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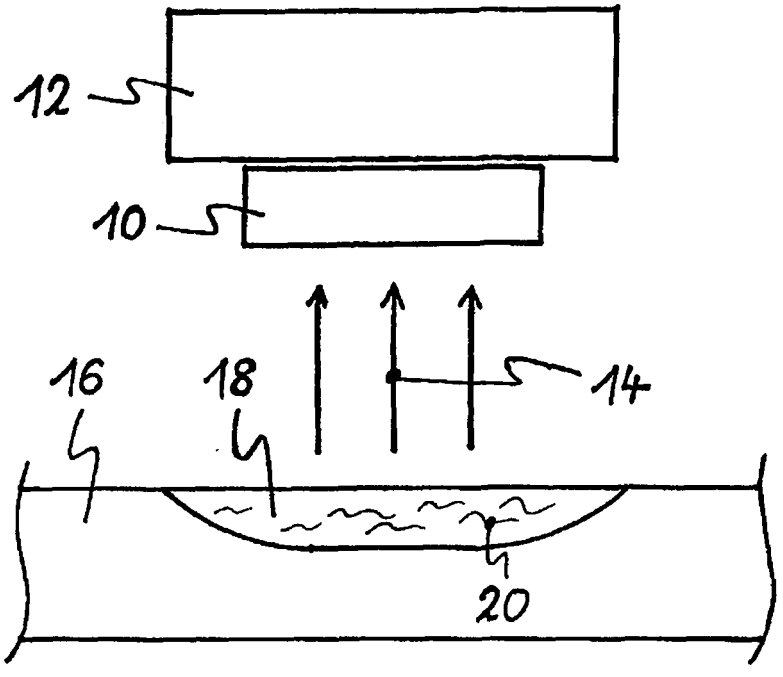
(54) A household appliance appliance with a fluid system and a device for detecting thermal and/or infrared radiation

(57) The present invention relates to a household appliance including a closed or at least partially closed fluid system containing a running and/or stationary fluid (20) or mixture comprising the fluid. The household appliance comprises an apparatus for detecting a thermal radiation (14) with least one thermopile sensor element (10). The thermopile sensor element (10) is arranged in an intervisibility of the fluid (20) in order to detect the thermal radiation (14) of the fluid (20). The present invention relates further to a corresponding method.

FIG. 1



EP 2 108 298 A1

Description

[0001] The present invention relates to a household appliance and a method for detecting a thermal radiation.

[0002] There are many household appliances having a fluid system containing running or stationary fluid or fluid mixtures, which mixtures may consist of different fluids or fluid(s) with solid and/or gaseous components, where it is necessary obtaining information about the temperature of said fluid or fluid mixture. Examples of such household appliances are washing machines, dish washers or laundry dryers with a condenser (condensation laundry dryers). The detected value or signal of the temperature of the fluid or fluid mixture may be used to control the operation of the household appliance. Further, the detected value of the temperature of the fluid may be displayed in order to inform the operator about the temperature of the fluid.

[0003] In known household appliances the temperature of the fluid is detected by one or more sensor elements, which are in a direct contact with the fluid. For example, the sensor element may be a temperature sensitive electric or electronic element, in particular a temperature sensitive resistor or transistor element. Typically, the sensor element is an NTC (negative temperature coefficient) sensor.

[0004] The sensor element is arranged in a fixed position within the fluid system. The sensor element requires electric connectors and wires in order to send signals out of the fluid system. The passageway for the wires through the wall of the fluid system risks a leakage in said wall. The sensor element and the wires have to be isolated. The temperature sensitive element reacts very slowly on a change of the temperature of the fluid.

[0005] The US 5,739,534 describes a system for detecting the presence of a fluid in a washing machine. The system comprises means for transmitting two or more infrared signals towards the fluid. The infrared signals have different wavelengths. Further, the system comprises means for detecting the infrared signals reflected on the fluid. By comparing the intensities of the infrared signals the presence of said fluid is determined.

[0006] In the US 5,396,715 a microwave clothes dryer is disclosed. The dryer comprises an infrared sensor the occurrence of heating which might lead to an outbreak of a fire in the clothes. In order to avoid this, the dryer comprises means for introducing water into the chamber of the dryer to wet the clothes.

