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(54) **ASSEMBLY OF A HOUSING AND A STEAM GENERATOR DEVICE**

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(57) **ABSTRACT**

In an assembly of a steam generator device (10) and a plastic housing (20), the steam generator device (10) is arranged inside the housing (20), and comprises the following elements: a steam generator shell (11) for containing water and steam; a heating element (14) for heating the steam generator shell (11) and its contents; and a heater plate (12) arranged between the heating element (14) and the steam generator shell (11) for improving heat transfer between the heating element (14) and the steam generator shell (11). In order to prevent the whole of the heater plate (12) and the heating element (14) from falling on a bottom (21) of the housing (20) in case of failure of the connection between the heater plate (12) and the steam generator shell (11), mounting supports (30) for supporting the heater plate (12) are bottom (21) of the housing (20), and which comprise a material that is resistant to high temperatures.

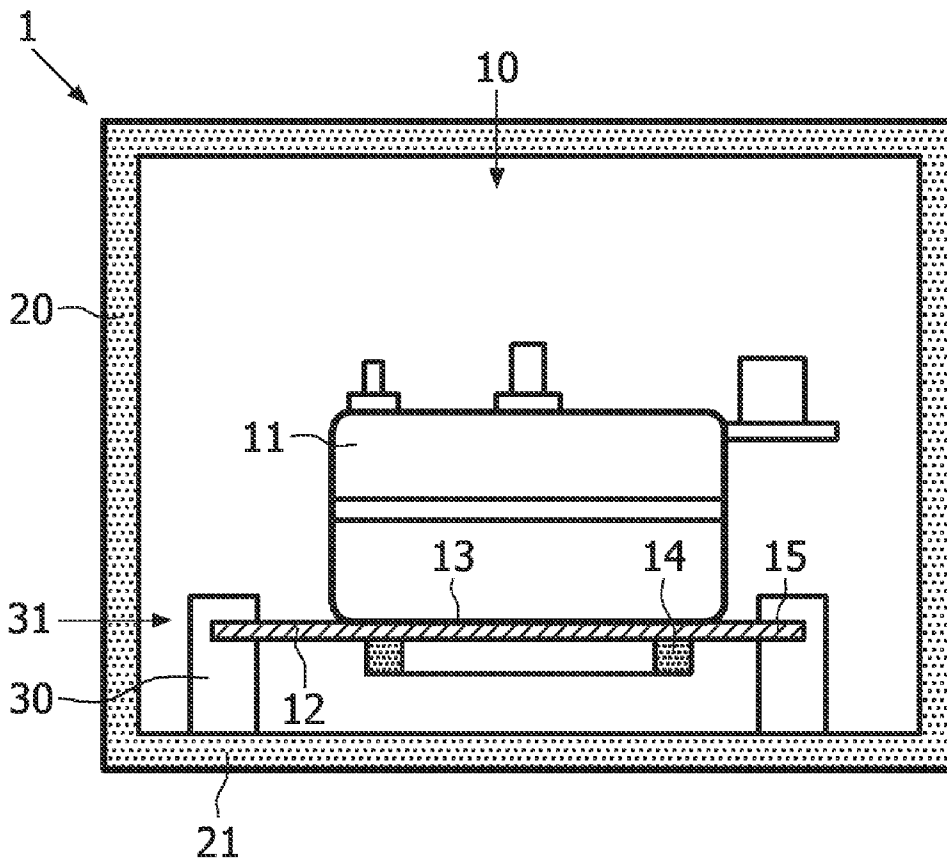
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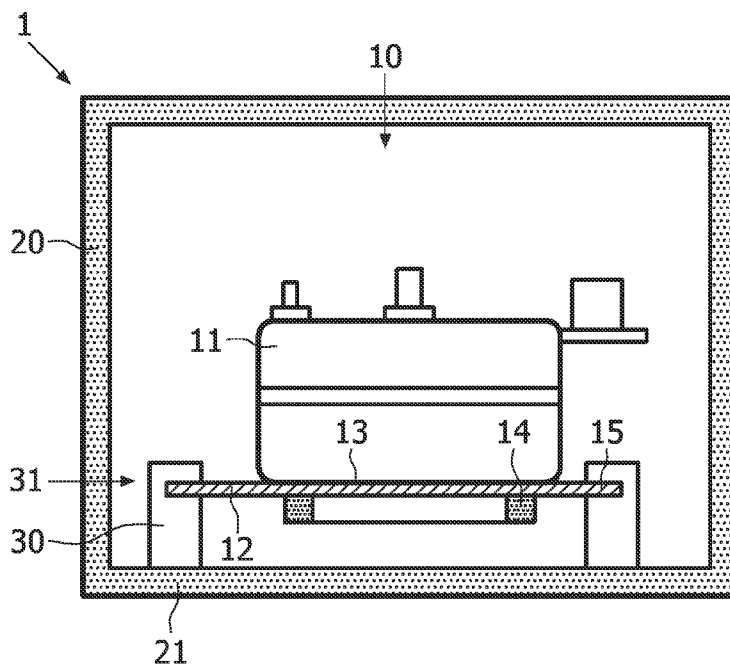


