fluid is drawn into the chamber by the suction creating device, an outlet through which liquid is discharged from the chamber by the pump, means for operating the said suction creating device and pump, and an air eliminator connected with the said outlet.

9. The combination of a chamber containing liquid, a rotary suction producing device submerged in the liquid within the chamber, a rotary pump arranged in the same chamber, a suction tube through which fluid is drawn into the chamber by the suction creating device, an outlet through which liquid is discharged from the chamber by the pump, means for operating the said suction creating device and pump, an air eliminator connected with the said outlet, and an additional air outlet leading from the said chamber.

10. The combination of a chamber containing liquid, a rotary suction producer submerged in the liquid, a rotary discharge pump disposed within the same chamber, means for rotating the said suction producer and pump, and provisions whereby air and liquid will be entrained into the said chamber by the said suction producer, and be expelled from the chamber by the said pump.

11. The combination of a chamber containing liquid, two or more flat parallel spaced circular disks, one or more vertical partitions between the disks and extending from the periphery inward and terminating short of the diametric center of the disks to form a space, there being an opening through one of the disks at the center thereof communicating with said space, a tubular member extending perpendicularly from the disk and communicating with said opening, a suction or intake tube, means connecting said tube with the said tubular member, means for rotating the disks about a common axis, whereby liquid will be drawn into the space between the disks by the rotation of the disks and thrown outward by the tangential action of the vertical partitions, into the chamber, and a centrifugal pump arranged within the chamber for discharging the accumulated liquid therefrom.

12. The combination of a chamber containing liquid, two or more flat parallel spaced circular disks, one or more vertical partitions between the disks and extending from the periphery inward and terminating short of the diametric center of the disks to form a space, there being an opening through one of the disks at the center thereof communicating with said space, a tubular member extending perpendicularly from the disk and communicating with said opening, a suction or intake tube, means connecting said tube with the said tubular member, means for rotating the disks about a common axis, whereby liquid will be drawn into the space between the disks by the rotation of the disks and thrown outward by the tan-

gential action of the vertical partitions, into the chamber, a centrifugal pump arranged within the chamber for discharging the accumulated liquid therefrom, there being an outlet from the chamber through which the liquid is discharged, and an air eliminator connected with said outlet.

13. An apparatus of the character described, embodying a chamber, an aspirator in the chamber, a discharge pump within the same chamber, means for actuating the aspirator and pump, and means for eliminating air from the liquid drawn into the chamber by the aspirator.

14. An apparatus of the character described, embodying a chamber, an aspirator in the chamber, a discharge pump within the same chamber, means for actuating the aspirator and pump, means for eliminating air from the liquid drawn into the chamber by the aspirator, and provisions whereby vapor drawn into the chamber by the aspirator will be condensed in said chamber.

15. An apparatus of the character described, embodying a chamber, an aspirator in the chamber, a discharge pump within the same chamber, means for actuating the aspirator and pump, means for eliminating air from the liquid drawn into the chamber by the aspirator, and means for trapping foreign matter in the chamber.

16. In a return line vacuum heating system, the provision of an apparatus of the character described, embodying a chamber, an aspirator therein, a pump also in the chamber and coöperating with the aspirator for discharging from the chamber liquid drawn thereinto by the aspirator, provisions whereby the air drawn into the chamber from the heating system by the aspirator will be separated from the liquid, and provisions whereby the air thus separated will escape from the chamber to the atmosphere.

17. In a return line vacuum heating system, the provision of an apparatus of the character described, embodying a chamber, an aspirator therein, a pump also in the chamber and coöperating with the aspirator for discharging from the chamber liquid drawn thereinto by the aspirator, provisions whereby the air drawn into the chamber from the heating system by the aspirator will be separated from the liquid, provisions whereby air thus separated will escape from the chamber to the atmosphere, and provisions whereby foreign matter will be trapped within the chamber.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 16th day of March, A. D. 1917.

EDWARD F. McCARTHY.

Witnesses:
FRANK N. REED,
J. H. JOCHUM, Jr.