[0007] It is an object of the present invention to provide a household appliance having a fluid system with a new possibility for detecting a temperature of the fluid, which allows in particular a contact less detection of the temperature of the fluid.

[0008] This object of the present invention is achieved by the household appliance according to claim 1 and the method according to claim 9.

[0009] A core idea of the present invention is to detect the thermal radiation of the fluid or fluid mixture in the fluid system of the household appliance (or: domestic appliance, home appliance) in order to obtain information about the temperature and/or other thermal quantities of the fluid, such as the radiation intensity.

[0010] The present invention allows a contact less detection or determination or measuring of the temperature and/or other thermal quantities of the fluid or fluid mixture since the thermal radiation detecting device does not have to be in contact and typically is not in contact with the fluid or fluid mixture when the thermal radiation from the fluid or fluid mixture is detected. The contact less measuring or determining of the temperature by detecting thermal radiation allows in particular that the radiation detecting device can be arranged outside of or separated from the fluid system of the appliance and that no electric connectors within the fluid system and no passageway for the wires in the wall of the fluid system are required so that there are no risks for a leakage in said wall.

[0011] The detection of the thermal radiation of the fluid or fluid mixture can also be indirect in the sense that the thermal radiation of a body, wall or container such as a tub of a washing machine or dish washer or pipe being in thermal contact with the fluid or fluid mixture is detected.

[0012] The term "thermal radiation" includes radiation, in particular electromagnetic radiation, of longer wavelength than visible light such as infrared radiation or radiation from the infrared spectrum as well as even longer wavelengths such as radiation from the microwave or even radio wavelength spectrum, e.g. wavelengths from typically 0.8 mm up to 1000 mm, in particular radiation in the wavelength range between 1 μm and 100 μm for temperatures in a temperature range up to about 100 °C.

[0013] In a preferred embodiment the radiation detecting device comprises at least one thermoelectric sensor element and/or pyroelectric sensor element and/or Bolometer and/or, preferably, thermopile sensor element.

[0014] Such sensor elements, in particular thermopile sensors, are known as such for contact less measuring of temperature, for instance from EP 1 296 122 B1, the disclosure of which is enclosed into the present application herewith by reference. A thermopile sensor element has the advantage that it reacts very fast on a change of the temperature of the fluid, at least much faster than the known NTC elements, and, thus, the control or surveillance of the temperature of the fluid can be improved and is reliable even when the fluid flows (inline measurement).

[0015] The radiation detecting device, in particular thermopile sensor element, is, in one embodiment, provided to detect the intensity of the thermal radiation from the fluid.

[0016] Further, radiation detecting device, in particular thermopile sensor element, may be provided to detect the temperature of the fluid directly or indirectly via the detected or measured radiation. For instance, the temperature of the fluid may be determined from the intensity of the thermal radiation.

[0017] According to a preferred embodiment the fluid system comprises at least one transparent or transmissive device which is transmissive for infrared and/or thermal radiation, in particular thermal radiation as defined above, and arranged between the radiation detecting device or sensor element, in particular thermopile sensor element, and the fluid or fluid mixture. Thus, the radiation detecting device, in particular thermopile sensor element, may be positioned at a distance or separated from the fluid.

[0018] The transmissive device may border or enclose at least partially the fluid or may be formed as a window arranged in a wall of the fluid system allowing for the detection of the temperature of the fluid in a certain position of the fluid system.

[0019] Alternatively, the transmissive device is a pipe or a pipe section of the fluid system. The transmissive pipe may be made of one single piece and can be easily produced.

[0020] For example, the transmissive device is made of a glass or plastic material that is suitably transmissive for the thermal radiation.

[0021] The radiation detecting device, in particular its sensor element such as thermopile sensor element, is preferably sensitive for infrared radiation or in the infrared spectrum. The infrared radiation from the fluid provides reliable information about the temperature of the fluid.