FIG. 1

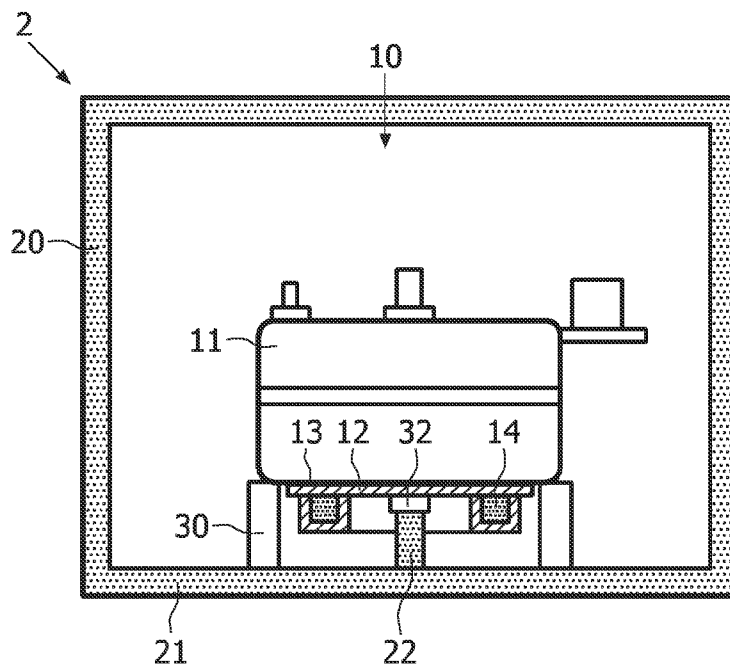


FIG. 2

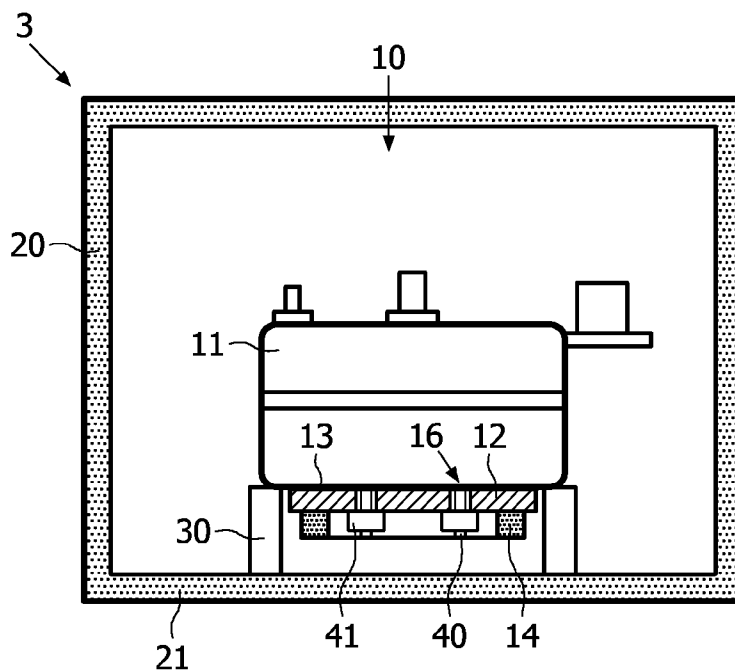


FIG. 3

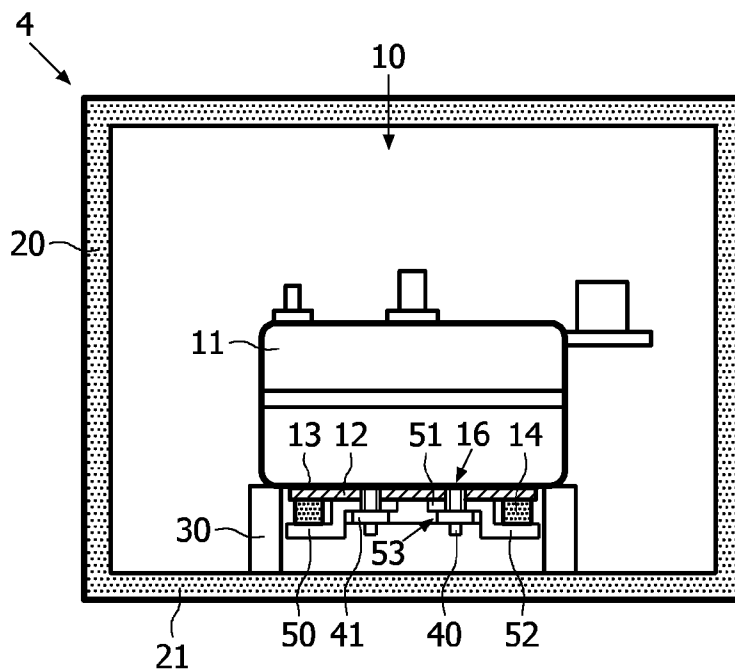


FIG. 4

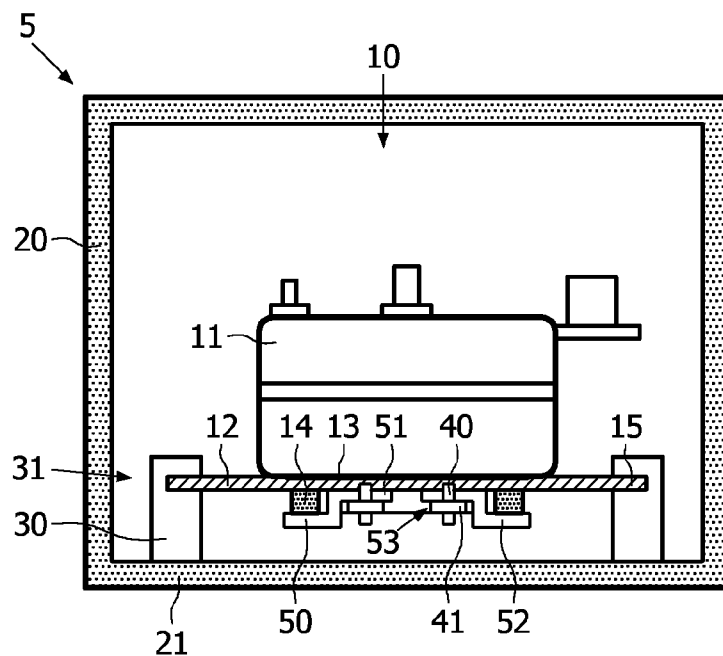


FIG. 5

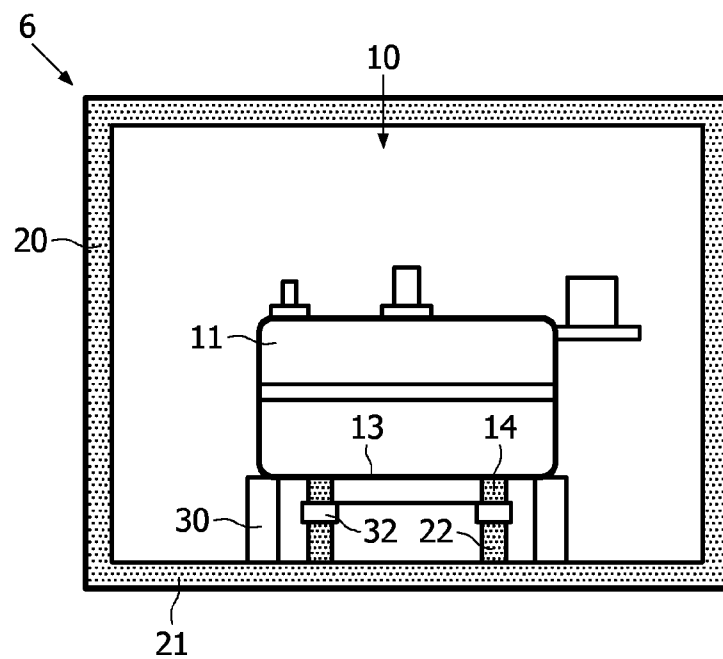


FIG. 6

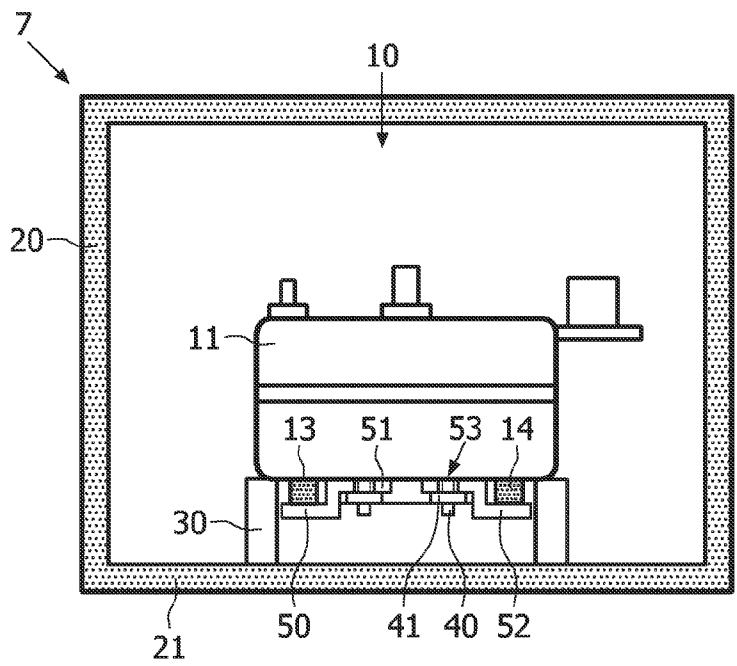


FIG. 7

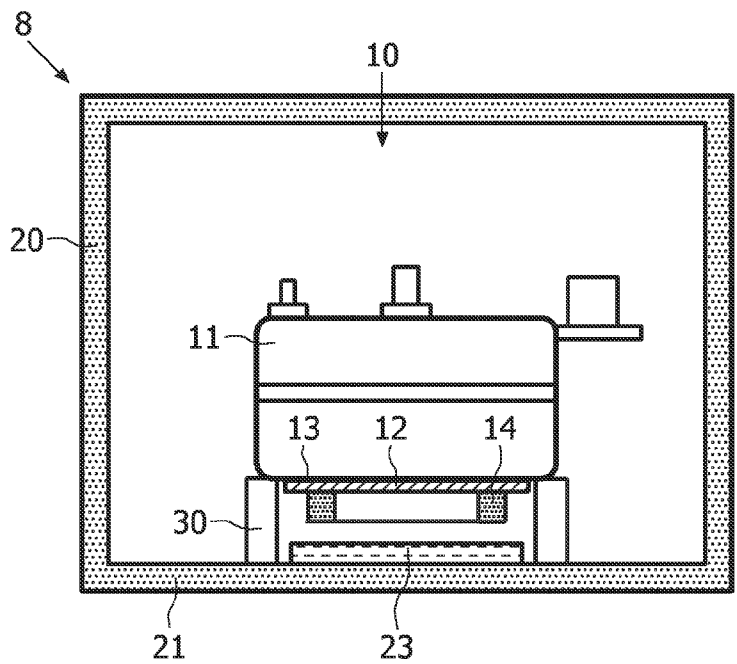


FIG. 8

### ASSEMBLY OF A HOUSING AND A STEAM GENERATOR DEVICE

[0001] The present invention relates to an assembly, comprising:

[0002] a housing; and

[0003] a steam generator device which is arranged inside the housing, and which comprises a steam generator shell for containing water and steam, and heating means connected to the steam generator shell for heating the steam generator shell and its contents.

[0004] Such an assembly is well known, and is applied in devices, which are adapted to delivering steam during their operation, for example a steam ironing device, a coffee maker and a facial sauna device.

[0005] For the purpose of producing heat during operation of the assembly, various suitable types of heating means are applicable. For example, the heating means may comprise a tubular heating element or a collection of flat resistive heating tracks, arranged on the steam generator shell. Also, the heating means may comprise a heating element and a heater plate, wherein the heater plate is arranged between the heating element and the steam generator shell, and serves for improving heat transfer between the heating element and the steam generator shell.

