



(11)

EP 3 805 661 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
14.04.2021 Bulletin 2021/15

(51) Int Cl.:
F24H 1/10 (2006.01) **F24H 9/00** (2006.01)
H05B 3/40 (2006.01) **H05B 3/44** (2006.01)
H05B 3/78 (2006.01)

(21) Application number: **19020561.7**

(22) Date of filing: **08.10.2019**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

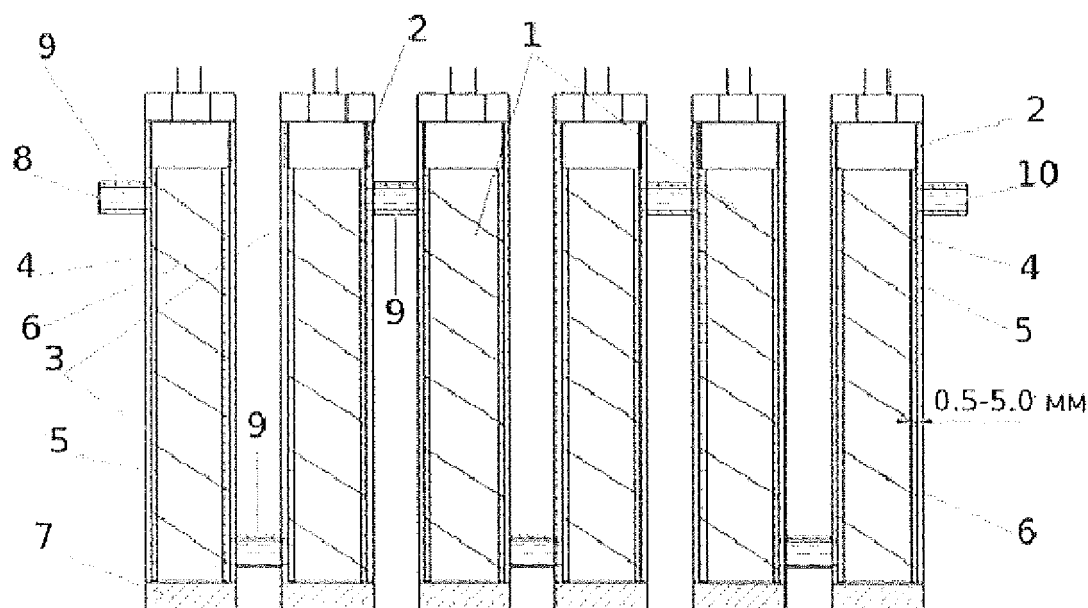
(71) Applicant: **Dimitriou, Tatiana**
6035 Larnaca (CY)

(72) Inventors:
• **Dimitriou, Tatiana**
6035 Larnaca (CY)
• **Gorbunov, Sergei**
620061 Yekaterinburg (RU)
• **Karimov, Baurzhan**
020000 Kokshetau (KZ)

(54) **HEATING DEVICE**

(57) The invention relates to devices for heating liquid heat transfer media intended for heating a heating medium in heating systems. It comprises modules, each of which is made in the form of a cylindrical shell with a bottom and inlet and outlet nozzles and is equipped with an electric heater. The heater is designed as a cylindrical cartridge heater and is fixed on the shell's axis by means of a threaded flange forming an annular gap, with its thick-

ness range reaching 0.5 to 5.0 mm. The circular annular gap on the cylindrical surface of the cartridge heater is equipped with a helical winding. The nozzles are installed on opposite sides in the upper and lower parts of the shell and are connected to the nozzles of the adjacent module, thus forming a single closed heating space. EFFECT: enhanced heating efficiency of the liquid heat transfer medium. 1 drawing.



Description

[0001] The invention relates to devices for heating liquid heat transfer media and can be used for heating a heating medium in heating systems.

