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(54) Titre : PROCEDE ET DISPOSITIF DE DESINFECTION DE LIQUIDES
(54) Title: METHOD FOR STERILIZING LIQUID AND LIQUID STERILIZATION DEVICE

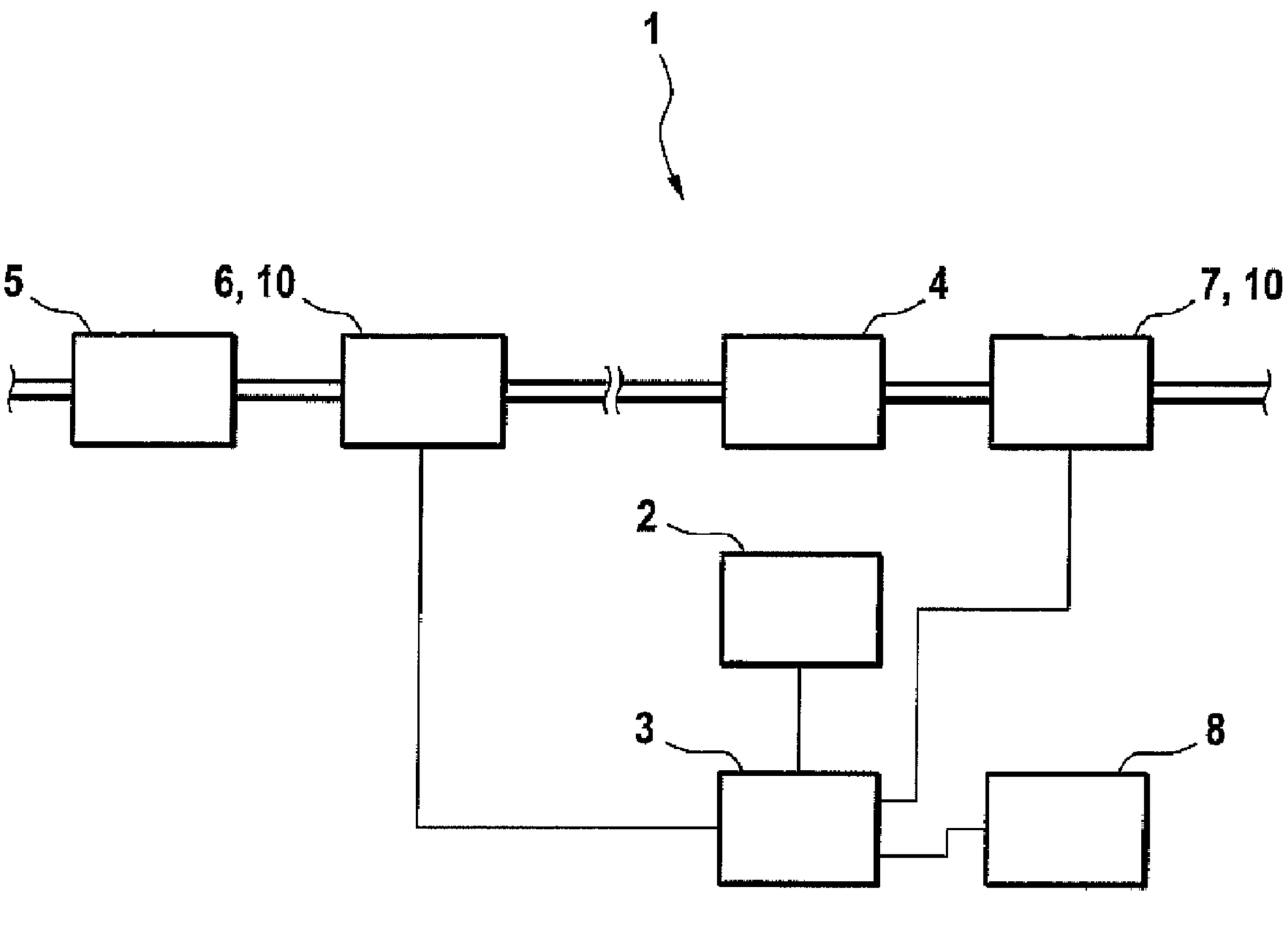

FIG.1

(57) Abrégé/Abstract:
The invention relates to a method for sterilizing liquids, wherein quantities of liquid flowing through at least one reaction chamber are irradiated by at least one UV lamp and are removed after irradiation. The UV lamp continues to be operated for a period Δt_1

