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(54) GAS WATER HEATING APPLIANCE WITH PRE-HEATING FUNCTION

(57) The present invention discloses a gas water heating appliance including a housing, a burner, a heat exchanger, and a pipe assembly. The pipe assembly includes incoming pipelines located at upstream of the heat exchanger and outgoing pipelines located at downstream of the heat exchanger. A water tank is disposed in the outgoing pipelines, and the water tank includes an electric heating device contained therein. The incoming pipelines has an inlet pipe section, and the pipe assembly further includes a circulation pipe section disposed in parallel with the inlet pipe section, and a circulation pump is disposed in the circulation pipe section. By employing the circulation pump, cold water accumulated in the pipelines and the water tank of the gas water heating appliance can be preheated, thereby providing instant hot water when users turn on the hot faucet.

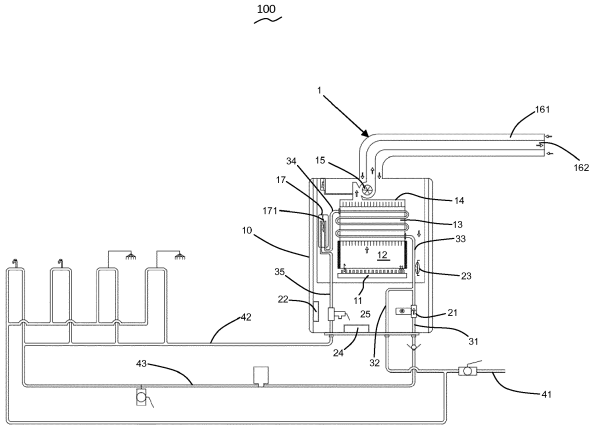


Fig. 1

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to the field of domestic gas appliances, and more particularly to hydraulic systems of gas water heating appliances.

BACKGROUND OF THE INVENTION

[0002] When turning on a hot faucet to start a gas water heating appliance, such as a gas water heater, a user often has to wait a long time for hot water output from the hot faucet. This is because, on one hand, there is a large amount of cold water staying in water pipelines within or outside of the appliance, especially for the gas-fired appliance with a small buffer tank that stores water, and this amount of cold water has to be drained out first and then hot water comes out; on the other hand, at the beginning of starting the gas water heater, for consideration of security, a blower will be first activated to exhaust residual gas within a combustion chamber and flue pipes, and the combustion burner will be ignited after the residual gas being all replaced by fresh air, during the period, hot faucet continuously outputs cold water. Obviously, the big volume of drained cold water causes the waste of water resources. In addition, this will lead to a poor user experience, for example, when the user desires to take a shower in winter, the user has to wait a long time to get hot water.

SUMMARY OF THE INVENTION

[0003] It is an object of present invention to provide a gas water heating appliance that is able to pre-heat cold water accumulated in the appliance so as to provide instant hot water when users turn on the hot faucet.

[0004] According to one aspect of the present invention there is provided a gas water heating appliance including a housing, a burner, a heat exchanger, and a pipe assembly. The pipe assembly includes incoming pipelines located at upstream of the heat exchanger and outgoing pipelines located at downstream of the heat exchanger. A water tank is disposed in the outgoing pipelines, and the water tank includes an electric heating device contained therein. The incoming pipelines has an inlet pipe section, and the pipe assembly further includes a circulation pipe section disposed in parallel with the inlet pipe section, and a circulation pump is disposed in the circulation pipe section.

[0005] Preferably, the appliance further includes a timer disposed in the housing, and the circulation pump starts working on a time preset by the timer.

[0006] Preferably, the appliance further includes a controller disposed in the housing for controlling the operation of the burner to heat cold water to a predetermined target outlet temperature.

[0007] Preferably, the timer is independent of the controller.

[0008] Preferably, the controller activates the circulation pump on the preset time and ignites the burner on detecting water flow within the pipelines reaches or exceeds a threshold.

