

## **ELECTRIC WATER HEATER**

### **FIELD**

[0001] The disclosure relates to a heater, and more particularly to an  
5 electric water heater.

### **BACKGROUND**

[0002] In general, an electric water heater may be classified as a vertical-  
type electric water heater or a horizontal-type electric water heater. The electric  
water heater has a water entry region, a water exit region disposed above the water  
10 entry region, and an instant heating region interconnecting the water entry region  
and the water exit region. The water entry region stores water from an external  
environment. A heating tube is disposed in the instant heating region so that water  
in the instant heating region may be instantly heated. The water exit region  
receives the water heated in the instant heating region, and delivers the heated  
15 water out of the electric water heater.

[0003] When the electric water heater does not deliver the water therefrom,  
a water temperature of the electric water heater remains at a predetermined  
temperature. As long as the water temperature is lower than the predetermined

temperature, the heating tube disposed in the instant heating region starts heating up. However, because the water exit region communicates with the instant heating region and is disposed above the water entry region, hot water tends to be accumulated in the water exit region. As a result, a water temperature difference  
5 between the water entry region and the water exit region increases, thereby causing the heating tube to frequently heat up and leading to an increase in electricity consumption. As a result, heat convection of the water heater is intensified, thereby generating more noises. In addition, heating pressure in the instant heating region may also increase.

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## SUMMARY

[0004] Therefore, an object of the disclosure is to provide an electric water heater that can alleviate at least one of the drawbacks of the prior art.

[0005] According to the disclosure, an electric water heater includes a water container, a heating unit that is disposed in the water container, and a  
15 partition unit that is mounted within the water container.

[0006] The partition unit and the water container cooperatively define a water entry space, an instant heating space that communicates with the water entry space, and a water exit space that is disposed above the instant heating space in

a top-down direction, and that communicates with the instant heating space. The instant heating space is adapted to introduce water from the water entry space into the water exit space. The partition unit has an elongated opening that is elongated in the top-bottom direction and that interconnects the water entry space and the instant heating space.

[0007] The heating unit includes a heating tube subunit that extends into the instant heating space, that is spaced apart from the elongated opening, and that is adapted to heat water.

[0008] A ratio of a length of the elongated opening in the top-bottom direction to a length of the instant heating space in the top-down direction ranges from 1:2 to 4:5.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

[0009] Other features and advantages of the disclosure will become apparent in the following detailed description of the embodiment(s) with reference to the accompanying drawings. It is noted that various features may not be drawn to scale.

[0010] Figure 1 is a sectional view illustrating an electric water heater according to a first embodiment of the disclosure.

[0011] Figure 2 is a perspective view of the first embodiment, illustrating a partition unit of the electric water heater.

[0012] Figure 3 is a sectional view of the first embodiment, illustrating a flowing state of heated water.

5 [0013] Figure 4 is a sectional view illustrating an electric water heater according to a second embodiment of the disclosure.

[0014] Figure 5 is a perspective view of the second embodiment, illustrating a partition unit of the electric water heater.

[0015] Figure 6 is a sectional view of the second embodiment, illustrating  
10 a flowing state of heated water.

#### **DETAILED DESCRIPTION**

[0016] Before the disclosure is described in greater detail, it should be noted that where considered appropriate, reference numerals or terminal portions of reference numerals have been repeated among the figures to indicate  
15 corresponding or analogous elements, which may optionally have similar characteristics.

[0017] It should be noted herein that for clarity of description, spatially relative terms such as “top,” “bottom,” “upper,” “lower,” “on,” “above,” “over,”

“downwardly,” “upwardly” and the like may be used throughout the disclosure while making reference to the features as illustrated in the drawings. The features may be oriented differently (e.g., rotated 90 degrees or at other orientations) and the spatially relative terms used herein may be interpreted accordingly.

5           [0018]     Furthermore, components in the drawings are not necessarily drawn to scale, but are schematically drawn to facilitate understanding of the embodiments of the disclosure.