[0022] In the preferred embodiment of the present invention the household appliance comprises at least one electronic circuit connected to the sensor element. The electronic circuit may be provided for receiving electric signals from the sensor element. For example, the electric signals correspond to the intensity of the thermal radiation from the fluid to sensor element. The electronic circuit may transform the electric signals into a value of the actual temperature of the fluid. In another example of the present invention, the electric signals correspond to the temperature of the fluid. The information about the temperature may be used for controlling the household appliance. If the fluid is behind or on the other side of the transmissive device, then the electric signals may correspond to the temperature of the fluid behind said transmissive device.

[0023] The electronic circuit may be provided for processing the electric signals from the sensor element and/or for controlling the household appliance. In particular, heating elements of the household appliance may be controlled in order to obtain a predetermined temperature of the fluid.

[0024] Since there may be a long distance between the fluid and the sensor element, the electronic circuit and the sensor element may be placed at the same position in the household appliance. Especially, the electronic circuit and the sensor element form a single structural member of the household appliance. This simplifies the production of the household appliance.

[0025] Furthermore, the household appliance may comprise at least one output device for displaying the actual temperature value of the fluid. This output device allows that the operator may be always informed about the actual temperature value of the fluid.

[0026] Furthermore, the radiation detecting device or its sensor element, in particular thermopile sensor element, is arranged in an inter-visibility of the fluid during detecting the thermal radiation of the fluid.

[0027] The invention will be described in further detail with reference to the drawing, in which

FIG 1 illustrates a schematic diagram of an apparatus for detecting a thermal radiation of a fluid within a household appliance according to a first embodiment of the present invention, and

FIG 2 illustrates a schematic diagram of an apparatus for detecting a thermal radiation of a fluid within a household appliance according to a second embodiment of the present invention.

[0028] FIG 1 illustrates a schematic diagram of an apparatus or a device for detecting a thermal radiation 14 of a fluid 20 within a household appliance such as a dish washer or a washing machine or a condensation laundry dryer or a steam cooking oven or water heater or iron, according to a first embodiment of the present invention.

[0029] The apparatus comprises a thermopile sensor element 10, an electronic circuit 12 and a transmissive or transparent device 18. In this embodiment the transparent device is formed as a window 18 within a pipe 16. The thermopile sensor element 10 is an infrared sensitive sensor element, typically sensing thermal radiation in the wavelength range between 1 μm and 100 μm for temperatures in a temperature range up to about 100 °C. The apparatus is arranged or installable in a household appliance with a system containing a running and/or stationary fluid 20.

[0030] In this example the pipe 16 forms a part of a circulation system in the household appliance. The circulation system contains the fluid 20. The fluid 20 irradiates the thermal radiation 14. The thermal radiation 14 is substantially an infrared radiation. The intensity of the thermal radiation 14 depends on the temperature of the fluid 20.

[0031] The window 18 is integrated in the wall of the pipe 16. The window 18 is made of a transparent material, like glass or plastic. In particular, the window 20 is transparent for the thermal radiation 14. The window 18 and the thermopile sensor element 10 are arranged in a position, that there is intervisibility between the fluid 20 and the thermopile sensor element 10. Thus, the thermopile sensor element 10 is able to detect the thermal radiation 14 from the fluid 20.

[0032] The thermopile sensor element 10 is electrically connected to the electronic circuit 12. The thermopile sensor element 10 sends electric signals to the electronic circuit 12. Said electric signals depend on the thermal radiation 14 and therefore on the temperature of the fluid

20. The electronic circuit 12 is provided to process the signals from the thermopile sensor element 10. Further, the electronic circuit 12 may be provided to control the household appliance.

[0033] The apparatus may comprise a displaying device in order to indicate the temperature of the fluid 20. Thus, the operator is informed about the actual temperature of the fluid 20.

[0034] FIG 2 illustrates a schematic diagram of the apparatus for detecting the thermal radiation 14 of the fluid 20 within the household appliance according to a second embodiment of the present invention.

[0035] The second embodiment of the apparatus comprises also the thermopile sensor element 10 formed as an infrared sensitive sensor element as well as the electronic circuit 12. In a similar way, the apparatus of the second embodiment is arranged or installable in the household appliance with the system containing a running and/or stationary fluid 20.

[0036] In this embodiment the apparatus comprises a transparent pipe 22 or pipe section. The transparent pipe 22 or pipe section, respectively, forms a part of the circulation system in the household appliance. The transparent pipe 22 is permeable for the thermal radiation 14 of the fluid 20.

