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Koula

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[54] **METHOD OF AND APPARATUS FOR GENERATING, MAINTAINING OR RE-ESTABLISHING A VACUUM IN A VACUUM VAPORIZATION APPARATUS FOR HEATING ONE OR MORE LIQUIDS**

[75] Inventor: **Zdenek Koula,** Regensdorf, Czechoslovakia

[73] Assignee: **Stotz & Co.,** Zurich, Switzerland

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[51] **Int. Cl.** **F22b 33/02**
[58] **Field of Search** 122/32, 33, 34, 37

[56] **References Cited**

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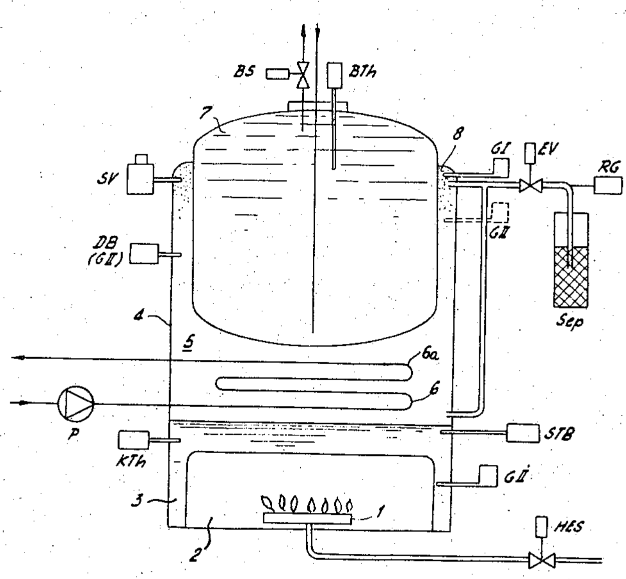
Primary Examiner—Kenneth W. Sprague
Attorney, Agent, or Firm—Werner W. Kleeman

[57] **ABSTRACT**

A method of, and apparatus for, generating, maintaining or re-establishing a vacuum in an evacuated or vacuum vessel operating according to the vacuum vaporization principle for heating one or a number of liquids which are separated from one another. According to the invention a heating fluid medium is heated until an excess pressure prevails in the initially sealed vacuum vessel and the vacuum vessel is first then briefly brought into flow communication with the atmosphere until the excess pressure has at least partially diminished.

