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(54) **Title:** METHOD AND DEVICE FOR PREPARING DRINKS BY MEANS OF EXTRACTION

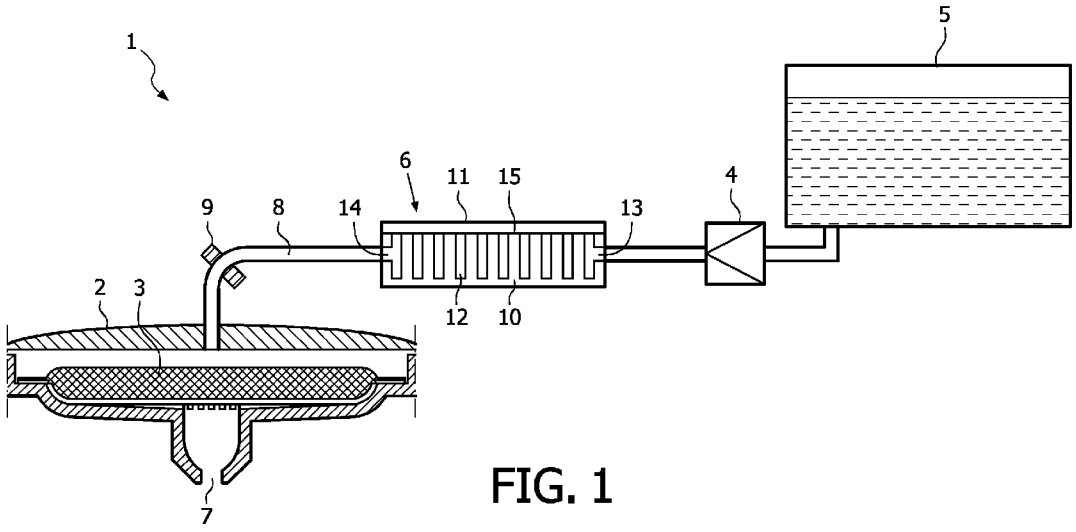


FIG. 1

(57) **Abstract:** The invention relates to a method for preparing drinks such as coffee, tea or soup by means of extraction, comprising the step of : A) pressing water through a pad (3) received in a holder (2) and filled with a product for extracting for the purpose of preparing the drink. The invention also relates to a device (1) for preparing a drink, in particular coffee or tea, by applying the method according to the invention, comprising: at least one holder (2) for receiving at least one pad (3) filled with a product for extracting, and at least one pump (4) coupled to the holder (2) for pressing the water under pressure through a pad (3) received in the holder. The invention further relates to an assembly of such a device (1) and at least one pad (3).

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Method and device for preparing drinks by means of extraction

The invention relates to a method for preparing drinks such as coffee, tea or soup by means of extraction. The invention also relates to a device for preparing a drink, in particular coffee or tea, by applying the method according to the invention. The invention further relates to an assembly of such a device and at least one pad.

The preparation of drinks by means of extraction by making use of a measured quantity of product for extracting, such as for instance ground coffee or tea, received in a pad is known. Particularly in recent years the popularity of preparing a drink by means of a pad has increased considerably. The device described in the preamble for preparing a drink using a pad is also already known, and is marketed under the name Senseo® by for instance Douwe Egberts, a subsidiary of Sara lee, and Philips. The Senseo® is adapted to prepare both coffee and tea. In order to make coffee with the Senseo® a coffee pad with ground coffee is placed in the pad holder. Hot water is then pumped through the coffee pad received in the holder, where extraction of the ground coffee takes place for (generally) half a minute. The coffee water is discharged via an outlet opening connecting to the holder and collected in a coffee cup, after which the coffee can be consumed. The coffee water will usually be guided under pressure into an intermediate compartment after leaving the holder, wherein foaming occurs as a result of a collision of the jet of coffee water with coffee water already present at the bottom of the compartment. Although the convenience of coffee pads, the time-saving of water supply under pressure and the attractive foam layer are deemed to be significant advantages of the Senseo® relative to a traditional filter coffee method, the known method for preparing drinks by making use of the known device in combination with the pads also has drawbacks. A significant drawback is that, when the pad is removed from the holder after water has flowed through the pad for the actual preparation of the drink, there is usually a relatively high risk of a user for instance burning him/herself on water which has not yet cooled and/or being soiled or stained by water which trickles out of the holder and in which extracts are dispersed. During removal of the pad from the holder there is moreover the danger of the surrounding area being contaminated by water dripping from the pad.

The invention has for its object to provide a relatively user-friendly method for preparing drinks by means of extraction.

The invention provides for this purpose a method of the type stated in the preamble, wherein the method comprises the steps of: A) leading water along or through at least one heating element, B) pressing the water through a pad received in a holder and filled with a product for extracting for the purpose of preparing the drink, C) generating steam by evaporation of water being in contact with said heating element, and D) pressing the steam through the pad after the heated water has been pressed through the pad. By pressing steam through the pad after preparing a hot drink, such as coffee, tea and soup , themoisture content, in the pad can be significantly reduced, whereby a used pad can be removed from the holder without a user being burned relatively quickly and easily by relatively hot water. Furthermore, the pad will not drip, or will at least do so to a far lesser degree, whereby the user him/herself is less likely to be stained or soiled with extracts dispersed in the water. An additional advantage of the method according to the invention is that the quantity of water provided with extract which is pressed out of the pad by the steam is optionally added to the drink, this further increasing the efficiency of the method according to the invention. The applied pad generally comprises an envelope which can for instance be manufactured from filter paper, in which envelope an extractable mixture is received. The envelope is herein permeable to water and substantially non-permeable to the extractable (granular) mixture received therein. The water used may be provided with additives, such as (non-)alcoholic substances. The heating element applied in the method according to the invention favourably has a dual functionality: on the one hand the heating element is adapted to heat the water to be pressed through the pad received in the holder, and on the other the same heating element is adapted to generate steam to be pressed through the pad received in the holder so as to enable at least partial drying of the pad before the pad is removed from the holder by a user. Hence, by applying a collective heating element, the favourable method according to the invention can be executed in a relatively efficient and effective manner. Commonly, a pre-known quantity of steam will generally have to be generated in order to enable the moisture content in the pad to be reduced satisfactorily. Although the heating means are commonly active during step A) to heat up the water in order to prepare a hot beverage, it is also conceivable that the heating element is inactive during step A) as a result of which a relatively cold beverage can be prepared by means of the

method according to the invention although subsequently steam will still be generated and purged through the pad to dry the pad as much as possible to counteract dripping of water out of the pad upon removal of the pad. During step D), it is also possible to envisage that a generally small water fraction is also pressed through the pad. It is possible here for instance to envisage a water/steam mixture being pressed through the pad during step D), wherein the steam fraction will generally be (considerably) larger than the water fraction in order to be able to realize drying of the pad. It is noticed that step C) and step D) can take place either successively, completely simultaneously, or simultaneously for a period of time.

In a preferred embodiment the heating element is a flow through heating element, in particular a flow through thick film heating element, said flow through heating element is provided with at least one inlet for water to be heated and at least one outlet for heated water and/or steam. By purging the water through the heating element, a relatively intensive contact of the water to be heated and the heating element can be forced, resulting in a relatively quick heating of the water and a relatively quick preparation of a hot drink. Purging of the water to be heated through the heating element is commonly realised by means of a pump. Moreover, a flow through heating element can also be used efficiently to generate steam within the heating element. By evaporating at least a fraction of water remaining in the heating element steam will be generated within the heating element, which steam can be led easily through the pad. Due to volume expansion during the generation of said steam, the steam will purge itself through the pad without making use of a pump or the like. In this latter case, it will commonly however be favourable that before step C) the inlet of heating element is closed to allow steam transport merely in the direction of the pad. In case a flow through heating element is used, the method according to the invention preferably also comprises step E) comprising at least partially refilling the heating element after the generation of steam according to step C). At least partially (re)filling the heating element with water will prevent excessive heating in a next brewing operation as well as the formation of steam in the initial stage of the next brewing operation. This will, moreover, be in favour of the lifespan of the heating element as such. An optimum filling degree of the heating element is commonly dependent on the situational circumstances, among which the geometry and dimensioning of a flow through channel structure of the heating element.

In a particular preferred embodiment the heating element is switched off after a determined period of time after step C) commences in order to be able to prevent excessive formation of steam and/or the heating element being allowed to boil dry (for a long time). The heating element will preferably be switched off after a period of time of between 1 and 10 seconds after step D) commences. It is expected that sufficient steam can be generated within said period of time to enable the moisture content in the pad to be reduced satisfactorily.

As mentioned above, the water is preferably pressed through the pad during step B) using a pump. A pressure of 1-2 bar is preferably applied during pressing of the water through the pad in order to enable the extraction efficiency to be optimized. In a particular preferred embodiment of the method according to the invention the heating element is positioned between the pump and the holder for the pad, wherein the pump is switched off after performing of step B) and before step C) is performed. By switching off the pump after step B) has been performed and leaving the heating element switched on, the water still in contact with the heating element will be heated further until a vapour results. The vapour is deemed here to be a gaseous state of the water and has a considerably higher specific volume than the water itself, which results in a pressure increase in the system, whereby the resulting vapour will be pressed out of the device via the holder and the pad received therein, while partly drying the pad.