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(57) Abrégé(suite)/Abstract(continued):
after removal of the quantity of liquid. The invention further relates to a liquid sterilization device (1) comprising at least one UV lamp (2) and at least one reaction chamber (4) through which the liquid to be sterilized flows as well as a tap (10) for removing quantities of liquid. A control and/or regulation device (3) is connected to the tap (10) and to the UV lamp (2) and continues to operate the UV lamp (2) for a period Δt_1 once the tap (10) is switched off.

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Erklärungen gemäß Regel 4.17:

— *Erfindererklärung (Regel 4.17 Ziffer iv)*

Veröffentlicht:

— *mit internationalem Recherchenbericht (Artikel 21 Absatz 3)*

[Fortsetzung auf der nächsten Seite]

(54) Title: METHOD FOR STERILIZING LIQUID AND LIQUID STERILIZATION DEVICE

(54) Bezeichnung : VERFAHREN ZUM ENTKEIMEN VON FLÜSSIGKEITEN UND FLÜSSIGKEITSENTKEIMUNGSVORRICHTUNG

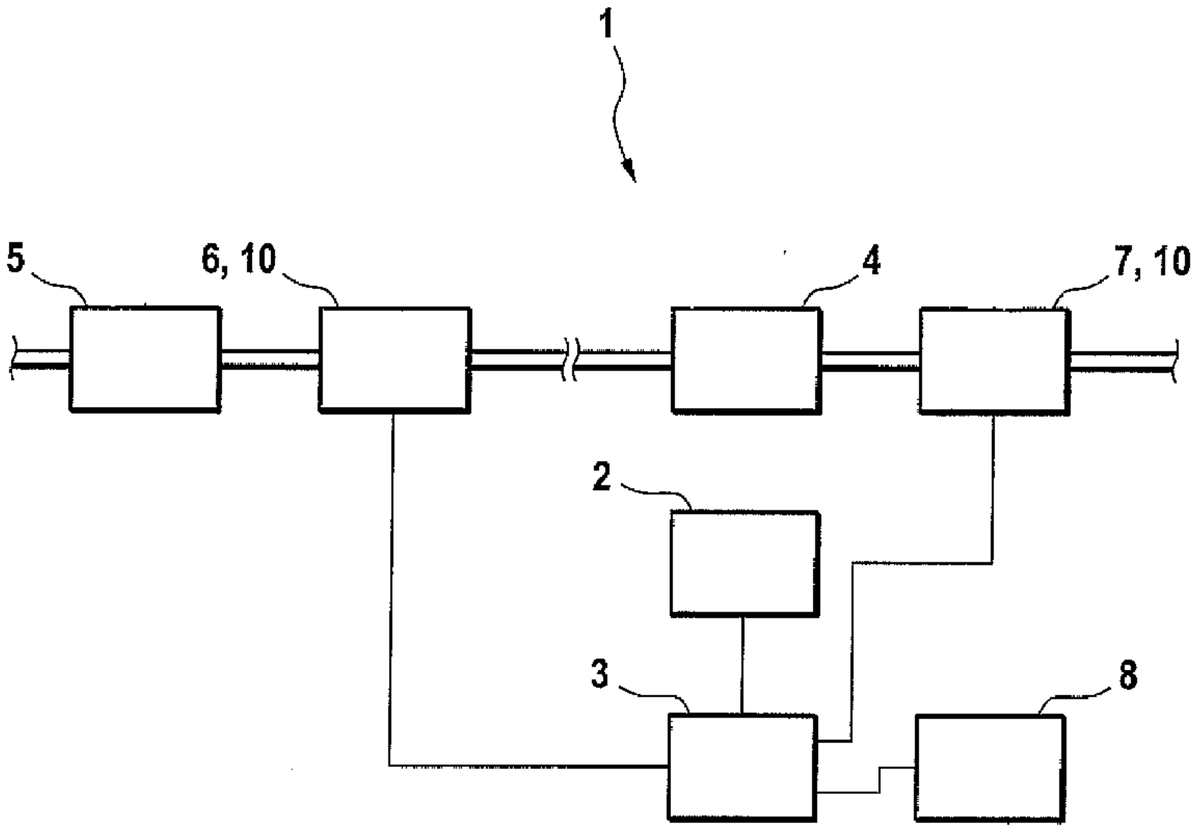

FIG.1

(57) Abstract: The invention relates to a method for sterilizing liquids, wherein quantities of liquid flowing through at least one reaction chamber are irradiated by at least one UV lamp and are removed after irradiation. The UV lamp continues to be operated for a period Δt_1 after removal of the quantity of liquid. The invention further relates to a liquid sterilization device (1) comprising at least one UV lamp (2) and at least one reaction chamber (4) through which the liquid to be sterilized flows as well as a tap (10) for removing quantities of liquid. A control and/or regulation device (3) is connected to the tap (10) and to the UV lamp (2) and continues to operate the UV lamp (2) for a period Δt_1 once the tap (10) is switched off.

(57) Zusammenfassung: Es wird ein Verfahren zum Entkeimen von Flüssigkeiten beschrieben, bei dem durch mindestens eine Reaktionskammer strömende Flüssigkeitsportionen von mindestens einer UV-Lampe bestrahlt und nach der Bestrahlung entnommen werden. Die UV-Lampe wird nach der Entnahme einer Flüssigkeitsportion für eine Zeitspanne Δt_1 weiterbetrieben.

[Fortsetzung auf der nächsten Seite]

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— *vor Ablauf der für Änderungen der Ansprüche geltenden Frist; Veröffentlichung wird wiederholt, falls Änderungen eingehen (Regel 48 Absatz 2 Buchstabe h)*