          [0019]     Referring to Figures 1 to 3, an electric water heater according to a first embodiment of the disclosure includes a water container 1, a partition unit 2,  
10     a heating unit 3, a water input pipe 4, and a water output pipe 5.

          [0020]     In this embodiment, the water container 1 is a vertical-type water container.

          [0021]     The partition unit 2 is mounted within the water container 1. The partition unit 2 and the water container 1 cooperatively define a water entry space  
15     201, an instant heating space 203 that communicates with the water entry space 201, and a water exit space 202 that is disposed above the instant heating space 203 in a top-down direction (Z), and that communicates with the instant heating space 203. The instant heating space 203 is adapted to introduce water from the

water entry space 201 into the water exit space 202.

[0022] In this embodiment, the partition unit 2 includes a partition plate 21 and a sleeve member 22 connected to the partition plate 21.

[0023] The partition plate 21 is disc-shaped, and has a communication hole 211 and an installation hole 212 spaced apart from the communication hole 211. The communication hole 211 and the installation hole 212 extend through a top surface and a bottom surface of the partition plate 21 in the top-bottom direction (Z). The top surface of the partition plate 21 and the water container 1 cooperatively define the water exit space 202.

[0024] The sleeve member 22 extends downwardly from the bottom surface of the partition plate 21, surrounds an axis (X), and defines the instant heating space 203. The axis (X) extends in the top-bottom direction (Z). The instant heating space 203 communicates with the water exit space 202 through the communication hole 211. The bottom surface of the partition plate 21, the sleeve member 22, and the water container 1 cooperatively define the water entry space 201. Furthermore, the sleeve member 22 has a circular cross-section, and is formed with an elongated opening 221 that is elongated in the top-bottom direction (Z) and that interconnects the water entry space 201 and the instant heating space 203. The elongated

opening 221 is rectangular in the top-bottom direction (Z). A ratio of a length (H1) of the elongated opening 221 in the top-bottom direction (Z) to a length (H2) of the instant heating space 203 in the top-down direction (Z) ranges from 1:2 to 4:5. In this embodiment, the ratio of the length (H1) to the length (H2) is 1:2.

5        [0025]    The heating unit 3 is disposed in the water container 1, and includes a heating tube subunit 31. The heating tube subunit 31 extends into the instant heating space 203, is spaced apart from the elongated opening 221, and is adapted to heat water.

         [0026]    The water input pipe 4 extends through a bottom end of the water  
10       container 1, communicates with the water entry space 201, and is adapted to introduce water into the water entry space 201.

         [0027]    The water output pipe 5 extends through the bottom end of the water container 1 and the instant heating space 203, and passes through the installation hole 212 into the water exit space 202. The water output pipe 5 communicates with  
15       the water exit space 202 and is adapted to output the water from the water exit space 202.

         [0028]    When the water input pipe 4 introduces the water into the water entry space 201, the water flows into the instant heating space 203 and the water

exit space 202 so that the instant heating space 203 and the water exit space 202 are full of the water. The heating tube subunit 31 heats the water in the instant heating space 203 to a predetermined temperature.

[0029] Because the temperature of the water heated in the instant heating space 203 is relatively high, the water heated in the instant heating space 203 may flow in the top-bottom direction (Z) to the water exit space 202 (as indicated by solid arrows in Figure 3). Meanwhile, because heat energy in the instant heating space 203 is greater than heat energy in the water entry space 201, the water heated in the instant heating space 203 may flow through the elongated opening 221 to the water entry space 201 such that the elongated opening 221 serves as a heat conduction channel. As shown in Figure 3, the water heated in the instant heating space 203 may flow to the water exit space 202 (as indicated by solid arrows) and may flow through the elongated opening 221 (as indicated by dashed arrows) to the water entry space 201. Accordingly, a water temperature of the entry space 201 is increased while the water temperature of the instant heating space 203 and a water temperature of the water exit space 202 are decreased so as to reduce water-temperature differences among the water entry space 201, the instant heating space 203, and the water exit space 202.