In a preferred embodiment the pressure drop of the water pressed through the holder is greater upstream and/or downstream of the pad than the pressure drop over the pad itself. The pressure drop over the pad will generally amount to about 0.1-0.2 bar. By making the pressure drop upstream and/or downstream of the pad greater than the pressure drop over the pad itself, for instance by using a flow restriction, the water can be prevented from being pressed through the pad too rapidly. Were this to happen, an optimal extraction could not then take place, and channels could moreover form in the pad relatively easily, which would further reduce the extraction efficiency. Formation of channels in the pad can occur relatively easily in the case the pad is provided with a relatively coarse-grained filling such as for instance a tea extract.

The invention also relates to a device of the type stated in the preamble, comprising at least one holder for receiving at least one pad filled with a product for extracting, which

holder is provided with at least one inlet opening and at least one outlet opening for passage water, at least one heating element adapted both for heating water to prepare the drink and for generating steam, at least one pump coupled to the heating element and the holder for pressing the heated water under pressure through a pad received in the holder to prepare the drink, wherein the device is adapted to press steam generated by the heating element through the pad received in the holder. Advantages of pressing steam through the pad after preparing a drink are already described at length above. A further advantage of purging the pad with steam is that residual water present in an intermediary conduit (outlet tube), mutually connecting the heating element and the pad holder, will also be purged and hence substantially be removed out of the intermediary conduit by means of the steam, which is favourable from a hygienic point of view. Moreover, in this manner it can be prevented that cooled down water remaining in the intermediary conduit is purged through the pad after which water heated by the heating element is purged through the pad in order to prepare a hot beverage, which would lead to an inefficient situation. In order to overcome this problem it is preferable that the device comprises a drain tube to drain the cold water fraction and hence to prevent the cold water fraction to be purged through the pad. More preferably, the device comprises a return tube to to prevent the cold water to be purged through the pad, wherein the cold water fraction is returned to a water supply, commonly formed by a water storage container, so that this water fraction can be usefully reused. Obviously in this latter case the device preferably comprises at least one valve to selectively open and close the drain tube, in particular the return tube, and selectively (alternating) open and close the intermediary conduit. The device is optionally be provided with a bypass conduit connected to the holder, said bypass conduit being arranged to bypass the heating element. By means of the bypass conduit relatively cold water can be purged directly through the pad to prepare a relatively cold beverage without making contact with the heating element. Alternatively, a cold beverage may be prepared by allowing the heating element to cool down and to purge water through the relatively cold heating element to and subsequently through the pad. The steam can be pressed through the pad in various ways. Only a small quantity of water is required to enable generation of a considerable amount of steam. 1.5 litres of steam can thus be generated from for instance 1 gram of water. In addition to the fact that the moisture content of the pad can be reduced in relatively efficient manner by means of steam, steam also has a cleaning action in the device since the steam kills micro-organisms and prevents deposition of

contaminants such as lime in the device according to the invention.An advantage of generating steam by means of the heating element which is also used for heating water to prepare the drink is that the steam can be generated in relatively simple, efficient and inexpensive manner on the basis of components already present in the device according to the invention, without additional specific components being necessary for this purpose.

In a preferred embodiment the device comprises a control unit for activating the pump for pressing the heated water under pressure through the pad. In a particular preferred embodiment the control unit is adapted for deactivating the pump for generating steam within the heating element, and preferably furthermore for deactivating the heating element a period of time after switching off the pump. As mentioned afore this period of time is preferably between 1 and 10 seconds.

In another preferred embodiment the device comprises a pressure relief valve to prevent an overpressure within the device. In this manner superheating of steam generated within the device due to (too) high pressures within the device can be prevented, as a result of which the risks of burning for consumers can be counteracted substantially. The pressure relief valve can for example be connected with the pad holder.

The flow through heating element is preferably formed by a thick-film heating element. The thick film is commonly formed by a resistive heating track adapted to develop heat when subjected to an electrical current. In a preferred embodiment the flow through heating element comprise a base structure and at least one top structure connecting to the base structure, said top structure is provided with at least one resistive heating track, wherein at least one non-linear channel structure is arranged between the base structure and the top structure for throughflow of water for heating, and wherein the base structure and the top structure are mechanically connected to each other. The channel structure is in fact bounded and formed here by both the base structure and the top structure . Heat can thus be transferred directly - without interposing another element - and therefore relatively efficiently from the heating element to the water for heating. Particularly in the case where water is driven through the channel structure at relatively high speed, a relatively efficient and rapid heat transfer per unit of volume of water can be achieved per unit of time. An additional advantage here is that precipitate, such as for

instance limescale, cannot be deposited in the channel structure, or at least hardly so, as a result of the relatively high flow speed of the water, which results in a relatively low-maintenance device. Because the channel structure does not take a linear form, the contact surface between the heating top structure and the water for heating situated in the channel structure can be maximized, which, in addition to a relatively rapid heating of the water to a desired temperature, also results in a relatively compact device for rapid and efficient heating of waters. Furthermore, application of the device according to the invention functioning in energetically advantageous manner generally results in a cost saving. Another important advantage of the device according to the invention is that a relatively strong assembly results from the physical, (direct), non-releasable connection between the base structure and top structure, wherein the channel structure can be sealed in relatively reliable, durable and firm manner. The mutual attachment of the top structure and the base structure therefore results in heating means being provided which can withstand relatively high water pressures (up to about 35 bar), whereby water can be guided through the channel structure under relatively high pressure. When the top structure and the base structure are only clamped together in laterally releasable manner, such a durability of the sealing of the channel structure cannot be realized, or only with great difficulty, wherein a large number of components would have to be applied for sealing of the device, which would result in a relatively bulky and expensive device. Due to the direct mutual attachment (connection) of the base structure and the top structure, the heating means through which water for heating can be guided under relatively high pressure (about 35 bar) can thus be provided in relatively simple yet firm, durable and reliable manner, whereby large quantities of water can be heated relatively quickly to a desired temperature. A further advantage of the heating means according to the present preferred embodiment is that, by applying the channel structure arranged between the base structure and the top structure, the surface area to volume ratio of the channel structure can be optimized for determined applications in relatively simple manner by for instance giving the channel or the channels of the channel structure a relatively flat (shallow) form, whereby the channel structure only acquires a limited volume, which can considerably improve the temperature increase of the water for heating per unit of time. The throughput time of the water through the heating means, and therewith through the device, can be reduced considerably by the significantly improved heating of the water per unit of time, whereby the heated water can be available to the user relatively quickly. The water can

herein be guided through the channel structure at a flow rate of up to several metres per second, preferably between 1 and 3 metres per second. Such a relatively high flow rate is usually particularly advantageous in that vapour bubbles which may form in the channel structure are generally flushed immediately out of the heating means. Such a relatively high flow rate furthermore prevents deposition of contaminants, such as lime and the like, on the top structure and/or the base structure. The deposition of contaminants on the top structure is particularly adverse for the heat transfer from the top structure to the water for heating. An additional advantage of the relatively limited volume of the channel structure and the associated improvement in the heat transfer per unit of time is that water present in the channel structure can be converted into vapour, in particular steam, relatively rapidly and easily for the purpose of ultimately being able to reduce the moisture content of the pad received in the holder.

It is noted that the non-linear channel structure is provided with one or more, optionally mutually parallel, non-linear channels, wherein the water for heating preferably runs through a non-linear two-dimensional, in particular a spiral route. It is however very well possible here to envisage parts of the channel structure nevertheless taking a linear form, but wherein the water runs through the heating means via a labyrinthine route. As stated in the above, the heating means according to the above stated preferred embodiment are adapted to withstand relatively high pressures as a result of the mutual physical connection of the top structure and the base structure. This has the advantage that water can be guided through the channel structure of the device under relatively high (test) pressure (up to about 35 bar) compared to conventional (operating) pressures (up to about 16 bar), whereby the water can be heated relatively rapidly to a desired temperature. In order to generate a reliable direct coupling between the top structure and the base structure, the base structure and the top structure are preferably mutually connected by means of at least one soldered connection. The advantage of a soldered connection is that such a connection is relatively strong and durable. A soldered connection is moreover heat-conducting, whereby heat generated by the top structure can be transferred to the base structure relatively rapidly and simply and without much heat loss so as to enable improved, and therefore accelerated, heating of the water for heating. The soldered connection can be formed by one or more soldering points, but can also be formed by a solder layer. In that case the solder layer will generally have a thickness which can vary from several micrometres to several millimetres. The soldered

connection preferably comprises at least one soldered seam. By means of applying one or more soldered seams the base structure and the top structure can on the one hand be mutually attached in reliable manner, and the channel structure can on the other be sealed in substantially medium-tight manner so that leakages of water from the device can be prevented. The soldered seam preferably extends along at least a part of a contact surface formed by the base structure and the top structure. It is even possible here to envisage substantially the whole contact surfaces of the base structure and the top structures being provided with solder for the purpose of forming the soldered connection. The soldered connection is generally formed by a mixture of high-melting metals, such as for instance a nickel-based solder, whereby the soldered connection can be realized in relatively simple manner and is moreover thermally conductive. Although application of a soldered connection will generally be the most practical, application of one or more welded connections, or optionally a glued connection (for instance by applying an epoxy glue), for mutually coupling the base structure and top structure is not precluded. It is also possible here to envisage the heating means being manufactured from plastic. More particularly, the base structure and at least a part of the heating means can herein be manufactured from plastic, wherein the mutual connection can be realized by a welded connection. However, since the temperature of the top structure will generally rise considerably during operation, manufacture of both the top structure and the base structure from metal will usually be recommended.

