(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 796 805 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
29.10.2014 Bulletin 2014/44

(51) Int Cl.:
F24H 6/00 *(2006.01)*

(21) Application number: **14165518.3**

(22) Date of filing: **22.04.2014**

(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

(30) Priority: **19.04.2013 GB 201307141**

(71) Applicant: **Johnson&Starley Limited**
Northampton, Northamptonshire NN4 7LZ (GB)

(72) Inventors:
- **Dee, Tom**
  Northampton, NN4 7LZ
  Northamptonshire (GB)
- **Williams, Ian**
  Northampton, NN4 7LZ
  Northamptonshire (GB)
- **Jelley, Adrian**
  Northampton, NN4 7LZ
  Northamptonshire (GB)
- **Cooper, Tim**
  Northampton, NN4 7LZ
  Northamptonshire (GB)
- **Worthing, Ken**
  Northampton, NN4 7LZ
  Northamptonshire (GB)
- **Whitlock, Martin**
  Northampton, NN4 7LZ
  Northamptonshire (GB)
- **Page, Glen**
  Northampton, NN4 7LZ
  Northamptonshire (GB)

(74) Representative: **McWilliams, David John**
Withers & Rogers LLP
4 More London Riverside
London SE1 2AU (GB)

(54) **Heating appliance**

(57) A heating appliance comprising a housing for a water heating system and an air heating system, wherein the water heating system is mounted in the housing and comprises a heat source and a first heat exchanger for transferring heat to a working fluid passing through the housing, and wherein the air heating system is mounted in the housing and comprises a water-to-air heat exchanger in communication with the working fluid and a source of air, for heating air using the working fluid.

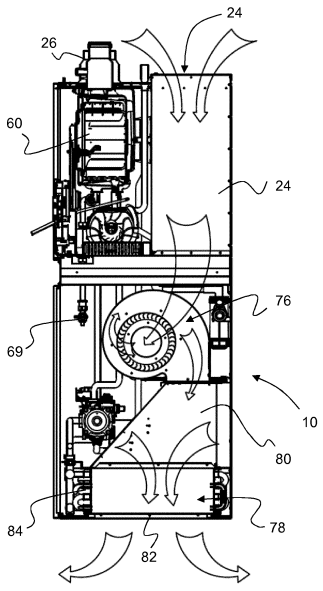


Fig. 8

EP 2 796 805 A1

Description

[0001] The present invention relates to a heating appliance, more particularly a heating appliance incorporating a water heating device.

[0002] It is common for a domestic dwelling to include a heating appliance, for providing a source of hot water for bathing and/or use in a central heating system. Such appliances are often referred to generically as 'boilers'.

[0003] There are numerous types of heater available on the market. Recent years have seen a call for heaters with improved efficiency. A variety of developments have arisen, such as incorporating a power generation mechanism into a heater in order to provide a combined heat and power apparatus.

[0004] The present invention provides an alternative heating appliance.

[0005] According to one aspect of the invention, there is provided a water heating appliance comprising a housing for a water heating system and an air heating system, wherein the water heating system is mounted in the housing and comprises a heat source and a first heat exchanger for transferring heat to a working fluid passing through the housing, and wherein the air heating system is mounted in the housing and comprises a water-to-air heat exchanger in communication with the working fluid and a source of air, for heating air using the working fluid,

[0006] Preferably the water-to-air heat exchanger is mounted below the heat source.

[0007] The water-to-air heat exchanger may be mounted below the first heat exchanger.

[0008] Preferably, the housing includes an air inlet, and the air heating system includes a fan for collecting air entering the housing via the inlet and an air guide for transferring the collected air to the water-to-air heat exchanger.

[0009] The fan and guide may be mounted below the heat source and/or the first heat exchanger.

[0010] Preferably, the housing defines an upper compartment for the heat source and first heat exchanger, and further wherein the housing defines a lower compartment for the water-to-air heat exchanger.

[0011] More preferably, the air heating system may further include a fan for collecting air and a guide for transferring the collected air to the water-to-air heat exchanger, and the fan and conduit may be mounted in the lower compartment.

[0012] In one embodiment, the housing includes an air inlet to allow air to pass into housing for supply to the air heating system.

[0013] The air inlet may be provided in an upper region of the housing, e.g. in the roof of the housing.

[0014] Preferably, an air duct is arranged in communication with the air inlet, and wherein the air duct is configured to guide incoming air downwards to a location below the heat source and/or the first heat exchanger. The first heat exchanger may be mounted on the air duct.

[0015] More preferably, the air duct is arranged behind the heat source and/or the first heat exchanger with respect to a front face of the housing.

[0016] In one embodiment, the housing defines an upper compartment for the heat source and first heat exchanger, and a lower compartment for the water-to-air heat exchanger, and wherein the air duct is provided in the upper compartment.

[0017] Preferably, the air duct is arranged for directing air from the air inlet down through the upper compartment to the lower compartment.

[0018] More preferably, air passing into the housing for the air heating system is directed to pass through an air filter before entering the lower compartment.

[0019] The air filter may be arranged between the upper and lower compartments.

[0020] The housing may define an intermediate chamber between the upper and lower chambers, and the air filter may be located in the intermediate chamber.

[0021] Preferably, the air filter is mounted in a movable cassette or drawer on the housing, movable between a closed position and an open position relative to the housing.

[0022] In one embodiment, the heat source and first heat exchanger comprises a gas-fired condensing heat exchanger unit.

[0023] Preferably, the gas-fired condensing heat exchanger unit may be mounted in an upper compartment of the housing, and the air-to-water heat exchanger may be mounted in a lower compartment of the housing.

