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

(11) **EP 4 530 541 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
**02.04.2025 Bulletin 2025/14**

(21) Application number: **23315370.9**

(22) Date of filing: **27.09.2023**

(51) International Patent Classification (IPC):
***F24C 15/32*** *(2006.01)* ***F24C 14/00*** *(2006.01)*

(52) Cooperative Patent Classification (CPC):
**F24C 15/327; F24C 14/005**

(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 ME MK MT NL NO PL PT RO RS SE SI SK SM TR**
Designated Extension States:
**BA**
Designated Validation States:
**KH MA MD TN**

(71) Applicant: **Illinois Tool Works Inc.**
**Glenview, IL 60025 (US)**

(72) Inventors:
- **LAGET, Fabrice**
  **Glenview, IL 60025 (US)**
- **DALLEST, Mathieu**
  **Glenview, IL 60025 (US)**

(74) Representative: **HGF**
**HGF SAS**
**Chez Regus - Rennes Cesson**
**2 rue Claude Chappe**
**35510 Cesson Sévigné (FR)**

(54) **HYDRAULIC CIRCUIT FOR COMBINATION OVEN**

(57) A hydraulic circuit (200) for a combination oven (100), the hydraulic circuit (200) comprising: a multi-function liquid reservoir (240); a drain line (270) configured to fluidly connect the multi-function liquid reservoir to a drain (272) so as to evacuate liquid from the multi-function . liquid reservoir, in use; and at least two among the following: an oven cavity feed line (260) configured to fluidly connect the multi-function liquid reservoir (240) to an oven cavity (120) of the combination oven (100); a grease collection line (280) configured to fluidly connect the multi-function liquid reservoir (240) to a receptacle (282) for grease so as to collect the grease from the multi-function liquid reservoir (240) and discharge said grease into the receptable (282); a descaling subcircuit fluidly connected to the multi-function liquid reservoir (240) and configured to supply descaling material to the multi-function liquid reservoir (240), in use.

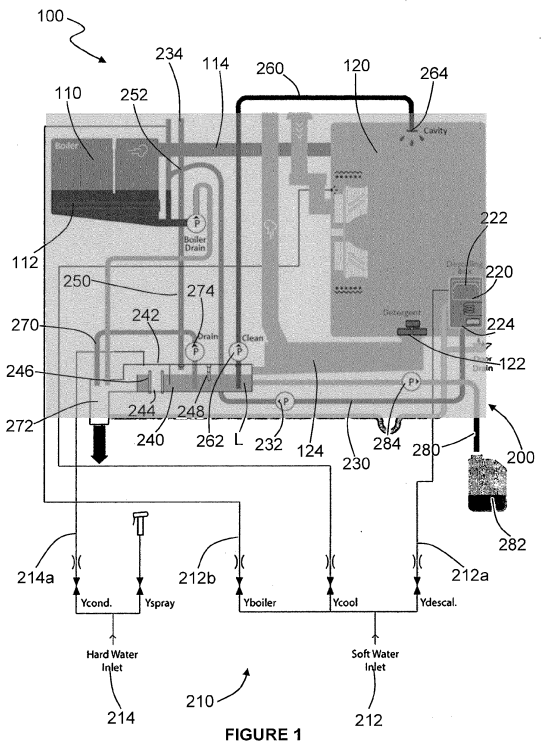


FIGURE 1

EP 4 530 541 A1

## Description

### Technical field of the invention

**[0001]** This invention relates generally to a hydraulic circuit. More specifically, although not exclusively, this invention relates to a hydraulic circuit for an oven, and in particular a combination oven and a combination oven comprising a hydraulic circuit.

### Technical background

**[0002]** Combination ovens, commonly known as combi ovens, are multifunction ovens that provide both steam and convection cooking technology and are often found in commercial or professional kitchens.

**[0003]** These ovens include an integrated boiler arranged to provide steam to an oven cavity in order to enable the steam cooking function. Due to their frequency of use in a commercial kitchen, descaling and cleaning cycles must be regularly carried out on the boiler and oven cavity.

**[0004]** It has been found that a separate descaling cycle must often be carried out on each of the boiler and oven cavity, wherein each cycle relies on a separate source of descaling material. It will be appreciated that this increases the time and complexity of oven maintenance.

**[0005]** Furthermore, the arrangement of pipework defining the hydraulic circuit for providing cleaning material to the boiler and oven cavity, and draining waste material after cleaning, is often complex and difficult to package within a small volume.