In a preferred embodiment, at least a part of the channel structure is arranged recessed into an outer surface, in particular a side of the base structure directed toward the top structure. The channel structure can already be prearranged in the base structure during manufacture of the base structure, but can also be arranged in the base structure at a later stage. The base structure is generally formed here by a plastic and/or metal carrier layer, in which one or more non-linear channels are arranged. The channel structure can be arranged as cavity in the base structure. The channel structure will generally be laterally bounded on one or more sides by a dividing wall. The dividing wall is preferably connected to the top structure via the soldered seam, while forming a seal for the channel structure in order to enable optimal sealing of the channel structure and thus prevention of water leakages. In a particular preferred embodiment the base structure comprises a base plate on which the dividing wall is arranged by means of at least one welded connection. The welded connection is generally formed here by a welded seam.

In this manner a medium-tight and relatively pressure-resistant device can be provided, which can already be tested for possible leakages just after assembly, and not only after the base structure and the top structure are finally clamped to each other via a separate (conventional) clamping construction. After assembly of the device the device has a supply opening and a discharge opening for water, and preferably also one or more receiving spaces for receiving one or more (thermal) sensors. In another preferred embodiment, at least a part of the channel structure is arranged recessed into the top structure. Such a preferred embodiment is advantageous in that the contact surface between the top structure and the water for heating can thus be increased, which will generally result in a more intensive and more rapid heating. It is also possible to envisage arranging the channel structure in the base structure as cavity pattern, wherein the top structure is provided with a counter-cavity pattern connecting onto the cavity pattern.

The channel structure preferably comprises a substantially two-dimensional geometry in order to enable a relatively flat embodiment of the heating means, which may be desirable for building the heating means into the device according to the invention. The manufacture of a device provided with a two-dimensional geometry is moreover relatively simple. Although it will generally be less recommended due to the generally relatively costly method of manufacture, it is however also possible to envisage providing the channel structure with a three-dimensional geometry, since a relatively compact device can still be thus manufactured. The channel structure preferably has an at least partly curved, and in particular spiral-shaped design. A spiral-shaped progression of the channel structure is generally relatively advantageous because the contact surface between the water for heating and the top structure (and the base structure) can be maximized, which can significantly improve the heat transfer per unit of time. In the case a channel structure is applied with a substantially spiral-shaped, zigzag-shaped or equivalent progression, the channel structure will be laterally bounded by only a single (identically curved) dividing wall. By attaching this dividing wall to the top structure by means of a soldered connection a substantially medium-tight channel structure, and thereby device, can be obtained, whereby water can be heated in relatively effective and efficient manner.

The top structure preferably has a substantially plate-like form. Plate-like top structures are already known commercially and are generally relatively cheap to manufacture. From a structural viewpoint it is moreover usually advantageous to apply a flat top structure. The top structure is then generally formed by an electric top structure which is preferably provided on a side remote from the channel structure with a track-like thick film for forced conduction of electric current so as to enable generation of a desired heat.

In another preferred embodiment, the channel length of the channel structure lies between 0.3 and 7 metres, in particular between 0.5 and 5 metres, and is more preferably substantially 2 metres. Such a length is generally sufficient to heat water, in particular water, from room temperature to a temperature of more than 90 degrees Celsius. Since the channel structure has a non-linear form, the volume taken up by the channel structure will be relatively limited, which enhances handling of the heating means.

In yet another preferred embodiment, the cross-section of the channel structure has a surface area which lies between 1 and 100 mm^2, in particular between 2 and 50 mm^2. The exact area generally depends on the specific application of the device. The non-linear channel structure preferably has an at least partly angular form. By arranging one or more angles in the channel structure a two-dimensional or optionally three-dimensional flow progression of the water for heating can be realized. The water can thus be guided relatively efficiently along the (relatively compact) top structure to thus be heated to a required temperature. In another preferred embodiment, the channel structure has an at least partly curved form. Water can for instance also be heated to a required temperature in relatively compact and intensive manner by giving the channel structure a substantially spiral form. In a preferred embodiment the base structure comprises a composite strip of a relatively high metal band and a relatively low metal band connected to the relatively high metal band, wherein the strip, wound up in spiral form, does in fact form the channel structure. The thermally conductive metal bands can for instance be formed by strip steel. A channel structure with a cross-section of 2x2 millimetres can for instance be formed by rolling up a composite strip of strip steel with a height of 6 millimetres and a thickness of about 0.6 millimetres, having attached thereto another strip steel with a height of 4 millimetres and a thickness of 2

millimetres. In an alternative embodiment the composite strip can also be given an integrated construction of a higher strip part and an adjacent, lower strip part. Although the metal strip is generally relatively rigid, the wound composite strip nevertheless possesses a certain flexibility since mutually adjacent strip parts of the strip can slide relative to each other. Such a flexible character is particularly advantageous in being able to compensate (considerable) deformations of the top structure, and thereby resulting height differences, during heating of the top structure, wherein the strip can connect permanently to the top structure in reliable and medium-tight manner irrespective of the degree of deformation of the top structure, whereby leakages of water, and gases evaporating therefrom, from the device can be prevented. In order to allow permanent connection of the strip to the top structure and to allow for de facto compensation for deformation of the top structure, the base structure, in particular the strip, is connected to the top structure by means of a soldered connection, whereby the formation of gaps between the top structure and the base structure can thus be prevented.

In yet another preferred embodiment, the base structure is formed by a plurality of separate, mutually connected base modules. The base modules can herein be of very diverse nature and can for instance be formed by partitions held at a mutual distance by spacers, wherein the relative orientation of the base modules determines the channel structure.

Because water can be heated relatively rapidly, intensively and efficiently using the heating means according to the above stated preferred embodiments, the water flow rate through the channel structure can be increased, on the one hand to prevent too intensive a heating of the water and on the other to increase the capacity of the device.

The pump flow rate of the pump, i.e. the number of units of water volume pumped through the pump per unit of time, can preferably be regulated. It can be advantageous to regulate the pump flow rate so as to be able to meet the user requirement in relatively simple manner. If a quantity of water with a desired final temperature is for instance required, the pump flow rate can be adjusted (temporarily) to be able to meet the requirement of the user relatively quickly. In a particular preferred embodiment the heating means are provided with sensor means coupled to the pump to enable the pump

flow rate to be regulated subject to the water temperature in the channel structure. The sensor means are herein preferably positioned before the device to measure the temperature of the relatively cold water. Together with a desired final temperature of the water and the heat-transfer capacity of the top structure, it is thus possible to calculate and apply the most ideal pump flow rate without any delay here occurring in the heating system, this latter in contrast to the situation in which the sensor means would be positioned after the heating means and would be adapted to detect the temperature of the heated water. By adjusting the pump flow rate it is for instance possible to prevent the water becoming overheated in the channel structure. When one or more critical temperatures are exceeded, the pump flow rate can be increased so that overheating can be prevented. In the case the water temperature in the channel structure is relatively low - if the top structure has for instance just been switched on - the pump flow rate can be (temporarily) reduced in order to increase to some extent the length of stay of the water in the channel structure, whereby an improved heating of the water can be achieved. It is noted in this respect that the device can also be connected to a conventional water mains, which water mains in fact functions as a pump. The pump flow rate can also be controlled by applying a tap or other control member. In a particular preferred embodiment the device comprises at least one inlet sensor for detecting the temperature of the water supplied to the heating means, and at least one outlet sensor for detecting the temperature of the water guided out of the heating means, whereby the temperature change of the water in the channel structure can be measured. In combination with measuring the power supplied to the water by the device, it is then possible to determine the volume of the supplied heated water, which may be relevant particularly in the case that a determined volume of water is desired at a determined temperature. One application hereof is for instance the dispensing of (a volume of) for instance a hot drink at a determined temperature. In this manner an optimal quantity of vapour, in particular steam, can also be generated in relatively simple and efficient manner so as to enable blowing of vapour through the pad.

