Nov. 6, 1923. 1,473,441

T. O. PERRY

AUTOMATIC MOTOR SWITCH

Filed June 30, 1922 3 Sheets-Sheet 1

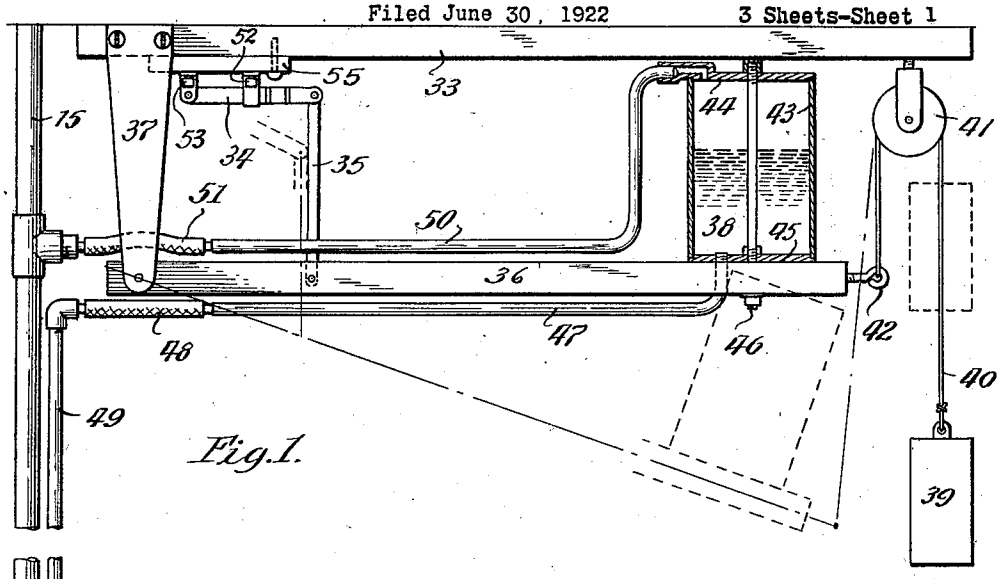
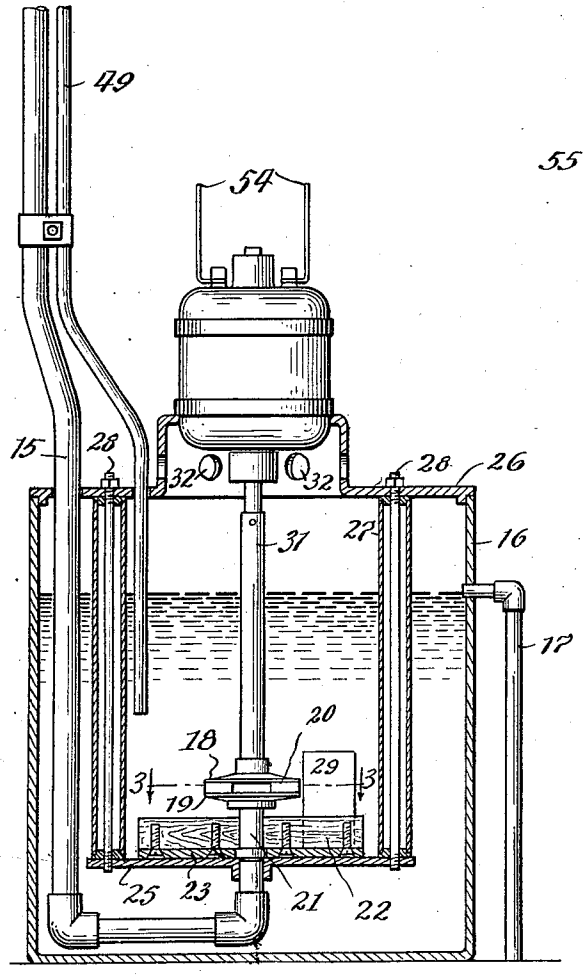


Fig. 1.



