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(54) **RECOVERY OF HEAT FROM WASTEWATER**

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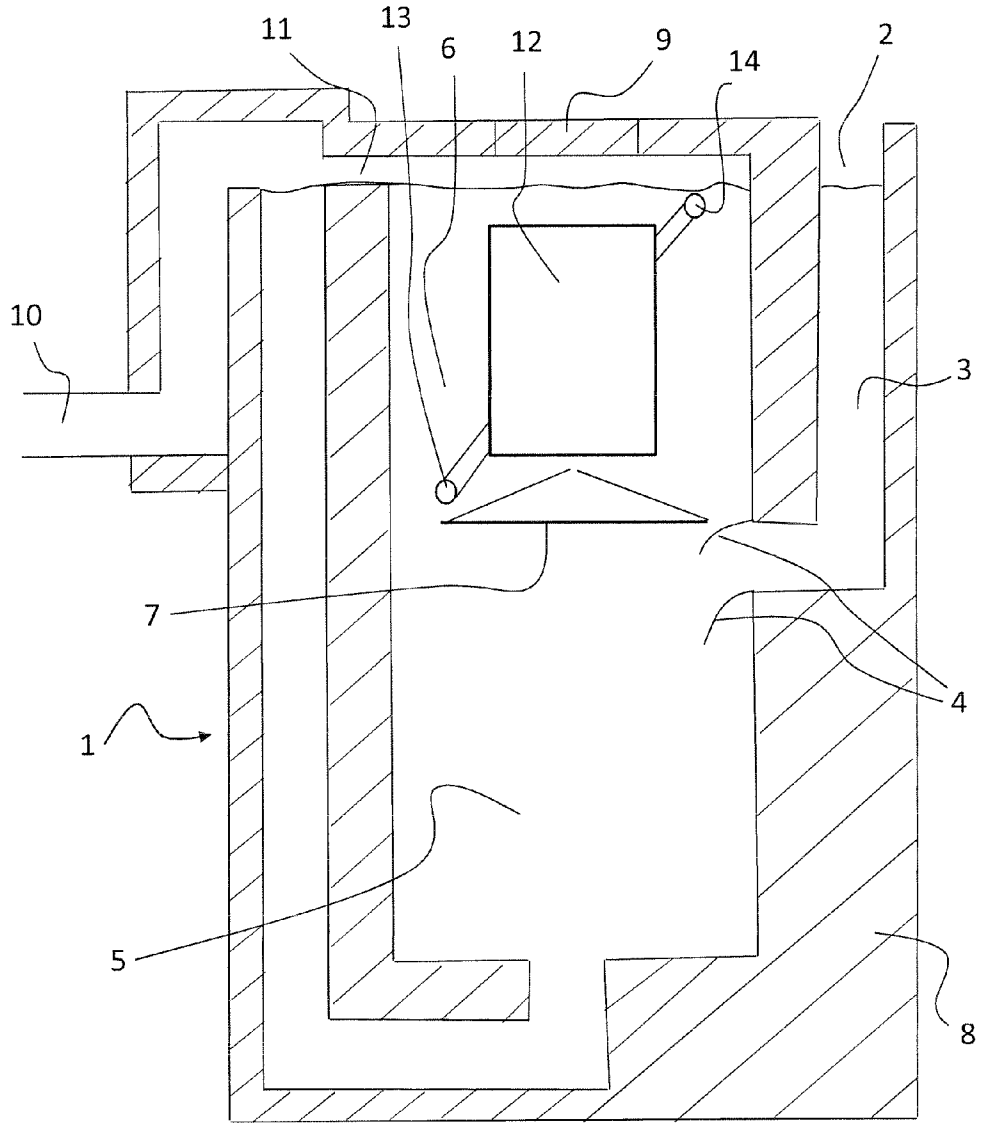
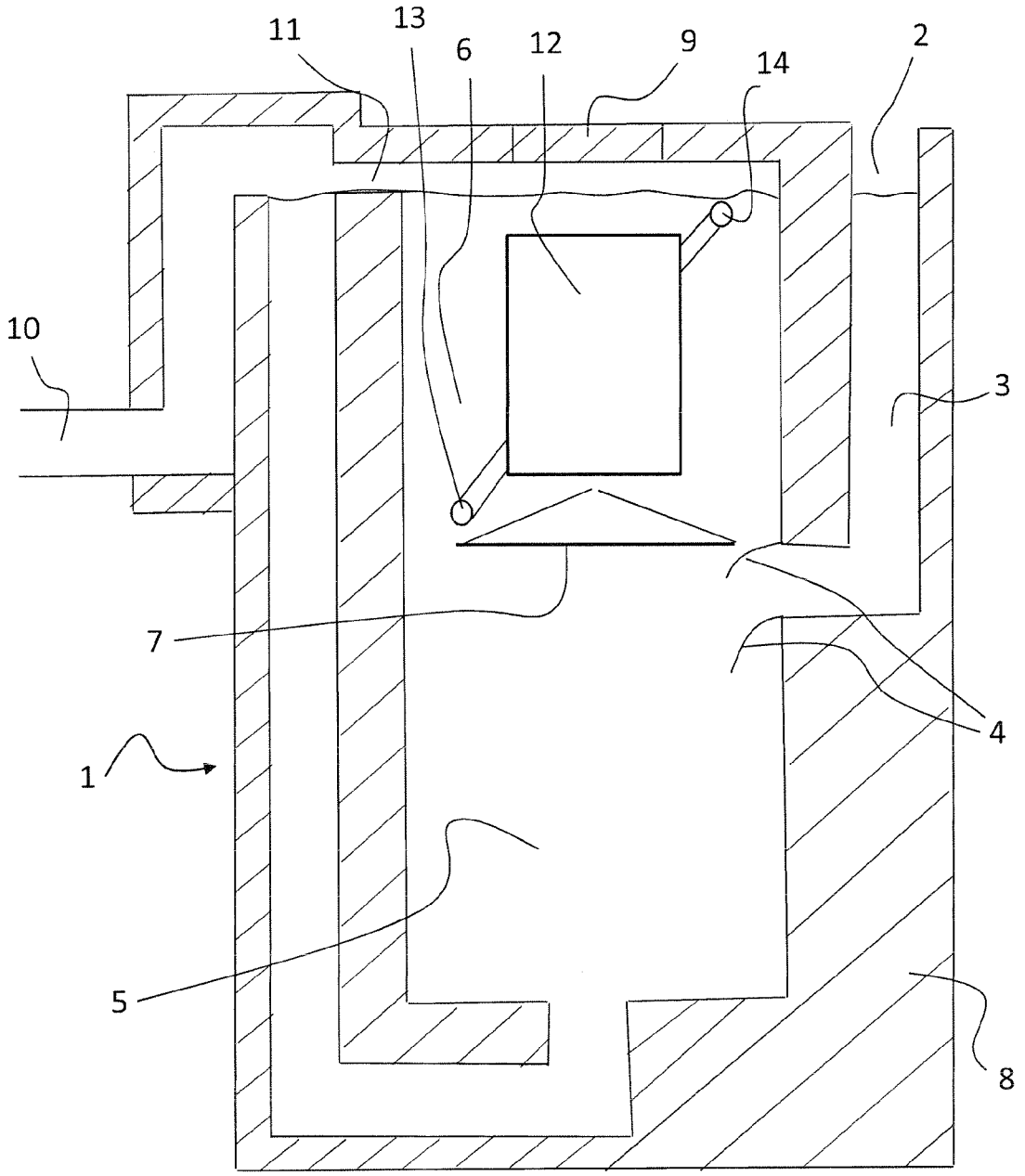
(57) **ABSTRACT**