In a preferred embodiment the device is provided with a flow restriction upstream and/or downstream of the holder. Advantages of applying a flow restriction have already been described in the foregoing. The flow restriction can for instance consist of a narrow passage formed in the inlet opening and/or the outlet opening, but can for instance also consist of a semi-permeable material, such as a sintered plate, through

which the water is guided. In a particular preferred embodiment the flow restriction is incorporated for switching on and off in the device. The flow restriction can for instance be formed by a tap which can be partially closed and opened again. In the case the tap is partially closed, a large part of the pressure drop will take place through the tap and to a lesser extent through the pad. This has the advantage that the optionally heated water will not flow through the pad too rapidly, thereby ensuring a good extraction. The partial closing of the tap will generally be desired, particularly in the case of preparing tea. It will be possible to switch off the flow restriction for the purpose of preparing coffee. For the preparation of coffee a flow restriction can optionally be arranged in or close to the outlet opening so as to enable creation of a layer of foam with fine bubbles on the coffee water, and generally to a significantly lesser extent to enable improvement of the extraction of coffee from the pad.

The holder preferably comprises a bottom element and an upright side wall connecting to the bottom element, wherein a number of channel-like grooves extending in radial direction to the outlet opening are arranged in the bottom, wherein the grooves extend from a position located a distance from the side wall and in the direction of the outlet opening. The advantage of the preferred embodiment in which the grooves do not extend as far as the side wall has the result that the quantity of water supplied to the holder flows substantially wholly via the pad to the outlet opening, thereby preventing water flowing directly via the groove to the outlet opening without interposing of the pad, usually referred to as the so-called bypass effect. The bypass effect is particularly found to be negligibly small when it is the case that the shortest distance between each of said grooves on the one hand and the upright side wall on the other is greater than 10% of a maximum diameter of the inner space of the holder. It is preferably the case that the shortest distance between each of said grooves on the one hand and the upright side wall on the other is at least practically equal to 20% of the maximum diameter of the inner space of the holder.

The device preferably comprises at least one supply container for water. The supply container will generally have a (re)fillable form and be filled with water.

In addition, the invention relates to an assembly of a device according to the invention and at least one pad filled with a product for extracting, wherein the pad is

accommodated releasably in the holder. Advantages of applying the device according to the invention, in which a pad is received for preparing a drink, have already been described at length in the foregoing. The applied pad, usually also referred to as pouch, generally comprises an envelope which can for instance be manufactured from filter paper, in which envelope an extractable mixture is received. The envelope is herein permeable to water and substantially non-permeable to the extractable ((coarse) grain) mixture received therein. At least a bottom part of the pad preferably fits substantially closely to a bottom element of the holder. The pad extends to a position close to the upright side wall of the holder. This means that it is generally important that the dimensions of the pad and the holder are adapted to each other. When the pad is for instance given a smaller form, the undesired bypass effect will occur despite the fact that said grooves preferably extend from a position a distance from the side wall and in the direction of the outlet opening.

The invention will be elucidated on the basis of non-limitative exemplary embodiments shown in the following figures. Herein:

figure 1 shows a cross-section of a device for preparing drinks according to the invention,

figure 2 shows a partly cut-away perspective view of a heating unit as applied in the device according to figure 1,

figure 3a shows a cross-section of a second embodiment of a heating unit for use in a device according to figure 1,

figure 3b shows a cross-section of the heating unit along line A-A as indicated in figure 3a,

figure 4 shows a schematic representation of another embodiment of a heating unit for use in a device according to the invention,

figure 5a shows a partly cut-away top view of yet another embodiment of a heating unit for use in a device according to the invention,

figure 5b shows a cross-section of the heating unit along line C-C as indicated in figure 5a,

figure 6 shows a top view of a holder applied in the device according to figure 1, and

figure 7 shows a cross-section of yet another heating unit for use in a device according to the invention.

Figure 1 shows a cross-section of a device 1 for preparing drinks according to the invention. Device 1 comprises for this purpose a holder 2 in which a pad 3 with a product for extraction is received in releasable manner, a pump 4 coupled to holder 2 to enable pumping of water held in a supply container 5 to holder 2, and a heating element 6 positioned between holder 2 and pump 4 for heating the water to be supplied to holder 2. In holder 2 the water will be pressed substantially through pad 3, whereafter the heated water enriched with extract can leave device 1 via an outlet opening 7 and can be collected by for instance a drink container (not shown). A feed conduit 8 coupled to flow through heating element 6 and holder 2 is provided with an adjustable flow restriction 9 for the purpose of being able to control the pressure drop upstream relative to pad 3 so as to be able to optimize the flow through pad 3, and therewith the extraction efficiency of the device 1. Coffee pads or tea pads will generally be applied in the shown device 1 for preparing coffee or tea respectively. It is however also possible to envisage other types of pad also being applied in device 1. Heating element 6 comprises a base structure 10 and a heating top structure 11 connecting thereto in substantially medium-tight manner. The heating top structure 11 is provided with one or more resistive heating tracks (thick film tracks), which is not shown in this figure. Between base structure 10 and top structure 11, and in particular in an upper surface of base structure 10, is arranged a non-linear, in particular zigzag-shaped (see figure 2) two-dimensional channel structure 12 for guiding the water for heating along top structure 11. The water for heating is pumped into channel structure 12 via a supply opening 13 and after being heated leaves channel structure 12 via a discharge opening 14. Top structure 11 and base structure 10 of heating element 6 of device 1 according to figure 1 are mutually connected in firm, durable and substantially medium-tight manner by means of a soldered connection 15. In the shown embodiment the soldered connection is limited to a (peripheral) soldered seam formed between base structure 10 and top structure 11. Owing to the non-linear channel structure 12 the water for heating can be guided at relatively high speed along a relatively large heating surface of the heating top structure 11, whereby the water can be heated in relatively efficient and intensive manner. An advantage hereof is that a heated drink can be prepared relatively quickly. Another significant advantage of device 1 according to figure 1 is that the moisture content in the pad can be reduced relatively rapidly and efficiently after use of the pad, whereafter the partially dried pad can be taken out of device 1 without a user being likely to be burned by the pad which is still moist and hot and/or being soiled or stained

by water in which extracts are dispersed and which trickles out of the pad. In this manner it will moreover be possible to minimize the chance of contaminating the surrounding area when removing pad 3 from holder 2. Reduction of the moisture content in pad 3 can be achieved by pressing steam through the pad for a short period of time (usually several seconds). The steam can be generated relatively efficiently by switching off pump 4 after preparation of the drink and temporarily keeping heating element 6 switched on. (More or less still) water water still located in heating element 6 will then be further heated by heating element 6 until steam is created. During this transformation from water water to steam a significant expansion in volume also takes place, whereby the steam is pressed forcibly through pad 3, this resulting in the advantageous, significant reduction of the moisture content in pad 3. It will be apparent that device 1 can also be applied for preparing cold (non-heated) drinks, by not switching on heating element 6 during preparation of the drink. Immediately after preparation of a cold drink, heating element 6 can be switched on in order to generate steam for the purpose of blowing vapour through the used pad 3. Although it will generally be less recommended, it is also possible to envisage heating element 6 also being adapted as a cooling element to enable cooling of water to be supplied to holder 4, whereby cooled drinks can also be prepared. However, immediately after preparation of the cooled drink, cooling element 6 will then have to be heated instantaneously in order to enable generation of the steam for blowing through pad 3. In such an embodiment variant use will therefore usually be made of a separate cooling element.

Figure 2 shows a partly cut-away perspective view of a heating element 6 as applied in device 1 according to figure 1. As shown clearly in figure 2, a zigzag-shaped channel structure 12 is arranged in base structure 10, which channel structure 12 connects to both supply opening 13 and discharge opening 14 of heating element 6. Top structure 11 has a plate-like form and is positioned on top of base structure 10, wherein top structure 11 and base structure 10 are mutually connected by means of a soldered connection 15. In the shown embodiment the soldered connection 15 is limited to a (peripheral) soldered seam formed between base structure 10 and top structure 11. In the present exemplary embodiment the top structure 11 is formed by an electrical top structure 11 which is preferably provided on a side remote from channel structure 12 with a track-like thick film for forced conduction of electric current in order to enable generation of the desired heat.

Figure 3a shows a cross-section of an alternative embodiment of a heating element 16 for use in a device according to figure 1. This cross-section represents a view along the line B-B as shown in figure 3b. Heating element 16 comprises a base structure 17 and a heating top structure connecting to base structure 17 (see figure 3b). The heating top structure is provided with one or more resistive heating tracks (not shown). Base structure 17 herein forms a spiral-shaped channel 18 for water for heating which is open on one side. Base structure 17 comprises for this purpose a base plate 19 on which a spirally oriented, upright dividing wall 20 is provided. Dividing wall 20 is herein adapted to bound channel 18 laterally. Both base plate 19 and dividing wall 20 are preferably manufactured from metal, in particular stainless steel. Dividing wall 20 is preferably connected to base plate 19 in substantially medium-tight manner by means of a soldered connection, in particular a soldered seam 25 (see figure 3b). In the shown exemplary embodiment channel 18 is sealed in medium-tight manner by the adjacent top structure. In order to have dividing wall 20 connect to the top structure in firm, reliable and medium-tight manner the top structure is preferably connected permanently to dividing wall 20 by means of a soldered seam 26. A peripheral seam of heating element 16 can herein be (additionally) sealed by means of a soldered connection or welded connection so as to enable improved medium-tightness of heating element 16. Channel 18 is provided with a supply 21 for water for heating and a discharge 22 for water heated by heating element 16. In order to enable relatively efficient connection of the top structure to base structure 17 by means of a soldered connection a solder stick 23 is preferably arranged to enable mutual alignment and mutual fixing of the top structure and the base structure 17.