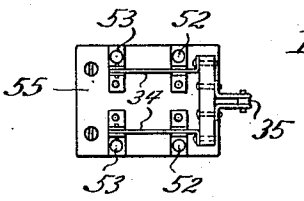
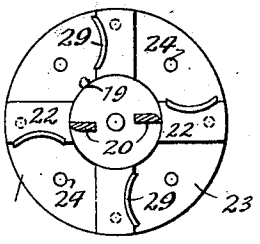


Fig. 2.

Fig. 3.



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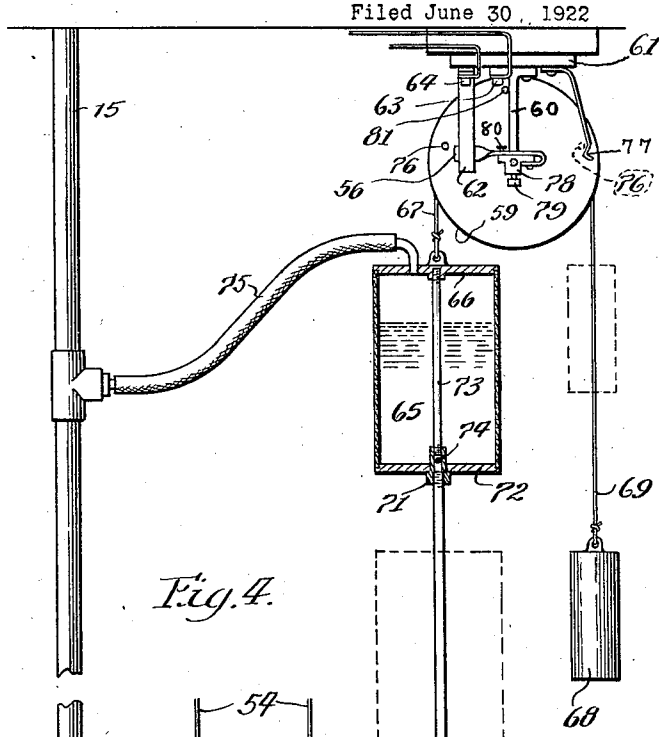


Fig. 4.

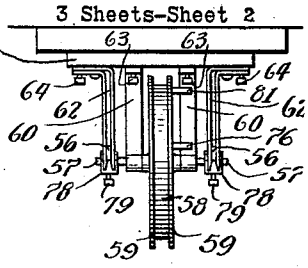


Fig. 5.

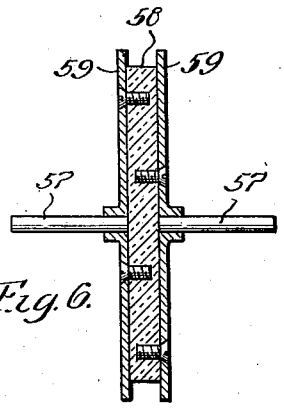


Fig. 6.

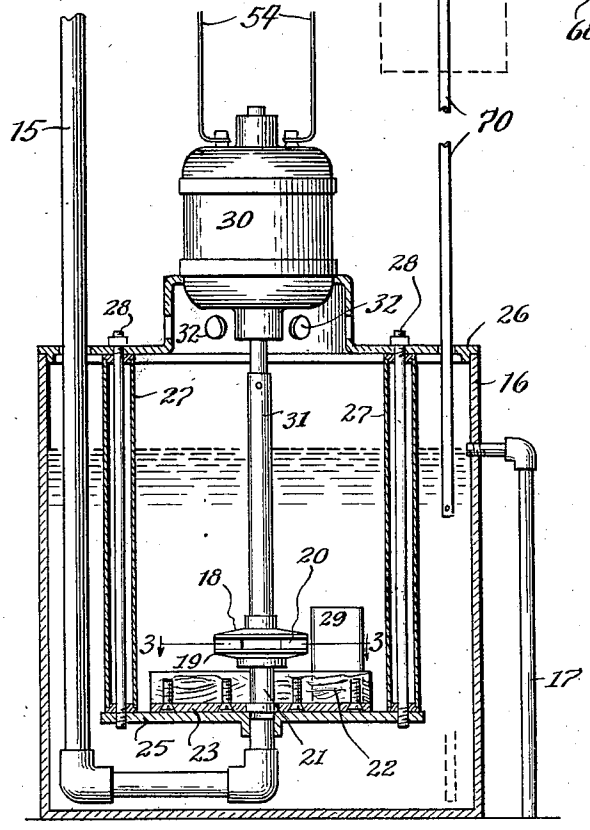
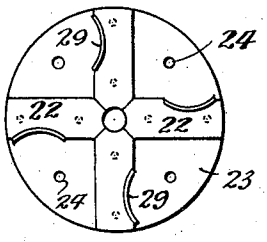