### Summary of the invention

**[0006]** It is therefore a first non-exclusive object of the invention to provide a hydraulic circuit for a combination oven that overcomes, or at least mitigates, the aforementioned drawbacks of the prior art hydraulic circuits discussed above.

**[0007]** In accordance with the present invention a hydraulic circuit for a combination oven is provided, the hydraulic circuit comprising:

- a liquid reservoir;
- one or more of the following:

    - ◦ a drain line configured to fluidly connect the liquid reservoir to a drain so as to evacuate liquid from the liquid reservoir, in use;
    - ◦ an oven cavity feed line configured to fluidly connect the liquid reservoir to an oven cavity of the combination oven;
    - ◦ a grease collection line configured to fluidly connect the liquid reservoir to a receptacle for grease;
    - ◦ a descaling subcircuit fluidly connected to the liquid reservoir and configured to supply descaling material to the liquid reservoir, in use;
    - ◦ an oven drain line configured to fluidly connect an outlet or drain of the oven cavity to the liquid reservoir;
    - ◦ a water supply line fluidly connected to the liquid reservoir and configured to supply water to the liquid reservoir, in use.

**[0008]** The grease collection line may be configured to collect grease from the liquid reservoir and discharge said grease into the receptacle.

**[0009]** The liquid reservoir may be or may comprise a multi-function liquid reservoir.

**[0010]** According to another aspect of the invention, there is provided a hydraulic circuit for a combination oven, the hydraulic circuit comprising:

a multi-function liquid reservoir ;
a drain line configured to fluidly connect the multi-function liquid reservoir to a drain so as to evacuate liquid from the multi-function liquid reservoir, in use; and
at least two among the following:

- ◦ an oven cavity feed line configured to fluidly connect the multi-function liquid reservoir to an oven cavity of the combination oven; and
- ◦ a grease collection line configured to fluidly connect the multi-function liquid reservoir to a receptacle for grease, e.g. so as to collect the grease from the multi-function liquid reservoir and discharge said grease into the receptable;
- ◦ a descaling subcircuit fluidly connected to the multi-function liquid reservoir and configured to supply descaling material to the multi-function liquid reservoir, in use.

**[0011]** The drain line may comprise a drain pump. More specifically, the drain pump may be configured to convey liquid from the liquid reservoir to the drain.

**[0012]** The drain pump may be or may comprise a liquid handling pump, for example a centrifugal pump or a screw pump.

**[0013]** The multi-function liquid reservoir may comprise the drain.

**[0014]** The oven cavity feed line may comprise a feed pump. More specifically, the feed pump may be configured to convey liquid from the multi-function liquid reservoir to the oven cavity, in use.

**[0015]** The oven cavity feed line may be or may comprise an oven cavity cleaning feed line.

**[0016]** The feed pump may comprise a liquid handling pump, for example a centrifugal pump or a screw pump.

**[0017]** The hydraulic circuit may comprise an oven drain line. More specifically, the oven drain line may be configured to fluidly connect an outlet of the oven cavity to the multi-function liquid reservoir.

**[0018]** The outlet or drain of the oven cavity may be located on a floor of the oven cavity.

**[0019]** The grease collection line may comprise a grease pump. More specifically, the grease pump may be configured to convey grease from the multi-function liquid reservoir to the receptacle, in use.

**[0020]** The receptacle may comprise a tank, container or reservoir.

**[0021]** The hydraulic circuit may comprise a water supply line. More specifically, the water supply line may be fluidly connected to the multi-function liquid reservoir and configured to supply water to the multi-function liquid reservoir, in use.

**[0022]** The descaling subcircuit may comprises a descaling feed line configured to fluidly connect a source of descaling material to a boiler of the combination oven, and a bypass line connecting the descaling feed line to the multi-function liquid reservoir such that a portion of the descaling material is provided to the multi-function liquid reservoir from the source of descaling material, in use.

**[0023]** The water supply line may be configured to supply cold water to the multi-function liquid reservoir.

**[0024]** The multi-function liquid reservoir may comprise a water level sensor and/or water level indicator.

**[0025]** The hydraulic circuit may comprise a descaling feed line.

**[0026]** The descaling feed line may be configured to fluidly connect a source of descaling material to a boiler of the combination oven.

**[0027]** The hydraulic circuit may comprise a source of descaling material.

**[0028]** The hydraulic circuit may comprise a bypass line.

**[0029]** The bypass line may fluidly connect the descaling feed line to the liquid reservoir, e.g. such that a portion of the descaling material is provided to the multi-function liquid reservoir from the source of descaling material, e.g. in use.