32 Claims, 4 Drawing Figures



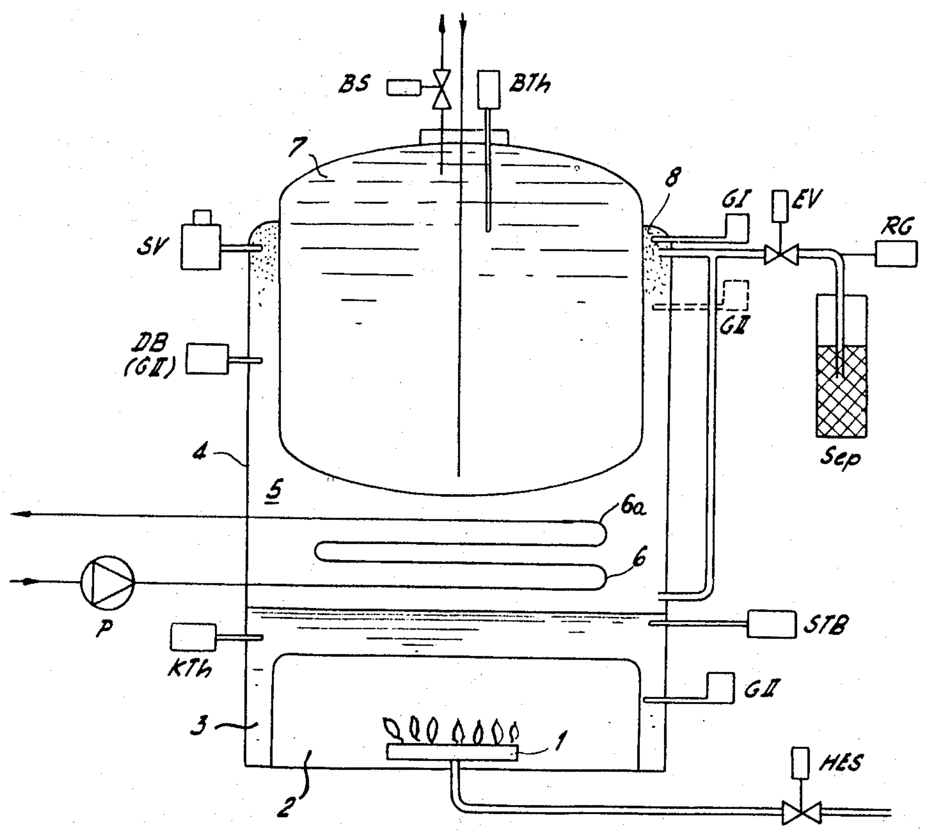


Fig. 1

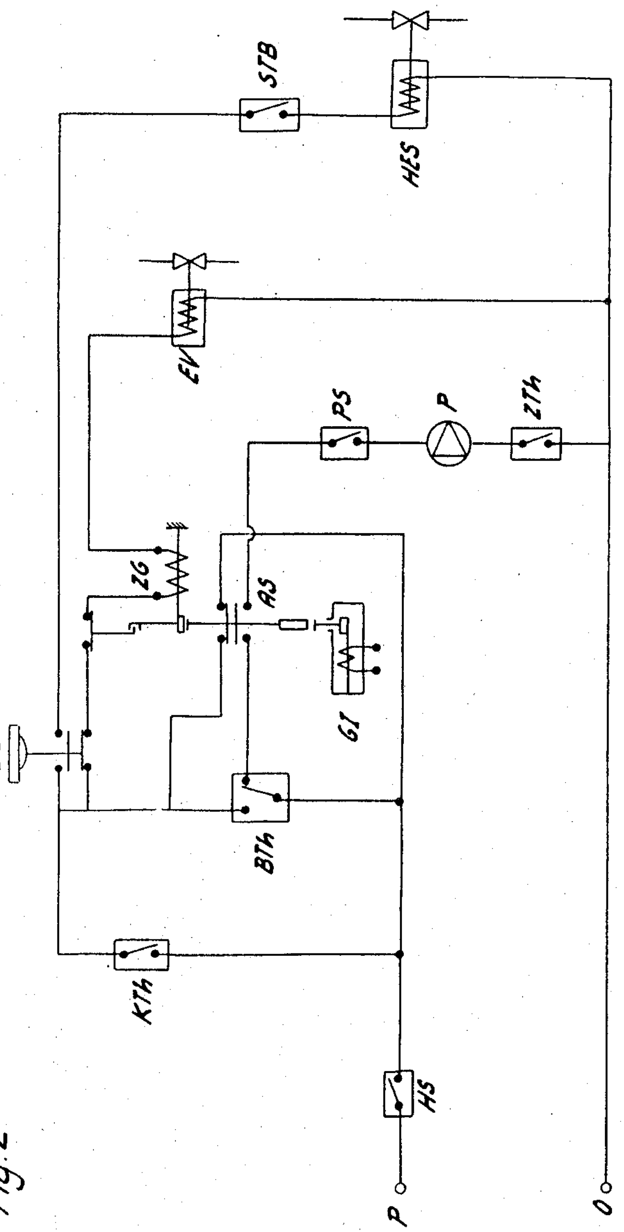


Fig. 2

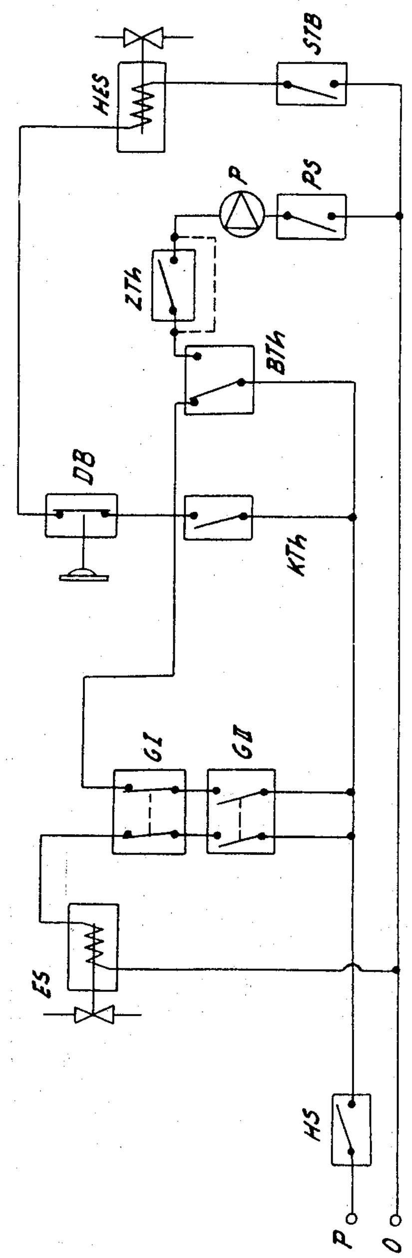


Fig. 3

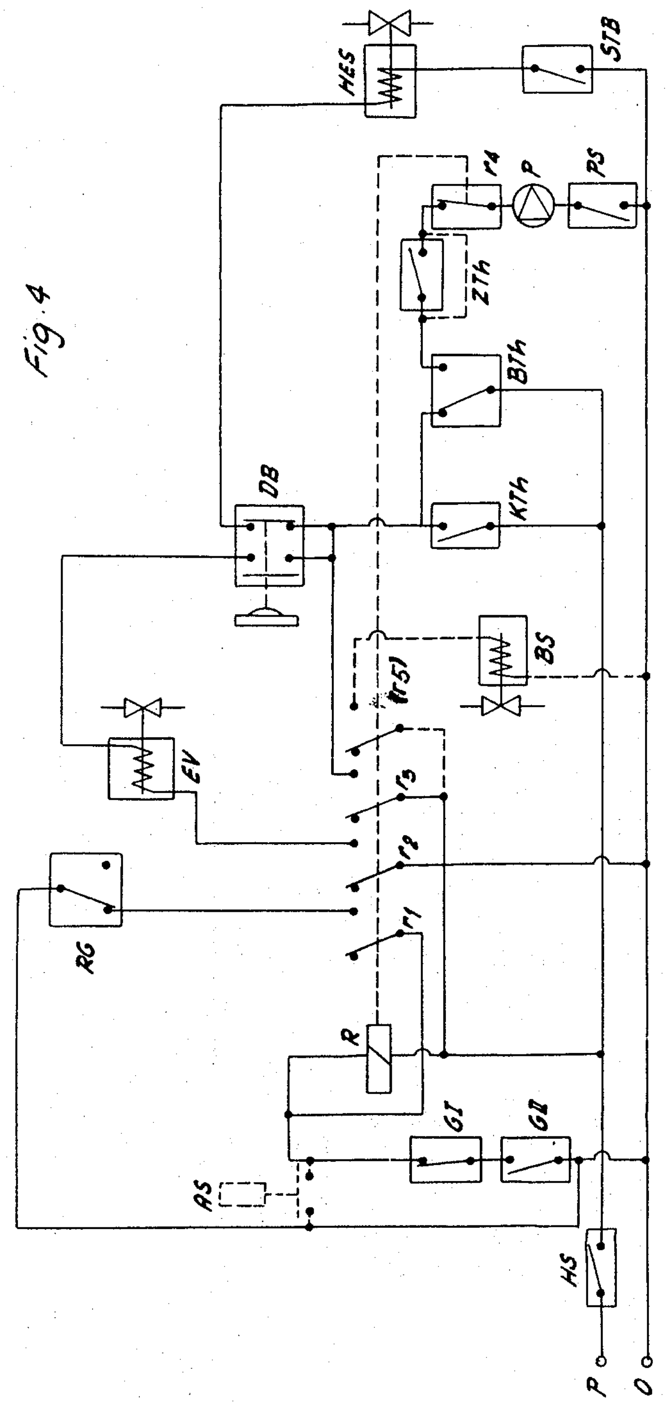


Fig. 4

METHOD OF AND APPARATUS FOR GENERATING, MAINTAINING OR RE-ESTABLISHING A VACUUM IN A VACUUM VAPORIZATION APPARATUS FOR HEATING ONE OR MORE LIQUIDS

BACKGROUND OF THE INVENTION

The present invention relates to a new and improved method of generating, maintaining or re-establishing a vacuum in an apparatus working according to the vacuum vaporization principle, the apparatus serving for heating one or a number of liquids which are separated from one another, and furthermore, pertains to a new and improved construction of apparatus for the performance of the inventive method.

Equipment of the previously mentioned type is, for instance, known from German patent 1,270,258. Such is constructed in a manner that during the thermally conductive connection with an evacuated vessel, the so-called vacuum vessel or container, partially filled with a vaporizable heating fluid medium, there is provided a separate heat exchanger for each liquid to be heated. All of the heat exchangers are practically exclusively heated by the vapor of the vaporizable heating fluid medium. This type of equipment is particularly used as a hot water heater, wherein as a general rule there are provided two heat exchangers. One of the heat exchangers serves to heat the water of a circulation heating installation, the other is designed as a boiler, and serves to heat-up the consumable water; the heating fluid medium likewise can be, for instance, water. In the discussion given hereinafter, unless there is otherwise specifically stated, the description will proceed with such hot water heater as its starting basis. Such type hot water heaters possess a number of decisive advantages in contrast to hot water heaters of different construction.