[0006] In respect of the latter possibility, various ways for joining together the steam generator shell, the heating element and the heater plate are known and applied in practice. For example, it is known to integrate the heating element with the heater plate by casting, and to join the heater plate to the steam generator shell by tightening the heater plate with nuts onto studs which are pre-welded on the steam generator shell. According to another, more cost effective way, the heater plate is joined to the steam generator shell by means of welding, wherein it is not necessary to perform complicated processes such as welding studs at predetermined positions, tightening nuts while applying a controllable force, and applying a heat conducting material such as paste or graphite between the heater plate and the steam generator shell.

[0007] When studs and nuts are used for the purpose of connecting the heater plate to the steam generator shell, it is important that the nuts are tightened very well. In this manner, good contact between the heater plate and the steam generator shell is obtained, on the basis of which a good transfer of heat from the heater plate to the steam generator shell is realized during operation of the steam generator device. However, as a result of firm tightening of the nuts, great stress is induced at the position where the studs are welded to the steam generator shell. The quality and strength of the welds are very critical, and the weld has to be strong in order to be capable of withstanding thermal cyclic stresses associated with operation of the steam generator device. If the welding quality is poor, the studs eventually drop off, due to fatigue. As a result, the whole of the heater plate and the heating element is separated from the steam generator shell, and drops on a bottom of the steam generator shell.