Es wird auch eine Flüssigkeitsentkeimungsvorrichtung (1) mit mindestens einer UV-Lampe (2) und mindestens einer von der Flüssigkeit durchströmten Reaktionskammer (4) sowie mit einer Zapfeinrichtung (10) zur Entnahme von Flüssigkeitsportionen beschrieben. Die Schalt- und/oder Regeleinrichtung (3), die an die Zapfeinrichtung (10) und an die UV-Lampe (2) angeschlossen ist, betreibt nach dem Ausschalten der Zapfeinrichtung (10) die UV-Lampe (2) über eine Zeitspanne Δt_1 weiter.

Method for sterilizing liquid and liquid sterilization device

Description

The invention relates to a method for sterilising liquids, wherein portions of liquid flowing through at least one reaction chamber are irradiated by at least one UV lamp and removed after irradiation. The invention also relates to a liquid sterilisation device.

Water sterilisation devices are also integrated into refrigeration appliances in order to sterilize cooled water delivered by the refrigeration appliance. In this context, it is essential that the cooled water is not warmed up by the sterilisation device. On the other hand, the cold water flowing through the reaction chamber cools the surroundings of the reaction chamber, thus also cooling the UV lamp which is located near the reaction chamber. As long as the UV lamp is in operation, however, the UV lamp will not be cooled to an extent adversely affecting its function.

The water is usually removed in portions from such devices, e.g. to fill drinking glasses one after the other. Once a particular removal act has finished, cooled water remains in the reaction chamber in order to be instantly available for the next dispensing act. The volume of water corresponding to the volume of the reaction chamber cools, amongst others, the UV lamp if the latter is only operated during the removal act. As a result, the lamp temperature falls quite rapidly, depending on the water temperature, so that in case of another dispensing act commencing shortly afterwards the UV lamp is either not ready for use or it takes too long until the UV output required for sterilisation is provided.

If there are longer breaks between the dispensing or removal acts, this problem usually does not occur since the UV lamp, which initially cooled down, will gradually warm up to ambient temperature, i.e. as a rule to room temperature (RT = 20°C), as does the cooled water in the reaction chamber, and as a result the UV lamp will usually have its starting temperature when another dispensing act is then initiated.

The UV lamp is at its starting temperature if the UV lamp is able to reach its intended UV output within 30 seconds after having been switched on. The starting temperature of the UV lamp usually lies within the range of from 15°C to 20°C.