During fabrication, or latest during placing into operation of the equipment, the vessel in which the heating fluid medium is vaporized must be evacuated. Previously this was regularly accomplished by means of a vacuum pump. Since it is also essential that the vacuum remains unchanged during the entire operating time the aforementioned vessel must be vacuum-tight welded and together with the therewith connected boiler jackets and control devices must be thoroughly checked with respect to its vacuum tightness prior to evacuation or at least prior to placing the equipment into operation. If impairment of the vacuum occurs during operation owing to the presence or occurrence of only slight leaks, then the advantageous characteristics of such boilers rapidly diminish. This is apparently attributable to the fact that air which has penetrated cannot simply uniformly distribute in the evacuated compartment. Quite to the contrary, at predetermined locations, especially at the topmost situated locations and at the same time furthest removed from the vaporization locality of the heating fluid medium, this air together with possibly prevailing hydrogen formed from chemical decomposition products of the heating medium, especially water, and the wall material of the evacuated vessel forms a gas cushion, so that such locations can be no longer properly heated by the vapor of the heating fluid medium. This rather surprising discovery is seemingly predicated upon some type of separator pipe-effect.

The need to provide a vacuum-tight welding and sealing of the boiler jacket and control devices considerably increases the cost of the equipment and the seal testing and repairing of possible leaks is cumbersome and troublesome.