[0024] The lower compartment of the housing may include a condensate trap for receiving condensate from the gas-fired condensing heat exchanger unit in the upper compartment.

[0025] Preferably, the heat source is a fuel-fired heat source, and the housing includes a flue terminal for connection to a flue for expelling combustion gases. The flue terminal may be arranged in the roof of the housing.

[0026] In one embodiment, the heating appliance may further comprise a user interface including controls for the appliance. The user interface may be mounted in the upper compartment. Preferably, the water-to-air heat exchanger consists of a box for receiving air to be heated and a plurality of water conduits for passing the working fluid through the box.

[0027] Other aspects and features of the invention will be readily apparent from the following description of one or more exemplary embodiments, made by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a schematic view from the front of a heating appliance incorporating a water heating system and an air heating system;

Figure 2 is a schematic view from one side of the heating unit of Figure 1;

Figure 3 is a schematic perspective view of the heat-

ing unit of Figures 1 and 2, with the filter cassette in an open position;

Figure 4 is similar to Figure 1 but shows the front cover removed;

Figure 5 is similar to Figure 2 but shows the side cover removed;

Figure 6 is a schematic perspective view showing principal components of the water and air heating systems of the heating unit of Figures 1 to 5;

Figure 7 is an enlarged view from a region of Figure 6;

Figure 8 is a schematic view of the heating unit of Figures 1 to 7, showing the path of air flow in an air heating mode;

Figure 9 is a schematic showing the water and air heating circuits of the heating unit; and

Figure 10 is a schematic showing an exemplary application for the heating unit in a domestic environment.

[0028] Referring to Figures 1 and 2, a heating appliance is indicated generally at 10. As will be apparent from the following description, the appliance 10 is in the form of a combined air heater and water heater, and so incorporates an air heating system and a water heating system.

[0029] The air heating and water heating systems are provided in a common housing 12. As will be described in more detail below, the primary components of the water heating system are mounted in an upper part of the housing, whereas primary components of the air heating system are provided in a lower part of the housing.

[0030] The housing 12 has a top wall 14, a bottom wall 16, opposing side walls 18, a rear wall 20 and a front wall 22. The housing 12 is generally rectangular in cross section. The housing 12 is deeper than it is wide. The housing 12 is configured for floor mounting, e.g. mounting on a plenum on the floor of a building or a similar support structure.

[0031] As will be described in more detail below, and as can be seen most clearly from Figure 3, the top wall 14 includes an air inlet 24 for allowing air to enter the appliance, and a flue turret 26 to allow exhaust gases to exit the appliance. The flue turret 26 is configured for connection to concentric flue ducts. The air inlet 24 is positioned rearward of the flue turret 26, proximal the rear wall 20 of the housing 12. The air inlet 24 is arranged in communication with an air duct of the appliance (described below with reference to Figures 4 to 7). In addition, water inflow/outflow pipes 28, 30 extend through the top 14 of the housing 12 (side by side one another, between the air inlet 24 and the flue turret 26), by means of which the appliance 10 can connected as part of a hot water system.

[0032] The front wall 22 of the housing 12 is formed from an upper cover 32, a lower cover 34 (located below the upper cover 32) and a central cover 36 (located between the upper cover 32 and the lower cover 34). As will be apparent from the following description, the upper cover 32 is associated with an upper compartment of the housing 12 (for primary components of the water heating system) and the lower cover 34 is associated with a lower compartment of the housing 12 (for primary components of the air heating system).

[0033] The central cover 36 forms part of drawer or cassette 38 which is movable along a horizontal axis between a stowed position (shown in Figures 1 and 2) and an extended position (e.g. shown in Figure 3). The cassette forms part of filter system, for filtering air passing from the air inlet 24 to the air heating system, as will be described in more detail below. Accordingly, a replaceable air filter 40 is provided in the cassette 38. A handle 42 is provided for engagement by a user during movement of the cassette 38.

[0034] The appliance 10 includes a user interface 44 (i.e. including controls for the appliance 10). In this embodiment, the user interface 44 is mounted behind a movable panel 46. The movable panel 46 is provided in the upper cover 32 of the housing 12. The panel 46 is movable between a closed position (see Figures 1 and 2), in which controls on the user interface are hidden from operation, and an open position (e.g. as shown in Figure 3), in which controls on the user interface 44 can be accessed by a user.

[0035] Referring now to Figures 4 and 5, it can be seen that the housing 12 effectively defines two compartments: an upper compartment 48 in which primary components of the water heating system are mounted, and a lower compartment 50 in which primary components of the air heating system are mounted.

[0036] Between the upper and lower compartments 48, 50, the appliance 10 defines an intermediate compartment 52 into which the filter cassette 38 can be received. As can be seen most clearly in Figures 6 and 7, the intermediate compartment 52 includes running surfaces 54 on which the cassette 38 is slidably movable, i.e. between its stowed and open positions.

[0037] An air duct 56 extends from the base of the upper compartment 48 to the air inlet 24. The air duct 56 is used for directing air towards the lower compartment 50 after entering the appliance though the air inlet 24 at the top of the housing 12. Although not visible in the drawings, the lower end of the air duct 56 defines an air outlet, for directing incoming air into the intermediate compartment 52, i.e. so that the air passes through the air filter in the filter cassette 38 when the cassette is in its stowed position. This prevents unwanted particles from entering the lower compartment 50 via the air duct 56.