Device for recovering heat originating from wastewater, characterized in that it comprises a tank (**1**) comprising at least two portions, a bottom portion (**5**) designed to store the cold wastewater and a top portion (**6**) designed to store the hot wastewater, the said portions being separated by stratification, and in that it comprises a heat exchanger (**12**) placed in the top portion (**6**).

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RECOVERY OF HEAT FROM WASTEWATER

[0001] The invention relates to a device for recovering heat, particularly suitable for recovering the heat from wastewater. It also relates to a method for recovering heat from wastewater.

[0002] The wastewater originating from one or more buildings includes water originating from showers, baths, washbasins, dishwashers, washing machines, etc. This water may be hot or cold and there are devices for recovering its heat, notably for the purpose of preheating the domestic hot water designed to resupply this or these buildings.

[0003] The existing devices for recovering heat are placed at different locations that are more or less far from the source of wastewater: they may be either directly at its outlet, at a shower or a bathtub, or more distant, at the main drains.

[0004] A current solution of the prior art consists in causing all the wastewater to flow into a heat exchanger for the purpose of recovering its heat. The drawback of this solution is that it is not optimized because, when cold water is present in the wastewater, its efficiency falls very markedly. Specifically, a particular feature of the management of wastewater arises from the fact that it can receive water at different temperatures, from cold temperatures close to the temperature of the water to be preheated.