Figure 3b shows a cross-section of heating element 16 along the line A-A as shown in figure 3a. Water can be introduced into heating element 16 via supply 21 and leaves the device via discharge 22 after passing through spiral channel 18. While running through channel 18 the water is heated directly, i.e. without interposing any other element, by the plate-like top structure 24 bounding channel 18. Since the channel section 18 is quite small (generally between 2 and 50 mm^2), the volume of heating element 16 is also relatively small. However, due to the efficient and intensive heat transfer from top structure 24 to the water, the water will be able to reach a desired temperature relatively quickly. In order to prevent overheating, in particular boiling, of the water during

preparation of the drink and to increase the capacity of heating element 16, the water will generally be pumped through heating element 16 at an increased pressure of between about 0.2 and 16 bar and at speeds preferably between 1 and 3 m/s. In the case the water is no longer being pumped through heating element 16, the water will begin to boil relatively quickly and will thus be converted into steam to enable blowing of vapour through a pad (see figure 1). Solder stick 23 is also connected to base plate 19 by a welded connection 27 or soldered connection. Top structure 24 is connected to base plate 19 by means of a peripheral welded seam or soldered seam 28 in order to make heating element 16 medium-tight and pressure-resistant. As it runs through channel 18 the water will preferably cover a channel length of 0.5, 1, 2, 4, 5 or 6 metres. Since the rate of flow of the water through channel 18 will usually be constant, the dimensioning of channel 18, in particular the length and the cross-section, determines the actual water flow rate, whereby heating element 16, and in particular the final temperature of the water for heating, can be modified relatively easily to the specific application for which heating element 16 is used. By modifying the dimensioning and geometry of channel 18 the rate of flow of the water can therefore be controlled, and therewith the amount of energy to be transferred to a unit of water volume. Furthermore, heat can be transferred in relatively efficient and effective manner using heating element 16 because the assembly of base structure 19 and top structure 24 forms a thermally coupled and highly conductive whole. In order to be able to facilitate connection of heating element 16 to a supply conduit and discharge conduit, supply 21 and discharge 22 are each provided with a coupling structure 29, 30. Each coupling structure 29, 30 can herein be fixed to base plate 19 of base structure 17 by means of a welded connection or soldered connection. As shown in figure 3b, top structure 24 comprises a conductive plate 31, on a side of which remote from dividing wall 20 is arranged a thick film 32 (track-like electrical resistance) for generating heat.

Figure 4 shows a schematic representation of another embodiment of an assembly 33 for use in a device according to the invention. Assembly 33 herein comprises a pump 34 and a non-linear, heatable channel structure 35 connected to pump 34. Channel structure 35 is herein formed by a single channel which takes both a curved and angular form. Channel structure 35 herein connects to a thick film element (not shown) for heating water flowing through channel structure 35. For this purpose relatively cold water is first guided via a conduit 36 to pump 34, whereafter the relatively cold water is guided

under pressure in the direction of channel structure 35 via another conduit 37. The water is heated to a desired temperature in channel structure 35. The heated water can be guided out of assembly 33 via a discharge conduit 38 and pressed through a pad received in a holder (not shown), whereby a hot drink can be prepared. Assembly 33 is also provided with a temperature sensor 40 which is coupled to pump 34 via a line 39 and which is positioned in or close to discharge conduit 38 of channel structure 35. If sensor 40 detects that the water temperature exceeds a critical limit, sensor 40 will increase the pump flow rate of pump 34 via a control unit (not shown) coupled to the sensor such that the (over)heated water will be flushed out of assembly 33 relatively quickly and/or the power of the thick film element will be adjusted, whereby further overheating can be prevented. Adjusting the power of the thick film element can be realized here by applying a plurality of individually activated heating tracks (not shown). A similar (reverse) situation can occur when the water is heated insufficiently, whereupon the pump flow rate can be (temporarily) reduced. Assembly 33 is preferably also provided with an inlet sensor (not shown) whereby the temperature change of the water in channel structure 35 can be measured. In combination with measuring the power supplied to the water by assembly 33, it is then possible to determine the volume of the heated water, which may be relevant particularly in the case that (a volume of) a hot drink is being dispensed.

Figure 5a shows a partly cut-away top view of yet another embodiment of a heating element for use in a device according to the invention. Heating element 41 comprises a support structure 42, which support structure 42 is provided on a top side with a plurality of recessed, non-linear channels 43 in parallel orientation, which channels 43 are mutually coupled on either side of support structure 42 by means of a collector 44. Channels 42 are adapted for throughflow of water and are provided with an inlet 45 and an outlet 46 for water. Another, flat part of the top side of support structure 42 is adapted to function as soldering surface 47 allowing the arrangement of a plate-like top structure 48 on the support structure so as to thus enable channels 43 to be covered in medium-tight manner. A (flat part of the) underside of top structure 48 also functions here as soldering surface. Support structure 42 can be permanently connected to top structure 48 by applying solder paste to at least one of the soldering surfaces and then heating the soldering surfaces.

Figure 5b shows a cross-section of the heating element along the line C-C as indicated in figure 5a. Figure 5b shows that a side of top structure 48 directed toward support structure 42 is also provided with (three) non-linear, identical (zigzag-shaped) channels 49. Channels 43 of support structure 42 herein connect over substantially the entire length to channels 49 of top structure 48. In this manner the channel volume of heating element 41 can still be increased to some extent, wherein the heat transfer capacity of heating element 41 is at least maintained. This figure further shows clearly that the sides directed toward each other of support structure 42 and top structure 48, i.e. the contact surface of the two components 42, 48, is provided with solder 50 to enable mutual connection of components 42, 48.

Figure 6 shows a top view of holder 2 applied in the device according to figure 1. Holder 2 is cup-shaped and comprises a bottom element 51 and an upright side wall 52 connecting to bottom element 51. Bottom element 51 is provided with outlet opening 7 for passage of the water enriched with the extract. A plurality of radially extending grooves 53 is arranged in bottom element 51, these grooves 53 extending from a position a distance from the side wall in the direction of outlet opening 7. The advantage hereof is that water supplied to holder 2 is generally pressed substantially not around but through a pad (not shown) received in holder 2, which considerably enhances the extraction efficiency of holder 2, and thereby of device 1. Grooves 53 each have a bottom sloping downward in the direction of outlet opening 7. The grooves enclose a mutual angle $\forall$ of 30°.

Figure 7 shows a cross-section of yet another heating element 54 for use in a device according to the invention. Heating element 54 comprises a first top structure 62, a second top structure 63 and a base structure 64 co-acting with the two top structures 62, 63. Base structure 64 comprises a spiral-shaped dividing wall 59, between which a spiral-shaped channel is formed. The spiral-shaped channel is herein bounded on one side by first top structure 62. Base structure 64 and second top structure 63 mutually enclose a steam chamber 58 for the purpose of (optionally) being able to generate steam. The base structure has a central inlet opening 55 for water for heating, and a first outlet opening 56 for water heated in the spiral-shaped channel and a second outlet opening 57 for steam formed in steam chamber 58. The heated water exiting via first outlet opening 56 can be heated by first top structure 62 and in addition optionally also

by second top structure 63. Top structures 62, 63 can be switched on and off individually. In the case that formation of steam is desired, the steam formed using second top structure 63 can then be guided to a steam collection space 60 via a membrane 61. The steam can then be discharged via second outlet opening 57. During or immediately before the formation of steam a pump (not shown) for supplying water for heating to heating element 54 will be switched off, whereby the steam can be generated in relatively efficient manner. Since the spiral-shaped channel will generally then be filled with water, the formed steam will be forcibly transported through membrane 61 and subsequently discharged to enable drying of a pad.

It will be apparent that the invention is not limited to the exemplary embodiments shown and described here, but that numerous variants, which will be self-evident to the skilled person in this field, are possible within the scope of the appended claims.

Claims

1. Method for preparing drinks such as coffee, tea or soup by means of extraction, comprising the steps of:

A) leading water along or through at least one heating element,

B) pressing the water through a pad received in a holder and filled with a product for extracting for the purpose of preparing the drink,

C) generating steam by evaporation of water being in contact with said heating element, and

D) pressing the steam through the pad after the heated water has been pressed through the pad.

2. Method according to claim 1, characterized in that the heating element is a flow through heating element, in particular a flow through thick film heating element, said flow through heating element is provided with at least one inlet for water to be heated and at least one outlet for heated water and/or steam.

3. Method according to claim 2, characterized in that before step C) the inlet of heating element is closed.

4. Method according to claim 2 or 3, characterized in that the method further comprises step E) comprising at least partially refilling the heating element after the generation of steam according to step C).

5. Method as claimed in any of the foregoing claims, characterized in that the heating element is switched off after a determined period of time during step C).