**[0030]** The descaling feed line may comprise a descaling feed pump.

**[0031]** The descaling feed pump may be configured to convey descaling material from the source of descaling material to the boiler.

**[0032]** The descaling feed pump may comprise a liquid handling pump, for example a centrifugal pump or a screw pump.

**[0033]** The multi-function liquid reservoir may comprise a housing, receptacle or box. The multi-function liquid reservoir may comprise a tray. The multi-function liquid reservoir may be enclosed.

**[0034]** The multi-function liquid reservoir may comprise an overflow. More specifically, the overflow may having an opening in a base of the multi-function liquid reservoir and a weir extending around the opening.

**[0035]** The overflow may having an opening in a base of the multi-function liquid reservoir.

**[0036]** The overflow may comprise a tube or pipe attached to the base of the multi-function liquid reservoir, e.g. surrounding the opening.

**[0037]** The overflow may comprise a weir extending around the opening.

**[0038]** Another aspect of the invention provides a combination oven comprising: an oven cavity; and a hydraulic circuit comprising: a multi-function liquid reservoir; a drain line configured to fluidly connect the multi-function liquid reservoir to a drain so as to evacuate liquid from the liquid reservoir, in use; an oven cavity feed line fluidly connecting the multi-function liquid reservoir to the oven cavity; and a grease collection line configured to fluidly connect the multi-function liquid reservoir to a receptacle for grease.

**[0039]** Another aspect of the invention provides a combination oven comprising: an oven cavity; and a hydraulic circuit as described above.

**[0040]** The drain line may comprise a drain pump.

**[0041]** The drain pump may be configured to convey liquid from the multi-function liquid reservoir to the drain, e.g. in use.

**[0042]** The oven cavity feed line may comprise a feed pump.

**[0043]** The feed pump may be configured to convey liquid from the multi-function liquid reservoir to the oven cavity, e.g. in use.

**[0044]** The grease collection line may comprise a grease pump.

**[0045]** The grease pump may be configured to convey grease from the multi-function liquid reservoir to the receptacle, e.g. in use.

**[0046]** The hydraulic circuit may comprise an oven drain line.

**[0047]** The oven drain line may fluidly connect an outlet of the oven cavity to the multi-function liquid reservoir.

**[0048]** The multi-function liquid reservoir, oven cavity feed line, oven cavity and oven drain line may together describe a cleaning subcircuit of the hydraulic circuit.

**[0049]** The combination oven may comprise a boiler.

**[0050]** The hydraulic circuit may comprise a descaling feed line configured to fluidly connect a source of descaling material to the boiler.

**[0051]** The hydraulic circuit may comprise a bypass line fluidly connecting the descaling feed line to the multi-function liquid reservoir such that a portion of the descaling material is provided to the multi-function liquid reservoir from the source of descaling material, in use.

**[0052]** The cleaning subcircuit may comprise the bypass line.

**[0053]** The descaling feed line may comprise a descaling feed pump.

**[0054]** The descaling feed pump may be configured to convey descaling material from the source of descaling material to the boiler, e.g. in use.

**[0055]** The descaling subcircuit may comprise the multi-function liquid reservoir, the descaling feed line, the bypass line, the oven cavity feed line and/or the descaling feed pump.

**[0056]** For the avoidance of doubt, any of the features described herein apply equally to any aspect of the invention. For example, the hydraulic circuit may comprise any one or more features of the combination oven relevant to the hydraulic circuit and vice-versa.

**[0057]** Within the scope of this application it is expressly intended that the various aspects, embodiments, examples and alternatives set out in the preceding paragraphs, in the claims and/or in the following description and drawings, and in particular the individual features thereof, may be taken independently or in any combination. That is, all embodiments and/or features of any embodiment can be combined in any way and/or combination, unless such features are incompatible. For the avoidance of doubt, the terms "may", "and/or", "e.g.", "for example" and any similar term as used herein should be interpreted as non-limiting such that any feature so-described need not be present. Indeed, any combination of optional features is expressly envisaged without departing from the scope of the invention, whether or not these are expressly claimed. The applicant reserves the right to change any originally filed claim or file any new claim accordingly, including the right to amend any originally filed claim to depend from and/or incorporate any feature of any other claim although not originally claimed in that manner.

## Brief description of the figures

**[0058]** Embodiments of the invention will now be described by way of example only with reference to the accompanying drawings in which:
[Fig. 1] is a schematic of a combination oven and hydraulic circuit in accordance with the present invention.

