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- **Frank, Marcus**
75056 Sulzfeld (DE)
- **Lehner, Marius**
75417 Mühlacker (DE)
- **Lange, Dominik**
76149 Karlsruhe (DE)

(71) Applicant: **ARPA SASU**
67350 Niedermodern (FR)

(74) Representative: **Patentanwälte**
Ruff, Wilhelm, Beier, Dauster & Partner mbB
Kronenstraße 30
70174 Stuttgart (DE)

(72) Inventors:
• **Jellimann, Jérémy**
67350 Niedermodern (FR)

(54) **COOKTOP AND METHOD FOR OPERATING A COOKTOP**

(57) A cooktop has a cooktop plate, heating devices under the plate and a suction opening on or in the plate, a fan and an air filter. An air duct is provided under the suction opening and leads to the air filter and to the fan. A grid-like cover is provided for the suction opening, wherein a support device for the cover is arranged under the suction opening. A weight detection device comprises at least two weighing sensors supporting the cover for weight load detection. A cooktop control is connected to

the weight detection device and to the fan, both for evaluating their functional state. The cooktop control is designed to detect and include the functional state of the fan in the evaluation of the weighing sensors and, depending on the functional state of the fan, to correct a result of an evaluation of the weighing sensors for detecting a weight load on the cover in such a way that an error in the detection of the weight load which increases with increasing power of the fan can be or is corrected.

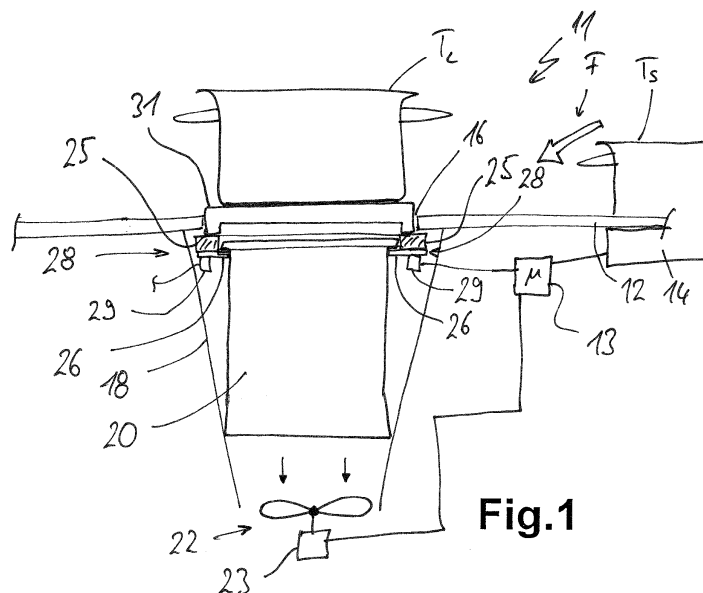


Fig.1

Description

Field of application and prior art

[0001] The invention is directed to a cooktop, wherein the cooktop has a weighing function realized with weighing sensors. Furthermore, the invention is directed to a method for operating such a cooktop.

[0002] It is known from WO 2019/138312 A1 to provide a cooktop with a weighing function by the provision of weighing sensors, wherein the weighing sensors are provided on a kind of grille covering a suction opening for an internal fume suction in the cooktop. Any object that is to be weighed can be put on this grille, and either a weighing function starts automatically or is initiated by an operator. The grille is placed on four weighing sensors for holding the grille evenly and in stable manner as well as for exactly measuring the weight of the object placed thereupon.

[0003] It is also known in the art, for example from DE 102012216935 A1, to place the whole cooktop onto weighing sensors on a kind of frame, which frame is mounted in a respective cutout in a working table in the kitchen. This allows for measurement of weight on the whole cooktop, but accordingly only of the whole cooktop and not just in a small and defined area.

Object and solution

[0004] It is an object of the invention to provide a cooktop with a practical and technically reliable weighing function which can be handled with comfort in many different situations and, in particular, needs only a limited number of additional components. Furthermore, a method is to be provided which allows for an efficient use of such a cooktop.

[0005] This object is solved by a cooktop having the features of claim 1 and by a method having the features of claim 27. Advantageous and preferred embodiments of the invention are the subject-matter of the further claims and will be explained in more detail below. In so doing, some of the features will be explained only for the cooktop or only for the method. However, independent of this, they are intended to be able to be applied both to the cooktop and also to the method on their own and independently of one another. The wording of the claims is incorporated in the description by express reference.

[0006] The cooktop has a cooktop plate, heating devices on or under the cooktop plate, a suction opening on or in the cooktop plate, a fan and at least one air filter. An air duct is provided under the suction opening, which leads to the air filter and to the fan, or in which the air filter and the fan are arranged. A cover is provided for the suction opening, the cover having holes and preferably being designed as a grid or a grille. The cover can be placed in on-fixed manner over the suction opening. A support device for the cover is provided, which support device arranged on or under the suction opening, pref-

erably pointing somewhat inside the opening. The cooktop has a weight detection device comprising the support device and at least one weighing sensor or at least two weighing sensors. The weighing sensors are supporting the cover in such a way that a weight load of the cover and any object being placed upon it can be detected at the weighing sensors. The cooktop has a cooktop control, the weight detection device being connected to the cooktop control for evaluating the weighing sensors. Also, the fan is connected to the cooktop control for evaluating its functional state. The cooktop control is designed to detect and include the functional state of the fan in the evaluation of the weighing sensors and, depending on the functional state of the fan, to correct a result of an evaluation of the weighing sensors for detecting a weight load on the cover in such a way that an error in the detection of the weight load can be or is corrected. Such an error in the detection of the weight load increases with increasing power of the fan due to a suction force being effective onto the cover alone, and in particular together with any large object being placed upon the cover. This allows for higher accuracy in the weight measurement, and can help to exclude any potential mistakes. In some cases, as will be explained later, a taring of the weight detection device and the control can help to establish a defined state. And then, if this state is not changed, for example by a varying power and speed of the fan, the weight measurement is much more exact.

[0007] In an embodiment of the invention, the cooktop may have a collecting container for liquid that has entered through the suction opening. Such a collecting container can preferably be provided on the air duct and/or on the support device and/or on the air filter. It is preferred to provide such a collecting container on the air filter. The collecting container can also be connected to the weight detection device and the weighing sensors in such a way that these detect a change in the weight load on the collecting container, so spilled liquid can be detected by its weight. Furthermore, the collecting container should be removable out of the air duct to allow for emptying and cleaning. The cooktop control can be designed in such a way that under the condition that no weight load has been detected on the cover before, in a case of an increase in the weight load by 1 g to 500 g within a time period of 2 seconds to 10 seconds, this is determined as an entry of liquid through the suction opening into the collecting container. After this, a signal is preferably generated and output to an operator for emptying or cleaning the collecting container.

[0008] In a preferred embodiment of the invention, the cover can be designed as a grid, preferably as a perforated grid or as a slotted grid in the kind of a grille. This allows for a good flow of air and cooking fumes into the suction opening while at the same time covering the opening against any objects incidentally falling in. Furthermore, any objects to be weighed such as pots, plates, bowls and the like can be easily put onto the cover and be safely placed there.