6. Method as claimed in claim 5, characterized in that the period of time lies between 1 and 10 seconds.

7. Method as claimed in any of the foregoing claims, characterized in that the heated water is pressed through the pad during step B) using a pump.

8. Method as claimed in claim 7, characterized in that the heating element is positioned between the pump and the holder for the pad, and that the pump is switched off after performing of step B) and before step C) is performed.

9. Method as claimed in any of the foregoing claims, characterized in that the pressure drop of the water pressed through the holder is greater upstream and/or downstream of the pad than the pressure drop over the pad itself.

10. Device for preparing a drink, in particular coffee or tea, by applying the method as claimed in any of the claims 1-9, comprising:

- - at least one holder for receiving at least one pad filled with a product for extracting, which holder is provided with at least one inlet opening and at least one outlet opening for passage water, at least one flow through heating element adapted both for heating water to prepare the drink and for generating steam,
- at least one pump coupled to the heating element and the holder for pressing the heated water under pressure through a pad received in the holder to prepare the drink,

wherein the device is adapted to press steam generated by the heating element through the pad received in the holder.

11. Device as claimed in claim 10, characterized in that the device comprises a control unit for activating the pump for pressing the heated water under pressure through the pad.

12. Device as claimed in claim 10 or 11, characterized in the control unit is adapted for deactivating the pump for generating steam within the heating element.

13. Device as claimed in claims 11 and 12, characterized in that the heating element is formed by a thick-film heating element.

14. Device as claimed in one claims 12-14, characterized in that the heating element comprises a base structure and at least one top structure connecting to the base structure, said top element being provided with at least one resistive heating track, wherein at least one non-linear channel structure is arranged between the base structure and the top

structure for throughflow of water for heating, and wherein the base structure and the top structure are mechanically connected to each other.

15. Device as claimed in claim 14, characterized in that the base structure and the top element are mutually connected by means of at least one soldered connection.

16. Device as claimed in claim 15, characterized in that the soldered connection is formed by at least one soldered seam.

17. Device as claimed in claim 16, characterized in that the soldered seam extends along at least a part of a contact surface formed by the base structure and the top element.

18. Device as claimed in claim 16 or 17, characterized in that the channel structure is bounded by at least one dividing wall, the dividing wall being connected to the top structure via the soldered seam, while forming a seal for the channel structure.

19. Device as claimed in claim 18, characterized in that the base structure comprises a base plate on which the dividing wall is arranged by means of at least one welded connection.

20. Device as claimed in any of the claims 14-19, characterized in that at least a part of the channel structure is arranged recessed into a side of the base structure.

21. Device as claimed in any of the claims 14-20, characterized in that at least a part of the channel structure is arranged recessed into the top structure.

22. Device as claimed in any of the claims 14-21, characterized in that the channel structure has a substantially two-dimensional geometry.

23. Device as claimed in any of the claims 14-22, characterized in that the channel structure has an at least partly curved design.

24. Device as claimed in claim 23, characterized in that the channel structure has a substantially spiral-shaped design.

25. Device as claimed in any of the claims 14-24, characterized in that the top structure has a substantially plate-like form.

26. Device as claimed in any of the claims 14-25, characterized in that the channel length of the channel structure lies between 0.3 and 7 metres, in particular between 0.5 and 5 metres.

27. Device as claimed in any of the claims 14-26, characterized in that the cross-section of the channel structure has a surface area which lies between 1 and 100 mm^2, in particular between 2 and 50 mm^2.

28. Device as claimed in any of the claims 14-27, characterized in that the channel structure has an at least partly angular form.

29. Device as claimed in any of the claims 14-28, characterized in that the base structure is formed by a plurality of separate, mutually connected base modules.

30. Device as claimed in any of the claims 10-29, characterized in that the pump flow rate of the pump can be regulated.

31. Device as claimed in any of the claims 14-30, characterized in that the heating means are provided with sensor means coupled to the pump to enable the pump flow rate to be regulated subject to the water temperature in the channel structure.

32. Device as claimed in claim 31, characterized in that the device comprises at least one inlet sensor for detecting the temperature of the water supplied to the device, and that the device comprises at least one outlet sensor for detecting the temperature of the water guided out of the device.

33. Device as claimed in any of the claims 10-32, characterized in that the device is provided with a flow restriction upstream and/or downstream of the holder.

34. Device as claimed in claim 33, characterized in that the flow restriction is incorporated for switching on and off in the device.

35. Device as claimed in any of the claims 10-34, characterized in that the holder comprises a bottom element and an upright side wall connecting to the bottom element, wherein a number of channel-like grooves extending in radial direction to the outlet opening are arranged in the bottom, wherein the grooves extend from a position located a distance from the side wall and in the direction of the outlet opening.

36. Device as claimed in any of the claims 10-35, characterized in that the device comprises at least one supply container for water.

37. Device as claimed in any of claims 10-36, characterized in that the device comprises a pressure relief valve to prevent an overpressure within the device.

38. Assembly of a device as claimed in any of the claims 10-37, and at least one pad filled with a product for extracting, wherein the pad is accommodated releasably in the holder.

39. Assembly as claimed in claim 38, characterized in that at least a bottom part of the pad fits substantially closely to a bottom element of the holder.