[0030] When the water temperature is lower than the predetermined temperature, the heating tube subunit 31 starts heating up. Because the water-temperature differences among the water entry space 201, the instant heating space 203, and the water exit space 202 may be reduced, and because the water temperature of the water entry space 201 is increased due to the water from the instant heating space 203 flowing through the elongated opening 221 therein, the water in the instant heating space 203 may be instantly heated by the heating tube subunit 31. Accordingly, heat convection of the electric water heater of the disclosure may be reduced, heating noises may be reduced, and heating pressure in the instant heating space 203 may be reduced

[0031] Figures 4 to 6 illustrate an electric water heater according to a second embodiment of the disclosure.

[0032] In this embodiment, the water container is a horizontal-type container.

[0033] The partition unit 2, in the second embodiment, includes a first partition plate 23, a second partition plate 24, and a third partition plate 25. The first partition plate 23 extends in the top-bottom direction (Z). The second partition plate 24 extends in the top-bottom direction (Z), and is spaced apart from the first

partition plate 23 in a left-right direction (Y) perpendicular to the top-bottom direction (Z). The third partition plate 25 extends in the left-right direction (Y), and interconnects a top end of the first partition plate 23 and a bottom end of the second partition plate 24. The first partition plate 23, the third partition plate 25, the second partition plate 24, and the water container 1 cooperatively define a left space region and a right space region within the water container 1. One of the left space region and the right space region serves as the water entry space 201. Another one of the left space region and the right space region serves as the water exit space 202 and the instant heating space 203. There is no partition plate to separate the water exit space 202 from the instant heating space 203. The water exit space 202 is disposed between the second partition plate 24 and the water container 1. The instant heating space 203 is disposed under the third partition plate 25 and between the first partition plate 23 and the water container 1. The first partition plate 23 is formed with the elongate opening 231. The heating tube subunit 31 extends into the instant heating space 203 in a spaced-apart manner from the elongate opening 231. The ratio of the length (H1) of the elongated opening 231 in the top-bottom direction (Z) to the length (H2) of the instant heating space 203 in the top-bottom direction (Z) to the length (H2) of the instant heating space 203 in the top-down direction (Z) ranges from 1:2 to 4:5. The ratio of the length (H1) to

the length (H2) is 1:2. In this embodiment, the second partition plate 24 has a through hole 241 extending therethrough in the left-right direction (Y).

[0034] The water input pipe 4 extends through a lateral surface of the water container 1, and passes through the through hole 241 of the partition plate 24 into the water entry space 201 so as to communicate with the water entry space 201. The water output pipe 5 extends through the lateral surface of the water container 1 into the water exit space 202.

[0035] As shown in Figure 6, the water in the instant heating space 203 may flow in the top-bottom direction (as indicated by the solid arrows) to the water exit space 202 and may flow in the left-right direction (as indicated by the dashed arrows) through the elongated opening 231 into the water entry space 201. As a result, the water-temperature differences among the water entry space 201, the instant heating space 203, and the water exit space 202 may be reduced.

[0036] Advantages of the electric water heater of the disclosure are summarized as follows.

[0037] 1. By virtue of the elongated opening 221(231) serving as the heat conduction channel for the water in the instant heating space 203 to flow into the water entry space 201, a heating transfer effect is improved. Accordingly, the water

temperature in the water entry space 201 may be increased, and the water-temperature differences among the water entry space 201, the instant heating space 203, and the water exit space 202 may be reduced, so the water in the instant heating space 203 may be instantly heated by the heating tube subunit 31.

5           [0038]    2. By virtue of reducing the water-temperature differences among the water entry space 201, the instant heating space 203, and the water exit space 202, the heat convection of the electric water heater of the disclosure may be reduced, the heating noises may be reduced, and the heating pressure in the instant heating space 203 may be reduced.