[0009] Preferably the support device is formed in the shape of a frame around the suction opening or circumferentially at the suction opening. A central opening in this frame can be somewhat smaller than the suction opening itself, for example to place the cover onto, but still be large enough. The outer contour of the support device can be larger than the suction opening. A width of the support device can be between 1 cm and 3 cm or 4 cm. The support device can be fixed to the underside of the cooktop plate, for example by gluing. The weighing sensors are in particular arranged to or in the support device and have a pressure region for a weight load, the pressure region being accessible or exposed from above. Preferably, the weight of the cover and any objects placed upon it acts upon these pressure regions of the weighing sensors. This serves for an exact weight measurement.

[0010] In one embodiment, separate support parts are arranged between the weighing sensors or their pressure regions, respectively, and the cover. The cover will then rest only on the support parts or be supported only on these support parts. A weight load is then passed on by the cover via the support parts to the weighing sensors or their pressure regions, respectively. The support parts are preferably movable in the vertical direction corresponding to a measuring path of the weighing sensors. Even more preferably, the support parts are fixed to the weighing sensors either directly or indirectly for an exact arrangement. They can be single parts that are to be mounted to the support device, either by screws or the like or simply by inserting into respective reception openings.

[0011] In a further embodiment, the air filter is fastened to the support device and in this case is arranged essentially below the suction opening. Preferably, the air filter is fastened to the support device independently of the weighing sensors or is supported in such a way on the weighing sensors. This can be in particular on the support parts in addition to the cover resting on these support parts mentioned before. The weighing sensors can then detect a change in a weight load due to a change to the state of the air filter, for example by more contamination collected in the air filter. The air filter can preferably be designed as a grease filter, which kind of filter has the known problem that it is used and is polluted heavily by cooking fumes. In particular, any small grease particles in these cooking fumes are filtered out by the grease filter and collected therein. This means that the weight of the grease filter is increased. After some time, the grease filter is saturated and should be changed or cleaned, which is possible for an operator, for example by cleaning in a dishwasher. In this way, a kind of automatic filter saturation function is achieved by use of the weight detection device.

[0012] In another embodiment, the suction opening can be arranged laterally next to the cooktop plate and adjoining the latter, so the suction opening is next to or directly adjoining the cooktop plate. The cooktop may preferably have two cooktop plates which are formed and

arranged separately from one another with a free space between them, and the suction opening is arranged between them.

[0013] In a further embodiment, the cooktop control can be designed in such a way that, in a first case in which, irrespective of the functional state of the fan, the weight detection device detects no weight load or detects a weight load with less than 50% of the weight load by the cover alone, this first case is defined as a missing cover or the cover not being present. Preferably, a corresponding signal to an operator is generated and/or the fan is stopped from starting. For this, the weight load by the cover alone can preferably be stored in the cooktop control for this function.

[0014] In a further embodiment with the fan switched off, the cooktop control can be designed in such a way that, in a second case in which the weight detection device detects only the weight load by the cover alone, this is defined as a cover being present without any further weight load on it. A deviation may have a maximum of $\pm 20\text{g}$, and the weight load of the cover alone should be stored in the cooktop control. The cooktop control may then preferably start a taring of the weight detection device and, in particular after taring, can display a weight of zero or "0 g" on a weight display of a user interface for an operator.

[0015] In a further embodiment with the fan switched off, the cooktop control is designed in such a way that, in a third case in which the weight detection device detects a higher weight load than only by the cover alone, this is defined as a third case as a cover being present with a further weight load object to be weighed thereon. The cooktop control may then preferably display the weight of the weight load on a weight display mentioned before for an operator. In particular the weight detection device has been previously tared as described before for an exact weight measurement. Preferably, it can be provided that, when the cooktop or the weight detection device is switched on without taring and a weight load of more than 20% above the known weight load by the cover alone has been detected, this sub-case is defined as the presence of an additional weight load on the cover. A corresponding signal is then generated as an error message to an operator because the taring may then be based on a wrong weight detection. An operator can override this error message if the additional weight comes from a plate or a bowl that the operator has placed upon the cover intentionally for weighing any objects therein. Then, after overriding this error message, the taring function can take place and the cover together with the additional weight is tared to zero. Subsequently, any objects can be placed in the plate or bowl and then their weight is measured and displayed.

[0016] In a further embodiment the cooktop control may be designed, in a fourth case with the fan being switched on at a known or detectable rotational speed, to cause the weight detection device to detect a higher weight load than would be detected by the cover alone

with the fan switched off. This additional weight comes from the suction force of the fan onto the cover. It may be in the range of 10 g to 300 g, depending on the rotational speed of the fan. A difference between the detected higher weight load and the weight load by the cover alone can be assigned to a correction value matching the known or detectable rotational speed of the fan. This may be used to define that no object is placed on the cover as an additional weight load. The additional weight can then be assigned to the fan if the measurement of the additional weight is exactly at the same time as the fan has been started, preferably within 1 to 3 seconds. Preferably, the rotational speed of the fan can thereupon be kept constant, and the cooktop control may tare the weight detection device. After taring, a weight zero or "0 g" is displayed on a weight display for an operator.

[0017] Preferably, the cooktop control may detect a change in the rotational speed of the fan during the detection of the weight load and thereupon stop the detection. A signal may be output to an operator indicating that taring must be repeated before an object to be weighed can be placed on the cover. A signal may also be output indicating that an object to be weighed, which has been placed on the cover, must be removed until the cooktop control has tared the weight detection device.

[0018] In a further embodiment the cooktop control can be designed to tare and to adjust the rotational speed of the fan in a fifth case in which the fan is switched on at a relatively low rotational speed. This relatively low rotational speed may in particular be less than 50% of the maximum rotational speed. A container for an object to be weighed is then placed on the cover and the weight detection device detects a higher weight load than according to the fourth case mentioned before. Then a taring takes place, and the rotational speed of the fan is not changed. Preferably, the rotational speed is left unchanged at least as long as a taring function and a subsequent weighing function are performed. It can be provided that following the taring according to the fifth case described before, the fan remains switched on at a relatively low rotational speed in a sixth case, and a weight load greater than zero on the cover is detected.

[0019] The weight of this weight load is then displayed on a weight display for an operator, in particular in "g". Preferably, the speed of the fan is kept constant.

[0020] In a further embodiment, in a seventh case, in which the fan is switched on at a relatively high rotational speed, and a weight load higher than only the weight load of the cover alone is detected, the cooktop control is designed to reduce the rotational speed of the fan to a relatively low rotational speed. Then the cooktop control will start taring, so that subsequently, with reduced rotational speed of the fan, a weight load on the cover can be detected. The relatively high rotational speed may in particular be more than 50% of the maximum rotational speed. The relatively low rotational speed can be less than 50% of the maximum rotational speed.

[0021] In a further embodiment, in an eighth case, in

which the fan is switched on, when the cooktop control detects a very high weight load on the cover, this is determined as complete covering of the cover, and an error message to an operator is generated. The fan may be at a high rotational speed, which in particular is more than 50% of the maximum rotational speed. The error message helps the operator to see the problem and do something about it, for example remove any object covering the cover.