[0002] The prior art includes a water heating electrode boiler called «Helen» comprising a shell with inlet and outlet nozzles for mounting in a circulation water supply system, communicating with an internal closed space of the boiler shell, and electrodes mounted inside the shell, laterally mounted on the boiler shell and threaded into the pipes, mounted on the side surface of the shell by insulating sleeves, wherein the boiler is provided with an electrode support for heating and at least one intensive heating electrode, included in a common electrical circuit (see patent RU 86275, class F22B 1/30, publ. 27.08.2009).

[0003] The prior art also includes a water heating electrode boiler comprising a metal-insulated shell with inlet and outlet nozzles for connection to a water heating system, and an electrode-heating element installed inside the shell along it, which is fixed to the shell by means of a pin, being simultaneously a phase terminal as well as terminals for connecting the neutral wire and the ground wire, having the stud-like shape and located on the shell on the sides of the phase terminal, the heating element is made of a modified graphite, or a cast iron alloy, or a non-magnetic steel stainless alloy, and the pin being a phase terminal is additionally insulated at a distance from the shell to the electrode by means of a build-up made of a high strength rubber (see Patent RU 109834, class F24H 1/00, publ. 27.10.2011).

[0004] Further, the prior art includes a water-heating boiler which has a cylindrical shell with a cover forming a closed heating circuit, a heating element installed in the center of the shell and nozzles secured on the shell's wall, at that one of the nozzles is installed tangentially to the shell, wherein the hot water boiler is of double pressure type, and the upper part of the shell is equipped with perforation, above which the casing of the second heating circuit is fixed, inside which the accumulator of the second heating circuit is installed, adjoined by a spiral connection to the first heating circuit, so that the spiral branch pipe is installed coaxially to the heating element, whereas the second heating circuit accumulator and the spiral nozzle are placed in the heat transfer medium of the first heating circuit (see patent RU 2166153, class F24H 1/00, publ. 27.04.2001).

[0005] The main disadvantages that the known boilers have in common are their low efficiency due to a large heating cavity used for heating the heat medium; a heating element with a small heating area not corresponding to the large heating cavity, thus requiring a large amount of electrical energy for the heat transfer medium to be heated to a desired temperature and finally, their manufacturing complexity.

[0006] The invention most closely relates to a heating device for a liquid heat transfer medium, comprising mod-

ules, each of which is made in the form of a cylindrical shell with a bottom and inlet and outlet nozzles and is equipped with an electric heater (see patent RU 2301378, class F24H 1/10, publ. 20.06.2007). The known device uses a three-phase induction heater, consisting basically of a winding on the outer part of the shell. Thus, a significant amount of energy is dissipated to the surroundings rather than used for heating of the liquid heat transfer medium, which is irrational, especially if the device is installed in a mechanical room. In addition, most of the heat medium volume is placed in the non-heated headers combining the modules, which rises the heating inertia and unjustifiably increases the size of the device. The engineering problem is to create a reliable high efficiency heating device which would allow the liquid heat medium to be heated quickly and with a minimum electricity consumption. The effects is an enhanced heating efficiency of liquid heat transfer medium. Thus, the engineering problem is solved and the technical result is achieved due to the fact that in the heating device designed for a liquid heat transfer medium containing modules, each of which has a cylindrical shell shape with a bottom as well as inlet and outlet nozzles and is equipped with an electric heater, the latter is designed as a cylindrical cartridge heater and is fixed on the shell's axis by means of a threaded flange forming an annular gap, with its thickness range reaching 0.5 to 5.0 mm, where the cylindrical surface of the cartridge heater is equipped with a helical winding, whereas the nozzles are installed on opposite sides in the upper and lower parts of the shell and are connected to the nozzles of the adjacent module, thus forming a single closed heating space.