[0008] In case of the heater plate being welded to the steam generator shell, many critical steps need to be taken. Among other things, brazing agent and brazing material need to be mixed according to a predetermined ratio, and surfaces of the heater plate and the steam generator shell need to be thoroughly cleaned in order to remove any form of contamination. Critical process parameters like temperature, pressure and a

supplied amount of brazing mixture also need to be set according to predetermined standards. Furthermore, it is necessary for the surfaces to be joined to have a reasonably good flatness. In view of the fact that the welding process involves many critical steps, there is a considerable risk of mistakes. Consequently, there is a considerable risk of a poor and incomplete weld.

[0009] A result of a poor weld being present between the heater plate and the steam generator shell is that poor transfer of heat from the heater plate to the steam generator shell is obtained. Eventually, the whole of the heater plate and the heating element may even detach from the steam generator shell and touch the housing.

[0010] The connection of the heating element to the heater plate may also be realized by means of a welding process. In such a case, it is also possible that the heating element detaches from the heater plate, and falls on the bottom of the housing. Likewise, in case the heating means only comprise a heating element which is directly connected to the steam generator shell through a weld or the like, it is possible that the connection of the heating element to the steam generator shell fails, whereupon the heating element contacts the housing.

[0011] In many cases, the housing is made of a plastic material, so that contact with a heater plate and/or a heating element is very dangerous, as this may lead to melting of the housing or may even cause a fire.

[0012] It is an objective of the present invention to solve the above-described problem of the entire heating means or a portion thereof falling on the bottom of the housing in case of failure of a relevant connection. In general, it is an objective of the present invention to reduce the danger of the housing getting burned in case at least a portion of the heating means gets disconnected from another portion of the heating means and/or the steam generator shell. This objective is achieved by means of an assembly of a housing and a steam generator device as described in the foregoing, further comprising means for preventing direct contact between the housing and any surface of the heating means in case of failure of a connection of at least a portion of the heating means to a remaining portion of the steam generator device.

[0013] In the following, for the sake of clarity, the term "potentially harmful item" is used to indicate the item that may get detached from the steam generator shell and/or another component of the steam generator device, and that may comprise the entire heating means or a portion thereof. In the assembly according to the present invention, due to the presence of the contact preventing means, it is sure that the potentially harmful item will never touch the housing.

[0014] Within the scope of the present invention, many suitable embodiments of the contact preventing means are feasible. For example, the contact preventing means may be adapted to constituting an obstruction between the housing and at least a portion of the heating means. Such contact preventing means may be constructed such as to prevent a fall of the potentially harmful item altogether, but that does not alter the fact that in principle, such contact preventing means may as well be constructed to allow only a limited fall of the potentially harmful item, wherein the fall of the potentially harmful item is stopped before the potentially harmful item reaches the housing. For example, it is possible that the contact preventing means comprise a layer of a thermal insulating and flame retarding material, which is arranged on at least a portion of a bottom of the housing. In case the potentially harmful item gets detached from the remaining portion of the

steam generator device, direct contact between the item and the housing is prevented by the layer. Moreover, due to the presence of the layer, a heating process of the housing is slowed down.

**[0015]** Furthermore, the contact preventing means may comprise holding means such as brackets for holding at least a portion of the heating means in place with respect to a remaining portion of the steam generator device, wherein the holding means are attached to the remaining portion of the steam generator device. Such holding means are adapted to holding the potentially harmful item in place under all circumstances, including a situation in which a connection of the item to the remaining portion of the steam generator device is broken. This embodiment of the contact preventing means is preferred, because, in case contact preventing means according to this embodiment are applied, the performance of the steam generator device is not much decreased in case of failure of the connection of the potentially harmful item to the remaining portion of the steam generator device. In view of the prevention of failure of the steam generator device, it is most preferred if the contact preventing means are adapted to holding a surface through which the heating means are connected to the steam generator shell against the steam generator shell in case of failure of the connection between the surface of the heating means and the steam generator shell.

**[0016]** According to a first practical possibility, the contact preventing means comprise mounting supports which are arranged on the housing, wherein the at least a portion of the heating means is supported by the mounting supports. In a practical embodiment, the mounting supports comprise a material that is resistant to high temperatures. Due to the presence of the mounting supports, the potentially harmful item can never touch the housing, and burning of the plastic material of the housing is totally prevented.

**[0017]** Advantageously, the steam generator shell is supported by the portion of the heating means which is supported by the mounting supports, so that the steam generator shell is indirectly supported by the mounting supports as well, and it is not necessary to take any other measures for the purpose of supporting the steam generator shell.

**[0018]** The heating means may comprise a disc-shaped component. Preferably, in such a case, the mounting supports comprise a recess for receiving a portion of a circumferential rim of the disc-shaped component of the heating means. Such a way of securely mounting the disc-shaped component of the heating means may be realized when at least the circumferential rim of the components is left uncovered.

**[0019]** According to a second practical possibility, the contact preventing means also comprise mounting supports, which are arranged on the bottom of the housing. However, according to this possibility, the steam generator shell rests on the mounting supports, wherein the bottom of the housing comprises at least one projecting portion which contacts a bottom side of at least a portion of the heating means, through a heat-resistant member. Due to the presence of the heat-resistant member, melting of the plastic of the portion projection of the bottom of the housing is avoided. In case the potentially harmful item gets detached from the steam generator shell, the item is still held in place by the projecting portion.

**[0020]** According to a third practical possibility, the contact preventing means comprise at least one rod-like securing member extending through a hole that is arranged in the heating means, wherein one end of the securing member is

connected to the steam generator shell. For example, the contact preventing means may comprise at least one stud and nut, wherein the stud extends through a hole that is arranged in the heating means, wherein one end of the stud is connected to the steam generator shell, and wherein the nut is arranged on another end of the stud. Preferably, at least two studs and nuts are applied. As the nuts are only used for the purpose of preventing the potentially harmful item from falling down, there is a no need for a high tightening force, so that the connection between the stud and the steam generator shell is not subjected to a heavy load. As the potentially harmful item cannot move beyond the nuts, and the nuts are held in place with respect to the steam generator shell by means of the studs, the potentially harmful item cannot get completely separated from the steam generator shell. Therefore, by applying the at least one stud and nut as described, a situation in which the heating means touch the housing cannot occur.