[0022] Preferably, the cooktop control can be designed to always check first, in accordance with the first case described before, whether the weight detection device also detects an additional weight load from at least a new and unused air filter or grease filter, respectively, in addition to the weight load from the cover alone. This helps in monitoring the contamination state of the filter.

[0023] In a further embodiment, in a second case with weighing the air filter, in which the fan is switched off and the weight detection device detects only the weight load by the cover together with the air filter, this is defined as the cover and the air filter being present without further weight load thereon. Preferably, the weight load of the cover together with the air filter, in particular the new and unused air filter, is stored in the cooktop control. After this, the cooktop control may tare the weight detection device and then a weight of zero or "0 g" is displayed at a weight display for an operator. The weight detection device is now ready for weighing. Preferably, the cooktop control can be designed in this case, when the weight of the cover and of a new and unused air filter is known, to subtract these known weights of the cover together with the new and unused air filter from a detected weight load. It is possible to determine therefrom the amount of contamination weight accumulated in the air filter. In particular a signal is output to an operator that the air filter is saturated and is to be replaced when a limit value for the contamination weight stored in the cooktop control is exceeded.

[0024] In an embodiment of the third case with weighing also the air filter, in which, with the fan switched off, the weight detection device detects a higher weight load than only by the cover together with the air filter, and the cooktop control being designed to store the weight load by the cover together with the air filter in the cooktop control, this is defined as a cover being present on the suction opening with further weight load thereon. The cooktop control may thereupon display a weight of the weight load on a weight display for an operator. Preferably, the weight detection device has been previously tared as described before, in particular automatically by the cooktop control. It can be provided that, when the cooktop or the weight detection device is switched on without taring and a weight load of more than 20% above the weight load only by the cover together with the air filter has been detected, this is defined as the presence of an additional weight load on the cover which is not intended. A corresponding signal is then generated as an error message to an operator.

[0025] In another first case when, irrespective of the functional state of the fan, the weight detection device detects no weight load or detects a weight load with less than 50% of the weight load only by the cover together with the air filter, this is defined as a missing cover and/or a missing air filter. Then a corresponding signal can be generated to an operator. As described before, the weight load by the cover together with the air filter should be stored in the cooktop control.

[0026] In another embodiment of a fourth case with weighing the air filter, with the fan being switched on with known or detectable rotational speed, the weight detection device detects a higher weight load than only by the cover together with the air filter. A difference between the detected higher weight load and the weight load only by the cover together with the air filter can be assigned to a correction value matching the known or detected rotational speed of the fan. Then, it can be defined that no object is placed on the cover as an additional weight load. Preferably the rotational speed of the fan is kept constant, and the cooktop control will tare the weight detection device. After taring, a weight zero or "0 g" is displayed on a weight display for an operator.

[0027] The cooktop control can be designed to tare and to adjust the rotational speed of the fan in a fifth case with weighing the air filter, in which the fan is switched on at a relatively low rotational speed, and a container for an object to be weighed is placed on the cover. The relatively low rotational speed may in particular be less than 50% of the maximum rotational speed. The weight detection device will then detect a higher weight load than according to the fourth case with weighing the air filter as described before. The cooktop control will then tare and leave a rotational speed of the fan unchanged, preferably at least as long as taring and subsequent weighing is performed. This serves to have constant and unchanging conditions. It may also be provided that following the taring according to the aforementioned fifth case in a sixth case, wherein the fan remains switched on at a relatively low rotational speed, a weight load greater than zero can be detected and this weight load is displayed on a weight display for an operator, in particular in "g". In this case, also the air filter is weighed.

[0028] In another embodiment of a seventh case with weighing the air filter, in which the fan is switched on at a relatively high rotational speed, and a weight load higher than only the weight load of the cover together with the air filter is detected, the cooktop control is designed to reduce the rotational speed of the fan to a relatively low rotational speed. The rotational speed may in particular be reduced to less than 50% of the maximum rotational speed. The relatively high rotational speed of before may preferably be more than 50% of the maximum rotational speed. After reducing the rotational speed of the fan, a taring is started, so that subsequently a weight load on the cover is detectable with reduced rotational speed of the fan. This allows for at least some removal of air and cooking fumes by suction while at the same

time not impeding the weighing process too much by the fan.

[0029] In a preferred embodiment of a method according to the invention, the cooktop control can detect and include the functional state of the fan in the evaluation of the weighing sensors. Depending on the functional state of the fan, the cooktop control may correct a result of an evaluation of the weighing sensors for detecting a weight load on the cover in such a way that an error in the detection of the weight load can be or is corrected. Such an error may increase with increasing power of the fan, and in particular be caused by the additional force acting upon the cover and any objects placed thereupon through the suction of air into the suction opening.

[0030] These and further features may be gathered from the claims and also from the description and the drawings, with the individual features being capable of being implemented in each case by themselves or severally in the form of sub-combinations in an embodiment of the invention and in other fields and being capable of constituting advantageous and independently patentable versions for which protection is claimed here. The subdivision of the application into individual sections and intermediate headings does not restrict the general validity of the statements made under these.

Description of the drawings

[0031] Examples of embodiments of the invention are shown in the drawings and are explained in more detail below. Thereby show in the drawings:

- Fig. 1 a schematical side view of a cooktop according to the invention having a weight detection device,
- Fig. 2 a view from above onto a cover on a suction opening at the weight detection device with two pots of varying size placed onto the cover,
- Fig. 3 the course of a detected weight and a power of a fan over time in various situations,
- Fig. 4 the course of weight and power of the fan similar to Fig. 3 in more situations and
- Fig. 5 a diagram of the measured weight by the suction force of the fan alone in dependency of the power level.

Detailed description of the embodiments

[0032] Fig. 1 shows a cooktop 11 according to the invention from the side, the cooktop 11 having a cooktop plate 12 and a cooktop control 13. Underneath the cooktop plate 12, heating devices 14 are placed for heating any pot T placed onto the cooktop plate 12 above. The heating device 14 is connected to the cooktop control 13 or to a power control part of it, respectively.

[0033] In the cooktop plate 12, a suction opening 16 is provided for drawing in air and cooking fumes F. The suction opening 16 is rectangular in this cooktop 11, but

could also have other shapes such as square or even rounded. The suction opening 16 opens into an air duct 18 arranged underneath. In the air duct 18, an air filter 20, which preferably is a so-called grease filter for filtering out grease and the like from air and cooking fumes F sucked in, is arranged and removably fixed. The air filter 20 is arranged underneath the suction opening 16 and inside the air duct 18 in such a way that all the air must pass this air filter 20. Beneath the air filter 20, a fan 22 with a fan motor 23 is provided, which sucks in the air and the cooking fumes F as described above. The fan motor 23 is also connected to the cooktop control 13 or to a power supply, respectively. Control of operation of the fan 22 is either via automatic programs or via operator commands entered into a user interface at the cooktop 11, which is not shown here. The fan 22 and the fan motor 23, respectively, can have a varying power, preferably in which the power level can be in several levels or steps such as three to five or even nine levels or steps.