10           [0039]    In the description above, for the purposes of explanation, numerous specific details have been set forth in order to provide a thorough understanding of the embodiment(s). It will be apparent, however, to one skilled in the art, that one or more other embodiments may be practiced without some of these specific details. It should also be appreciated that reference throughout this specification  
15           to “one embodiment,” “an embodiment,” an embodiment with an indication of an ordinal number and so forth means that a particular feature, structure, or characteristic may be included in the practice of the disclosure. It should be further appreciated that in the description, various features are sometimes grouped

together in a single embodiment, figure, or description thereof for the purpose of streamlining the disclosure and aiding in the understanding of various inventive aspects; such does not mean that every one of these features needs to be practiced with the presence of all the other features. In other words, in any described  
5 embodiment, when implementation of one or more features or specific details does not affect implementation of another one or more features or specific details, said one or more features may be singled out and practiced alone without said another one or more features or specific details. It should be further noted that one or more features or specific details from one embodiment may be practiced together with  
10 one or more features or specific details from another embodiment, where appropriate, in the practice of the disclosure.

**CLAIMS:**

1. An electric water heater comprising:

a water container;

a heating unit that is disposed in said water container; and

5 a partition unit that is mounted within said water container, said partition unit and said water container cooperatively defining

a water entry space,

an instant heating space that communicates with said water entry space, and

10 a water exit space that is disposed above said instant heating space in a top-down direction, and that communicates with said instant heating space, said instant heating space being adapted to introduce water from said water entry space into said water exit space, said partition unit having an elongated opening that is elongated in the top-bottom direction and that interconnects said  
15 water entry space and said instant heating space;

wherein said heating unit includes a heating tube subunit that extends into said instant heating space, that is spaced apart from said elongated opening, and that is adapted to heat water; and

wherein a ratio of a length of said elongated opening in the top-bottom direction to a length of said instant heating space in the top-down direction ranges from 1:2 to 4:5.

2. The electric water heater as claimed in Claim 1, wherein:

5           said partition unit includes a partition plate and a sleeve member connected to said partition plate;

          a top surface of said partition plate and said water container cooperatively define said water exit space;

          said sleeve member extends downwardly from a bottom surface of said  
10       partition plate, surrounds an axis, defines said instant heating space, and is formed with said elongated opening; and

          said bottom surface of said partition plate, said sleeve member and said water container cooperatively define said water entry space.

3. The electric water heater as claimed in Claim 2, wherein said axis extends in  
15       the top-bottom direction.

4. The electric water heater as claimed in Claim 1, wherein:

          said partition unit includes

          a first partition plate that extends in the top-bottom direction,

a second partition plate that extends in the top-bottom direction, and that is spaced apart from said first partition plate in a left-right direction perpendicular to the top-bottom direction, and

a third partition plate that extends in the left-right direction, and that  
5 interconnects a top end of said first partition plate and a bottom end of said second partition plate;

said first partition plate, said third partition plate, said second partition plate, and said water container cooperatively define a left space region and a right space region within said water container, one of said left space region  
10 and said right space region serving as said water entry space, another one of said left space region and said right space region serving as said water exit space and said instant heating space;

said water exit space is disposed between said second partition plate and said water container;

15 said instant heating space is disposed under said third partition plate and between said first partition plate and said water container; and

said first partition plate is formed with said elongate opening.

5. The electric water heater as claimed in Claim 1, further comprising a water

input pipe that communicates with said water entry space and that is adapted to introduce water into said water entry space.

6. The electric water heater as claimed in Claim 2, further comprising a water output pipe that communicates with said water exit space and that is adapted to output water from said water exist space.
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7. The electric water heater as claimed in Claim 1, further comprising a water output pipe that communicates with said water exit space and that is adapted to output water from said water exist space, said water output pipe extending through said instant heating space.