From German patent 270,722 there is known to the art a technique for generating a vacuum in a relatively small vacuum vessel, according to which initially a small opening is produced in one of the walls of the vacuum vessel and thereafter the heating fluid medium, namely water, is brought to a state of boiling. Consequently, the air is expelled and now the opening is again closed, so that during cooling a negative pressure prevails in the vacuum vessel.

This technique is basically only suitable for the incipient generation of the vacuum, not however for maintaining a vacuum which has once been gernerated or for re-establishing a vacuum when the same has been impaired, since producing the opening prior to heating brings with it of necessity a complete pressure equalization between the interior of the vacuum vessel and the atmosphere.

Even during the incipient generation of a vacuum this technique, as a practical matter, is only suitable for small vacuum vessels, approximately of the size of the cooking vessel depicted in the drawing of the aforementioned patent, not however for large installations of the previously mentioned type. The reason for this is that the described procedures of necessity only can operate at atmospheric pressure; during the entire time of boiling of the heating fluid medium there prevails in the vacuum compartment a pressure which, depending upon the size of the opening, almost exactly corresponds to the atmospheric pressure or at best only inconsequentially exceeds the same. Hence, the expulsion of air proceeds in a corresponding slow manner, so that this proposed technique cannot readily be considered because of time considerations when working with large vacuum vessels.

SUMMARY OF THE INVENTION

Hence, it is a primary object of the present invention to provide an improved method of, and apparatus for, generating, maintaining or re-establishing a vacuum in equipment operating according to the vacuum vaporization principle in a manner not associated with the aforementioned drawbacks and limitations of the prior art proposals.

Another object of the present invention relates to a simplified method of, and apparatus for, generating as well as maintaining or re-establishing a vacuum in equipment of the previously mentioned type during its operation.

Now in order to implement these and still further objects of the invention, which will become more readily apparent as the description proceeds, the invention contemplates that the vaporizable heating fluid medium is heated to such an extent until an excess or overpressure prevails in the initially sealed vacuum vessel, and that the vacuum vessel is first then briefly brought into flow communication with the atmosphere until the excess pressure has at least partially decreased.

For instance, there is generated in the vessel to be evacuated an excess or overpressure of 0.2 to 0.5 atmospheres excess pressure.

It is preferable to being the vessel to be evacuated into flow communication with the atmosphere and to vent the same at those locations where there can form cushions of non-condensed gases, namely at the region of the locations furthest removed from the vaporization locality of the heating fluid medium. For maintaining or re-establishing the vacuum the evacuation operation can be undertaken either periodically independently of the condition of the vacuum, for instance once to five times per year, but however as a precautionary matter according to requirements as a function of a measurement value which is dependent upon the state of the vacuum.

The inventive method possesses a number of different decisive advantages. Initially the sealability check can be limited to a minimum or completely eliminated. Further, there is dispensed with the necessity of generating vacuum-tight welding connections at the vacuum vessel and between such and the connected boiler jackets and control devices.

In particular, in a simple manner it is now possible to interconnect individual parts of the vacuum vessel which are constructionally separated from its remaining parts, if desired also separately fabricated and after the installation of the equipment connected with one another by means of detachable connections, for instance flange connections, as such has been described more fully in German patent publication 2,149,884. Evacuation can occur in the most simple manner, without the need to resort to the use of special auxiliary means, after placing the equipment into operation. Finally, in the most simple manner and without placing particular requirements on servicing, the desired vacuum can be re-established at any time during operation. Consequently, it is possible to realize a considerably improved continual operational efficiency. Although previously there has only been employed steel as the material for the evacuated vessel, it is now also possible to use less expensive materials, especially cast iron and to design the evacuated vessel, if desired, even as a sectionalized or jointed vessel.

The equipment for carrying out the method is manifested by the features that at least one shut-off element is provided by means of which it is possible to place into flow communication with the atmosphere the region of those locations internally of the vacuum vessel which are situated furthest from the vaporization locality of the heating fluid medium, and there is also provided a control means which brings about opening of the shut-off element after reaching a predetermined excess pressure in the vacuum vessel and again closes the shut-off element upon reaching a pressure in the vacuum vessel which at least corresponds to the atmospheric pressure.

It is advantageous to employ as the shut-off element for this purpose a special vent valve which operates analogous to an overpressure valve or can be electrically actuated or directly or indirectly by a pressurized medium. With suitable construction of a pressure limiting device, which is anyway present with insulations of the previously mentioned type and the function of which will be considered more fully hereinafter, it is however possible to dispense with a special vent valve.

In this case the pressure limiting device is to be constructed such that it firstly functions as a pressure relief valve, and secondly, in the excess pressure range or at latest during drop of the excess pressure internally of the vessel to be evacuated switches back to atmospheric pressure and again closes. As the shut-off element there also can be employed the already available safety valve.

During the performance of the method for maintaining or re-establishing a vacuum during operation, it is advantageous during the heating of the heating fluid medium to reduce or completely suppress the withdrawal of heat by the heat exchanger or heat exchangers from the system, since otherwise the heat-up time will become impermissibly long. In the case of hot water heaters of the previously mentioned tpye, during evacuation, at least the heating circulation system should be shut-off; removal of water from the boiler is less important provided that it is maintained within normal limits. While with the heating circulation system shut-off and suppressed water removal from the boiler one must reckon with heat-up times of, for instance, 10 to 30 seconds, during increased water removal from the boiler the heat-up time can amount to as much as one-half of a day, and with the heating circulation system not shut-off and cold weather it is possible that the system may not heat up at all to an extent sufficient to establish an excess pressure.