[0034] Mounted underneath the suction opening 16 is a support device 25, preferably in the form of a rectangular frame corresponding to the suction opening 16 or somewhat smaller. The support device 25 has filter holders 26, which are protruding into the air duct 18 and onto which the air filter 20 is placed and held in position. The support device 25 again is placed on a weight detection device 28, of which two weighing sensors 29 are shown. In reality, this may be two, three or four weighing sensors, which carry all the weight of the support device 25. As such, they carry the weight of the air filter 20 and also of a cover 31 placed upon the support device 25. In consequence, any weight change to the air filter 20 and/or to the cover 31, for example by placing a pot T upon it, is registered by the weight detection device 28. Via a connection of the weighing sensors 29 to the cooktop control 13, this can be advantageously evaluated.

[0035] The weight of the cover 31, preferably also of the air filter 20, that can be weighed by the weight detection device 28 is known and stored in the cooktop control 13. Furthermore, as is generally known from weighing systems, a taring function is provided which allows for setting any weight display to zero for a subsequent weighing operation. This allows for example to place a pot T₁ onto the cover 31 to allow for an easy, comfortable and exact weighing operation. As can be easily imagined, such a taring function can on the one hand be started or initiated by an operator via a user interface mentioned above. Alternatively, it can be started automatically by the cooktop control 13 if any of the operations or functional states described above have been detected or shall be started. One option for example is to start a taring function each time a weighing function is started, either by an operator command or by the cooktop control 13 itself.

[0036] By the connection of the fan 22 to the cooktop control 13, the functional state of the fan 22 can be included in the evaluation of the weight detection device 28 and the weighing sensors 29, respectively. This can

be easily understood when taking additionally into account the view of Fig. 2 onto the cover 31 in the suction opening 16 in the cooktop plate 12 from above. From Fig. 2 it can also be taken that the cover 31 is formed as a kind of grille or grid, such that most of the suction opening 16 is open for air and cooking fumes F to stream into. If the large pot T₁ shown in continuous line is placed upon the cover 31, it covers about 60% to 70% of its area. In consequence, 60% to 70% of the suction cross-section is blocked. This again has the effect that the pot T₁ is drawn downwards by the suction force. This obviously leads to the effect that the force acting upon the cover 31 is not only from the pure weight of the pot T₁, but also additionally by this suction force. This seemingly leads to a measured weight being higher than in reality. In this case, the cooktop control 13 can either stop the operation of the fan 22 if a weighing function is started. Alternatively, it can block any change to the state of the fan 22 or to an increase or decrease of a power of the fan 22, such that stable conditions are held. Furthermore, a taring function can be automatically started or an operator can be instructed to do such if, for example by an operator command, the power of the fan 22 is changed.

[0037] It can also be taken from Fig. 2 that if the smaller pot T_s shown in dotted line is placed upon the cover 31, this would rather not lead to any change of a weight measurement by the weight detection device 28 if the state of the fan 22 would be changed, either by increasing or by decreasing the supplied power.

[0038] In Fig. 3, the measured weight m at the weight detection device 28 is shown over time in thin line. In thick line, the power P supplied to the fan 22 is shown. Before the time zero, a negative weight m is measured which may be due to any error in the system that need not be critical. At the time zero, a taring function is effected, which brings the measured weight m to zero. At the time t₁, the weight suddenly jumps up to any amount, which, after a weighing function including a taring has started at the time zero, is obviously a sign that now an object to be weighed has been put onto the cover 31 by an operator. In consequence, also because the fan 22 is in an off-state, this weight m is simply displayed at a user interface to the operator to indicate the weight of the object placed upon the cover 31.

[0039] At the time t₂, the power P of the fan 22 is increased to a first level or step. This at once leads to the value of the measured weight m to be somewhat higher. If this difference is generally 10 g to 300 g or for example around 20 g to 100 g, the cooktop control 13 draws the conclusion that this is due to the above-described effect of an object to be weighed placed upon the cover 31 being sucked down by the fan 22. In consequence, although the measured weight m at the weight detection device 28 has become higher, this is according to the definition only due to the increased power of the fan 22. In consequence, no change to the displayed weight at the user interface is made, the same value is still put out.

[0040] Some time after that, at the time t₃, the power

P of the fan 22 is increased once more to the next level or step, which is also a significant increase, for example of about 100%. The increase in the measured weight m is about the same as at the time t_2 , and consequently the cooktop control 13 corrects the measured weight m again such that the original value of the time before activating the fan 22 is displayed. This means that the cooktop control 13 has recognized and classified this repeated increase in the measured weight m as an increase in power of the fan 22 leading to the object placed on the cover 31 being drawn down with more force.

[0041] At time t_4 with a constant power P of the fan 22, the measured weight m starts to increase slowly. This may be such that at a time t_5 for example 5 seconds to 10 seconds later, an increased weight of about 50 g for example is detected. As usually no operation with adding any weight onto the cover 31 takes such a long time, this is interpreted as liquid, for example from boiling water leaving a pot T placed on the cooktop plate 12, has entered the suction opening 16 and is collected in the air filter 20 or a respective collection container provided at the air filter 20. In consequence, the cooktop control 13 determines this as a case of spilled liquid in the air duct 18 and will output a corresponding command to an operator to clean the air duct 18 or the air filter 20, respectively. This is preferably done via the user interface.

[0042] In Fig. 4, the influence of the power P of the fan 22 is constant due to the power P being held constant. At the time zero, the weight detection device 28 has been activated and tared. At a time t_6 a weight of for example 20 g is detected. If the time t_6 is not very long after the operator has started the weighing function, for example only 5 seconds to 10 seconds, this can be interpreted as the start of the weighing function and the operator has put an object onto the cover 31 weighing about 20 g. If no weighing function has been started by the operator, this could on the one hand be interpreted as a sudden entering of liquid into the air duct 18 as described before. Alternatively, such a small weight can be any object being placed erroneously onto the cover 31, which again would bring the cooktop control 13 to output an error on the user interface for the operator.

[0043] In a case not shown here, if the measured weight has changed massively before such a slightly higher weight has been detected, this could be interpreted as a case that a pot or the like on the cover 31 has only been moved somewhat, for example in a way that the suction opening 16 is covered with a higher degree leading to an increased suction force onto the pot, this increasing the measured weight m .

[0044] The measured weight m is staying constant until a point of time t_7 , when the measured weight m starts growing again. This can be very slow, such that for example only after a time t_8 of several operating hours of the fan 22 later the measured weight m has increased for about 10 g to 20 g, the cooktop control 13 will interpret this is the air filter 20 being polluted with the respective weight amount of dirt, mainly grease, in its function as a

grease filter. If such is recognized by the cooktop control 13, a respective command to the operator is output to clean the air filter 20.

[0045] Such a long time observation of the weight is preferably done any time that the cooktop control 13 can be sure that no object is placed on the cover 31 and before a taring function has been made, as the taring function will of course remove such an effect.

[0046] Also the other cases described before can be easily taken from the figures of the exemplary embodiment of the invention and the description before. It is for example also possible to demand from an operator to weigh the cover 31 alone, in particular after having tared the weight detection device 28, such that the cooktop control 13 can store this weight for further use in the weight detection and evaluation.