[0038] In general terms, the water heating system includes a heat source mounted in the upper compartment

48 and arranged so that operation of the heat source causes heating of a supply of water. In exemplary embodiments, the heat source takes the form of a gas boiler. In the illustrated embodiment, the heat source takes the form of a gas-fired condensing heat exchanger unit 60, e.g. of known construction. However, other forms of heat source may be incorporated, e.g. other kinds of fuel-fired boilers or heat exchangers, or an engine (e.g. a sterling engine or ic-engine) having a heat exchanger in communication with an exhaust of the engine.

[0039] The heat exchanger unit 60 is mounted on an outer wall 72 of the air duct 56, by opposing brackets 74. As can be seen, the heat exchanger unit 60 is arranged in front of the air duct 56, with respect to the rear wall 20 of the housing 12. In use, incoming water is directed into the heat exchanger unit 60 via heat conductive pipe work (e.g. copper pipe), where it is heated by heat transfer to the pipe work, and then directed out of the heat exchanger unit 60. This is described in more detail below with reference to Figures 7 and 8.

[0040] The appliance 10 includes a condensate trap 66. In the illustrated embodiment, the condensate trap 66 is located below the heat exchanger unit 60, more particularly in the lower compartment 50. Condensate is able to flow to the trap 66 under gravity via a condensate conduit 68 arranged between the heat exchanger unit 60 and the condensate trap 66.

[0041] In the illustrated embodiment, an external supply of gas is connectable to the appliance 10, e.g. via a cock 69, and the appliance 10 includes a gas valve 70 for controlling the supply of gas to the heat exchanger unit 60.

[0042] Exhaust gases from operation of the heat exchanger unit 60 are expelled through the roof of the appliance 10 via the flue turret 26 in the top wall 14 of the housing 12.

[0043] In general terms, the air heating system consists of a water to air heat exchanger 78 mounted in the lower compartment 50 of the housing 12. In use, heated water from the water heating system is directed down to the lower compartment and through the water to air heat exchanger 78. The air heating system also includes an air fan 76 for collecting air present within the lower compartment (i.e. having passed though the filter cassette 38 from the air duct 56), and an air transition guide 80 for directing air from the air fan 76 to the water to air heat exchanger 78. The fan 76 and air transition guide 80 are mounted in the lower compartment 50.

[0044] The water-to-air heat exchanger 78 is mounted on the base wall 16 of the housing 12. In general terms, the water to air heat exchanger 78 consists of a box 82 for receiving air from the transition guide. It also includes plurality of water conduits 84 extending within the box 82. As will be described below, in an air heating mode of operation for the appliance 10, heated water is conveyed through the conduits 84 in order to heat air within the box 82. Although not visible in the drawings, one or more air outlets are provided for directing heated air out of the box 82 and the appliance. The air outlet(s) may, for example, be in the base wall 16 of the housing. One or more air ducts may be connected to the air outlet(s), for conveying the heated air to a demand location remote from the appliance.

[0045] Figure 8 illustrates an exemplary airflow path for the appliance 10 in an air heating mode.

[0046] Other primary components of the appliance are illustrated schematically in Figure 9. These include a pump 86, and a diverter valve 88.

[0047] An exemplary method of operation for heating water via the appliance 10 will now be described with reference to Figures 1 to 9.

[0048] Water is supplied to the appliance 10 via inlet pipe 28. Pump 86 and diverter valve 88 are operated to cause water to be driven through the heat exchanger unit 60. When the heat exchanger unit 60 is operating, the water is heated as it passes through the heat exchanger unit 60. The user interface can be used to set the desired temperature.

[0049] Condensate from operation of the heat exchanger unit 60 is collected in the condensate trap. Any exhaust gases from operation of the heat exchanger unit 60 expelled through the turret 26.

[0050] The heated water can be delivered to demand location, e.g. external to the appliance 10. However, if air heating is required, at least a proportion of the heated water is diverted to the water-to-air heat exchanger 78. The air circulation fan is operated to draw air into the unit via the inlet 24 and air duct. The air is delivered into the water-to-air heat exchanger 78 and heat is transferred to the air as it passes through the water-to-air heat exchanger 78.

[0051] Accordingly, it will be understood that the combined water and air heating appliance 10 is operable to heat water and provide a source of heated air.

[0052] The user interface can be used to automate the air-heating and water-heating modes of operation, e.g. on a timer. In addition, the unit can be utilised to provide ventilation, by operation of the air fan without the use of heated water in the water-to-air heat exchanger 78.

[0053] The appliance may be configured to override the warm air heating function if a heated water demand is made to the appliance.

[0054] An exemplary use for the appliance 10 is illustrated in Figure 7, where the appliance 10 forms part of a hot water system 100 in a domestic dwelling.

[0055] The hot water system 100 includes a water heating circuit 102 and a hot water supply 104. The appliance 10 is used to heat water in the water heating circuit 102. The heated water is then conveyed away from the appliance 10 through a supply conduit 106. The supply conduit 106 directs the heated water to a transfer conduit 108, which extends inside a storage cylinder 110. The transfer conduit 108 is connected between the supply conduit 106 and a return conduit 112, such that the water is directed back to the appliance 10 after passing through the storage cylinder 110, e.g. for reheating and

recirculation within the water heating circuit 102.

[0056] The storage cylinder 110 receives a supply of water from a cold water storage tank 114. The heated water from the appliance 10 is used to heat the water in the cylinder 110. The heated water in the cylinder can then be used on demand via the hot water supply 104.

[0057] A feed tank 116 is arranged in communication between the supply conduit 106 and the return conduit 112, in order to complete the water heating circuit 102.