[0009] Preferably, the appliance further includes a temperature sensor associated with the incoming pipelines, and the controller controls the operation of the burner according to the predetermined target outlet temperature, a real outlet temperature, and a temperature detected by the temperature sensor.

[0010] Preferably, the temperature sensor is disposed at a common pipe section communicating with both the inlet pipe section and the circulation pipe section.

[0011] Preferably, the appliance further includes a pressure regulating device associated with the incoming pipelines or the outgoing pipelines.

[0012] Preferably, the pressure regulating device is a pressure relief valve or an expansion vessel.

[0013] By employing the circulation pump, cold water accumulated in the pipelines and the water tank of the gas water heating appliance can be preheated, thereby providing instant hot water when users turn on the hot faucet. In addition, since the timer is disposed independently of the controller, it can activate the circulation pump without assistance of the controller, in other words, the timer and the circulation pump can be added to any gas water heating appliances to realize the preheating function without modifications to the existing electric circuit boards.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] For a more complete understanding of the present invention, and the advantages thereof, reference is now made to the following descriptions taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a schematic plan view showing a gas water heating appliance in accordance with one embodiment of present invention, wherein the appliance is connected with external pipelines and water equipments.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0015] Reference will now be made to the drawing figures to describe the preferred embodiments of the present invention in detail. However, the embodiments can not be used to restrict the present invention. Changes such as structure, method and function obviously made to those of ordinary skill in the art are also protected by the present invention.

[0016] Gas water heating appliances could be fired with combustible gas, such as natural gas, city gas, liquefied petroleum gas, methane, etc., thereby supplying hot water and/or heating living space for domestic sani-

tary usage and heating purpose, such as gas water heaters and/or gas boilers. A gas water heater will be exemplified hereinafter.

[0017] Refer to Fig. 1, a gas water heater 1 includes a housing 10, and a burner 11, a heat exchanger 13, a flue hood 14, an air supply fan 15 all contained in the housing 10, and flue pipes. Wherein, the flue pipes can take the form of annular tubes, that is, the flue pipes define an outer passageway 161 for being passed through by incoming air and an inner passageway 162 for being passed through by exhausting flue gas. When the gas water heater 1 is running, the external air is introduced in via the outer passageway 161 by the air supply fan 15 and mixed with incoming gas so as to together feed to the burner 11. The mixture of gas and air is ignited in the burner 11 and combusted in the combustion chamber 12 defined by the burner 11 and the heat exchanger 13. The combustion gas at a high temperature is driven by the air supply fan 15 to pass through the heat exchanger 13, and cold water flowing in tubes surrounding an outer casing of the heat exchanger 13 is heated to be hot water. The flue gas is collected by the gas hood 14 and discharged out through the inner passageway. As the construction and the working principle of gas water heaters are known in the art, a detailed description is omitted for purpose of brevity and simplicity

[0018] A pipe assembly is disposed in the housing 10 and connected with the heat exchanger 13. The pipe assembly includes incoming pipelines located upstream of the heat exchanger 13 and outgoing pipelines located downstream of the heat exchanger 13. In this embodiment, the outgoing pipelines includes a first outgoing pipe 34 connected with the heat exchanger 13 and a second outgoing pipe 35 connected with external pipelines 42. A water tank 17 is disposed between the first and the second outgoing pipes 34, 35, and an electric heating device 171 is disposed in the water tank 17. The electric heating device 171 can be an electric heating rod or an electric tracing band. When the gas water heater 1 operates at a normal heating mode, the electric heating device 171 operates as well, so that the water output from the second outgoing pipe 35 can maintain at a stable outlet temperature, to avoid the output water to blow hot and cold. The incoming pipelines includes an inlet pipe section 32 connected with water main pipelines 41, a circulation pipe section 31 disposed in parallel with the inlet pipe section 32, and a common pipe section 33. The common pipe section 33 has one end communicated with both the inlet pipe section 32 and the circulation pipe section 31, and the other end communicated with tubes surrounding the heat exchanger 13.