[0047] In Fig. 5, the diagram shows the result of the weight measurement which only depends on objects placed above the suction opening 16 in view of changing power levels of the fan 23. These power levels range from 0 to 9, wherein the power of the fan 23 does not necessarily increase linearly, although this might be provided. The division of power between each of the power levels can be varying or inconsistent, respectively. In level 1, the fan 23 moves about 90 m³/h through the suction opening 16 and the air duct 18. In level 9, the fan 23 moves about 498 m³/h through the suction opening 16 and the air duct 18, so this is the maximum power of the fan 23. The weight measurement does not give an indication of a varying actual weight, because the actual weight is kept constant. The degree of coverage of the suction opening 16 by different objects placed thereupon changes resulting in different weight measurements as explained below.

[0048] The lowest graph shows the suction opening 16 being covered only by the cover 31 alone, the filter 20 has been removed. The weight of the cover 31 itself has been eliminated by taring, that is why the measurement shows 0 g at power level 0, and 11 g at power level 1. In this level 1, the fan 23 moves about 90 m³/h through the suction opening 16 and the air duct 18. In level 9, the fan 23 moves about 498 m³/h through the suction opening 16 and the air duct 18, so this is the max power of the fan 23.

[0049] If for example the fan 23 is operated with a relatively high power level 7, this cover 31 effects the same amount of force on the weight detection device 28 corresponding to slightly less than 200 g. This means that the coverage effect by the cover 31 alone due to the suction force of the fan 23 corresponds to a weight of nearly 200 g. So the coverage effort depending on the state of the fan 23 should be somehow cancelled or neutralized, respectively.

[0050] The next higher graph shows the suction opening 16 being not covered by anything, but only the filter 20 has been inserted into the air duct 18. So the measurement at the weight detection device 28 shows 30 g at power level 1, which means that the resistance to the

airflow by the filter 20 is higher than by the cover 31. At high power level 7, the measurement results in slightly less than 400 g. So the filter 20 alone has much more resistance to the airflow than the cover 31 in the grille-like form.

[0051] The next higher third graph shows the filter 20 inserted and the cover 31 placed upon the suction opening 16, but the effect is not nearly the one of the other two graphs added, but only slightly higher than by the filter 20 alone. At power level 1, the weight detection device 28 measures 31 g, and at high power level 7, it measures 425 g. So the effect by the coverage is higher once more.

[0052] The fourth graph shows weight measurement with the filter 20 inserted, the cover 31 placed upon the suction opening 16 and a pot T_s with diameter 150 mm placed upon the cover 31. At power level 1, the weight detection device 28 measures 50 g, and at high power level 7, it measures 705 g. So the effect by the coverage again is higher. The pot T_s placed upon the cover 31 closes some of its openings, thus increasing the covering effect significantly once more.

[0053] The fifth graph shows weight measurement with the filter 20 inserted, the cover 31 placed upon the suction opening 16 and a larger pot T_L with diameter 180 mm placed upon the cover 31. At power level 1, the weight detection device 28 measures 63 g, and at high power level 7, it measures 890 g. So the effect by the coverage is of course higher than before resulting in a significant force corresponding to about 900 g.

[0054] The invention seeks to reduce or even eliminate this effect caused by the coverage of the suction opening 16 and even any effect on the filter 20. This helps improve weighing functions in the cooktop 11 and their accuracy.

Claims

1. Cooktop having:

- a cooktop plate,
- heating devices on or under the cooktop plate,
- a suction opening on or in the cooktop plate,
- a fan and an air filter,
- an air duct under the suction opening, which leads to the air filter and to the fan, or in which the air filter and the fan are arranged,
- a cover for the suction opening, the cover having holes and preferably being designed as a grid,
- a support device for the cover, which is arranged on or under the suction opening,
- a weight detection device, the weight detection device comprising the support device and at least two weighing sensors, the weighing sensors supporting the cover in such a way that a weight load of the cover can be detected at the weighing sensors,

- a cooktop control, the weight detection device being connected to the cooktop control for evaluating the weighing sensors, and the fan being connected to the cooktop control for evaluating the functional state of the fan,

characterized in that:

the cooktop control is designed to detect and include the functional state of the fan in the evaluation of the weighing sensors and, depending on the functional state of the fan, to correct a result of an evaluation of the weighing sensors for detecting a weight load on the cover in such a way that an error in the detection of the weight load which increases with increasing power of the fan can be or is corrected.

2. Cooktop according to claim 1, characterized in that

- a collecting container for liquid that has entered through the suction opening is provided on the air duct and/or on the support device and/or on the air filter,
- the collecting container is connected to the weight detection device and the weighing sensors in such a way that these detect a change in the weight load on the collecting container,
- the cooktop control is designed in such a way that under the condition that no weight load has been detected on the cover before a case of an increase in the weight load by 1 g to 500 g within a time period of 2 seconds to 10 seconds is determined as an entry of liquid through the suction opening into the collecting container, wherein preferably a signal is generated to an operator for emptying or cleaning the collecting container.

3. Cooktop according to claim 1 or 2, characterized in that the cover is designed as a grid, preferably as a perforated grid or as a slotted grid.

4. Cooktop according to one of the preceding claims, characterized in that the support device is formed in the shape of a frame around the suction opening or circumferentially at the suction opening, the weighing sensors being fastened to or in the support device and having a pressure region for a weight load, the pressure region being accessible or exposed from above.

5. Cooktop according to one of the preceding claims, characterized in that separate support parts are arranged between the weighing sensors and the cover, the cover resting only on the support parts or being supported only on these support parts and a weight load being passed on by the cover via the support parts to the weighing sensors, the support parts being movable in the vertical direction corresponding to a measuring path of the weighing sen-

sors.