It is therefore an object of the invention to provide a method for sterilising liquids where the UV lamp has at least its starting temperature at the beginning of each liquid removal act, without the need to operate the UV lamp continuously, which would lead to unnecessary power consumption.

This object is achieved by means of a method in which liquid at a temperature below the starting temperature of the UV lamp is sterilised, the UV lamp continues to be operated for a period Δt_1 after removal of a portion of liquid, and the period Δt_1 is selected such that the volume of liquid retained in the reaction chamber is warmed up at least to the starting temperature of the UV lamp.

It has been found that the UV lamp need not be operated during the entire break between two removal acts, which would lead to unnecessary power consumption since the same quantity of liquid would be irradiated all the time.

It is sufficient to continue to operate the UV lamp only for a defined period Δt_1 after removal of a portion of water, i.e. after the dispensing process.

This period Δt_1 is selected such that the volume of liquid remaining in the reaction chamber is preferably warmed up such that the UV lamp is prevented from permanently cooling down to below its starting temperature. It is therefore preferred that the period Δt_1 be selected such that the volume of liquid retained in the reaction chamber is warmed up at least to the starting temperature of the UV lamp.

Since this starting temperature is usually within the range of the room temperature, it is sufficient to select the period Δt_1 such that the volume of liquid retained in the reaction chamber is warmed up at least to room temperature.

The liquid which is sterilised is preferably water. The liquid can have a temperature below the starting temperature of the UV lamp and/or below room temperature (RT = 20°C). Preferably, liquids at a temperature of particularly ≤ 12°C, particularly preferred ≤ 7°C, are sterilised. As another embodiment, water containing additives can be sterilised.

It is therefore preferred that the lower the temperature of the liquid to be sterilised is, the longer the period the Δt_1 is selected to be.

It is sufficient to continue to operate the UV lamp for a period Δt_1 if the starting temperature of the lamp approximately corresponds to the ambient temperature of the liquid sterilisation device.

In the case that the ambient temperature of the liquid sterilisation device should be below room temperature (RT = 20°C) or below the starting temperature of the UV lamp and the breaks between the removal acts are quite long, the UV lamp will cool down to ambient temperature over time. In these cases, it is preferred that the UV lamp be operated for at least a further period Δt_2 between the removal of two portions of liquid.

In the case of long breaks between the removal processes, it is recommended to operate the UV lamp for a period Δt_2 again and again, to ensure that the UV lamp has at least its starting temperature at the beginning of each subsequent removal process.

In this context, it is advantageous if the lamp temperature is measured and at least the action of switching on the UV lamp for operation of the UV lamp for the period Δt_2 is carried out in dependence on the lamp temperature.

The length of the period Δt_1 and/or of the period Δt_2 can also be regulated in dependence on the lamp temperature that has been measured. This method has the advantage that the number of periods Δt_2 as well as the lengths of the periods Δt_1 and/or Δt_2 can be suitably adapted in the case of changing ambient conditions.

In this way, it is ensured that the UV lamp is always ready for operation while power consumption is minimal.

The object is achieved by means of a liquid sterilisation device which is characterised in that a liquid at a temperature below the starting temperature of the UV lamp flows through the reaction chamber (4), that a switching and/or control device is provided which is connected to the dispensing device and to the UV lamp, wherein the switching device continues to operate the UV lamp for a period Δt_1 after the switching off of the dispensing device, wherein the period Δt_1 is selected such that the volume of liquid retained in the reaction chamber after the dispensing device has been switched off is warmed up to at least the starting temperature of the UV lamp.

According to another embodiment, the switching device is configured such that it continues to operate the UV lamp at least for a further period Δt_2 between the removal of two portions of liquid.

Preferably, at least one temperature sensor is provided. The temperature sensor is preferably arranged at the UV lamp for measuring the lamp temperature.

This temperature sensor or a further temperature sensor can also be a bimetallic element for measuring the ambient temperature. The bimetallic element is preferably arranged in the switching device and/or control device. If, however, the switching and/or control device itself generates much heat, it is preferred that the bimetallic element be provided outside the switching and/or control device.