Fig. 7.



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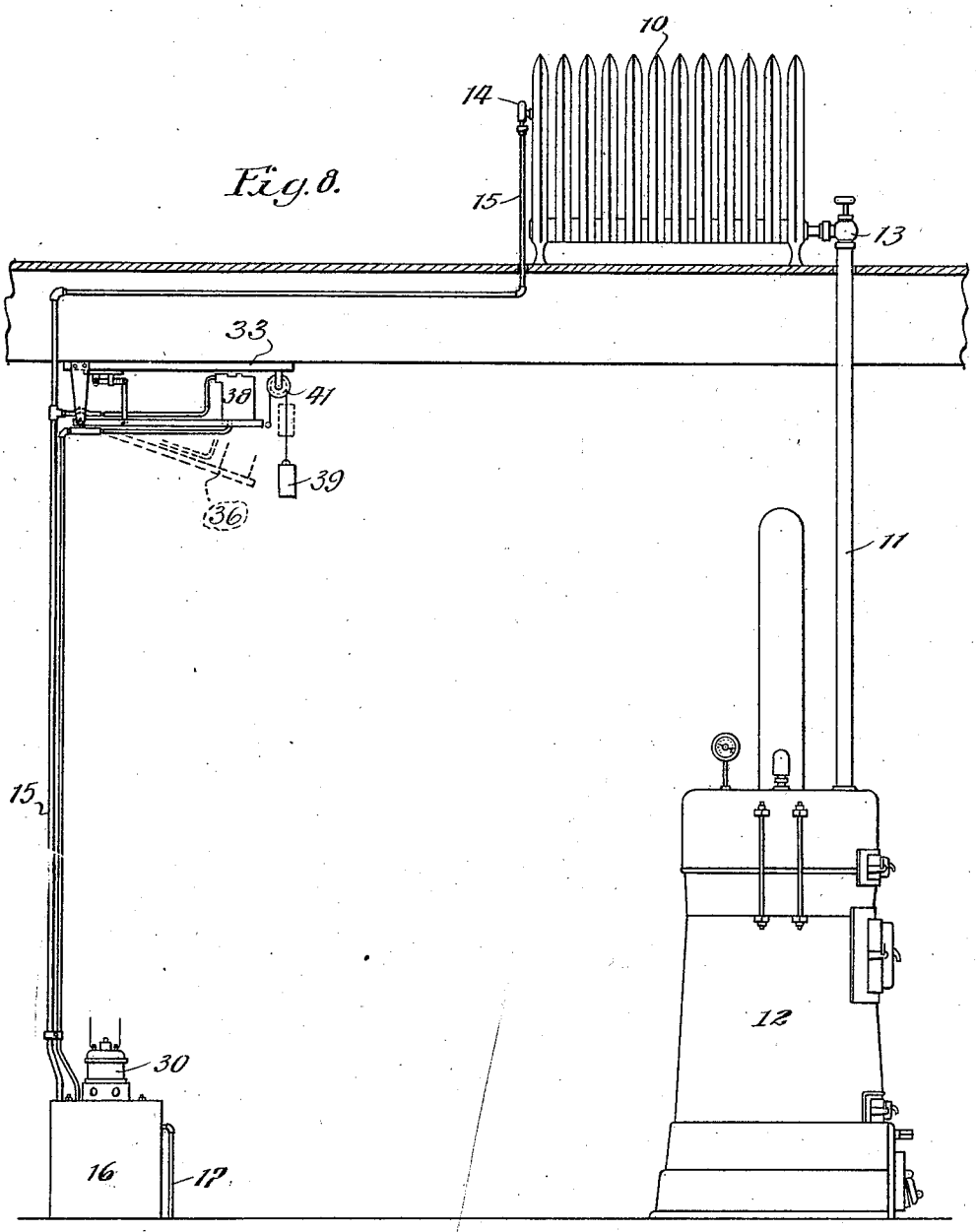
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Fig. 8.