6. Cooktop according to claim 4 or 5, **characterized in that** the air filter, which is preferably designed as a grease filter, is fastened to the support device and in this case is arranged essentially below the suction opening, wherein in particular the air filter is fastened to the support device independently of the weighing sensors or is supported in such a way on the weighing sensors, preferably on the support parts according to claim 5, that the weighing sensors detect a changing weight load due to a change to the state of the air filter.
7. Cooktop according to one of the preceding claims, **characterized in that** the suction opening is arranged laterally next to the cooktop plate and adjoining the latter, the cooktop preferably having two cooktop plates which are formed separately from one another, and the suction opening being arranged between the two cooktop plates.
8. Cooktop according to one of the preceding claims, **characterized in that** the cooktop control is designed in such a way that, in a first case in which, irrespective of the functional state of the fan, the weight detection device detects no weight load or detects a weight load with less than 50% of the weight load by the cover alone, wherein the weight load by the cover alone is stored in the cooktop control, to define this first case as a missing cover and preferably to generate a corresponding signal to an operator and/or stop the fan from starting.
9. Cooktop according to one of the preceding claims, **characterized in that** the cooktop control is designed, in a second case in which, with the fan switched off, the weight detection device detects only the weight load by the cover alone, preferably with a deviation of maximum +/- 20g, the weight load by the cover alone being stored in the cooktop control, to define this second case as a cover being present without any further weight load on it, the cooktop control preferably then taring and, in particular after taring, displaying a weight of zero or "0 g" on a weight display for an operator.
10. Cooktop according to one of the preceding claims, **characterized in that** the cooktop control is designed, in a third case in which, with the fan switched off, the weight detection device detects a higher weight load than only by the cover alone, the weight load by the cover alone being stored in the cooktop control, to define this third case as a cover being present with a further weight load thereon, the cooktop control then preferably displaying the weight of the weight load on a weight display for an operator, in particular the weight detection device having been previously tared according to claim 9, wherein preferably in the sub-case that, when the cooktop or the weight detection device is switched on without taring, a weight load of more than 20% above the weight load by the cover alone has been detected, this sub-case is defined as the presence of an additional weight load on the cover and a corresponding signal is generated as an error message to an operator.
11. Cooktop according to any one of the preceding claims, **characterized in that** the cooktop control is designed, in a fourth case in which the fan is switched on at a known or detectable rotational speed, to cause the weight detection device to detect a higher weight load than can be detected by the cover alone when the fan is switched off, and a difference between the detected higher weight load and the weight load by the cover alone can be assigned to a correction value matching the known or detectable rotational speed of the fan, to define that no object is placed on the cover as an additional weight load.
12. Cooktop according to claim 11, **characterized in that** thereupon the rotational speed of the fan is kept constant, and the cooktop control tares, wherein in particular after taring a weight zero or "0 g" is displayed on a weight display for an operator.
13. Cooktop according to claim 11 or 12, **characterized in that** the cooktop control detects a change in the rotational speed of the fan during the detection of the weight load and thereupon stops the detection and outputs a signal to an operator that taring must be repeated before an object to be weighed is placed on the cover or that an object to be weighed which has been placed on the cover must be removed until the cooktop control has tared.
14. Cooktop according to one of the preceding claims, **characterized in that** the cooktop control is designed to tare and to adjust the rotational speed of the fan in a fifth case in which the fan is switched on at a relatively low rotational speed, a container for an object to be weighed is placed on the cover and the weight detection device detects a higher weight load than according to the fourth case according to claim 11, to tare and to leave a rotational speed of the fan unchanged, preferably to leave it unchanged at least as long as taring and subsequent weighing is performed, wherein in particular following the taring according to the fifth case in a sixth case, wherein the fan remains switched on at a relatively low rotational speed, a weight load greater than zero on the cover is detected and the weight of this weight load is displayed on a weight display for an operator, preferably in "g".
15. Cooktop according to one of the preceding claims,

characterized in that the cooktop control is designed, in a seventh case, in which the fan is switched on at a relatively high rotational speed, which is in particular more than 50% of the maximum rotational speed, and a weight load higher than only the weight load of the cover alone is detected, the cooktop control is designed to reduce the rotational speed of the fan to a relatively low rotational speed, in particular less than 50% of the maximum rotational speed, and then to tare, so that subsequently with reduced rotational speed of the fan a weight load on the cover is detectable.

16. Cooktop according to one of the preceding claims, **characterized in that** the cooktop control is designed, in an eighth case in which the fan is switched on, in particular is switched on at a high rotational speed, which in particular is more than 50% of the maximum rotational speed, to detect a very high weight load on the cover, to determine this as complete covering of the cover and to generate an error message to an operator.

17. Cooktop according to claims 6 and 8, **characterized in that** the cooktop control is designed to always check first, in accordance with the first case, whether the weight detection device also detects an additional weight load from at least the new and unused air filter in addition to the weight load from the cover alone.

18. Cooktop according to claims 6 and 9, **characterized in that** the cooktop control is designed, in a second case in which with the fan switched off the weight detection device detects only the weight load by the cover together with the air filter, wherein the weight load of the cover together with the air filter is stored in the cooktop control, to define this as the cover and the air filter being present without further weight load thereon, wherein preferably thereupon the cooktop control tares and in particular after taring at a weight display for an operator a weight of zero or "0 g" is displayed.

19. Cooktop according to claim 18, **characterized in that** the cooktop control is designed in the second case, when the weight of the cover and of a new and unused air filter is known, to subtract these known weights of the cover together with the new and unused air filter from a detected weight load and to determine therefrom the amount of contamination weight accumulated in the air filter, wherein preferably, when a limit value for the contamination weight stored in the cooktop control is exceeded, a signal is output to an operator that the air filter is saturated and is to be replaced.

20. Cooktop according to claims 6 and 10, **character-**

ized in that the cooktop control is designed, in the third case in which, with the fan switched off, the weight detection device detects a higher weight load than only by the cover together with the air filter, the weight load by the cover together with the air filter being stored in the cooktop control, defining this as a cover present on the suction opening with further weight load thereon, wherein preferably thereupon the cooktop control displays a weight of the weight load on a weight display for an operator, wherein in particular the weight detection device has been previously tared according to claim 9 or 20.

21. Cooktop according to claim 20, **characterized in that** in the sub-case that, when the cooktop or the weight detection device is switched on without taring, a weight load more than 20% above the weight load only by the cover together with the air filter has been detected, this is defined as the presence of an additional weight load on the cover and a corresponding signal is generated as an error message to an operator.

22. Cooktop according to one of the preceding claims, **characterized in that** the cooktop control is designed in such a way that, in a first case in which, irrespective of the functional state of the fan, the weight detection device detects no weight load or detects a weight load with less than 50% of the weight load only by the cover together with the air filter, wherein the weight load by the cover together with the air filter is stored in the cooktop control, to define this first case as a missing cover and/or air filter, and preferably to generate a corresponding signal to an operator.

23. Cooktop according to claims 6 and 11, **characterized in that** in a fourth case, in which the fan is switched on with known or detectable rotational speed, the weight detection device detects a higher weight load than only by the cover together with the air filter, and a difference between the detected higher weight load and the weight load only by the cover together with the air filter can be assigned to a correction value matching the known or detected rotational speed of the fan, it is defined that no object is placed on the cover as an additional weight load, wherein preferably the rotational speed of the fan is kept constant and the cooktop control tares, wherein in particular after taring a weight zero or "0 g" is displayed on a weight display for an operator.

24. Cooktop according to one of the preceding claims, **characterized in that** the cooktop control is designed to tare and to adjust the rotational speed of the fan in a fifth case in which the fan is switched on at a relatively low rotational speed, which is in particular less than 50% of the maximum rotational

speed, a container for an object to be weighed is placed on the cover and the weight detection device detects a higher weight load than according to the fourth case according to claim 23, to tare and to leave a rotational speed of the fan unchanged, preferably to leave it unchanged at least as long as taring and subsequent weighing is performed. 5

25. Cooktop according to claim 24, **characterized in that** following the taring according to the fifth case in a sixth case, wherein the fan remains switched on at a relatively low rotational speed, a weight load greater than zero is detected and this weight load is displayed on a weight display for an operator, in particular in "g". 10 15