[0058] The invention provides a combined warm air and water heating unit. Separation of the key components of the water heating and warm air heating systems between upper and lower parts of the housing, with incoming air ducted down through the upper part of the housing to the lower part of the housing has been found to optimise packaging of key components of the appliance for use as a floor-mounted heating unit. Mounting the condensing heat exchanger on the air duct has been found to contribute to reduced noise and vibration. Also, arranging the heat source in front of the air duct has allowed for simplified access for maintenance. The provision of a filter system between the two parts of the housing has also provided advantages in terms of packaging, assembly and maintenance. The use of a sliding filter cassette has provided further advantages in this regard.

Claims

1. A heating appliance comprising a housing for a water heating system and an air heating system, wherein the water heating system is mounted in the housing and comprises a heat source and a first heat exchanger for transferring heat to a working fluid passing through the housing, and wherein the air heating system is mounted in the housing and comprises a water-to-air heat exchanger in communication with the working fluid and a source of air, for heating air using the working fluid,
wherein the housing defines an upper compartment for the heat source and first heat exchanger, and further wherein the housing defines a lower compartment for the water-to-air heat exchanger.

2. A heating appliance according to claim 1, wherein the housing includes an air inlet, and the air heating system includes a fan for collecting air entering the housing via the inlet and an air guide for transferring the collected air to the water-to-air heat exchanger.

3. A heating appliance according to claim 2 wherein the fan and guide are mounted below the heat source and/or the first heat exchanger.

4. A heating appliance according to any preceding claim, wherein the air heating system includes a fan for collecting air and a guide for transferring the collected air to the water-to-air heat exchanger, and wherein the fan and conduit are mounted in the lower compartment.

5. A heating appliance according to any preceding claim, wherein the housing includes an air inlet to allow air to pass into housing for supply to the air heating system, and
wherein the air inlet is provided in an upper region of the housing.

6. A heating appliance according to claim 5, wherein an air duct is arranged in communication with the air inlet, and wherein the air duct is configured to guide incoming air downwards to a location below the heat source and/or the first heat exchanger,
wherein the first heat exchanger is mounted on the air duct.

7. A heating appliance according to claim 6, wherein the air duct is arranged behind the heat source and/or the first heat exchanger with respect to a front face of the housing.

8. A heating appliance according to claim 6 or claim 7, wherein the air duct is provided in the upper compartment.

9. A heating appliance according to any of claims 6 to 8, wherein the air duct is arranged for directing air from the air inlet down through the upper compartment to the lower compartment,
wherein air passing into the housing for the air heating system is directed to pass through an air filter before entering the lower compartment,
wherein said air filter is arranged between the upper and lower compartments.

10. A heating appliance according to claim 9, wherein the air filter is mounted in a movable cassette or drawer on the housing, movable between a closed position and an open position relative to the housing.

11. A heating appliance according to any preceding claim, wherein the heat source and first heat exchanger comprises a gas-fired condensing heat exchanger unit.

12. A heating appliance according to claim 11, wherein the gas-fired condensing heat exchanger unit is mounted in an upper compartment of the housing, and wherein the air-to-water heat exchanger is mounted in a lower compartment of the housing,
wherein the lower compartment of the housing includes a condensate trap for receiving condensate from the gas-fired condensing heat exchanger unit in the upper compartment.

13. A heating appliance according to any preceding

claim, wherein the heat source is a fuel-fired heat source, and the housing includes a flue terminal for connection to a flue for expelling combustion gases, wherein the flue terminal is arranged in the roof of the housing.

14. A heating appliance according to any preceding claim, further comprising a user interface including controls for the appliance, wherein the user interface is mounted in the upper compartment.

15. A heating appliance comprising a housing for a water heating system and an air heating system, wherein the water heating system is mounted in the housing and comprises a heat source and a first heat exchanger for transferring heat to a working fluid passing through the housing, and wherein the air heating system is mounted in the housing and comprises a water-to-air heat exchanger in communication with the working fluid and a source of air, for heating air using the working fluid,
wherein the housing includes an air inlet to allow air to pass into housing for supply to the air heating system.
wherein the air inlet is provided in the roof of the housing.
wherein an air duct is arranged in communication with the air inlet, and wherein the air duct is configured to guide incoming air downwards to a location below the heat source and/or the first heat exchanger.
wherein the first heat exchanger is mounted on the air duct.