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UNITED STATES PATENT OFFICE.

THOMAS O. PERRY, OF OAK PARK, ILLINOIS.

AUTOMATIC MOTOR SWITCH.

Application filed June 30, 1922. Serial No. 572,075.

To all whom it may concern:

Be it known that I, THOMAS O. PERRY, a citizen of the United States, residing in Oak Park, in the county of Cook and State of Illinois, have invented a new and useful Automatic Motor Switch, of which the following is a specification.

My invention relates to improvements in motor switches which are required to automatically control the intermittent operation of a motor which actuates a pump or aspirator for reducing or increasing air pressure in a tank or system normally closed against admission of external air, so as to maintain within maximum and minimum limits approximately uniform tension due to the action of the pump. My invention is especially applicable to systems in which water is an essential medium for exhausting the air and also a necessity of the system. The application of my invention to a vacuum heating system is illustrated in the accompanying drawings, in which—

Fig. 1 is a side elevation of the apparatus essential to operation of the switch showing in section the cistern and some parts which support the aspirator therein; Fig. 2, an inverted plan of the motor switch, represented as an ordinary knife switch such as is commonly used for control of electric motors; Fig. 3, a sectional plan of the submerged aspirator taken below the line 3—3 on Figs. 1 and 4; Fig. 4, a side elevation of the apparatus modified in form; Fig. 5, an elevation of the modified switch viewed at right angles to its position shown in Fig. 4; Fig. 6, an enlarged sectional elevation of the modified switch pulley and its divided axle; Fig. 7, a plan of the submerged bearing for the aspirator; and Fig. 8, a general outline in elevation to a reduced scale showing the application of my invention to a vacuum heating system.

Similar numerals refer to similar parts throughout the several views.

The radiator 10, which may be one of a system, receives steam in the ordinary way through a steam main 11 which connects with a boiler 12 supposedly located in a basement of a building. A hand valve 13 serves for regulating the flow of steam through the main. The water of condensation is supposed in this case to flow by gravitation back into the boiler by way of the steam main 11. An ordinary air vent valve 14 is shown attached to the radiator and is supposed to prevent or restrict escape of steam but to allow air to pass out freely. An air-line suction pipe 15 leads from the air valve into the basement or to any convenient place for disposing of any chance leakage of steam past the air valve. This is the ordinary arrangement in simple steam heating systems. In our improvement the suction pipe 15 is carried into an open low-level cistern 16 located on or below the basement floor. An overflow pipe 17 connected near the top of the cistern serves for carrying away surplus accumulation of water. The cistern is supposed to be first filled with water or some fluid up to the overflow connection and to constantly retain that amount of fluid which can not escape. The aspirator consists of two small discs 18 and 19 axially separated, as shown, and having the cylindrical intervening space interrupted on opposite sides of the periphery by partitions 20 which unite the two discs to each other. The lower disc 19 has a tubular journal 21 underneath which turns in a suitable bearing composed of four pieces of wood 22 arranged radially and fastened upon a bearing plate 23 so that their inner ends unite closely to form the bearing at the center of the bearing plate as shown in Fig. 7. The screw holes 24 serve for fastening the bearing plate 23 upon the larger supporting plate 25 which is suspended from the cistern cover 26 by means of tubular posts 27 and inclosed suspension rods 28. Four water brakes 29 are shown fastened to the wood bearings 22 and extending up above the discs around whose periphery they are equally spaced without touching. These water brakes serve to increase the efficiency of the aspirator by holding the submerging liquid against its tendency to rotate with the discs. The lower end of the air line suction pipe 15 connects with the supporting plate 25 just below the tubular journal 21 as shown in Figs. 1 and 4. The actuating motor 30, here shown as of the vertical electric type, rests on the cistern cover 26 and has its shaft directly connected with the upper aspirator disc 18 by means of the intermediate aspirator shaft 31. The vent holes 32 in the cover allow free escape of the air delivered through the submerging liquid by the aspirator.