Hence, the equipment of the invention advantageously incorporates a control element which during evacuation reduces or completely suppresses the withdrawal of heat by the heat exchanger or heat exchangers.

If the method is employed for periodically maintaining of re-establishing with foresight the vacuum, then the evacuation operation can be readily initiated manually, since carrying such out once or twice per heating period is sufficient as a general rule. However, for periodically initiating evacuation there also can be provided a timer clock or equivalent.

Generally, it is however of advantage to construct the equipment such that evacuation occurs as a function of a measurement magnitude or value which furnishes information about the state of the vacuum, and if necessary is automatically carried-out. For this purpose the vessel to be evacuated is provided with at least one measurement value transmitter which delivers a measurement value regarding the state of the vacuum, and there is also provided means which automatically initiates the evacuation operation upon exceeding or falling below respectively, a predetermined boundary value of the measurement value.

As the measurement value for the state of the vacuum there can be employed, for instance, the quantity of air present in the evacuated vessel, for instance determined by means of an ionization chamber or a Geissler tube. Such measurement value transmitters are, however, expensive, so that it is advantageous to employ as the measurement value the temperature and/or pressure conditions internally of the evacuated vessel.

Thus, there can be employed as the measurement value for the state of the vacuum the behavior of two temperatures, of which one is measured at a location of the evacuated vessel at which there can form a cushion of non-condensed gases, the other temperature being measured at a location at which such cushion does not form, or there can be employed the relationship of the temperature of the heating fluid medium to the temperature of the liquid heated by the heat exchanger, especially the return flow of a circulation heating installation. In such cases there are provided two temperature sensors or feelers arranged at appropriate locations.

On the other hand, there can be employed as the measurement value for the state of the vacuum also the relationship of the temperature which is measured at one locality of the evacuated vessel where there can form a cushion of non-condensed gases to the pressure in the evacuated vessel. In this case there are provided a temperature feeler and a pressure feeler at appropriate locations. In the event that the initiation of the evacuation occurs automatically on the basis of a measurement value which provides information concerning the state of the vacuum, then there can be provided means which terminate the evacuation operation upon exceeding or falling below a predetermined boundary value thereof or another measurement value of the evacuation operation. If the evacuated vessel is provided with a pressure sensor or feeler then there is advantageously employed the measurement value delivered thereby for terminating the evacuation operation.

Generally, it is however sufficient if the evacuation operation is simply permitted to take place during a fixed predetermined time duration and after the expiration thereof is interrupted. For this purpose there can be provided a simple timer which determines the duration of the evacuation operation. The loss in heating fluid medium occurring during venting amounts, as a general rule, only to a few cubic centimeters and therefore is so slight that the time duration can be employed with a relatively large safety margin. For this reason it is possible, as mentioned, to carry out with foresight the evacuation operation periodically.

In any event an additional liter of heating fluid medium is sufficient for an operating duration of at least 5 to 20 years. Larger losses in heating fluid medium are determined in any event by the conventionally available safety temperature limiting device which safeguards the installation against running dry.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood and objects other than those set forth above, will become apparent when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawings wherein:

FIG. 1 is a schematic illustration of a hot water heater operating according to the vacuum vaporization principle and equipped with different functional or operational elements; and

FIGS. 2 to 4 depict three different control circuits for the evacuation of the equipment depicted in FIG. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Describing now the drawings, the hot water heater depicted by way of example in FIG. 1 will be seen to comprise a combustion compartment or chamber 2 heated by a suitable heating source 1, for instance gas. The infeed of thermal energy is controlled by a heating energy gate or valve HES. The combustion compartment 2 is formed by the lowermost portion of the evacuated vessel or container 4 and which is filled with water 3, and in the vapor compartment 5 of which there is arranged a heat exchanger 6 of a circulating heating installation provided with a circulating pump P. Moreover, the major portion of the boiler 7 is surrounded by the vapor compartment 5, this boiler serving to generate and store hot water which is to be consumed.

The control of the hot water heater occurs during normal operation, for instance, by means of a vessel thermostat KTh and the boiler thermostat BTh.

As safety elements there are normally available:

a. a safety temperature limiter or limiting means STB arranged in the part of the evacuated vessel 4 filled with water 3, this temperature limiting means safeguarding the installation against running dry, i.e. operating in a dry state; and

b. a pressure limiter or limiting means DB arranged in the vapor compartment 5 of the evacuated vessel 4, this pressure limiting means safeguarding the installation against exceeding a predetermined maximum pressure; both elements (STB and DB) act upon the heating energy valve or gate HES; and

c. a mechanically operating safety valve SV, which also can be constructed as a rupturable membrane or the like, and safeguards the installation directly against exceeding a predetermined maximum pressure.