Preferably, the volume of the reaction chamber < the volume of a portion of liquid. This has the advantage that the volume of liquid which is located in the reaction chamber during longer idle times and is warmed up to room temperature there makes only a small contribution to the total volume of the portion of liquid during the next act of dispensing cooled water. As an overall result, a cooled portion of liquid can be provided in this manner.

The liquid sterilisation device is preferably used in a refrigeration appliance or in conjunction with an appliance for dispensing cooled liquid, in particular cooled water.

In the accompanying Figure, a liquid sterilisation device 1 is schematically depicted, which can be connected to a water pipe by means of a connector 5. The water supplied flows through a valve 6 and enters a reaction chamber 4, where the water is irradiated by a UV lamp 2, thus sterilising it. The sterilised water leaves the water sterilisation device 1 via an outlet 7. The outlet 7 may be provided with a push button or the like to start the dispensing process.

The valve 6 and the outlet 7 are parts of the dispensing device 10, which are connected to a switching and/or control device 3. To initiate the dispensing process, the push button at the outlet 7 is actuated, whereupon the switching and/or control device 3 opens the valve 6 to allow water from the water pipe to flow in via the connector 5. Once the dispensing act has finished, the valve 6 is closed by the switching and/or control device 3.

Furthermore, a temperature sensor 8 is provided which is also connected to the switching and/or control device 3. Once the dispensing act has finished, the switching and/or control device continues to operate the UV lamp 2 for the period Δt_1. The switching and/or control device 3 illustrated in the Figure is also designed to operate the UV lamp 2 at least for a further period Δt_2 between two removals of portions of liquid.

List of reference numerals

1	Liquid sterilisation device
2	UV lamp
3	Switching and/or control device
4	Reaction chamber
5	Connector
6	Valve
7	Outlet
8	Temperature sensor
10	Dispensing device

Claims for entry into the national phase

1. Method of sterilising liquids, wherein portions of liquid flowing through at least one reaction chamber are irradiated by at least one UV lamp having a starting temperature and are removed from the reaction chamber after irradiation, wherein liquid at a temperature below the starting temperature of the UV lamp is sterilised, the temperature of the liquid being lower than or equal to 12°C,
the UV lamp continues to be operated for a period Δt_1 after removal of a portion of liquid, and
the period Δt_1 is selected such that the volume of liquid retained in the reaction chamber is warmed up at least to the starting temperature of the UV lamp.

2. Method according to claim 1, **wherein** the lower the temperature of the liquid to be sterilised is, the longer the period Δt_1 is selected to be.

3. Method according to claim 1, wherein the UV lamp is operated for at least a further period Δt_2 between the removal of two portions of liquid.

4. Method according to claim 1, wherein the lamp temperature is measured and at least the action of switching on the UV lamp for operation of the UV lamp during the period Δt_2 is carried out in dependence on the lamp temperature.

5. Method according to claim 1, wherein the lamp temperature is measured and at least one of the length of the period Δt_1 and the length of the period Δt_2 is regulated in dependence on the temperature of the UV lamp.

6. Method according to claim 1, wherein the liquid that is sterilised is water or water containing additives.

7. Method according to any one of claims 1-6, wherein the volume of the reaction chamber (4) is selected to be smaller than the volume of a portion of liquid.

8. Liquid sterilisation device (1) comprising at least one UV lamp (2) having a starting temperature, and comprising at least one reaction chamber (4) through which the liquid flows, the temperature of the liquid being lower than or equal to 12°C, and comprising a dispensing device (10) for removing portions of liquid, **wherein**
liquid at a temperature below the starting temperature of the UV lamp (2) flows through the reaction chamber (4),
a switching and/or control device (3) is provided which is connected to the dispensing device (10) and to the UV lamp (2), and the switching and/or control device (3) continues to operate the UV lamp (2) for a period Δt_1 after the switching off of the dispensing device (10), wherein the period Δt_1 is selected such that the volume of liquid retained in the reaction chamber after the dispensing device has been switched off is warmed up to at least the starting temperature of the UV lamp.

9. Device according to claim 8, wherein the switching and/or control device (3) continues to operate the UV lamp (2) at least for a period Δt_2 between the removal of two portions of liquid.