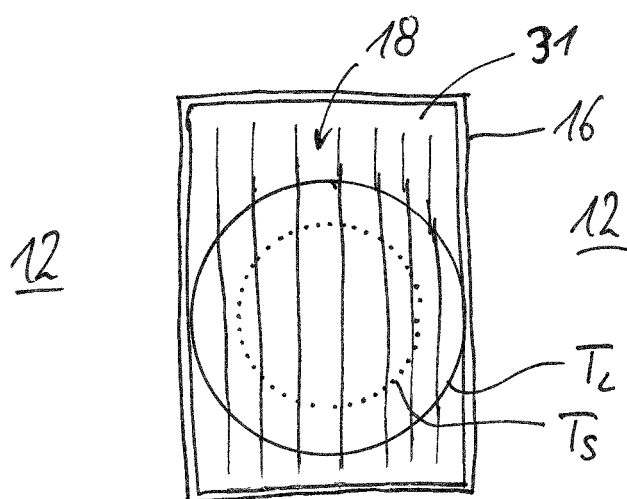
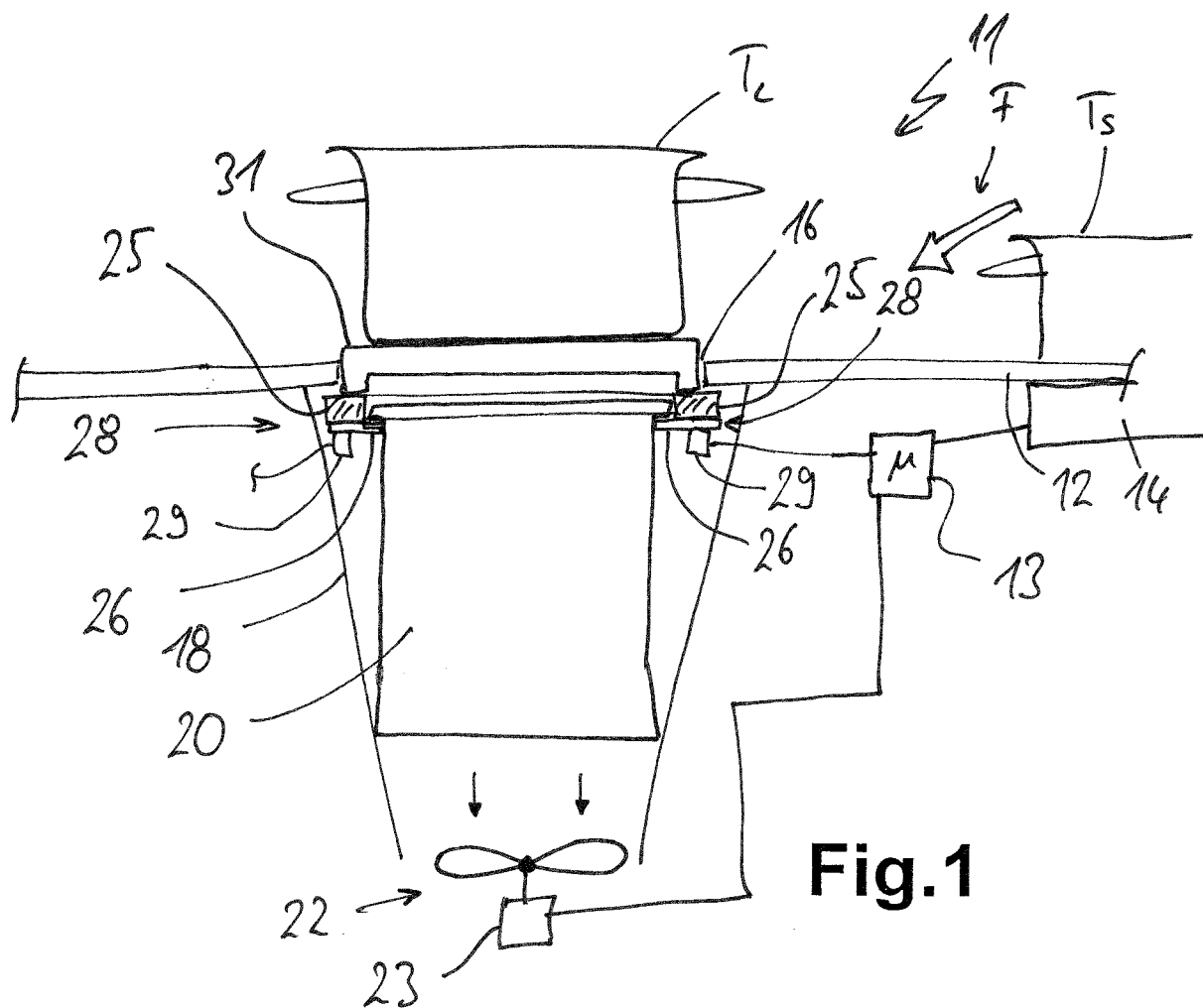
26. Cooktop according to one of the preceding claims, **characterized in that** the cooktop control is designed, in a seventh case, in which the fan is switched on at a relatively high rotational speed, which is in particular more than 50% of the maximum rotational speed, and a weight load higher than only the weight load of the cover together with the air filter is detected, the cooktop control is designed to reduce the rotational speed of the fan to a relatively low rotational speed, in particular less than 50% of the maximum rotational speed, and then to tare, so that subsequently with reduced rotational speed of the fan a weight load on the cover is detectable. 20 25 30