**[0021]** It is possible that the heating means of the assembly according to the present invention comprise a heating element for producing heat and a heater plate arranged between the heating element and the steam generator shell for improving heat transfer between the heating element and the steam generator shell. In such a case, it is preferred if the assembly comprises holding means for holding the heating element in place with respect to the heater plate; and at least one rod-like securing member extending through both a hole that is arranged in the heater plate and a hole that is arranged in the holding means, wherein one end of the securing member is connected to the steam generator shell. For example, in case the heating element is connected to the heater plate through a weld, it is advantageous to have the holding means, as there is a risk of the heating element getting detached from the heater plate. When the holding means are applied and the connection between the heating element and the heater plate is broken, there is no risk of the heating element touching the housing and melting or even burning the housing.

**[0022]** Furthermore, as the holding means are secured by means of a securing member, who is also applied for the purpose of keeping the heater plate in place against the steam generator shell, an application of additional means for securing the holding means is avoided. For example, the holding means comprise brackets, and the securing member comprises a stud, wherein one side of the stud is connected to the steam generator shell. In such a case, top side of the heater plate is positioned against the steam generator shell, wherein a number of studs are arranged such as to extend through holes in the heater plate, and brackets are arranged on a bottom side of the heater plate, wherein the studs extend through holes in the brackets as well. Hence, in such a case, when nuts are arranged on free ends of the studs, both the heater plate and portions of the brackets having a hole for letting pass a stud are clamped between the steam generator shell and the nuts.

**[0023]** The above-described embodiments of the assembly according to the present invention represent only a few of the numerous feasible possibilities. Within the scope of the present invention, any type of contact preventing means may be applied, wherein it is important that these means are capable of preventing contact between the housing and any surface of the heating means in case of failure of a connection between the heating means or a portion thereof and a remaining portion of the steam generator device.

**[0024]** The present invention also relates to a device, which is adapted to delivering steam during its operation, compris-

ing an assembly according to the present invention. Examples of such a device are a steam ironing device, a garment steamer, a coffee maker, a facial sauna device, a steam cooker, a steam sanitizer and a vacuum cleaner.

[0025] The present invention will now be explained in greater detail with reference to the figures, in which similar parts are indicated by the same reference signs, and in which:

[0026] FIG. 1 diagrammatically shows an assembly of a steam generator device and a housing, according to a first preferred embodiment of the present invention;

[0027] FIG. 2 diagrammatically shows an assembly of a steam generator device and a housing, according to a second preferred embodiment of the present invention;

[0028] FIG. 3 diagrammatically shows an assembly of a steam generator device and a housing, according to a third preferred embodiment of the present invention;

[0029] FIG. 4 diagrammatically shows an assembly of a steam generator device and a housing, according to a fourth preferred embodiment of the present invention;

[0030] FIG. 5 diagrammatically shows an assembly of a steam generator device and a housing, according to a fifth preferred embodiment of the present invention;

[0031] FIG. 6 diagrammatically shows an assembly of a steam generator device and a housing, according to a sixth preferred embodiment of the present invention;

[0032] FIG. 7 diagrammatically shows an assembly of a steam generator device and a housing, according to a seventh preferred embodiment of the present invention; and

[0033] FIG. 8 diagrammatically shows an assembly of a steam generator device and a housing, according to an eighth preferred embodiment of the present invention.

[0034] FIG. 1 diagrammatically shows an assembly 1 of a steam generator device 10 and a housing 20, according to a first preferred embodiment of the present invention. The steam generator device 10 is positioned inside the housing 20, which is made of a plastic material. The assembly 1 is intended to be part of a device which is suitable for steam delivery, such as a steam ironing device, an active ironing board, a steamer, a steam cleaner or a facial sauna device. For sake of clarity, a hose or the like for conducting steam that is generated by the steam generator device 10 during operation is not shown.

[0035] The steam generator device 10 comprises a steam generator shell 11 for containing water and steam. The steam generator shell 11 is manufactured from stainless steel, and is composed of two preformed halves, which are joined by means of welding. Furthermore, the steam generator device 10 comprises a heater plate 12 arranged at a bottom 13 of the steam generator shell 11 and a heating element 14 arranged at a bottom side of the heater plate 12. For example, the heating element 14 may be U-shaped or shaped like a segment of a circle.

[0036] In the example as shown in FIG. 1, the heater plate is attached to the bottom 13 of the steam generator shell 11 by brazing, wherein an inter-metallic layer for improving transfer of heat is formed. Likewise, the heating element 14 is attached to the bottom side of the heater plate 12 by brazing.

[0037] During operation of the steam generator device 10, the heating element 14 is activated. Under the influence of heat produced by the heating element 14, the heater plate 12 is heated. In the process, heat is transferred from the heater plate 12 to the steam generator shell 11, so that the steam generator shell 11 is heated as well. Eventually, in this way, it

is achieved that water that is present inside the steam generator shell 11 is heated to steam.

[0038] It is important to avoid direct contact between the steam generator device 10 and the housing 20, because if the housing 20 would be touched by one or more hot components of the steam generator device 10 during operation, a disadvantageous result would be obtained, namely melting or burning of the plastic. Therefore, the steam generator device 10 is mounted on at least two mounting supports 30, which are made of a material that is resistant to high temperatures.

[0039] In particular, the heater plate 12 covers the entire bottom 13 of the steam generator shell 11, wherein a circumferential rim 15 of the heater plate 12 projects with respect to the bottom 13 of the steam generator shell 11. Portions of the free circumferential rim 15 of the heater plate 12 are accommodated inside recesses 31 arranged in the mounting supports 30. In this configuration, the steam generator shell 11 is supported by the heater plate 12. An advantage of this configuration is that in case the connection between the heater plate 12 and the steam generator shell 11 fails, both the heater plate 12 and the steam generator shell 11 stay in place, and there is no risk of a hot component of the steam generator device 10 touching the housing 20, so that melting or burning of the plastic of the housing 20 is avoided.