## Detailed description of the invention

**[0059]** Referring now to Figure 1, there is shown a combination oven 100 having a hydraulic circuit 200. The combination oven 100 includes a boiler 110 connected to an oven cavity 120. The boiler 110 is configured to provide steam to the oven cavity 120, in use, in order to enable a steam cooking function.

**[0060]** As will be described in greater detail below, the combination oven 100 includes a water supply 210 having a soft water inlet 212 and a hard water inlet 214. A first stream 212a of the soft water inlet 212 is provided to a source of descaling material 220. The source of descaling material 220 is fluidly connected to the boiler 110 by a descaling feed line 230, and is fluidly connected to a multi-function liquid reservoir 240 by a bypass line 250.

**[0061]** An oven cavity feed line 260 fluidly connects the multi-function liquid reservoir 240 to the oven cavity 120 such that descaling material that is conveyed along the bypass line 250 to the multi-function liquid reservoir 240 can be conveyed to the oven cavity 120.

**[0062]** The boiler 110 includes a water supply, provided by a second stream 212b of the soft water inlet 212, and a heating element 112. A conduit 114 fluidly connects the boiler 110 to the oven cavity 120 to allow the passage of steam. The floor of the oven cavity 120 includes an outlet 122, and an oven drain line 124 fluidly connects the outlet 122 to the multi-function liquid reservoir 240. The oven drain line 124 is configured to drain descaling material, grease cleaning product, air and condensate from the oven cavity 120.The oven drain line 124 may evacuate air to avoid overpressure in the oven cavity 120.

**[0063]** The multi-function liquid reservoir 240 also includes a water supply line from a first stream 214a of the hard water inlet 214. The water supply is a cold water supply in this embodiment, and is configured to provide cooling to condensates within the multi-function liquid reservoir 240.

**[0064]** The source of descaling material 220 is provided within a container 222 and is shown within the oven cavity 120 in Figure 1. However, it will be appreciated that this need not be the case. Instead, the source of descaling material 220 may be located within a separate compartment of the combination oven 100.

**[0065]** The source of descaling material 220 comprises a powder in this embodiment, and the water supply 212a is configured to pass through the powder from the top of the container 222 towards the bottom of the container 222 so as to form a descaling solution. The descaling feed line 230 is connected to the floor 224 of the container 222.

**[0066]** The descaling feed line 230 includes a descaling feed pump 232 downstream of the container 222. The descaling feed pump 232 is a centrifugal pump in this embodiment and is configured to convey the descaling solution from the source of the descaling material 220 to the boiler 110. As is shown in Figure 1, the boiler 110 is elevated relative to the source of descaling material 220 and therefore the descaling feed pump 232 is arranged to provide the necessary head in order to provide the descaling solution to the boiler 110. It will be appreciated that the portion of the descaling feed line 230 passing behind the liquid reservoir 240 is continuous, and not broken as may be suggested by Figure 1.

**[0067]** The bypass line 250 is fluidly connected to the descaling feed line 230 downstream of the descaling feed pump 232 via a branch pipe 252. in order to prevent backflow of descaling solution from the bypass line 250 towards the descaling feed pump 232, the descaling feed line 230 includes a vent 234.

**[0068]** In the present embodiment, the multi-function liquid reservoir 240 is positioned at a lower elevation than the boiler 110 and the branch pipe 252 such that a portion of the descaling solution being conveyed along the descaling feed line 230 by the descaling feed pump 232 is provided to the multi-function liquid reservoir 240 via the bypass line 250. in particular, less than 50% of the descaling material conveyed along the descaling feed line 230 is provided to the multi-function liquid reservoir 240 by the bypass line 250.

**[0069]** The oven cavity feed line 260 includes a feed pump 262, in the form of a centrifugal pump in this

embodiment, configured to covey the descaling solution from the multi-function liquid reservoir 240 to the oven cavity 120. As is shown in Figure 1, the oven cavity 120 is elevated relative to the source of multi-function liquid reservoir 240 and therefore the feed pump 262 is arranged to provide the necessary head in order to provide the descaling solution to the oven cavity 120.

**[0070]** The oven cavity feed line 260 terminates with one or more nozzles 264 located within the oven cavity 120. In use, the descaling solution is provided to the oven cavity 120 via the one or more nozzles 264.In addition to descaling, it will be appreciated that the over cavity feed line 260 is also used for cleaning and rinsing the oven cavity 120.

**[0071]** A drain line 270 fluidly connects the multi-function liquid reservoir 240 to a drain 272 so as to evacuate liquid from the multi-function liquid reservoir 240, in use. The drain line 270 includes a drain pump 274, in the form of a centrifugal pump in this embodiment, located between the multi-function liquid reservoir 240 and the drain 272.