[0007] The drawing shows the proposed six-module heating device in cross-section;

SUBSTANCE: the proposed heating device consists of universal single-type modules the number of which is determined by the tasks set. Each module comprises an electric cylindrical cartridge heater 1 with a threaded flange 2, installed along the axis of the cylindrical shell 3 forming the circular annular gap 4 with thickness ranging from 0.5 to 5.0 mm with the inner surface of the side wall 5 of the cylindrical shell 3. The indicated circular annular gap 4 thickness corresponds to the maximum heat transfer coefficient for the heat transfer media used nowadays: with a thinner circular annular gap 4, the probability of the heater and inner surface of the side wall 5 of the cylindrical shell 3 to come in contact (usually with thermal conductivity being higher than that of the heat transfer medium) increases drastically, which results in more efficient heating of the cylindrical shell 3 rather than the heat transfer medium. At the same time, with the circular annular gap 4 being thicker, the external flows of the heat transfer medium need more time to warm up and do not contribute to the heating of the room, while continuing to consume the energy for maintaining the circulation. The cylindrical surface of the cylindrical cartridge heater 1 is equipped with helical winding 6 and the screw cavity formed communicates with the inlet and outlet openings

of the cylindrical shell 3. The cylindrical shell 3 is closed at one side by the welded bottom 7, and at the other side by means of the threaded flange 2 one-tightly closing it. It not only considerably simplifies the manufacturing process, but also minimizes the number of inevitably heated structural parts.

[0008] The liquid heat medium enters the heating device through the inlet opening 8 formed by the inlet nozzle 9 in the upper part of the cylindrical shell 3. Passing along the entire circular annular gap 4 of the first module, the heat medium moves towards the outlet nozzle 9 (similar to the inlet nozzle 9) but set in the lower part of the cylindrical shell 3. The outlet nozzle 9 of the first module is connected to the inlet nozzle 9 of the adjacent module to form a single closed heating space. Such type of connection arrangement between the modules not only makes it possible to minimize the heat loss to the surrounding space and to accelerate to the utmost the heating of the liquid heat transfer medium, but also applies a universal structure of the modules (i.e., the inlet nozzle turns into the outlet nozzle by means of turning of the module by 180°), thus allowing to assemble the device with any number of them. The heated heat medium is directed to the heating system through the outlet opening 10 of the last module.

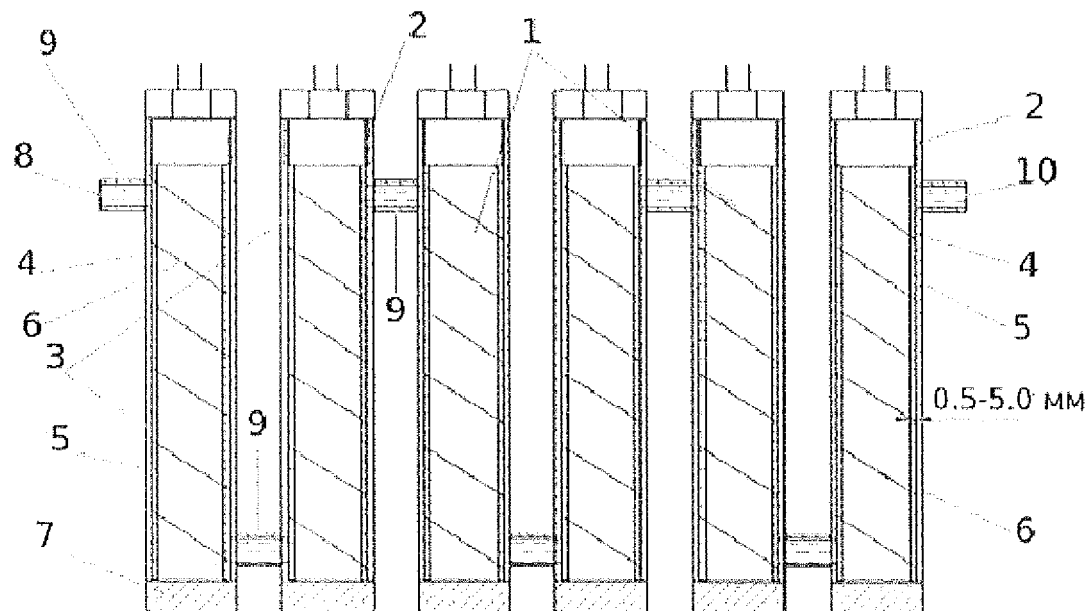
[0009] The proposed device operates as follows. The heat transfer medium spinning around in the circuit of heating system, enters the heating device through the inlet opening 8. Passing along the closed inter-tube space of the circular annular gap 4, the heat from the cylindrical cartridge heater 1 is heated and discharged through the outlet opening 10 into the circuit of the heating system. Running on cylindrical surface of the cylindrical cartridge heater 1 is provided with the helical winding 6 communicating with the inlet and outlet nozzles 9, the flow reverses its direction and moves at an angle around the cylindrical cartridge heater 1, increasing the stroke length in the hot zone of the circular annular gap 4.