[0019] A circulation pump 21 is disposed in the circulation pipe section 31. A timer 22 and a controller 24 are both disposed in the housing 10. The controller 24 may be a logic control circuit consists of a number of electronic components, or may incorporate a Micro Controller Unit (MCU). Of course, the controller can also use other types of integrated circuits, such as Field Programmable Gate Array (FPGA) etc.. In this embodiment, the timer 22 is an electronic timer, and it can turn on the power based on users' settings. The timer 22 can be independent of the controller 24, and it has a user interface for being input settings by users. When a pre-set time arrives, the circulation pump 21 is activated, and the controller 24 can detect a water flows via a flow sensor (not shown), thereby taking appropriate actions, which will be described in details hereinafter. The advantage of the timer 22 being independent of the controller 24 is that, the timer 22 and the circulation pump 21 can be added to any gas water heating appliances to realize appropriate functions which will be described without modification to the existing electric circuit boards. It should be apparent to those skilled in the art that, the timer 22 can also communicate with the controller and let the controller 24 control the circulation pump, however, the control circuit has to be modified in this case.

[0020] A user can set the timer 22 to pre-heat cold water accumulated in the pipe assembly and the water tank 17 of the gas water heater 1, so that the user can enjoy instant hot water when the hot faucet is turned on. For example, the user intends to take a shower at nine o'clock in the evening, so he can set the timer 22 to start the appliance to work at a pre-heat mode at eight forty-five in the evening in advance. When it reaches the preset time, the circulation pump 21 is energized, and in the meantime, the controller 24 can sense a water flow within the pipelines via the flow sensor. When the water flow reaches or exceeds a lower threshold, e.g. 2.2 L/min, the related components will be activated to work, like the air supply fan and the combustion burner. Driven by the circulation pump 21, water flow passes through the circulation pipe section 31, the common pipe section 33, the heat exchanger 13, the first outgoing pipe 34, the water tank 17, the second outgoing pipe 35, the external pipelines 42, 43 and returns to the circulation pipe section 31. The circulation of water flow repeats till the temperature of water reaches a pre-determined outlet temperature and maintain at this temperature.

[0021] A temperature sensor 23 can be associated with the incoming pipelines, preferably, the temperature sensor 23 is disposed at the common pipe section 33. When the user turns on the hot faucet to take a shower, the gas water heater 1 enters a normal heating mode, and cold water introduced from the water main pipelines 41 passes through the inlet pipe section 32 and enters the common pipe section 33. At this time, the circulation pump 21 can stop working, or continue to work. If the circulation pump 21 continues to work, the water passing through the circulation pipe section 31 will enter the common pipe section 33 and merges with the cold water from the incoming pipe section 32. Different from a traditional gas water heater, in this case, the controller 24 could not control the operation of the appliance based on the temperature of inlet water coming from the water main pipelines 41. Since the temperature sensor 23 is disposed at the common pipe section 33, regardless of the circulation

pump works or not, the temperature detected by the temperature sensor 23 can be regarded as the temperature of inlet cold water for being used by the controller to control appropriate operations of the appliance. For example, the controller 24 may continuously adjust combustion power of the burner according to the temperature detected by the temperature sensor 23, a real outlet temperature that can be detected by another temperature sensor (not shown) disposed at water outlet, and a predetermined target outlet temperature.

[0022] Within the circulation pipelines, temperature changes cause pressure changes, therefore, in order to ensure that the pressure inside the circulation pipelines is within a safe range, there is a need to provide pressure regulating device associated with the circulation pipelines. The pressure regulating device can be disposed in the incoming pipelines or the outgoing pipelines, in this embodiment, the pressure regulating device 25 is disposed at the second outgoing pipe 35 before hot water outlet, and it can be a pressure relief valve. When the pressure within the pipelines is larger than certain threshold, the pressure relief valve will automatically open to drain a part of water, so that the pressure within the pipelines can be back to a balance value. In other alternative embodiments, the pressure regulating device can be an expansion vessel that also play a role in regulating the internal pressure of the pipelines.