In the event there exists a poor vacuum in the evacuated vessel 4 then a gas cushion 8 forms at the uppermost region or portion of the vapor compartment 5. This gas cushion 8 primarily consists of air, however can also contain hydrogen from the chemical decomposition of the water with the wall material of the evacuated vessel 4. This portion and if necessary still other parts of the vapor compartment 5 are connected with the venting or vent valve EV. The slight quantity of water which escapes through this vent valve during venting is either collected in a separator Sep or directly at the flue.

For controlling the evacuation operation on the basis of the condition of the vacuum there can be provided at the indicated locations the measurement value transmitters or sensors GI and GII; also the pressure limiting device or pressure limiter DB when suitably constructed can serve as the measurement value transmitter GII. For the termination of the evacuation operation there can be provided a special resetting measurement value transmitter RG.

For preventing the removal of the consumable water from the boiler 7 during the evacuation operation there can be provided a consumable water lock or valve BS.

The reference characters or symbols which have not yet been discussed above, as the same appear in the circuits depicted in FIGS. 2 to 4, have the following significance:

AS — Starting switch
HS — Main switch
IG — Pulse generator or transmitter
PS — Pump switch
R — Relay
ZG — Timer
ZTh — Room thermostat

The circuit depicted in FIG. 2 is in the first instance contemplated for periodic manual operation. When employing the depicted pulse transmitter IG it is however also suitable for automatic evacuation, wherein the actuation of the pulse transmitter can occur either periodically by a timer or clock or on the basis of the state of the vacuum determined by the measurement value transmitter means (both of which have not been particularly depicted).

This circuit functions as follows: upon actuation of the starting switch AS (depicted position), whether such be manually, or by virtue of the action of the pulse transmitter IG, the normal control or regulation of the hot water heater depicted in FIG. 1 is bridged in such a manner that the delivery of thermal energy of the heating system to the heating coil *6a* of the heat exchanger **6** of the circulation heating system is prevented in that the circulation pump P is placed out of operation and the possibly provided consumable water valve or gate BS (FIG. 1) is closed. As a result, the water **3** in the evacuated vessel **4** is immediately heated-up by the complete output of the heating source **1.** The pressure in the evacuated vessel **4** climbs until reaching an excess pressure of about 0.3 to 0.5 atmospheres, depending upon the response pressure of the pressure limiting means DB. As mentioned, it is recommended during venting that no consumable water be removed from the boiler **7,** so that the heating-up operation and accordingly the entire procedure occurs more quickly. Removal of water will not, however, in any case prevent the function of the operation. Sooner or later, however in any event first after response of the pressure limiting means DB (depicted position) the vent valve EV will automatically open and at the same time the timer ZG responds which, for instance, can be constructed as a bimetallic element. Within a few seconds the undesired gas cushion **8** together with a small quantity of water vapor escapes. The ejected air separates from the water vapor in the separator Sep and escapes into the ambient surroundings, and the quantity of water collected in the separator Sep slowly evaporates or is removed when desired.

After a predetermined time as determined by the setting of the timer ZG the latter switches-off the starting switch AS, and with a fully automated apparatus, if desired, simultaneously also the pulse transmitter IG and thus closes the vent valve EV. At the same time the original normal control is again placed into operation.

In FIG. **3** there is depicted a simple and very inexpensive automatically operating circuit in which the withdrawal of thermal energy by the circulation heating installation is not throttled. This circuit operates on the basis of the measurement values of two measurement value transmitters GI and GII. Of these two measurement value transmitters the measurement value transmitter GI is temperature-dependent and arranged in the zone where there can form a gas cushion. The other measurement value transmitter GII can be temperature-dependent or pressure-dependent and is arranged externally of the zone where there can form a gas cushion.

The depicted circuit functions as follows:

In the case of a poor vacuum there exists between the water **3** and the upper portion of the evacuated vessel **4** a temperature difference which is that much greater the poorer the vacuum and is brought about by an air cushion **8** at the upper portion of the evacuated vessel **4.** This temperature difference is employed for the control of the automatic evacuation operation by means of the two separate measurement value transmitters GI and GII. With the measurement value transmitter GI the temperature at the upper portion of the evacuated vessel **4** is measured. If, for instance, with a poor vacuum at the upper portion there prevails a temperature of less than 95°C then the measurement value transmitter GI remains closed.

The measurement value transmitter GII measures the temperature or the pressure in the evacuated vessel **4** and can be a thermostat or a pressure switch. During a random heating-up phase, for instance during heating-up of the boiler the measurement value transmitter GII closes upon reaching a temperature of 100°C or a pressure of 1 atmospheres absolute.

If the measurement value transmitter GI has not opened in the presence of a poor vacuum, then the vent valve EV is actuated via the measurement value transmitters GI and GII and is opened until the upper portion, after venting of the gas cushion, has been heated-up beyond 95°C by the vapor atmosphere which is now again present. The measurement value transmitter GI therefore opens at for instance 95°C and the vent valve EV is again closed.

In order that the vessel, upon switching-off the vessel thermostat KTh or the boiler thermostat BTh, can be further furnished with thermal energy in the evacuation phase parallel contacts of the measurement value transmitters GI and GII shunt or bridge the vessel control.