[0040] FIG. 2 diagrammatically shows an assembly 2 of a steam generator device 10 and a housing 20, according to a second preferred embodiment of the present invention. The assembly 2 according to the second preferred embodiment of the present invention resembles the assembly 1 according to the first preferred embodiment of the present invention to a large extent. Differences between the assemblies 1, 2 are related to the way in which the heating element 14 is connected to the heater plate 12, and to the type of means which are provided for the purpose of keeping the heater plate 12 from falling down in case the connection of the heater plate 12 to the steam generator shell 11 fails.

[0041] In the steam generator device 10 of the assembly 2 according to the second preferred embodiment of the present invention, the heating element 14 is integrated with the heater plate 12 by casting. In this way, it is not possible for the heating element 14 to get detached from the heater plate 12.

[0042] Like the assembly 1 according to the first preferred embodiment of the present invention, the assembly 2 according to the second preferred embodiment of the present invention comprises at least two mounting supports 30. However, in the assembly 2 according to the second preferred embodiment of the present invention, the mounting supports 30 serve for directly supporting the steam generator shell 11. In this configuration, the mounting supports 30 do not play a role in stopping the heater plate 12 from falling down in case the connection between the heater plate 12 and the steam generator shell 11 fails. In stead, additional means are applied in the form of at least one projecting portion 22 of a bottom 21 of the housing 20, which contacts the bottom side of the heater plate 12 through a heat-resistant member 32, which comprises heat-insulating rubber, for example. Due to the presence of the heat-resistant member 32, direct contact of the projecting portion 22 of the bottom 21 of the housing 20 and a hot component of the steam generator device 10 is avoided, so that melting or burning of the projecting portion 22 is avoided.

[0043] The projecting portion 22 of the bottom 21 of the housing 20 may have any suitable shape. For example, the projecting portion 22 may be formed as a boss or a rib. In the

assembly 2 according to the second preferred embodiment of the present invention, in case the connection of the heater plate 12 to the steam generator shell 11 fails, the whole of the heater plate 12 and the heating element 14 still stays in place, as it is supported by the at least one projecting portion 22 of the bottom 21 of the housing 20.

[0044] FIG. 3 diagrammatically shows an assembly 3 of a steam generator device 10 and a housing 20, according to a third preferred embodiment of the present invention. The assembly 3 according to the third preferred embodiment of the present invention resembles the assembly 2 according to the second preferred embodiment of the present invention to a large extent. Differences between the assemblies 2, 3 are related to the way in which the heating element 14 is connected to the heater plate 12, and to the type of means which are provided for the purpose of keeping the heater plate 12 from falling down in case the connection of the heater plate 12 to the steam generator shell 11 fails.

[0045] In the assembly 3 according to the third preferred embodiment of the present invention, the heating element 14 is attached to the bottom side of the heater plate 12 by brazing, wherein an inter-metallic layer is formed. Furthermore, the assembly 3 according to the third preferred embodiment of the present invention comprises at least two studs 40 and nuts 41. One end of the studs 40 is attached to the bottom 13 of the steam generator shell 11 through a weld. The studs 40 extend through holes 16 which are arranged in the heater plate 12, wherein the nuts 41 are arranged on a free end of the studs 40. In this way, the nuts 41 form a barrier, which prevents the heater plate 12 from falling down in case the connection between the heater plate 12 and the steam generator shell 11 is broken. Preferably, the nuts 41 are not used for pressing the heater plate 12 against the bottom 13 of the steam generator shell 11, as a result of which the welds between ends of the studs 40 and the bottom 13 of the steam generator shell 11 are guarded against a heavy load, and there is practically no risk of the studs 40 breaking off of the steam generator shell 11.

[0046] FIG. 4 diagrammatically shows an assembly 4 of a steam generator device 10 and a housing 20, according to a fourth preferred embodiment of the present invention. The assembly 4 according to the fourth preferred embodiment of the present invention resembles the assembly 3 according to the third preferred embodiment of the present invention to a large extent, with this difference that the assembly 4 according to the fourth preferred embodiment of the present invention additionally comprises at least two brackets 50 which are arranged on the heater plate 12, and which serve for holding the heating element 14 in place in case the connection of the heating element 14 to the heater plate 12 fails.

[0047] Each bracket 50 has a base portion 51 and a holding portion 52. In the base portion 51, a hole 53 is provided. The brackets 50 are mounted at the bottom side of the heater plate 12 by means of the studs 40 and nuts 41. In particular, each stud 40 extends through a hole 16 in the heater plate 12 and a hole 53 in a base portion 51 of a bracket 50, wherein one end of the stud 40 is attached to the steam generator shell 11, and wherein a nut 41 is arranged on a free end of the stud 40.

[0048] A right position of the bracket 50 on the bottom side of the heater plate 12 is a position in which the hole 53 in the base portion 51 of the bracket 50 is aligned with a hole 16 in the heater plate 12, and in which the holding portion 52 is located underneath a portion of the heating element 14. In this way, it is achieved that the heating element 14 is prevented

from falling from the heater plate 12 in case the connection of the heating element 14 to the heater plate 12 fails.

[0049] In the assembly 4 according to the fourth preferred embodiment of the present invention, the studs 40 and nuts 41 have a function in both holding the heater plate 12 in place in case the connection between the heater plate 12 and the bottom 13 of the steam generator shell 11 is broken and securing the brackets 50 by means of which the heating element 14 is held against the heater plate 12. An advantage of this double application of the studs 40 and nuts 41 is that it is not necessary to provide separate means for separately performing the functions as mentioned. Within the scope of the present invention, however, it is not necessary that the means which are applied for the purpose of preventing the heater plate 12 from contacting the housing 20 in case of failure of the connection of the heater plate 12 to the steam generator shell 11 are also applied for the purpose of holding the heating element 14 against the bottom side of the heater plate 12. For example, it is also possible that the brackets 50 are force-fit into the heater plate 12 or that the brackets 50 are attached to the heater plate 12 by means of studs 40 which are force-fit into the heater plate 12 and nuts 41. The latter possibility is illustrated by means of FIG. 5, in which an assembly 5 according to a fifth preferred embodiment of the present invention is shown. The assembly 5 according to the fifth preferred embodiment of the present invention resembles the assembly 1 according to the first preferred embodiment of the present invention to a large extent, with this difference that the brackets 50 are provided for holding the heating element 14 against the heater plate 12 in case of failure of the connection between the heating element 14 and the heater plate 12, so that it is not possible for the heating element 14 to fall from the heater plate 12.