[0023] By employing the circulation pump, cold water accumulated in the pipelines and the water tank of the gas water heating appliance can be preheated, thereby providing instant hot water when users turn on the hot faucet. In addition, since the timer is disposed independently of the controller, it can activate the circulation pump without assistance of the controller, in other words, the timer and the circulation pump can be added to any gas water heating appliances to realize the preheating function without modifications to the existing electric circuit boards.

[0024] It is to be understood, however, that even though numerous, characteristics and advantages of the present invention have been set forth in the foregoing description, together with details of the structure and function of the invention, the disclosed is illustrative only, and changes may be made in detail, especially in matters of number, shape, size, and arrangement of parts within the principles of the invention to the full extent indicated by the broadest general meaning of the terms in which the appended claims are expressed.

Claims

1. A gas water heating appliance (1) comprising a housing (10), a burner (11), a heat exchanger (13), and a pipe assembly, wherein the pipe assembly comprises incoming pipelines located at upstream of the heat exchanger and outgoing pipelines located at downstream of the heat exchanger, and a water tank (17) is disposed in the outgoing pipelines, said water tank comprises an electric heating device (171) contained therein; **characterized in that**, said incoming pipelines has an inlet pipe section (32), and said pipe assembly further comprises a circulation pipe section (31) disposed in parallel with said inlet pipe section, and a circulation pump (21) is disposed in said circulation pipe section.

2. A gas water heating appliance according to claim 1, **characterized in that**, said appliance further comprises a timer (22) disposed in the housing, and said circulation pump starts working on a time preset by the timer.

3. A gas water heating appliance according to claim 2, **characterized in that**, said appliance further comprises a controller (24) disposed in the housing for controlling the operation of the burner to heat cold water to a predetermined target outlet temperature.

4. A gas water heating appliance according to claim 3, **characterized in that**, said timer is independent of the controller.

5. A gas water heating appliance according to claims 3 or 4, **characterized in that**, said controller activates the circulation pump on the preset time and ignites the burner on detecting water flow within the pipelines reaches or exceeds a threshold.

6. A gas water heating appliance according to claim 3, **characterized in that**, the appliance further comprises a temperature sensor (23) associated with the incoming pipelines, and the controller controls the operation of the burner according to the predetermined target outlet temperature, a real outlet temperature, and a temperature detected by said temperature sensor.

7. A gas water heating appliance according to claim 6, **characterized in that**, said temperature sensor is disposed at a common pipe section (33) communicating with both the inlet pipe section (32) and the circulation pipe section (31).

8. A gas water heating appliance according to claim 1, **characterized in that**, the appliance further comprises a pressure regulating device (25) associated with the incoming pipelines or the outgoing pipelines.

9. A gas water heating appliance according to claim 8, **characterized in that**, said pressure regulating device is a pressure relief valve or an expansion vessel.