The circuit depicted in FIG. **3** only operates upon transition from the negative pressure region into the excess pressure region.

In contrast to this circuit it is possible, with the circuit depicted in FIG. **4,** to shift the operating point in the negative pressure region such that the vent valve EV first then opens at the excess pressure region above the pressure limiting means DB.

Both of the measurement value transmitters GI and GII operate in the same manner and are similarly arranged as for the circuitry of FIG. **3.** If both measurement value transmitters GI and GII are closed then the relay R has a voltage applied thereto and is energized. As soon as it has been energized it must be held via the restoring measurement transmitter RG and the contact r_1 since the measurement value transmitter GI after reaching a predetermined temperature, for instance 90°C, has switched-off. The contact r_3 bridges the vessel thermostat KT*h* and the boiler thermostat BT*h*, so that in any event the complete output of the heat source **1** can be transferred to the water **3** in the evacuated container **4.**

The contact r_4 blocks the removal of energy by the circulation heating system in that the circulating pump P is switched-off. If desired, the relay R possesses a further contact r_5 which also blocks via a consumable water gate or valve BS the removal of hot consumable water from the boiler **7.**

At the overpressure region, for instance at 0.3 atmospheres absolute, the pressure limiting means or limiter DB switches via the already closed contact r_2 the vent valve EV into its open position. Thus there initially escapes air or vapor out of the gas cushion **8.** As soon as the expelled air has been saturated with vapor then the restoring measurement value transmitter RG opens. This is for instance formed as a thermostat which is set to 95°C and which switches as soon as the escaped medium has reached this temperature, which means that it is now no longer air rather vapor.

Consequently, the relay R again switches back into its starting position and the installation is again normally controlled.

If desired there can additionally be provided a starting switch AS by means of which the evacuation operation can be manually placed into operation at any random point in time.

By means of the circuits depicted in FIGS. 3 and 4 it is also possible, with different arrangements of the measuring location, by means of the measurement value transmitter GI to measure the temperature of the water 3 and by means of the measurement value transmitter GII the pressure in the evacuated vessel 4. In the event a good vacuum is present then the measurement value transmitter GI opens before the measurement value transmitter GII closes. In the case of a poor vacuum the pressure climbs quicker than the water temperature and the measurement value transmitter GII closes before the measurement value transmitter GI opens.

A further possibility resides in constructing both the measurement value transmitter GI as well as also the measurement value transmitter GII as temperature-sensitive measurement value transmitters and to arrange both of them at the upper portion of the evacuated vessel 4 (phantom lined position of measurement value transmitter GII). In the case of a good vacuum both of the measurement value transmitters will be located in the vapor atmosphere and thus register the same temperature. Now if the vacuum is poorer, that is to say, the gas cushion becomes that much greater then the upper measurement value transmitter G_1 is surrounded by the gas cushion and the temperature thereat drops, whereas the temperature at the lower measurement value transmitter GII remains unchanged. Owing to the temperature difference between the measurement value transmitters GI and GII which occurs, it is possible to deliver, for instance by means of a differential thermostat, a switching pulse to one of both circuits for venting. If the vacuum becomes still poorer then the gas cushion becomes so large that is also encloses the lower measurement value transmitter GII, whereby the previously existing temperature difference between the measurement value transmitters GI and GII is again eliminated. Also this operation can be employed for control purposes. In this case there exists in the presence of a still sufficient vacuum in the heated-up state a temperature difference between both of the measurement value transmitters GI and GII and the compensation of which brings about triggering of the venting operation.

While there is shown and described present preferred embodiments of the invention, it is to be distinctly understood that the invention is not limited thereto, but may be otherwise variously embodied and practiced within the scope of the following claims. Accordingly,

What is claimed is:

1. A method of generating, maintaining or re-establishing a vacuum in a vacuum vessel of an apparatus working according to the vacuum vaporization principle for heating one or a number of liquids which are separated from one another, wherein a heating fluid medium is heated and the vacuum vessel which at this period of time is in flow communication with the atmosphere, after expulsion of the air, is sealed-off, whereupon during cooling of the heating fluid medium there prevails in the vacuum vessel a negative pressure, the improvement comprising the steps of heating the heating fluid medium to such an extent until in the initially sealed-off vacuum vessel there prevails an excess pressure, and first then briefly bringing into flow communication with the atmosphere the vacuum vessel until the excess pressure has at least partially diminished.

2. The method as defined in claim 1, wherein for maintaining or re-establishing the vacuum the vacuum vessel at the region of the location thereof removed furthest from the vaporization locality of the heating fluid medium is brought into flow communication with the atmosphere.

3. The method as defined in claim 1, including the step of reducing the removal of heat from the system during evacuation.

4. The method as defined in claim 1, including the step of completely suppressing the removal of heat from the system during evacuation.

5. The method as defined in claim 1, including the step of periodically carrying out the evacuation operation independent of the state of the vacuum in order to maintain or re-establish the vacuum.