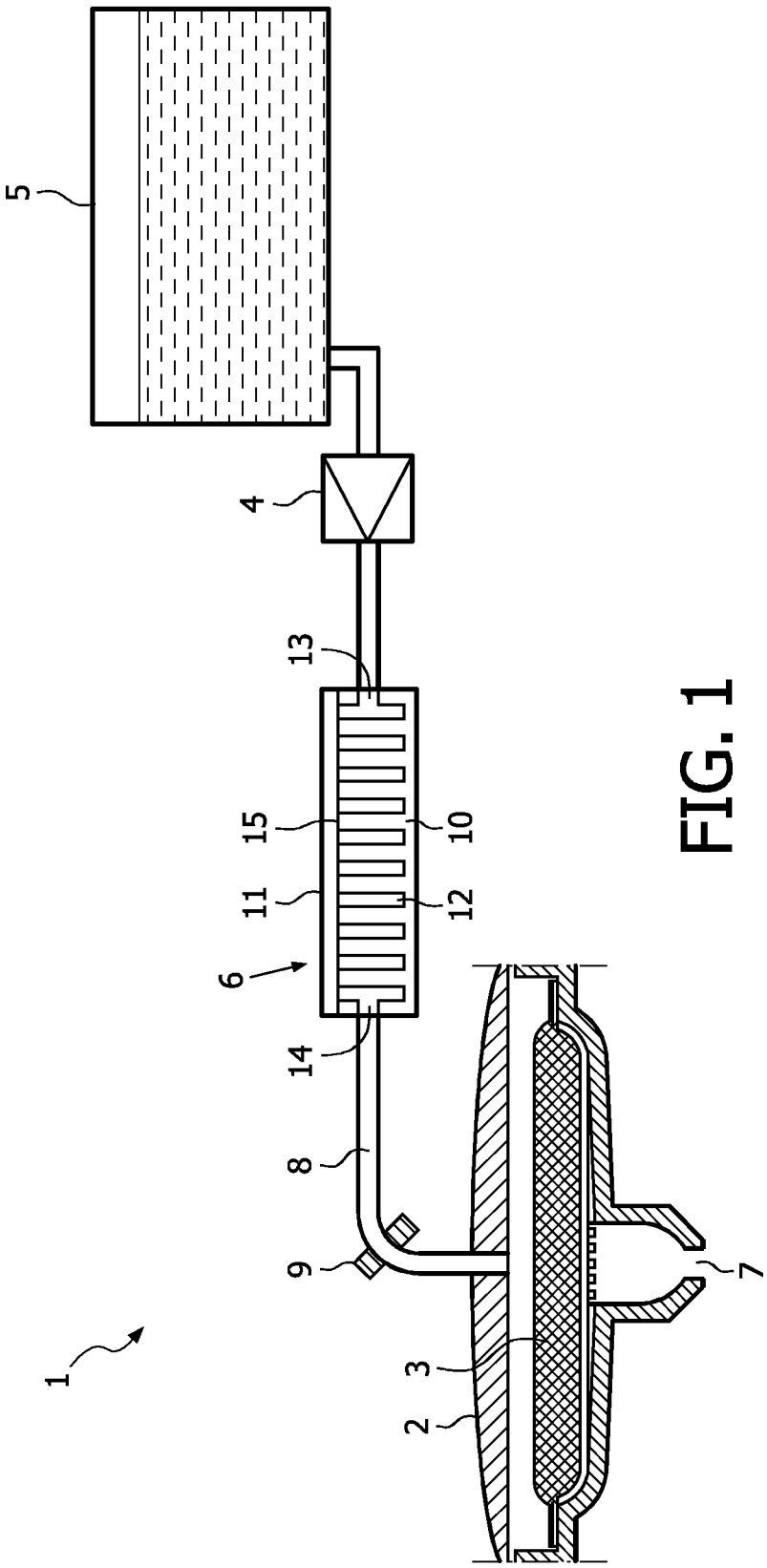


FIG. 1

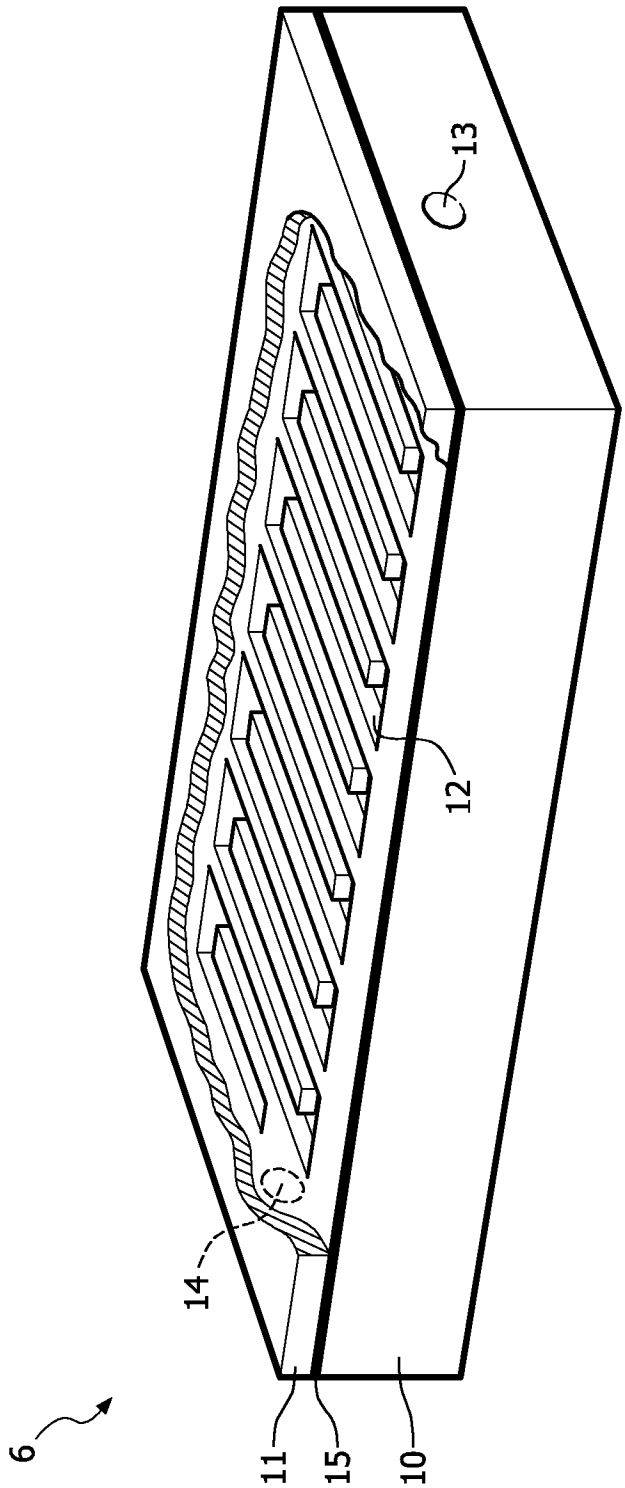
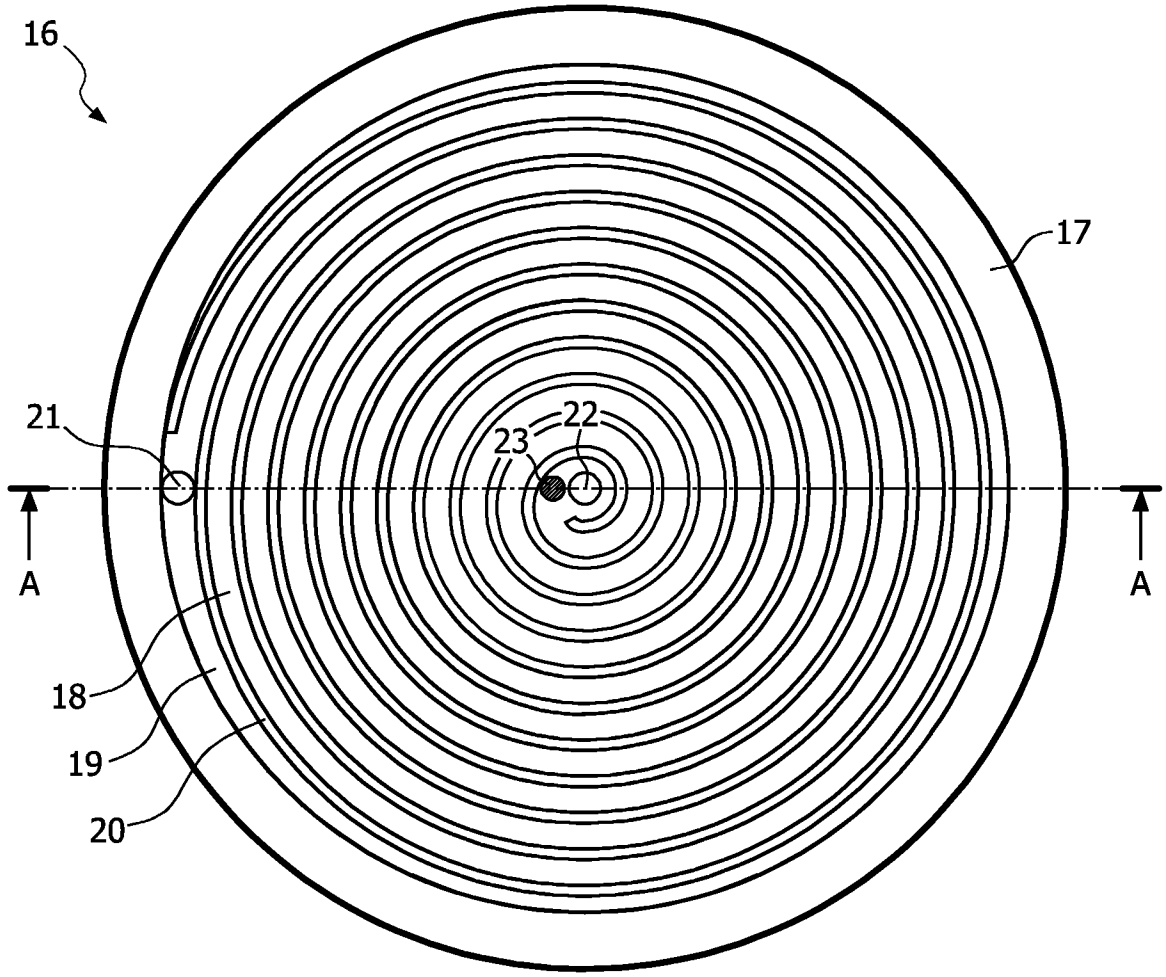