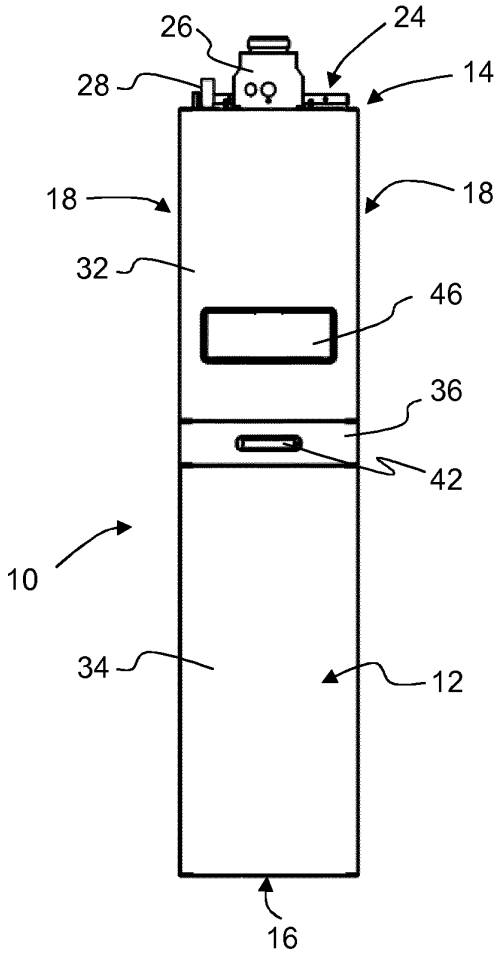

26
24
28
14
18
18
32
46
36
42
10
34
12
16

Fig. 1

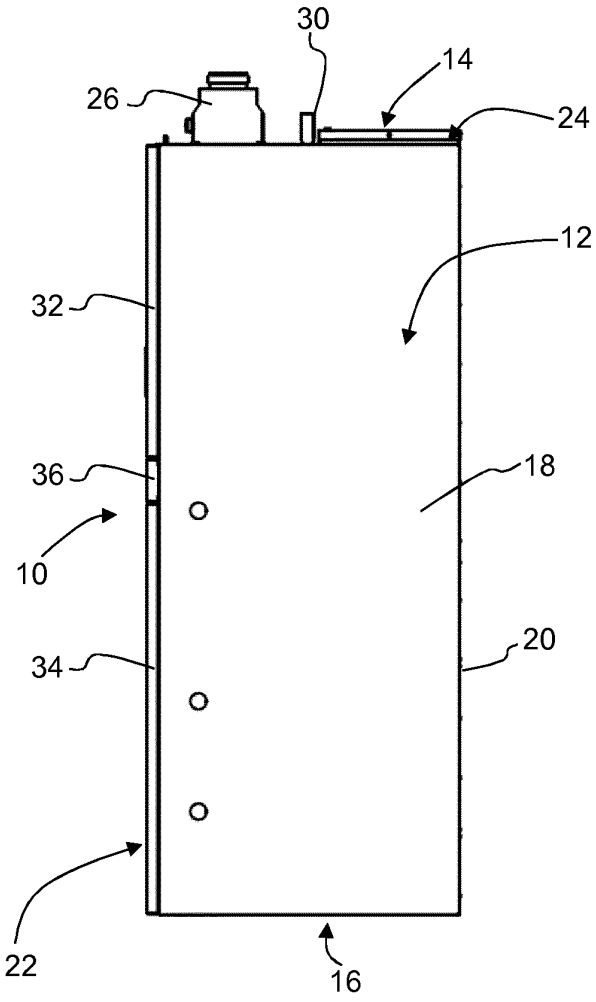

30
14
26
24
12
32
36
18
10
20
34
22
16

Fig. 2

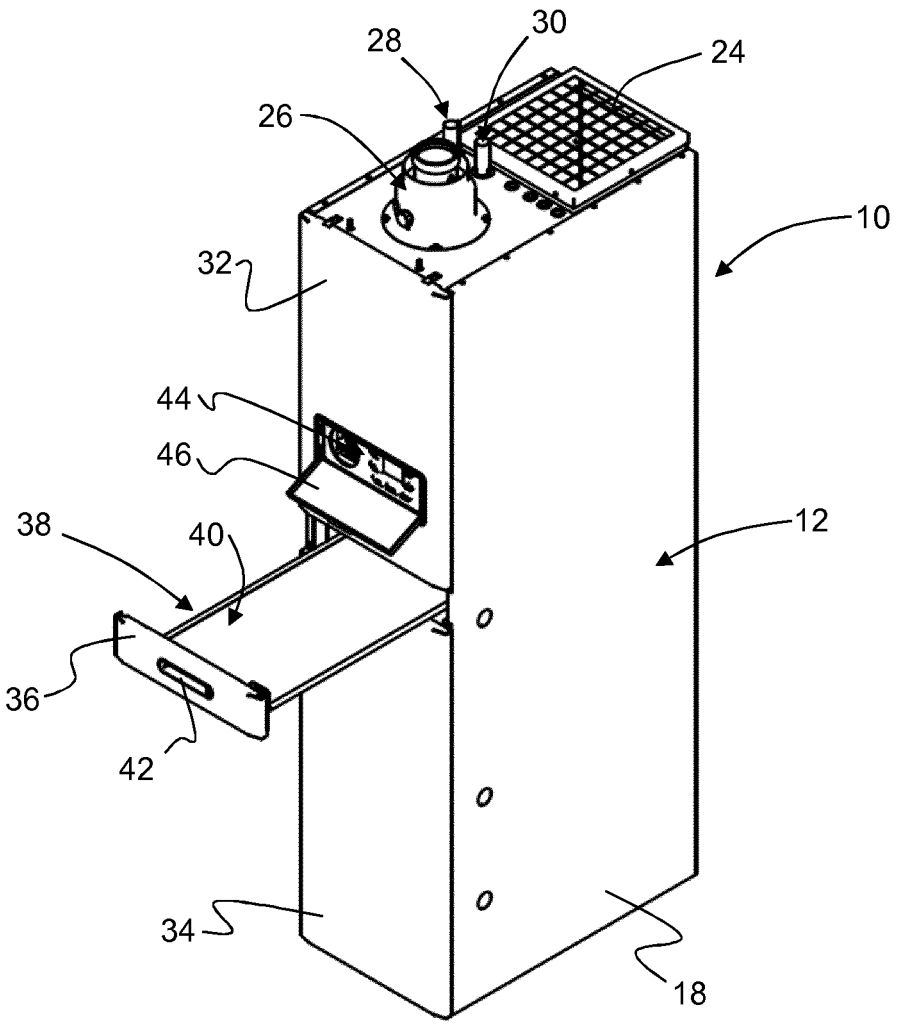


Fig. 3

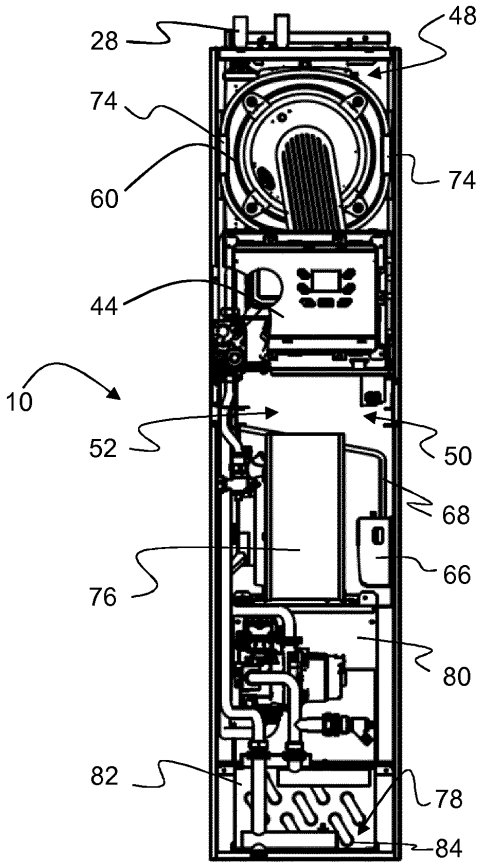

28
48
74
74
60
44
10
52
50
68
66
76
80
82
78
84

Fig. 4

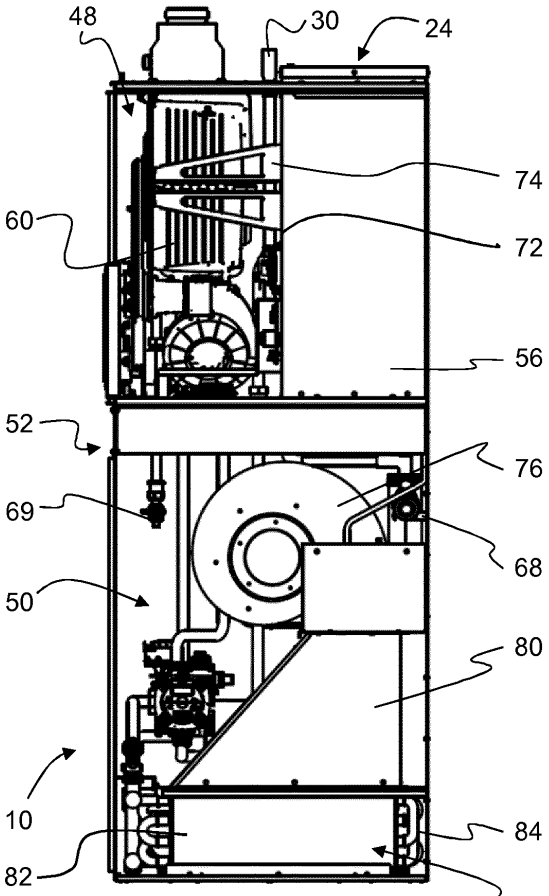

48
30
24
74
60
72
56
52
76
69
68
50
80
10
84
82
78

Fig. 5

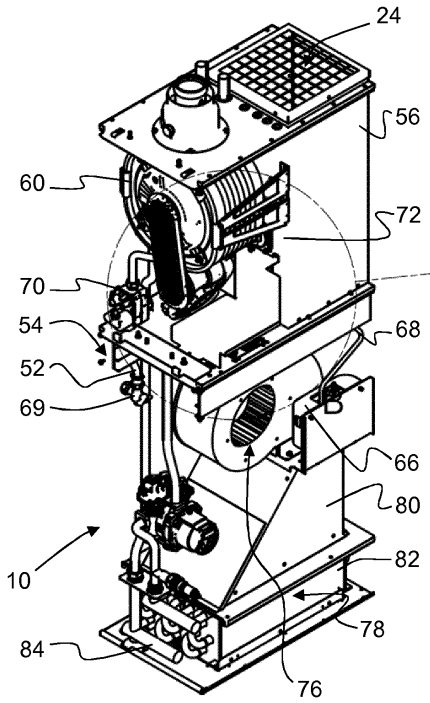

24
56
60
72
70
54
52
69
68
66
80
82
10
78
84
76

Fig. 6

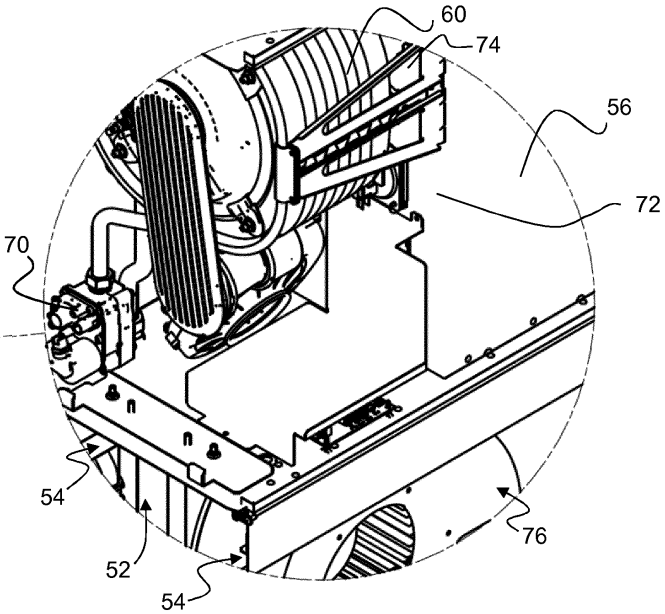

60
74
56