An ordinary electrical knife switch is shown in Fig. 1 as attached to a ceiling board 33 which in turn is supposed to be attached to the basement ceiling. The blade

34 of the switch is shown pushed up to the closed circuit position and its open position is indicated by dotted lines. A link 35 pivotally connects the switch blade with the actuating lever 36 fulcrumed at one end to the bracket 37 depending from the ceiling board 33. The other end of the actuating lever extends some distance horizontally and carries a liquid chamber 38 whose weight and that of the lever is overbalanced by the counterweight 39. This counterweight 39 could have been directly applied by extending the lever both ways beyond the fulcrum, but is here shown as suspended by a cord 40 which runs over a ceiling pulley 41 and down to a screw eye connection 42 with the end of the lever as shown. The liquid chamber 38 rests on the lever 36 and its cylindrical body 43 is preferably made of glass. The body 43 is clamped between upper and lower enclosing heads 44 and 45 by means of the binding rod 46 whose lower end extends down through the lever with a nut beneath. A supply pipe 47 connects with the lower enclosing head 45 of the chamber 38 and extends along the under side of the lever 36 to a point near the fulcrum where a short flexible tube 48 is inserted to join with the vertical pipe 49 which extends some distance downward into the liquid within the low-level cistern 16. A suction tube 50 connects with the upper inclosing head 44 of the chamber 38 and is carried along the upper surface of the actuating lever, connecting near the fulcrum with the air line suction pipe 15 by means of a short flexible tube 51. The flexible tube connections 48 and 51 permit the actuating lever to swing about its fulcrum as required to make and break electrical connection with the motor by means of the switch blade 34. The binding screws 52 connect with the main and return wires of the electric current supply. The binding screws 53 are supposed to connect with the wires 54 which supply the motor 30. The switch parts are mounted on an insulating base 55 attached to the ceiling board 33.

The operation is as follows: With the motor switch closed as shown in Fig. 1 the aspirator 18—19 whirls rapidly in the submerging liquid and draws air by entrainment from the airline pipe 15 and the radiator 10 until the vacuum tension suffices to draw liquid up from the low-level cistern 16 into the chamber 38 by way of the supply pipe 47—49. Before the chamber 38 is entirely filled with liquid, the combined weight of the liquid and chamber suffices to overcome the resistance of the counterweight 39 with the result that the actuating lever turns about its fulcrum downward to the position indicated by dotted lines. Consequently, the switch blade 34 is made to open and stop the motor. The liquid in the chamber 38 will be held there by vacuum tension once established and prevent further operation of the motor until through leakage or other cause the vacuum tension is reduced sufficiently to allow the liquid to flow back into the low-level tank; but, before the chamber is entirely emptied, the counterweight 39 will again overbalance the chamber and lever and cause the switch to close and restart the motor. The variations in vacuum tension required to effect these successive openings and closings of the switch depends largely on the size of the chamber 38 and the vertical distance through which it is allowed to move. It is found practicable to operate with a variation considerably less than is respresented by one inch of mercury. Fig. 1 represents to scale an ordinary vacuum heating system in which the distance from floor to ceiling is about nine feet and the variation in vacuum tension ranges from about six to seven feet of water. In Figs. 1 and 4 the vertical pipes 15, 49 and 70 are shown interrupted on account of the enlarged scale. The elevation of the chamber 38 above the low-level cistern 16 determines the degree of vacuum tension that will be maintained. For maintaining unusually high tension, mercury could be substituted for water in the low-level cistern. The liquid in the cistern absolutely prevents air leakage back into the system through the pipe 15. This aspirator requires submersion in liquid in order to operate, and therefore no extra cistern is required for operating the motor switch. In steam heating systems, the chance leakage of steam past the air valves on the radiators, which chance is almost sure to occur, serves a useful purpose in supplying the low-level cistern with enough water to compensate for the loss through evaporation. The system would not fail to operate if the radiators were not supplied with air valves to prevent escape of steam, but steam would be wasted unless the amount of steam entering the air line suction pipe is materially restricted. The effectual provision against leakage of air back through the means employed for exhaustion reduces to a minimum the amount of motive power required by insuring long intervals of rest for the motor between brief operating periods.