6. The method as defined in claim 5, including the step of automatically carrying out the evacuation operation at least once to five times per year.

7. The method as defined in claim 1, including the step of carrying out the evacuation operation as a function of a measurement value which is dependent upon the state of the vacuum in order to maintain or re-establish the vacuum.

8. The method as defined in claim 7, including the step of automatically carrying out the evacuation operation.

9. The method as defined in claim 7, including the step of employing as the measurement value for the state of the vacuum the quantity of air present in the vacuum vessel.

10. The method as defined in claim 7, including the step of employing as the measurement value for the state of the vacuum the relationship between two temperatures, wherein one temperature is the temperature at the region of the location of the vacuum vessel which is furthest removed from the vaporization locality of the heating fluid medium and the other temperature is the temperature measured at a location which is situated closer to the vaporization locality of the heating fluid medium.

11. The method as defined in claim 7, including the step of employing as the measurement value the relationship of the temperature which prevails at the region of the location of the vacuum vessel furthest removed from the vaporization locality of the heating fluid medium to the pressure prevailing in the vacuum vessel.

12. The method as defined in claim 7, further including the step of using as the measurement value the relationship of the temperature of the heating fluid medium to the temperature of at least one heated liquid.

13. The method as defined in claim 12, wherein the heated liquid is the return flow liquid of a circulation heating installation.

14. An apparatus for generating, maintaining, or re-establishing a vacuum in a vacuum vessel of an apparatus working according to the vacuum vaporization principle for heating one or a number of liquids which are separated from one another, comprising a vacuum vessel, at least one shut-off element provided for the vacuum vessel by means of which it is possible to bring into flow communication with the atmosphere the region of that location of the interior of the vacuum vessel which

is furthest removed from the vaporization location of the heating fluid medium, and control means for opening said shut-off slement after reaching a predetermined excess pressure in the vacuum vessel and reclosing said shut-off element upon reaching a pressure in the vacuum vessel which corresponds at least to the atmospheric pressure.

15. The apparatus as defined in claim **14,** wherein said shut-off element comprises venting valve means.

16. The apparatus as defined in claim **15,** wherein the venting valve means is an electrical vent valve.

17. The apparatus as defined in claim **15,** wherein the venting valve means is a pressure actuated venting valve.

18. The apparatus as defined in claim **14,** wherein said shut-off element comprises a valve constituting a pressure limiting means which within the excess pressure region or latest during drop of the excess pressure to the atmospheric pressure switches into its closed state.

19. The apparatus as defined in claim **14,** wherein the shut-off element is a valve comprising a safety valve which within the excess pressure region or latest during drop of the excess pressure to the atmospheric pressure switches and again closes.

20. The apparatus as defined in claim **14,** further including a control element for reducing or completely suppressing the removal of heat from the system during evacuation.

21. The apparatus as defined in claim **20,** further including a timer clock for periodically initiating the evacuation.

22. The apparatus as defined in claim **14,** wherein the vacuum vessel is equipped with at least one measurement value transmitter delivering a measurement value for the state of the vacuum, and means for automatically initiating evacuation upon exceeding or falling below a predetermined boundary value of the measurement value.

23. The apparatus as defined in claim **22,** further including a timer for determining the duration of the evacuation operation.

24. The apparatus as defined in claim **22,** further including means for terminating the evacuation operation upon exceeding or falling below another predetermined boundary value of the measurement value of the evacuation operation.

25. The apparatus as defined in claim **22,** wherein

there is provided as the measurement value transmitter an ionization chamber which is in operable association with the vacuum vessel.

26. The apparatus as defined in claim **22,** wherein the measurement value transmitter comprises a Geissler tube which is operatively associated with the vacuum vessel.

27. The apparatus as defined in claim **22,** wherein said measurement value transmitter comprises two temperature feelers, one of said temperature feelers being arranged at the region of the location of the vacuum vessel which is furthest removed from the vaporization location of the heating fluid medium, the other temperature feeler being arranged at a location which is closer to the vaporization location of the heating fluid medium.

28. The apparatus as defined in claim **27,** wherein the other temperature feeler is located in the heating fluid medium itself.

29. The apparatus as defined in claim **22,** wherein said measurement value transmitter comprises two temperature feelers, both of said temperature feelers being arranged at the region of the location of the vacuum vessel which is located furthest from the vaporization locality of the heating fluid medium in such a manner that upon the formation of a gas cushion at such region one of the temperature feelers is enclosed sooner by the gas cushion than the other temperature feeler.

30. The apparatus as defined in claim **22,** wherein the measurement value transmitter comprises a temperature feeler which is arranged at the region of the location of the vacuum vessel which is furthest removed from the vaporization location of the heating fluid medium, and a pressure feeler for measuring the pressure in the vacuum vessel.

31. The apparatus as defined in claim **22,** wherein the measurement value transmitter comprises two temperature feelers, one of the temperature feelers measuring the temperature of the heating fluid medium, the other temperature feeler measuring the temperature of at least one of the heated liquids.

32. The apparatus as defined in claim **31,** wherein the other temperature feeler measures the temperature of the liquid in the return flow of a circulation heating installation.

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