[0005] Therefore, a general object of the invention is to propose a solution for recovering heat from wastewater with an efficiency that is improved relative to the solutions of the prior art.

[0006] Accordingly, the invention is based on a device for recovering heat originating from wastewater, characterized in that it comprises a tank comprising at least two portions, a bottom portion, designed to store the cold wastewater, separated by a stratification plate from a top portion, designed to store the hot wastewater, being separated by stratification, in that it comprises a duct for orienting the wastewater to the bottom portion of the tank and in that it comprises a heat exchanger placed in the top portion.

[0007] This stratification plate may be made of metal with a thickness of between 0.8 and 1.2 millimetres.

[0008] The bottom portion of the tank may comprise a volume of between 20 n and 30 n litres and the top portion may comprise a volume of between 40 n and 60 n litres, where n is the number of inhabitants planned for the building.

[0009] Moreover, the device for recovering heat may comprise an inlet for the wastewater, a duct for orienting the wastewater to the bottom portion of the tank and an outlet for draining the wastewater.

[0010] The tank may be mainly made of plastic such as PVC.

[0011] The wall of the tank may comprise an insulator equivalent to a polyurethane foam that is 100 millimetres thick.

[0012] The heat exchanger may comprise a copper coil. It may comprise an inlet for the domestic hot water circuit and an outlet to the domestic hot water circuit in order to transmit the preheated domestic water to the domestic hot water circuit.

[0013] The invention also relates to a method for recovering heat originating from wastewater, characterized in that it comprises the following steps:

[0014] separation of the hot wastewater from the cold wastewater by stratification;

[0015] transfer of the heat from the hot wastewater to a fluid to be preheated.

[0016] The first step may consist in separating and storing the hot and cold water in two distinct portions of one and the same tank, and the second step may consist in recovering the heat from the hot water by means of a heat exchanger placed in the hot portion.

[0017] The first step may comprise a preliminary step of feeding the hot and cold wastewater into the same bottom portion of one and the same tank before obtaining their separation as mentioned above.

[0018] These objects, features and advantages of the present invention will be explained in detail in the following description of a particular embodiment given in a non-limiting manner with respect to the single attached figure which represents schematically a device for recovering the heat from wastewater according to one embodiment of the invention.

[0019] The invention is based on the concept of separating the hot and cold wastewater in order to allow the optimized recovery of the heat from the hot wastewater.

[0020] The embodiment described with reference to FIG. **1** is based on a storage and heat-recovery tank **1** which comprises mainly two zones, one zone in which the hot portion of the wastewater is stored and one zone in which the cold portion is stored.

[0021] The wastewater arrives through an inlet **2** positioned in its top portion and is guided through a duct **3** then a directional pipe **4** to a bottom portion **5** of the storage volume of the tank **1**. This bottom portion is also called a buffer zone **5**. It allows the separation of the hot and cold water by stratification. The hot water rises and is stored in the top portion **6** of the tank **1**, the said water being separated from the buffer zone **5** by a separation or stratification plate **7**. Above the latter there is a roof having two downward slopes in order to prevent waste being held in the top portion **6** of the tank. The storage volume of the tank is closed by insulated walls **8** limiting the heat losses.

[0022] The tank is fitted with an inspection manhole cover **9** for its maintenance and notably its cleaning. A recirculation channel **11** is positioned between the storage volume and the drain **10** in order to limit the clogging of the tank. A filter, not shown, may be provided upstream of the tank in order to prevent waste entering. A drainage valve may be provided for draining the tank during maintenance operations.

[0023] The top portion **6** of the tank is therefore the hot portion of the tank. It makes it possible to conserve the hot wastewater. In this portion, an exchanger **12** is arranged, in which the domestic hot water enters through an inlet **13** and exits through an outlet **14** in order to receive the heat transmitted by the hot wastewater. This exchanger **12** therefore makes it possible to preheat the domestic hot water. This top portion **6** of the tank remains at a high and not very variable temperature, which ensures the optimal and stable recovery of heat for the preheating.

[0024] The volume of the tank has dimensions in order to optimize its efficiency. The function of the buffer zone **5** is to store the cold wastewater: it must have sufficient volume to ensure the correct separation of the hot and cold water but must not be too big so as not to increase the bulk and the cost of the assembly. In the event of the arrival of cold wastewater this water must be able to flow away without disrupting the hot zone of the tank. A volume of 100 litres is ideal for a house

of four occupants. More generally, a volume of between 80 and 120 litres could be appropriate in such an example.