[0037] Unlike the first embodiment of FIG 1, where the pipe 16 comprises-the transparent window 18, in the second embodiment of FIG 2 the pipe 22 itself is transparent. The pipe 22 and the pipe section may be made of the transparent material, like special transparent glass or plastic. Said material is transparent for the thermal radiation 14. The pipe 22 or pipe section, respectively, is also arranged in the position, that there is intervisibility between the fluid 20 and the thermopile sensor element 10. This allows the thermopile sensor element 10 to detect the thermal radiation 14 from the fluid 20.

[0038] The household appliance with the apparatus according to the present invention allows a contact less detection of the temperature of the fluid 20. The invention requires no holes in the pipe 16 and 22. Thus, there is no risk of a leakage in the pipe 16 and 22 because of the temperature sensor element 10.

[0039] Further, the thermopile sensor element 10 can be arranged in every position, where the inter-visibility between the thermopile sensor element 10 and the window 18 or the transparent pipe 22, respectively, exists. The thermopile sensor element 10 may be arranged in a relative long distance from the fluid. In particular, the thermopile sensor element 10 may be placed on or besides the electronic circuit 12.

[0040] The apparatus and the household appliance according to the present invention allow a very fast detection of the temperature, since the heat is transferred by radiation. The thermopile sensor element 10 causes no parasitic capacities. The thermopile sensor element 10 causes no problems for the electromagnetic compatibility.

[0041] Although illustrative embodiments of the present invention have been described herein with reference to the accompanying drawing, it is to be understood that the present invention is not limited to those precise embodiments, and that various other changes and modifications may be affected therein by one skilled in the art without departing from the scope or spirit of the invention. All such changes and modifications are intended to be included within the scope of the invention as defined by the appended claims.

List of reference numerals

[0042]

10	thermopile sensor element
12	electronic circuit
14	thermal radiation
16	pipe
18	window
20	fluid
22	transparent pipe

Claims

1. Household appliance, in particular dish washer, washing machine, condensation laundry dryer or steam cooking oven, comprising
a fluid system containing a running and/or stationary fluid (20) or fluid mixture and
a radiation detecting device for detecting thermal radiation (14) from the fluid (20) or fluid mixture to determine the temperature of the fluid (20) or fluid mixture.

2. The household appliance according to claim 1, wherein the fluid system is a closed system or a circulation system.

3. The household appliance according to claim 1 or 2, wherein the radiation detecting device comprises at least one thermoelectric sensor element or pyroelectric sensor element or Bolometer sensor element or thermopile sensor element (10).

3. The household appliance according to any of the preceding claims, wherein the radiation detecting device, in particular the thermopile sensor element (10), is provided to detect the intensity of the thermal radiation from the fluid (20) or fluid mixture in order to derive the temperature from the detected intensity or to detect the temperature of the fluid or fluid mixture directly.

4. The household appliance according to any one of the preceding claims, wherein the fluid system comprises at least one transmissive device (18; 22) which is arranged between the radiation detecting

device (10) and the fluid (20) or fluid mixture and which is made from a material transmissive for the thermal radiation (14) of the fluid or fluid mixture, in particular a glass or plastics or a polymer material.

5. The household appliance according to claim 4, wherein the at least one transmissive device (18; 22) borders or encloses at least partially the fluid (20) or fluid mixture and/or is a window (18) arranged in a wall of the fluid system and/or is a pipe (22) or a pipe section of the fluid system.

6. The household appliance according to any one of the preceding claims, wherein the radiation detecting device, in particular thermopile sensor element (10), is sensitive for infrared radiation (14).

7. The household appliance according to claim 3, wherein the radiation detecting device comprises at least one electronic circuit (12) connected to and/or provided for receiving electric signals from the at least one sensor element, in particular thermopile sensor element (10), and/or provided for controlling the household appliance, in particular a heating device for heating said fluid or fluid mixture, wherein preferably the electronic circuit (12) and the sensor element (10) are placed at the same position in the household appliance and/or form a single structural member of the household appliance.

8. The household appliance according to any one of the preceding claims, comprising at least one output device for displaying the actual temperature value of the fluid (20) or fluid mixture.