[0010] Thus, the claimed technical solution increases the heating capacity of the device due to an increase of the number of modules rather than power of heaters, allowing to maximize the heating efficiency of the heating medium at a minimum consumption of electric power and simplifying the manufacturing process of the proposed device.

heater is equipped with a helical winding, whereas the nozzles are installed on opposite sides in the upper and lower parts of the shell and are connected to the nozzles of the adjacent module, thus forming a single closed heating space

Claims

1. The heating device for a liquid heat transfer medium comprising modules, each of which is made in the form of a cylindrical shell with a bottom, inlet and outlet nozzles and is equipped with an electric heater. The difference is that the latter is designed as a cylindrical cartridge heater and is fixed on the shell's axis by means of a threaded flange forming an annular gap, with its thickness range reaching 0.5 to 5.0 mm, where the cylindrical surface of the cartridge





EUROPEAN SEARCH REPORT

Application Number
EP 19 02 0561

5

10

15

20

25

30

35

40

45

50

55

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	JP H08 94175 A (TOA ELECTRONICS; CYTEC KK) 12 April 1996 (1996-04-12) * abstract; figure 1 *	1	INV. F24H1/10 F24H9/00 H05B3/40 H05B3/44 H05B3/78
X	JP 2007 003154 A (RASUKO KK) 11 January 2007 (2007-01-11) * abstract; figure 1 *	1	
X	EP 1 731 849 A1 (MATSUSHITA ELECTRIC IND CO LTD [JP]) 13 December 2006 (2006-12-13) * abstract; figures 1-37 * * paragraphs [0164], [0182] *	1	
X	WO 2015/082434 A1 (VALEO SYSTEMES THERMIQUES [FR]) 11 June 2015 (2015-06-11) * abstract; figure 3b * * page 9 - page 12 *	1	
X	KR 2013 0006003 A (EXAENC CORP [KR]) 16 January 2013 (2013-01-16) * figures 1,3,4 *	1	
X	US 2014/050466 A1 (GIFFELS THOMAS [DE] ET AL) 20 February 2014 (2014-02-20) * abstract; figures 1-4 *	1	TECHNICAL FIELDS SEARCHED (IPC) F24H H05B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 17 December 2019	Examiner García Moncayo, O
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 19 02 0561

5

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

17-12-2019

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP H0894175 A	12-04-1996	NONE	
JP 2007003154 A	11-01-2007	NONE	
EP 1731849 A1	13-12-2006	EP 1731849 A1	13-12-2006
		KR 20060097062 A	13-09-2006
		US 2007143914 A1	28-06-2007
		US 2011036544 A1	17-02-2011
		WO 2005057090 A1	23-06-2005
WO 2015082434 A1	11-06-2015	EP 3080523 A1	19-10-2016
		FR 3014542 A1	12-06-2015
		JP 2017503990 A	02-02-2017
		WO 2015082434 A1	11-06-2015
KR 20130006003 A	16-01-2013	NONE	
US 2014050466 A1	20-02-2014	CN 103629805 A	12-03-2014
		DE 102012107600 A1	20-02-2014
		US 2014050466 A1	20-02-2014

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- RU 86275 [0002]
- RU 109834 [0003]
- RU 2166153 [0004]
- RU 2301378 [0006]