FIG. 2



B-B

FIG. 3a

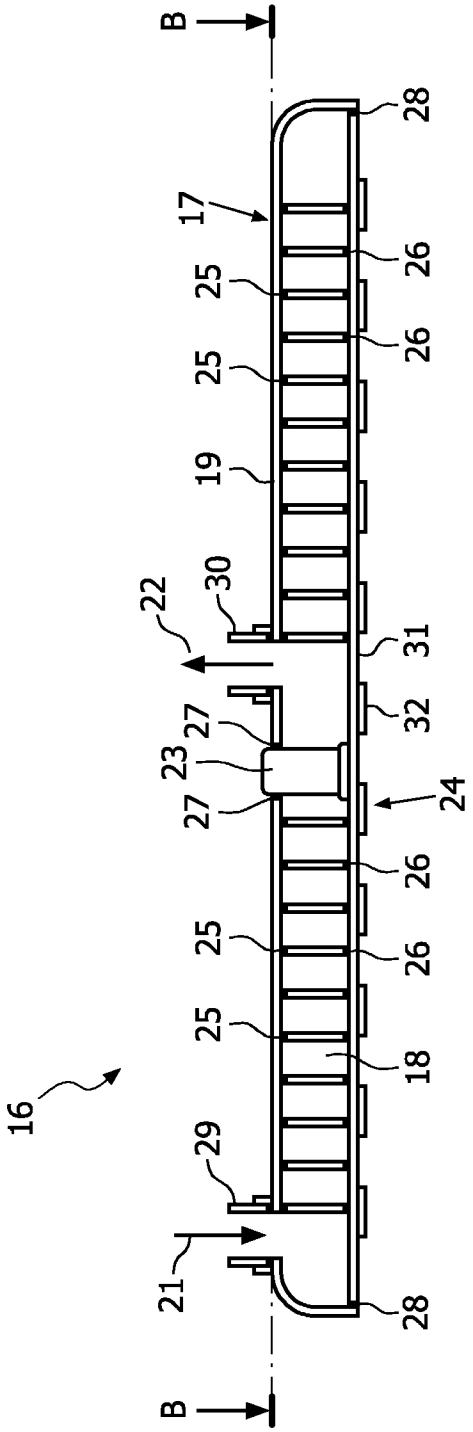

B
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B
A-A

FIG. 3b

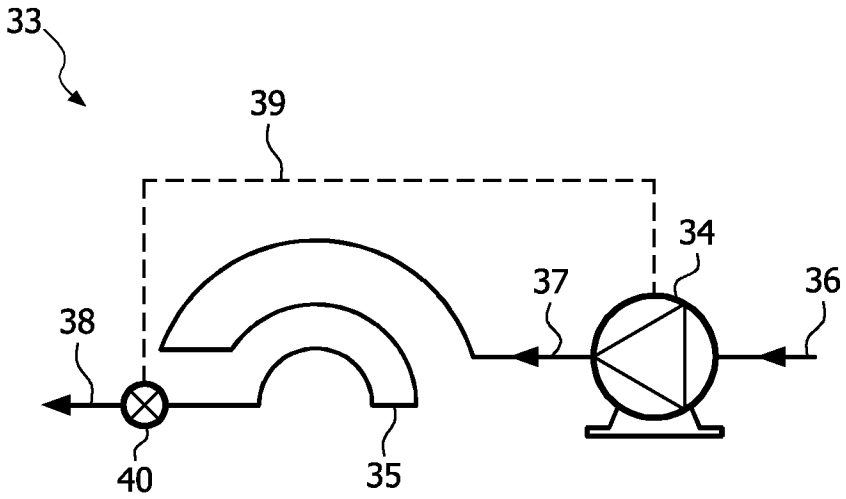


FIG. 4

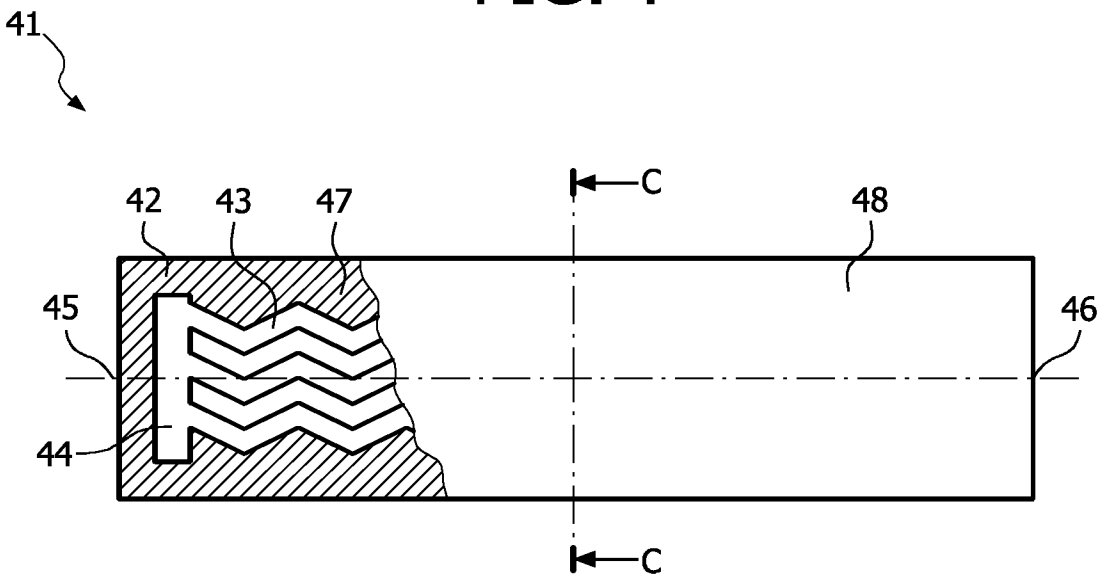
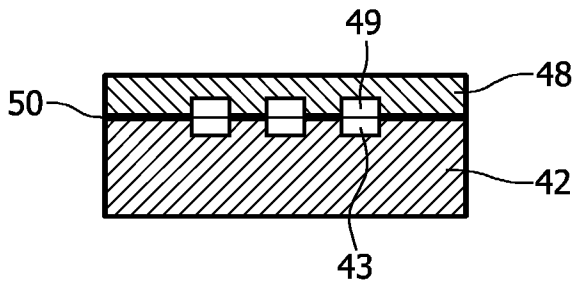


FIG. 5a



C-C

FIG. 5b

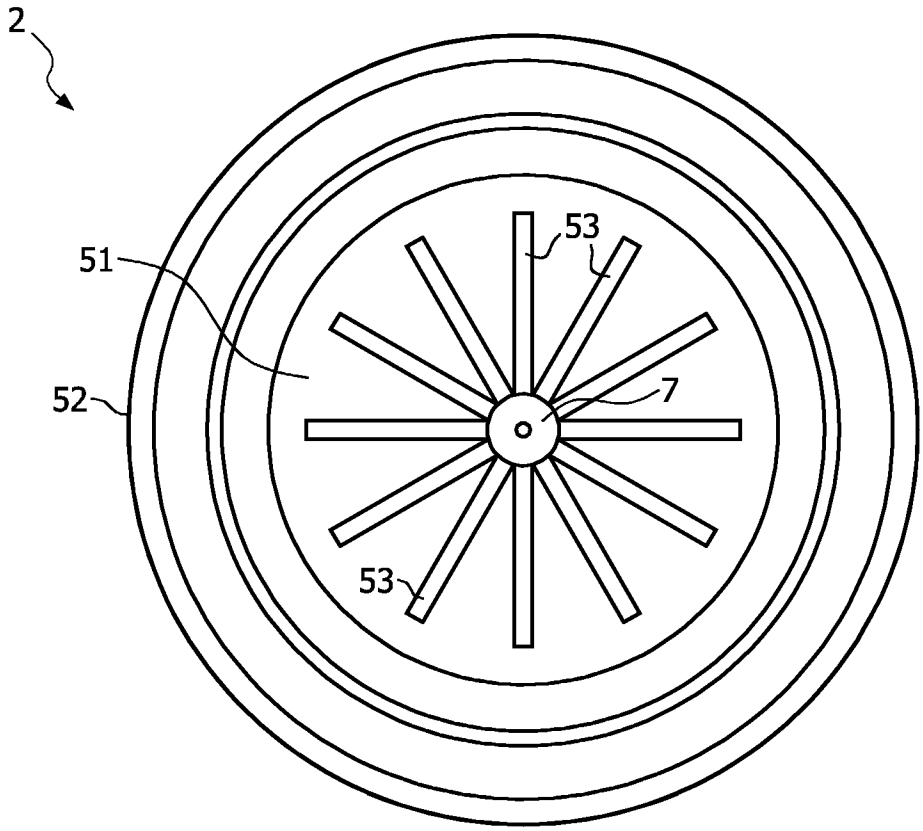


FIG. 6

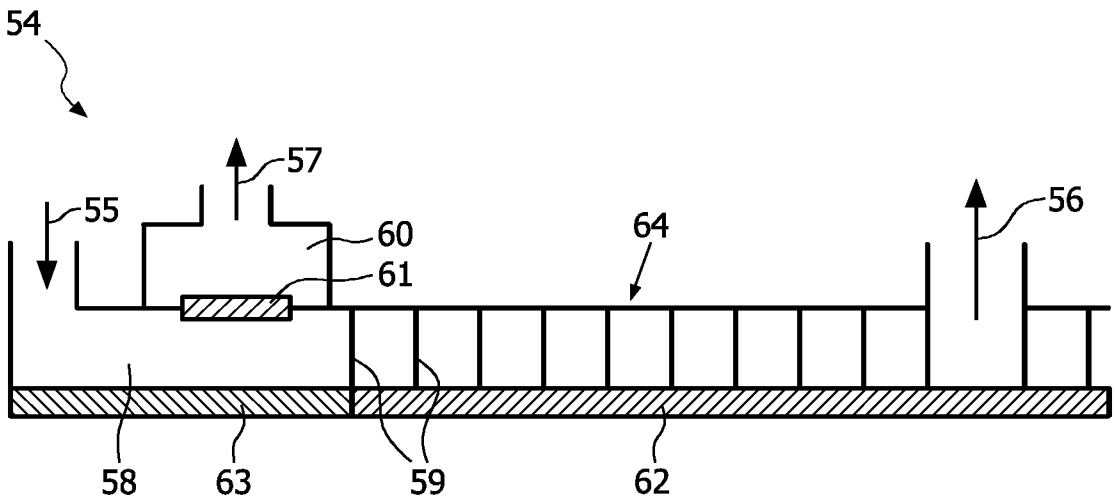


FIG. 7

INTERNATIONAL SEARCH REPORT

International application No
PCT/NL2008/050187

A. CLASSIFICATION OF SUBJECT MATTER
INV. A47J31/54

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A47J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 074 207 A (CIMBALI SPA [IT] GRUPPO CIMBALI S P A [IT]) 7 February 2001 (2001-02-07) column 1, paragraph 2 - paragraph 4	1-11,13, 33-39
Y	column 1, paragraph 7 column 4, paragraph 27 figures 1A,1B figures 2A,2B	14-32
Y	NL 1 029 792 C2 (FERRO TECHNIEK HOLDING B V [NL]) 27 February 2007 (2007-02-27)	14-32
A	the whole document	1,10,38

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
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