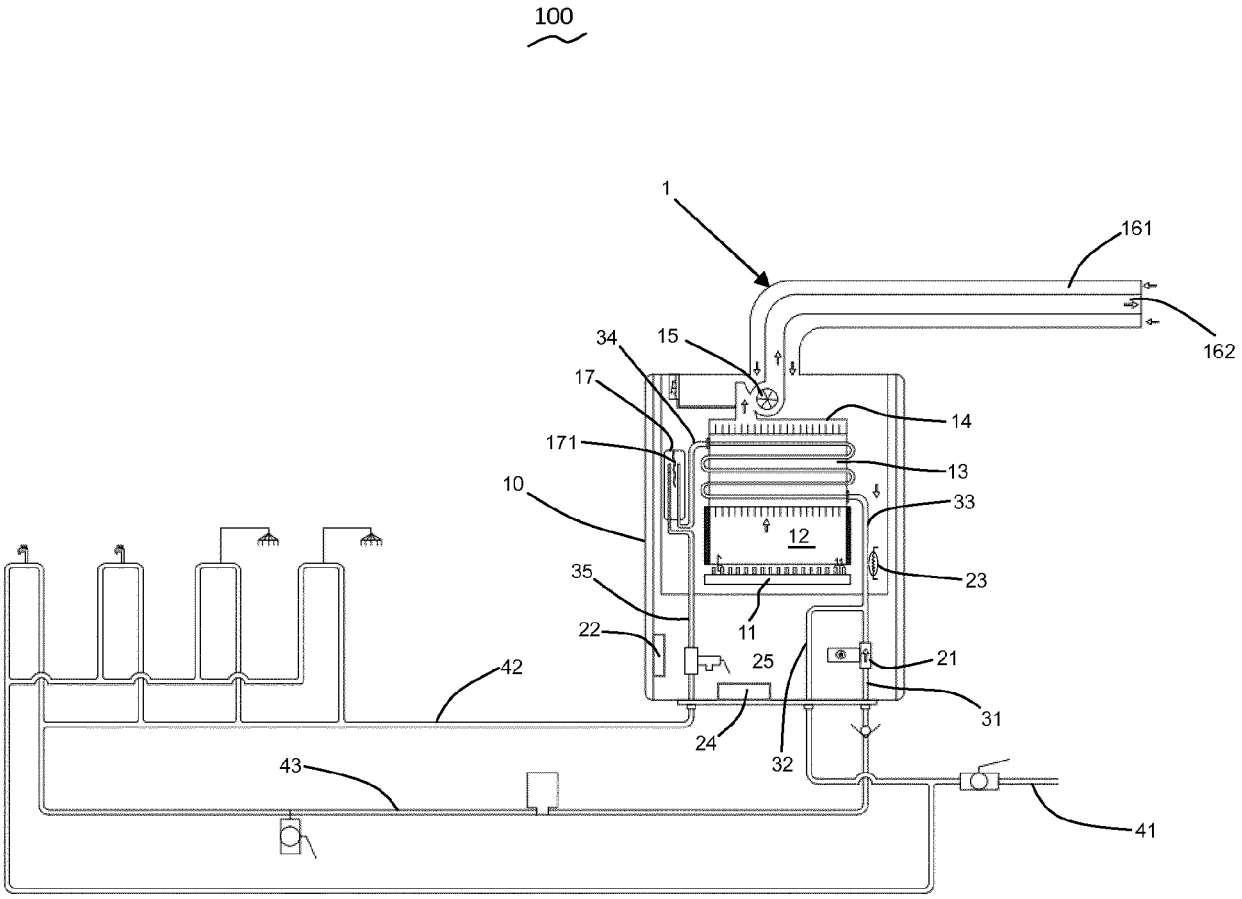

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Fig. 1

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EUROPEAN SEARCH REPORT

Application Number
EP 16 19 1336

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	CN 203 258 724 U (CHENGDU QIANFENG ELECTRONIC CO LTD) 30 October 2013 (2013-10-30)	1-9	INV. F24H1/41 F24H9/00
Y	* page 1, paragraph 1 - page 5, paragraph 56; figures 1,2,4 *	2-7	F24H9/20 F24D17/00
X	US 3 249 303 A (TOWNSEND ESLEY L) 3 May 1966 (1966-05-03)	1,8,9	
Y	* column 1, line 60 - column 4, line 15; figure 1 *	2-7	
Y	DE 195 09 419 A1 (GRUBERT KLAUS [DE]) 19 September 1996 (1996-09-19) * column 1, lines 9-24 *	2-7	

TECHNICAL FIELDS SEARCHED (IPC)

F24H
F24D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	10 February 2017	Hoffmann, Stéphanie

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 16 19 1336

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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10-02-2017

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CN 203258724 U	30-10-2013	NONE	
US 3249303 A	03-05-1966	NONE	
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82