[0050] The brackets 50 as shown constitute only one feasible example of means for keeping the heating element 14 in place 12 with respect to the heater plate 12 in case of failure of the connection between the heating element 14 and the heater plate 12. Within the scope of the present invention, other suitable means such as clips may be applied.

[0051] It will be clear to a person skilled in the art that the scope of the present invention is not limited to the examples discussed in the foregoing, but that several amendments and modifications thereof are possible without deviating from the scope of the present invention as defined in the attached claims.

[0052] For example, in the assembly 1 according to the first preferred embodiment of the present invention, it is not necessary that portions of the circumferential rim 15 are accommodated in the mounting supports 30. It is also possible that the heater plate 12 is positioned on top of the mounting supports 30, wherein suitable connecting means such as screws are applied for securing the heater plate 12 on the mounting supports 30.

[0053] In the assembly 2 according to the second preferred embodiment of the present invention, at least one projecting portion 22 of the bottom 21 of the housing 20 with a heat-resistant member 32 on top is applied for the purpose of keeping the whole of the heater plate 12 and the heating element 14 in place in case of failure of the connection between the heater plate 12 and the steam generator shell 11. That does not alter the fact that it is also possible to omit the projecting portion 22 of the bottom 21 of the housing 20 and to apply only mounting supports 30 for both the purpose of supporting the steam generator shell 11 and the purpose of

preventing the whole of the heater plate 12 and the heating element 14 from falling on the bottom 21 of the housing 20 in case the connection between the heater plate 12 and the steam generator shell 11 is broken.

[0054] Furthermore, it is possible to have an assembly in which mounting supports 30 or projecting portions 22 of the bottom 21 of the housing 20 with a heat-resistant member 32 on top are arranged such as to contact the heating element 14 and to keep both the heating element 14 and the heater plate 12 from falling down in case of failure of the connection between the heating element 14 and the heater plate 12 and of the connection between the heater plate 12 and the steam generator shell 11, respectively.

[0055] Instead of the studs 40 and nuts 41 as shown in FIGS. 3 and 4, any other suitable securing members for preventing the heater plate 12 from falling down in case of failure of the connection of the heater plate 12 to the steam generator shell 11 may be applied, such as rivets. In general, it is advantageous to apply a rod-like securing member, wherein one end of the securing member is attached to the steam generator shell 11, for example through a weld.

[0056] In the foregoing, an assembly 1-5 of a steam generator device 10 and a plastic housing 20 is shown. The steam generator device 10 is arranged inside the housing 20, and comprises the following elements: a steam generator shell 11 for containing water and steam; a heating element 14 for heating the steam generator shell 11 and its contents; and a heater plate 12 arranged between the heating element 14 and the steam generator shell 11 for improving heat transfer between the heating element 14 and the steam generator shell 11. In order to prevent the whole of the heater plate 12 and the heating element 14 from falling on a bottom 21 of the housing 20 in case of failure of the connection between the heater plate 12 and the steam generator shell 11, contact preventing means 30, 31; 22, 32; 40, 41 for obstructing a path between the heater plate 12 and the housing 20 and/or for holding the heater plate 12 against the steam generator shell 11 in case of failure of the connection between the heater plate 12 and the steam generator shell 11 are provided. Furthermore, in order to prevent the heating element 14 from falling on the bottom 21 of the housing 20 in case of failure of the connection between the heating element 14 and the heater plate 12, the contact preventing means are also adapted to obstructing a path between the heating element 14 and the housing 20 and/or for holding the heating element 14 against the heater plate 12. For example, the contact preventing means comprise brackets 50 which are mounted at a bottom side of the heater plate 12, wherein a holding portion 52 of the brackets 50 extends just below the heating element 14.

[0057] The assemblies 1-5 of a housing 20 and a steam generator device 10 as shown in FIGS. 1-5 comprise a heater plate 12 and a heating element 14 for the purpose of heating the steam generator shell 11 and its contents during operation. The heater plate 12 serves for improving heat transfer between the heating element 14 and the steam generator shell 11. Furthermore, due to the presence of the heater plate 12, a heating process which takes place during operation is very well controllable. Nevertheless, the application of a heater plate 12 as shown is not necessary, and embodiments of the assembly according to the present invention in which only a heating element 14 is applied for the purpose of heating the steam generator shell 11 and its contents are feasible. In FIGS. 6 and 7, two embodiments of the assembly according to the present invention are diagrammatically shown, which

comprise a heating element 14 that is directly attached to the bottom 13 of the steam generator shell 11 by brazing.

[0058] FIG. 6 diagrammatically shows an assembly 6 of a steam generator device 10 and a housing 20, according to a sixth preferred embodiment of the present invention. The assembly 6 according to the sixth preferred embodiment of the present invention resembles the assembly 2 according to the second preferred embodiment of the present invention to a large extent, with this difference that in the assembly 6 according to the sixth preferred embodiment of the present invention, the heater plate 12 is absent. Furthermore, in the assembly 6 according to the sixth preferred embodiment of the present invention, at least one projecting portion 22 of the bottom 21 of the housing 20 is applied, whereas in this embodiment, the projecting portion 22 contacts the heating element 14 through a heat-resistant member 32. In FIG. 6, two of such projecting portions 22 are shown. In case the connection between the heating element 14 and the bottom 13 of the steam generator shell 11 fails, the projection portions 22 of the bottom 21 of the housing 20 prevent the heating element 14 from falling on the bottom 21 of the housing 20.