A modified form of the motor switch and actuating mechanism is shown in Figs. 4, 5 and 6. The switch blades 56 are fixed to the outer extremities of a metal switch axle 57 the two halves of which are separated by a disc of insulating material 58 interposed between two flanges 59 to which the inner ends of the shaft halves are secured in line with each other as shown in Fig. 6. The peripheries of the flanges 59 project beyond the insulating disc 58 so that their combination form a grooved pulley. The axle 57 has two bearing brackets 60 depending from

an insulating plate 61 on either side of the grooved pulley 58—59. The split contactors 62 also depend from the insulating plate 61 so as to come within range of the switch blades 56 which are disposed to make and break contact with the contactors by giving the pulley 58—59 reciprocating rotation. Connected with the bearing brackets 60 are binding screws 63 for wires leading to the source of electric current. The binding screws 64 establish connection between the contactors 62 and the motor wires 54. Figs. 4 and 5 show both switch blades in contact with the contactors closing both the main and return lines as required for operating the motor 30. The switch chamber 65 is similar in construction to the chamber 38 but its upper head 66 is hung by a non-conducting cord 67 which winds around the grooved pulley 58—59 and is fastened thereto. A counterweight 68 is suspended by a cord 69 which winds around and is fastened to the pulley 58—59 in reverse direction to the similar cord 67 so as to over-balance and lift the chamber 65 when empty or not too heavily charged with liquid. The supply pipe 70 communicates with the bottom of the switch chamber 65 through a clamping nut 71 which has a reduced extension reaching through the lower head 72 into the chamber where it screws on to the lower end of the clamping rod 73 whose upper end screws into the upper head 66. The reduced extension of the nut 71 has a perforation 74 just above the upper surface of the lower head 72 through which liquid can enter into and escape from the chamber. The supply pipe 70, in this case, screws into and hangs directly down from the clamping nut 71 into the liquid in the low-level cistern 16, passing loosely through the cover 26 which serves as a guide. The flexible tubing 75 establishes communication between the upper end of the chamber 65 and the suction pipe 15 and is long enough to allow several inches vertical rise and fall of the chamber. The operation is essentially the same as in the previous described construction, but the supply pipe 70 does not require flexible connection, as the submerged end can rise and fall with the switch chamber of which it in reality forms a part. This modified form also has the advantage of greater compactness than that first described.