72
70
54
52
54
76

Fig. 7

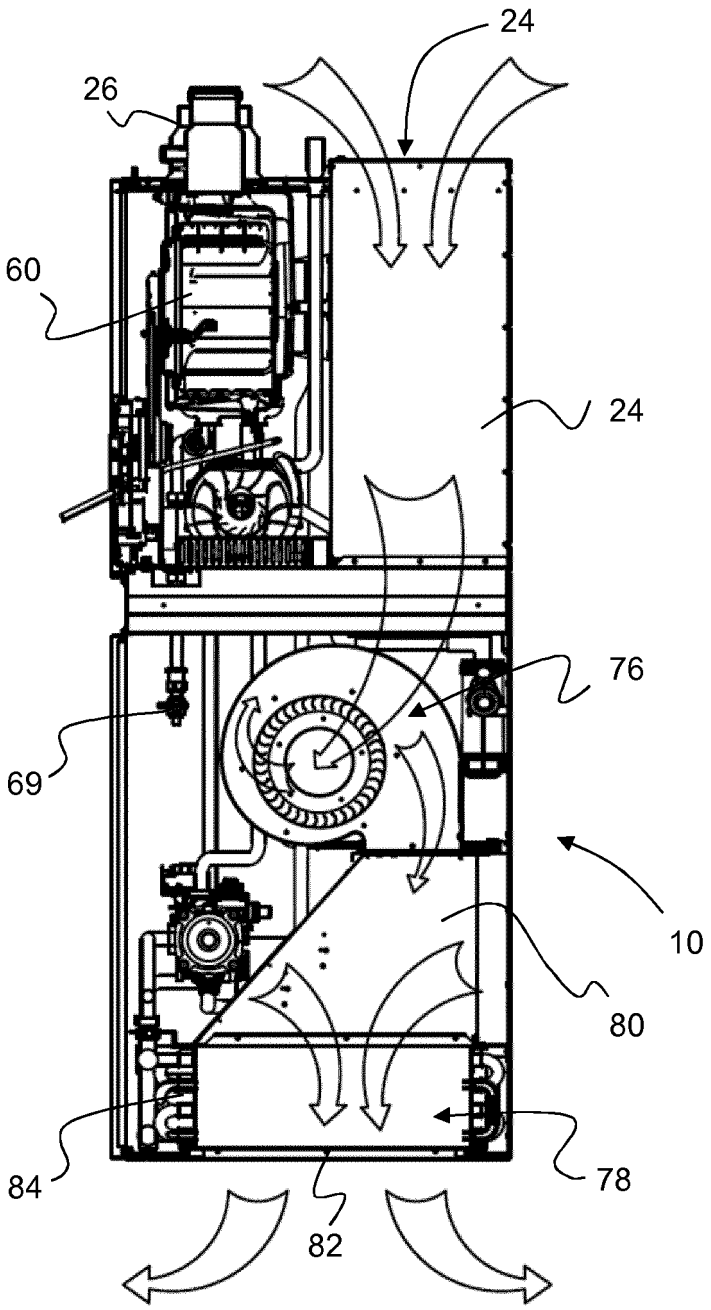


Fig. 8

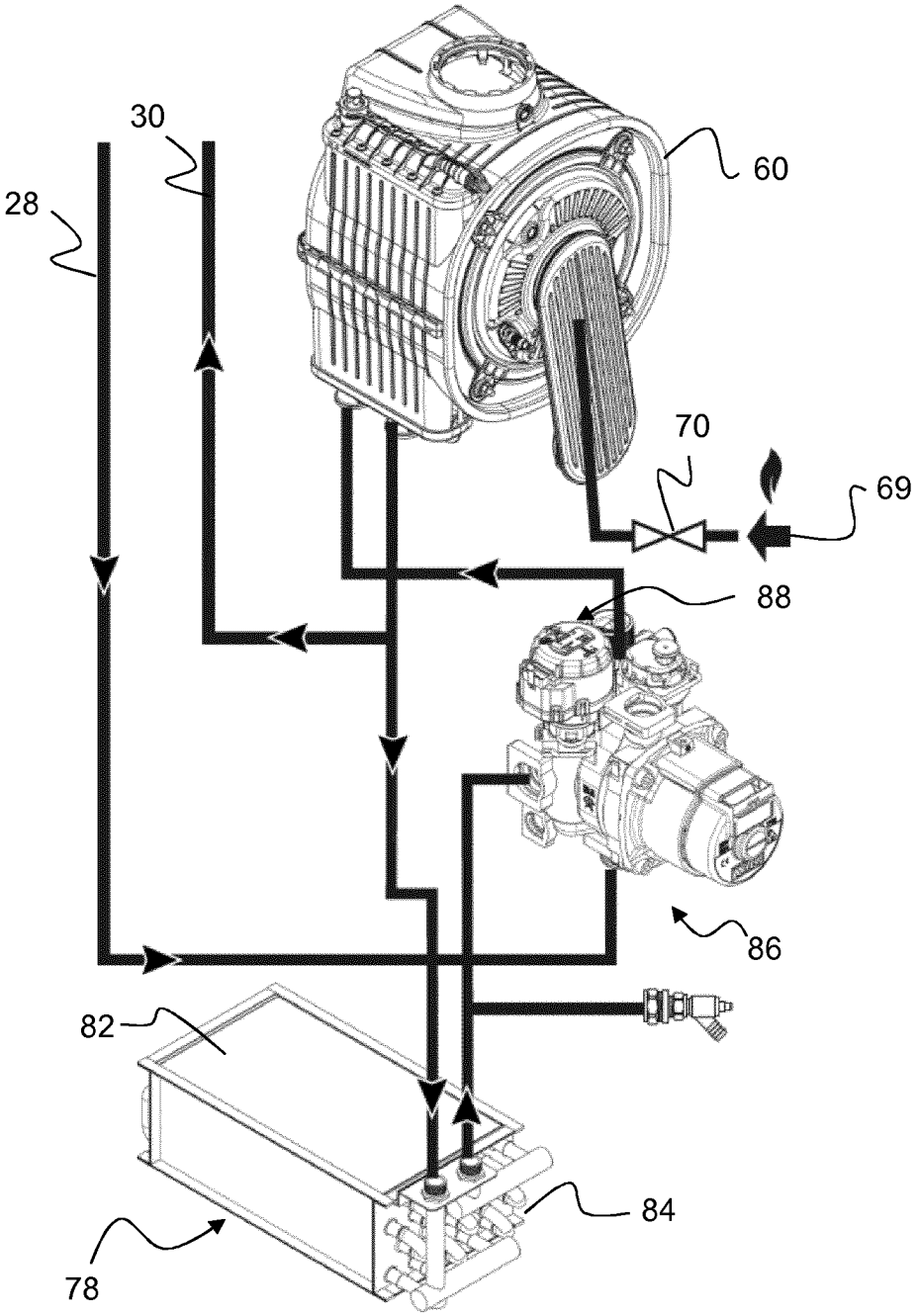


Fig. 9

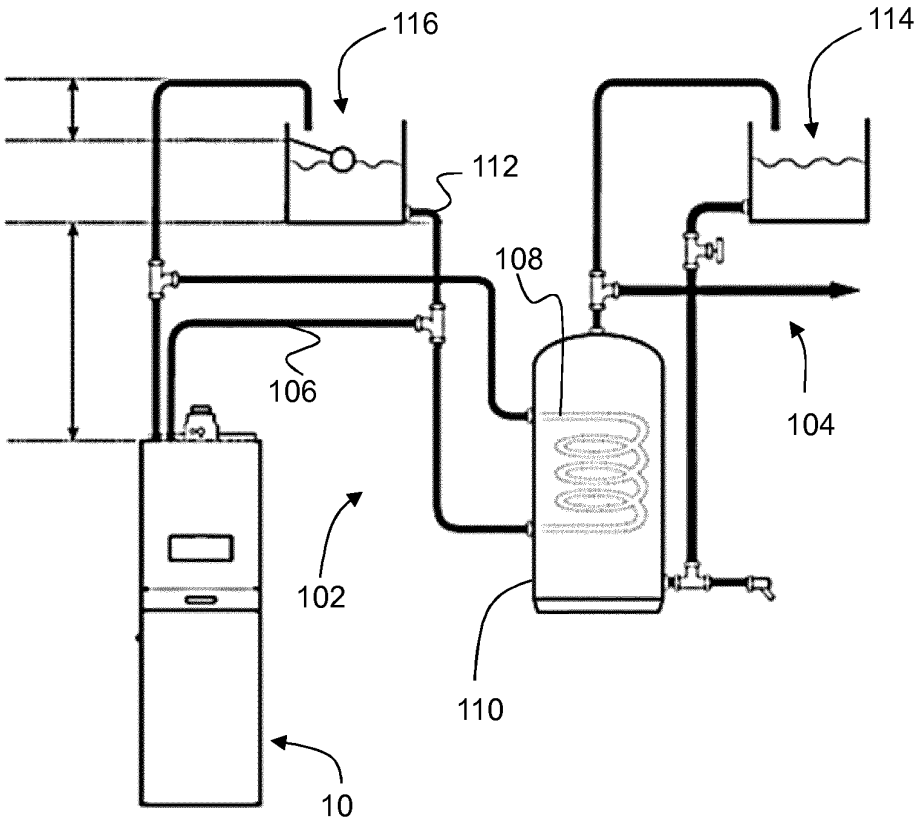


Fig. 10

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 14 16 5518

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	CH 218 845 A (ZUEBLIN CARL DIPL ING [DE]) 15 January 1942 (1942-01-15) * page 1 - page 2; figure 1 *	1,2,5-8, 14,15	INV. F24H6/00
X Y	GB 1 302 697 A (MYSON HEAT EXCHANGERS LTD. [GB]) 10 January 1973 (1973-01-10) * page 1 - page 2; figures 1-3 *	1-5,11, 13-15 9,10	