[0025] Similarly, the volume of the hot zone is important: it must represent a good compromise in order to allow the storage of a sufficient quantity of hot water without generating too much heat loss. Thus a volume of 200 litres would be ideal for a house of four occupants. More generally, a volume of between 160 and 240 litres could be appropriate in this example.

[0026] This solution has been described above as an example for an individual dwelling. However, it is perfectly suitable for a collective dwelling such as an apartment block, for industry or the tertiary sector. Thus, for n people in the building, the tank could have a volume of its buffer zone **5** of between 20 n and 30 n and/or a volume of the hot zone **6** of between 40 n and 60 n.

[0027] This device for recovering heat may be placed in a basement of the building involved or outside.

[0028] The tank may be made of plastic, such as PVC for example, insulated by a polyurethane foam jacket 100 millimetres thick, or, as a variant, by any equivalent insulator. The exchanger may comprise a portion of the copper coil type. The various couplings may be made of plastic, such as PVC. The stratification plate may be made of metal, the thickness of which is approximately one millimetre, that is to say between 0.8 and 1.2 millimetres. The tank may have a cylindrical shape, being of circular section, the stratification plate then also having a circular shape. The tank has been described in an embodiment comprising two distinct zones separated by a separation plate. As a variant, it is possible for these two zones not to be separated. Moreover, it is possible to conceive of more than two zones for applications requiring several levels of hot temperature.

[0029] The invention has been illustrated in the context of the recovery of heat from wastewater in order to preheat the domestic hot water. However, this heat recovery could be used for any other heating requirement.

[0030] The invention also relates to the method for recovering heat from the wastewater of a building, characterized in that it comprises the following steps:

[0031] separation of the hot wastewater from the cold wastewater by stratification;

[0032] transfer of the heat from the hot wastewater to a fluid to be preheated.

[0033] Finally, the present invention clearly achieves the object sought. The top portion of the tank comprises the hot wastewater not influenced by a flow of cold wastewater, which allows it to be kept at a high temperature which optimizes the heat transfer to the domestic water to be heated. The heat of the wastewater is not lost in a mixture with the cold wastewater but recovered optimally. This makes it possible to recover approximately 75% of the calories lost in the wastewater. Moreover, the device is not very bulky and not very costly and is suitable for easy installation in any building.

1-10. (canceled)

11. Device for recovering heat originating from wastewater, wherein it comprises a tank comprising at least two portions, a bottom portion, designed to store the cold wastewater, separated by a stratification plate from a top portion, designed to store the hot wastewater, being separated by stratification, in that it comprises a duct for orienting all of the wastewater entering through the bottom portion of the tank and in that it comprises a heat exchanger placed in the top portion.

12. Device for recovering heat according to claim **11**, wherein the stratification plate is made of metal with a thickness of between 0.8 and 1.2 millimetres.

13. Device for recovering heat for a building according to claim **11**, wherein the bottom portion comprises a volume of between 20 n and 30 n litres and/or in that the top portion comprises a volume of between 40 n and 60 n litres, where n is the number of inhabitants planned for the building.

14. Device for recovering heat according to claim **11**, wherein it comprises an inlet for the wastewater and an outlet for draining the wastewater.

15. Device for recovering heat according to claim **11**, wherein the tank is mainly made of plastic such as PVC.

16. Device for recovering heat according to claim **11**, wherein the wall of the tank comprises an insulator equivalent to a polyurethane foam that is 100 millimetres thick.

17. Device for recovering heat according to claim **11**, wherein the heat exchanger comprises a copper coil.

18. Device for recovering heat according to claim **11**, wherein the heat exchanger comprises an inlet for the domestic hot water circuit and an outlet to the domestic hot water circuit in order to transmit the preheated domestic water to the domestic hot water circuit.

19. Method for recovering heat originating from wastewater, wherein it comprises the following steps:

arrival of all of the wastewater in the bottom portion of a tank;

separation of the hot wastewater from the cold wastewater by stratification;

transfer of the heat from the hot wastewater to a fluid to be preheated.

20. Method for recovering heat according to claim **19**, wherein the second step consists in separating and storing the hot and cold water in two distinct portions of one and the same tank, and in that the third step consists in recovering the heat from the hot water by means of a heat exchanger placed in the hot portion.

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