An additional feature is shown in Fig. 4 which is not absolutely essential but serves to insure a full sliding contact between the switch blades and contactors and a quick break when the blades are withdrawn. A retarding pin 76 which projects from one side of the switch pulley 58—59 meets and passes a yielding obstruction 77 flexibly depending from the insulating plate 61 during the final movement of rotation just before the descending chamber 65 reaches its lowest position of descent. So, before the reverse, or closing movement, of the switch can proceed beyond a beginning, the rotation of the pulley is interrupted until the supply of liquid in the chamber 65 is further depleted, insuring a more forcible closing of the switch. This in itself, when the switch again opens, insures a quick break, which may be still further accelerated by attaching the switch blade 56 to the axle 57 by flexible connection. In Fig. 4, the switch blade is represented as a piece of thin elastic metal of considerable length bent and fastened to a holding block 78 which in turn is secured to the axle 57 by means of the set screw 79. A shoulder pin 80 inserted into the holding block and loosely piercing the switch blade limits the yielding movement upward of the blade just before the break occurs. A stop pin 81 projecting from the side of the pulley 58—59 limits the downward movement of the counterweight 68 by coming in contact with the bearing bracket 60. The downward movement of the switch chamber 65 may be limited by contact of the supply pipe 70 with the bottom of the low-level cistern 16 as indicated by dotted lines.

I claim:

1. In a heating system, in combination with the radiators and the air-line suction pipe leading from said radiators, of a low level cistern containing liquid, an aspirator submerged in said cistern, submerged connection between said aspirator and said air-line suction pipe, a motor for actuating said aspirator, a motor switch for control of said motor, a switch chamber displaceable downward when charged with liquid, a counterweight disposed to raise said chamber when liquid is discharged therefrom, operative connection between said chamber and said motor switch, a supply pipe leading down from the bottom of said chamber into the liquid of said low level cistern, flexible pipe connection between the top of said chamber and said air-line suction pipe and means for restricting the passage of vapor and water from said radiators into said air-line suction pipe, substantially as herein set forth.

2. In a heating system, the combination with the radiators and the air-line suction pipe leading from said radiators, of a low-level cistern containing liquid, an aspirator having submerged connection in said cistern with said air-line suction pipe, a motor for actuating said aspirator, a motor switch for control of said motor, a switch chamber displaceable downward when charged with liquid, a counterweight disposed to raise said chamber when liquid is discharged therefrom, operative connection between said chamber and said motor switch, a supply pipe leading down from the bottom of said chamber into the liquid in said low-level cis-

tern, flexible tube connection between the top of said chamber and said air-line suction pipe and means for restricting the passage of vapor and water from said radiators into said air-line suction pipe, substantially as herein set forth.

3. In a heating system, the combination with the radiators and the air-line suction pipe leading from said radiators, of a low-level cistern containing liquid, an aspirator having submerged connection in said cistern with said air-line suction pipe, a motor for actuating said aspirator, a motor switch for control of said motor, a switch chamber displaceable downward when charged with liquid, a counterweight disposed to raise said chamber when liquid is discharged therefrom, operative connection between said chamber and said motor switch, a supply pipe leading down from the bottom of said chamber into the liquid in said low-level cistern and flexible tube connection between the top of said chamber and said air-line suction pipe, substantially as herein set forth.

4. In a vacuum system, the combination with the air-line suction pipe, of a low-level cistern containing liquid, an aspirator having submerged connection in said cistern with said suction pipe, a motor for actuating said aspirator, a motor switch for control of said motor, a switch chamber displaceable downward when charged with liquid, a counterweight disposed to raise said chamber when liquid is discharged therefrom, operative connection between said chamber and said motor switch, a supply pipe leading down from the bottom of said chamber into the liquid in said tank and flexible tube connection between the top of said chamber and said air-line suction pipe, substantially as herein set forth.

5. In a vacuum system, the combination with the suction pipe for removing air, of a low-level cistern containing liquid, an aspirator in said tank submerged in the liquid, submerged connection between said aspirator and said suction pipe, a motor for actuating said aspirator, a motor switch for control of said motor, a switch chamber displaceable downward when charged with liquid, a counterweight disposed to raise said chamber when liquid is discharged therefrom, operable connection between said chamber and said motor, a supply pipe leading down from the bottom of said chamber into the liquid in said low-level cistern and flexible tube connection between the top of said chamber and said suction pipe, substantially as herein set forth.

THOMAS O. PERRY.