9. A method for detecting a thermal radiation (14) of a running and/or stationary fluid (20) or mixture comprising a fluid within a closed or at least partially closed fluid system of a household appliance with an apparatus for detecting a thermal radiation (14) with least one thermopile sensor element (10), wherein the thermopile sensor element (10) is arranged in an intervisibility of the fluid (20) during detecting the thermal radiation (14) of the fluid (20).

10. The method according to claim 9 being performed in an household appliance to any one of the claims 1 to 8.

FIG. 1

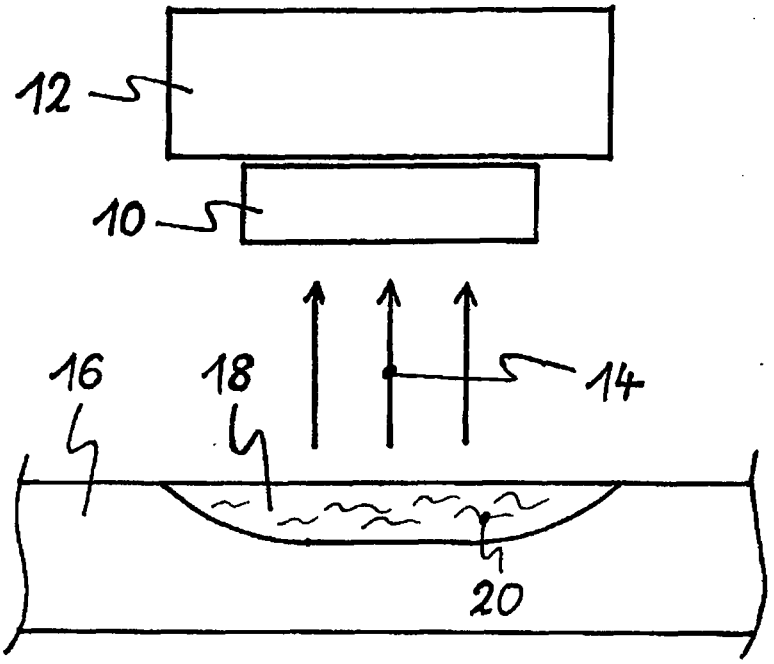
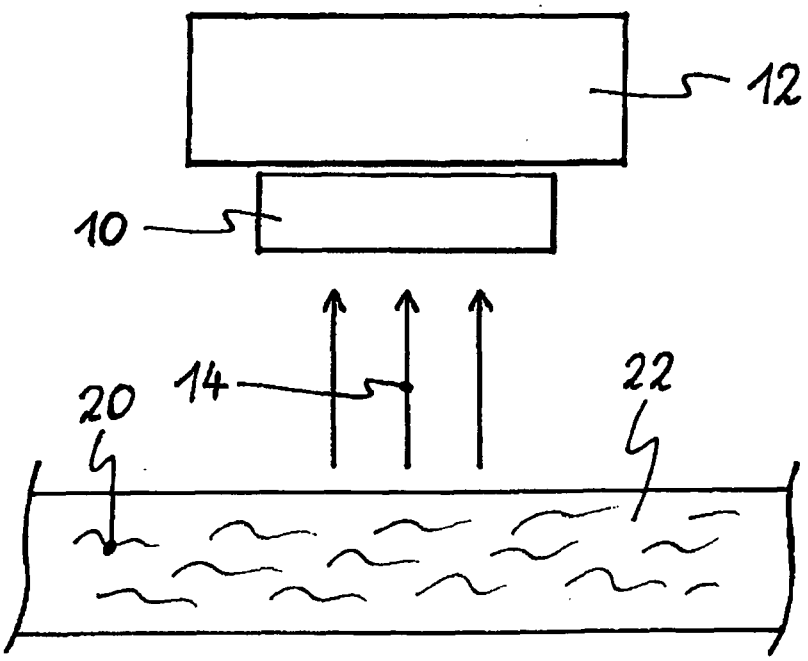


FIG. 2



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EUROPEAN SEARCH REPORT

Application Number
EP 08 00 6949

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	10 September 2008	Weinberg, Ekkehard

CATEGORY OF CITED DOCUMENTS

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