[0059] FIG. 7 diagrammatically shows an assembly 7 of a steam generator device 10 and a housing 20, according to a seventh preferred embodiment of the present invention. The assembly 7 according to the seventh preferred embodiment of the present invention resembles the assembly 4 according to the fourth preferred embodiment of the present invention to a large extent, with this difference that in the assembly 7 according to the seventh preferred embodiment of the present invention, the heater plate 12 is absent. Furthermore, in the assembly 7 according to the seventh preferred embodiment of the present invention, brackets 50 are applied, whereas in this embodiment, the brackets 50 serve for keeping the heating element 14 in place against the bottom 13 of the steam generator shell 11. Consequently, in this embodiment, the studs 40 extending from the bottom 13 of the steam generator shell 11 and the nuts 41 arranged on the free ends of the studs 40 are used for the purpose of attaching the brackets 50 to the bottom 13 of the steam generator shell 11, wherein the base portion 51 of the brackets 50 is clamped between the bottom 13 of the steam generator shell 11 and the nuts 41. When the heating element 14 detaches from the bottom 13 of the steam generator shell 11, the heating element 14 is still kept in place by the brackets 50.

[0060] Within the scope of the present invention, the means which are applied for preventing contact between the housing 20 and heating means 12, 14 of the steam generator device 10 do not necessarily need to be adapted for preventing the heating means 12, 14 or a portion thereof from falling down. In principle, the heating means 12, 14 are allowed to fall down, as long as a situation in which these means 12, 14 land on the bottom 21 of the housing 20 is prevented. An example of an assembly in which the heating means 12, 14 comprise a heating element 14 and a heater plate 12, and in which both the heating element 14 and the whole of the heating element 14 and the heater plate 12 are allowed to fall down, is diagrammatically shown in FIG. 8.

[0061] In particular, FIG. 8 diagrammatically shows an assembly 8 of a steam generator device 10 and a housing 20, according to an eighth preferred embodiment of the present invention. In this assembly 8, the steam generator shell 11 is supported by mounting supports 30. Furthermore, the heater plate 12 is attached to the bottom 13 of the steam generator

shell 11 by brazing, and the heating element 14 is attached to a bottom side of the heater plate 12 by brazing as well.

[0062] The assembly 8 does not comprise any means for keeping the heater plate 12 against the bottom 13 of the steam generator shell 11 in case of failure of the connection between the heater plate 12 and the bottom 13 of the steam generator shell 11. Also, the assembly 8 does not comprise any means for keeping the heating element 14 against the bottom side of the heater plate 12 in case of failure of the connection between the heating element 14 and the heater plate 12. In order to prevent the heating element 14 or the whole of the heating element 14 and the heater plate 12 from directly touching the bottom 21 of the housing 20 in case of failure of a relevant connection, a layer 23 comprising a thermal insulating and flame retarding material is arranged on the bottom 21 of the housing 20. When the heating element 14 or the whole of the heating element 14 and the heater plate 12 falls down, the heating element 14 or the whole of the heating element 14 and the heater plate 12 lands on the layer 23. Due to the presence of the layer 23, a heating process of the housing 20 is slowed down, so that there is time for a user of the assembly 8 to take appropriate action in order to avoid burning of the housing 20. In the process, it is important that the user is warned that the housing 20 is heated up. To this end, any suitable detecting and indicating means may be applied. For example, the detecting means may comprise a thermal sensor in the form of a small amount of thermal paint sprayed onto the housing, and the indicating means may comprise a buzzer, which is activated such as to produce noise when the thermal sensor senses a temperature that is higher than an allowable temperature.

- 1. Assembly comprising:
  - a housing;
  - a steam generator device which is arranged inside the housing, and which comprises a steam generator shell for containing water and steam, and heating means connected to the steam generator shell for heating the steam generator shell and its contents; and
  - means for preventing direct contact between the housing and any surface of the heating means in case of failure of a connection of at least a portion of the heating means to a remaining portion of the steam generator device.
- 2. Assembly according to claim 1, wherein the contact preventing means are adapted to constituting an obstruction between the housing and at least a portion of the heating means.
- 3. Assembly according to claim 1, comprising mounting supports arranged on the housing, wherein at least a portion of the heating means is supported by the mounting supports.
- 4. Assembly according to claim 3, wherein the steam generator shell is supported by the portion of the heating means which is supported by the mounting supports.
- 5. Assembly according to claim 3, wherein the heating means comprise a disc-shaped component, and wherein the

mounting supports comprise a recess for receiving a portion of a circumferential rim of the disc-shaped component of the heating means.

6. Assembly according to claim 1, comprising mounting supports arranged on a bottom of the housing, wherein the steam generator shell rests on the mounting supports, and wherein the bottom of the housing comprises at least one projecting portion which contacts a bottom side of at least a portion of the heating means, through a heat-resistant member.

7. Assembly according to claim 1, wherein the contact preventing means comprise at least one rod-like securing member extending through a hole that is arranged in the heating means, wherein one end of the securing member is connected to the steam generator shell.

8. Assembly according to claim 1, wherein the contact preventing means comprise a layer of a thermal insulating and flame retarding material, which is arranged on at least a portion of a bottom of the housing.

9. Assembly according to claim 1, wherein the contact preventing means comprise holding means for holding at least a portion of the heating means in place with respect to a remaining portion of the steam generator device, wherein the holding means are attached to the remaining portion of the steam generator device.

10. Assembly according to claim 9, wherein the holding means comprises brackets.

11. Assembly according to claim 1, wherein the contact preventing means are adapted to holding a surface through which the heating means are connected to the steam generator shell against the steam generator shell in case of failure of the connection between the surface of the heating means and the steam generator shell.

12. Assembly according to claim 1, wherein the heating means comprise a heating element for producing heat and a heater plate arranged between the heating element and the steam generator shell for improving heat transfer between the heating element and the steam generator shell.

13. Assembly according to claim 12, comprising holding means (50) for holding the heating element in place with respect to the heater plate; and at least one rod-like securing member extending through both a hole that is arranged in the heater plate and a hole that is arranged in the holding means, wherein one end of the securing member is connected to the steam generator shell.

14. Device which is adapted to delivering steam during its operation, such as a steam ironing device, a garment steamer, a coffee maker, a facial sauna device, a steam cooker, a steam sanitizer or a vacuum cleaner, comprising an assembly according to claim 1.

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