X	DE 198 10 002 A1 (MAHR SOEHNE GMBH THEO [DE]) 16 September 1999 (1999-09-16) * column 5 - column 8; figures 1, 2 *	1-8, 11-13,15	
X	DE 17 53 301 A1 (WESPER SOC DE MECANIQUE ET DE) 29 July 1971 (1971-07-29) * page 3 - page 10; figures 1-4 *	1-8,11, 13-15	
X	US 4 825 847 A (PERRON JOSEPH [CA]) 2 May 1989 (1989-05-02) * column 2 - column 3; figure 1 *	1-3,5-8, 14,15	
Y	DE 199 62 118 A1 (SUNGUR ATEF [DE]) 5 July 2001 (2001-07-05) * column 4, line 33 - line 58 *	9,10	TECHNICAL FIELDS SEARCHED (IPC) F24H
Y	WO 2011/078731 A1 (TIMOSHENKO IGOR VALERIEVICH [RU]) 30 June 2011 (2011-06-30) * abstract *	10	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	18 September 2014	Riesen, Jörg

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 14 16 5518

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.

18-09-2014

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CH 218845 A	15-01-1942	NONE	
GB 1302697 A	10-01-1973	NONE	
DE 19810002 A1	16-09-1999	NONE	
DE 1753301 A1	29-07-1971	DE 1753301 A1 FR 1515147 A	29-07-1971 01-03-1968
US 4825847 A	02-05-1989	NONE	
DE 19962118 A1	05-07-2001	NONE	
WO 2011078731 A1	30-06-2011	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82