10. Device according to claim 8, wherein at least one temperature sensor (8) is provided.

11. Device according to claim 10, wherein the temperature sensor (8) is arranged at the UV lamp (2) for measuring the lamp temperature.

12. Device according to claim 10, wherein the temperature sensor (8) is a bimetallic element for measuring the ambient temperature.

13. Device according to claim 12, wherein the bimetallic element is arranged in the switching and/or control device (3).

14. Use of the liquid sterilisation device according to claim 8 in a refrigeration appliance and/or in conjunction with an appliance for dispensing cooled liquid.

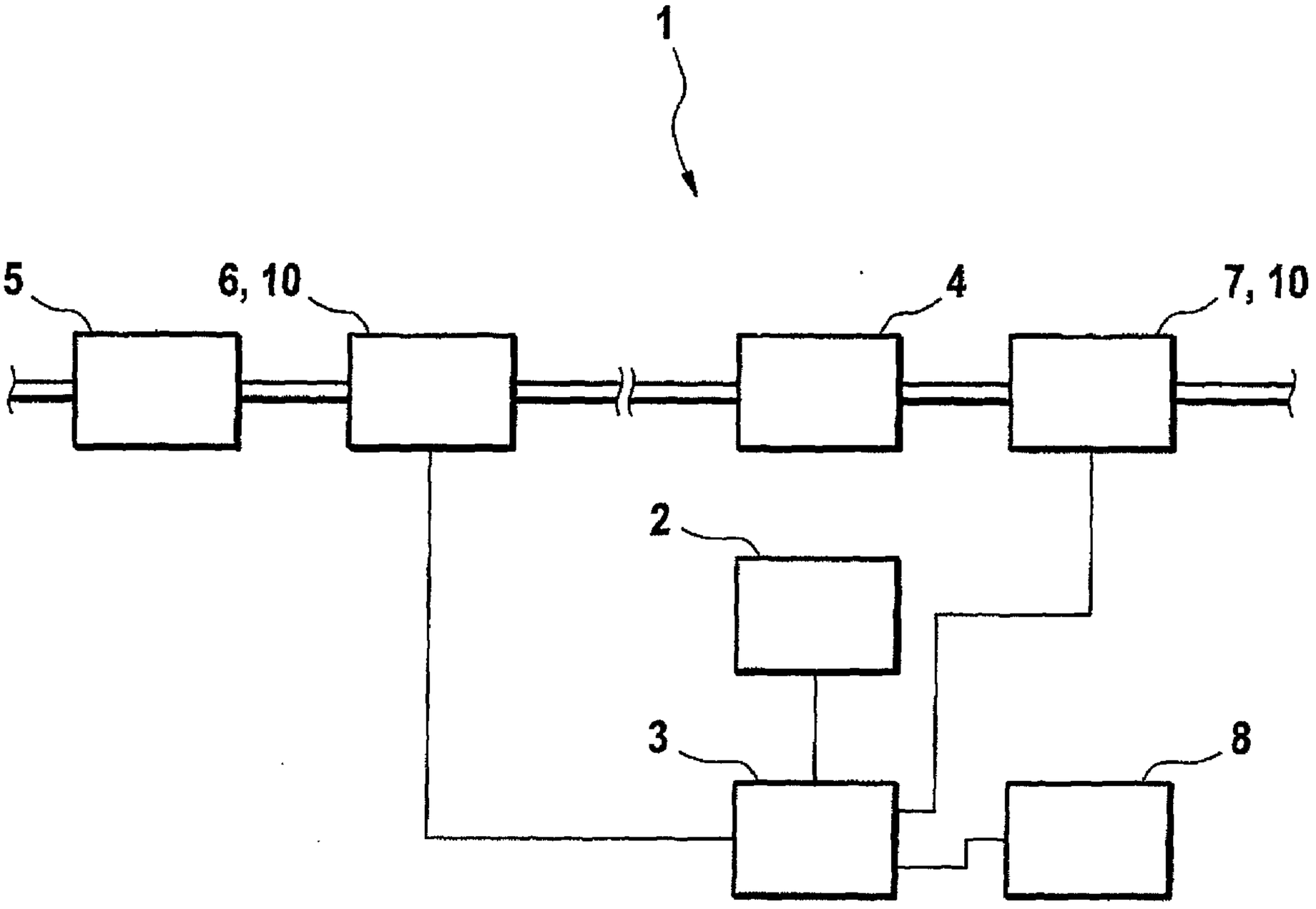

FIG.1

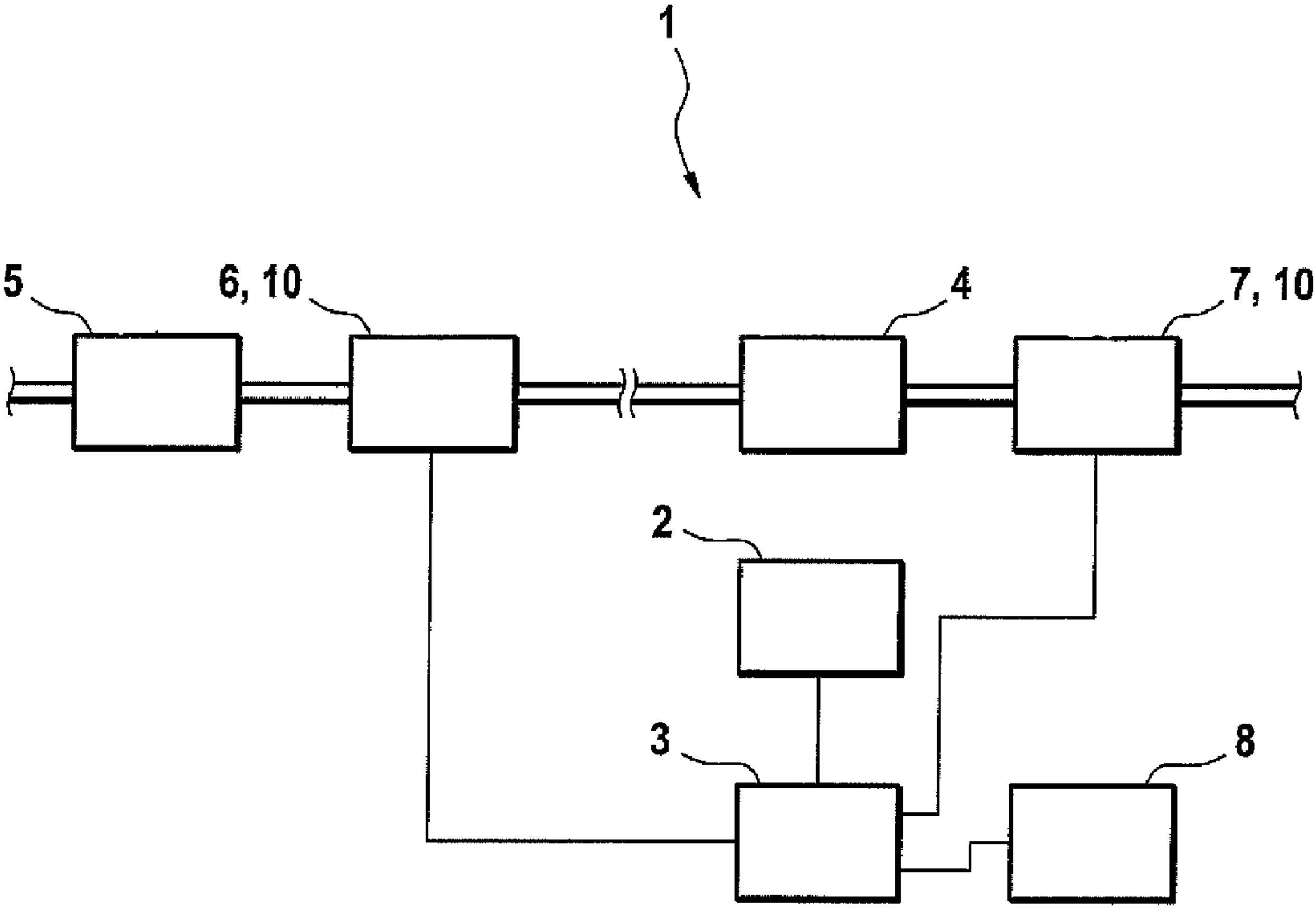

FIG.1