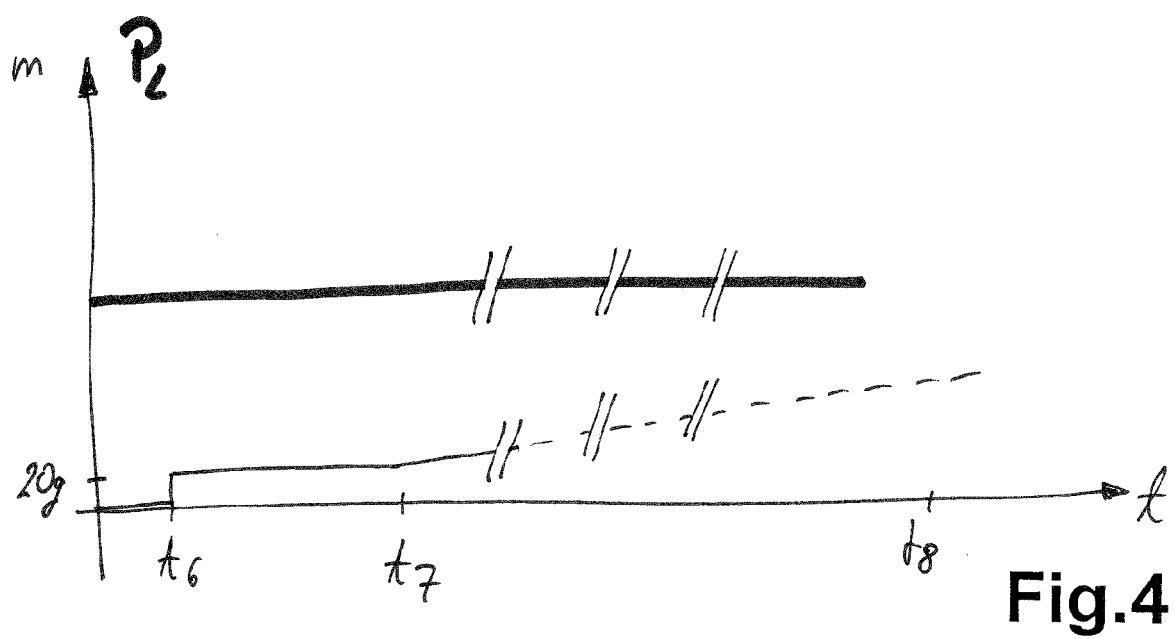
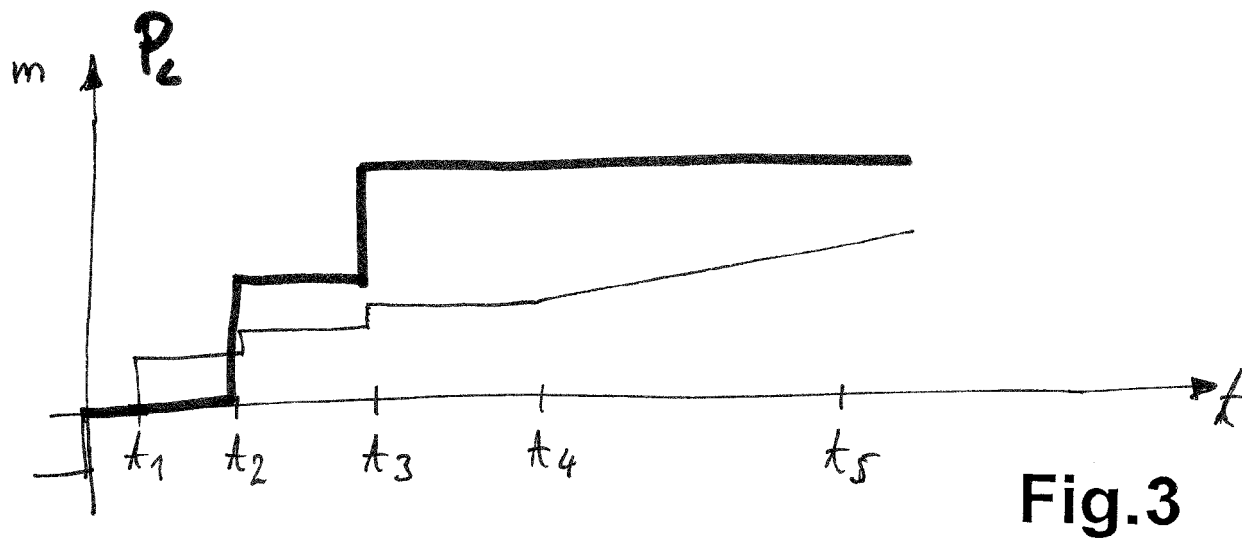
27. Method for operating a cooktop according to one of the preceding claims, **characterized in that** the cooktop control detects and includes the functional state of the fan in the evaluation of the weighing sensors and, depending on the functional state of the fan, corrects a result of an evaluation of the weighing sensors for detecting a weight load on the cover in such a way that an error in the detection of the weight load which increases with increasing power of the fan can be or is corrected. 35 40

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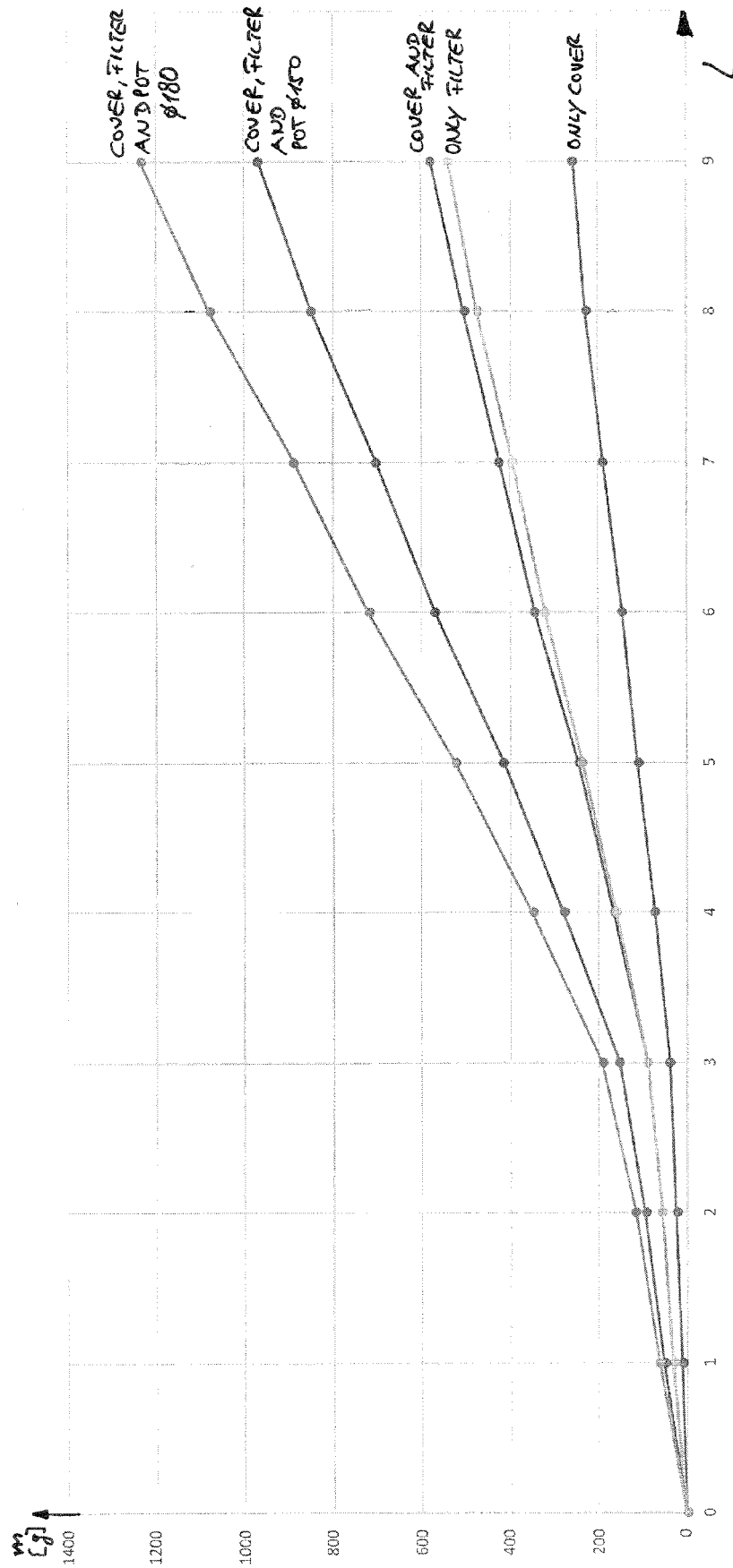


Fig. 5



EUROPEAN SEARCH REPORT

Application Number

EP 22 20 4065

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A, D	WO 2019/138312 A1 (ELICA SPA [IT]) 18 July 2019 (2019-07-18) * figures 1-2 * -----	1-27	INV. F24C7/08 F24C15/20
			TECHNICAL FIELDS SEARCHED (IPC)
			F24C
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		14 June 2023	Meyers, Jerry
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			
T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 22 20 4065

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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14-06-2023

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2019138312 A1	18-07-2019	CA 3086120 A1	18-07-2019
		CN 111615606 A	01-09-2020
		EP 3737891 A1	18-11-2020
		JP 2021510411 A	22-04-2021
		RU 2020121699 A	30-12-2021
		US 2021063234 A1	04-03-2021
		WO 2019138312 A1	18-07-2019

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2019138312 A1 [0002]
- DE 102012216935 A1 [0003]