**[0072]** A grease collection line 280 fluidly connects the multi-function liquid reservoir 240 to a receptacle 282 for grease. The grease collection line 280 includes a grease pump 284, which is a centrifugal pump in this embodiment. The grease pump 284 is configured to convey grease that is received at the multi-function liquid reservoir 240, via the oven drain line 124, to the receptacle 282.

**[0073]** The multi-function liquid reservoir 240 includes an enclosed housing 242 in this embodiment. A liquid overflow is provided by an opening 244 in the base of the housing 242, and a weir 246 provided by a tube or pipe connected to the base and surrounding the opening 244. A water level sensor 248 extends from an upper surface of the housing 242 and is configured to determine the level of liquid L therewithin. It can also be seen from Figure 1 that the drain 272 is formed as part of the housing 242 and therefore multi-function liquid reservoir 240.

**[0074]** It will be appreciated that the multi-function liquid reservoir 240, oven cavity cleaning feed line 260, oven cavity 120 and oven drain line 124 may together describe a cleaning subcircuit of the hydraulic circuit 200.

**[0075]** It will also be appreciated that the multi-function liquid reservoir 240, the descaling feed line 230, the bypass line 250 and/or the descaling feed pump 232 may together describe a descaling subcircuit of the hydraulic circuit 200. The descaling subcircuit may further comprise the oven cavity feed line 260.

**[0076]** It will be appreciated by those skilled in the art that several variations to the aforementioned embodiments are envisaged without departing from the scope of the invention.

**[0077]** It will also be appreciated by those skilled in the art that any number of combinations of the aforementioned features and/or those shown in the appended drawings provide clear advantages over the prior art and are therefore within the scope of the invention described herein.

## Claims

1. A hydraulic circuit (200) for a combination oven (100), the hydraulic circuit (200) comprising:

   a multi-function liquid reservoir (240);
   a drain line (270) configured to fluidly connect the multi-function liquid reservoir to a drain (272) so as to evacuate liquid from the multi-function liquid reservoir, in use; and
   at least two among the following:

   - an oven cavity feed line (260) configured to fluidly connect the multi-function liquid reservoir (240) to an oven cavity (120) of the combination oven (100); and
   - a grease collection line (280) configured to fluidly connect the multi-function liquid reservoir (240) to a receptacle (282) for grease so as to collect the grease from the multi-function liquid reservoir (240) and discharge said grease into the receptable (282);
   - a descaling subcircuit fluidly connected to the multi-function liquid reservoir (240) and configured to supply descaling material to the multi-function liquid reservoir (240), in use.

2. A hydraulic circuit (200) according to claim 1, wherein the drain line (270) comprises a drain pump (274) configured to convey liquid from the multi-function liquid reservoir to the drain (272).

3. A hydraulic circuit (200) according to claim 1 or claim 2, wherein the multi-function liquid reservoir (240) comprises the drain (272).

4. A hydraulic circuit (200) according to any preceding claim, wherein the oven cavity feed line (260) comprises a feed pump (262) configured to convey liquid from the multi-function liquid reservoir (240) to the oven cavity (120), in use.

5. A hydraulic circuit (200) according to any preceding claim, comprising an oven drain line (124) configured to fluidly connect an outlet of the oven cavity (120) to the multi-function liquid reservoir (240).

6. A hydraulic circuit (200) according to any preceding claim, wherein the grease collection line (280) comprises a grease pump (284) configured to convey grease from the multi-function liquid reservoir (240) to the receptacle (282), in use.

**7.** A hydraulic circuit (200) according to any preceding claim, comprising a water supply line (210) fluidly connected to the multi-function liquid reservoir (240) and configured to supply water to the multi-function liquid reservoir (240), in use.

**8.** A hydraulic circuit (200) according to any claims 1 to 7, wherein the descaling subcircuit comprises a descaling feed line (230) configured to fluidly connect a source of descaling material to a boiler of the combination oven, and a bypass line connecting the descaling feed line to the multi-function liquid reservoir (240) such that a portion of the descaling material is provided to the multi-function liquid reservoir (240) from the source of descaling material, in use.

**9.** A hydraulic circuit according to any preceding claim, wherein the multi-function liquid reservoir (240) comprises an overflow having an opening in a base of the multi-function liquid reservoir (240), and a weir extending around the opening.

**10.** A combination oven (100) comprising:

an oven cavity (120); and
a hydraulic circuit (200) according to any claims 1 to 9.

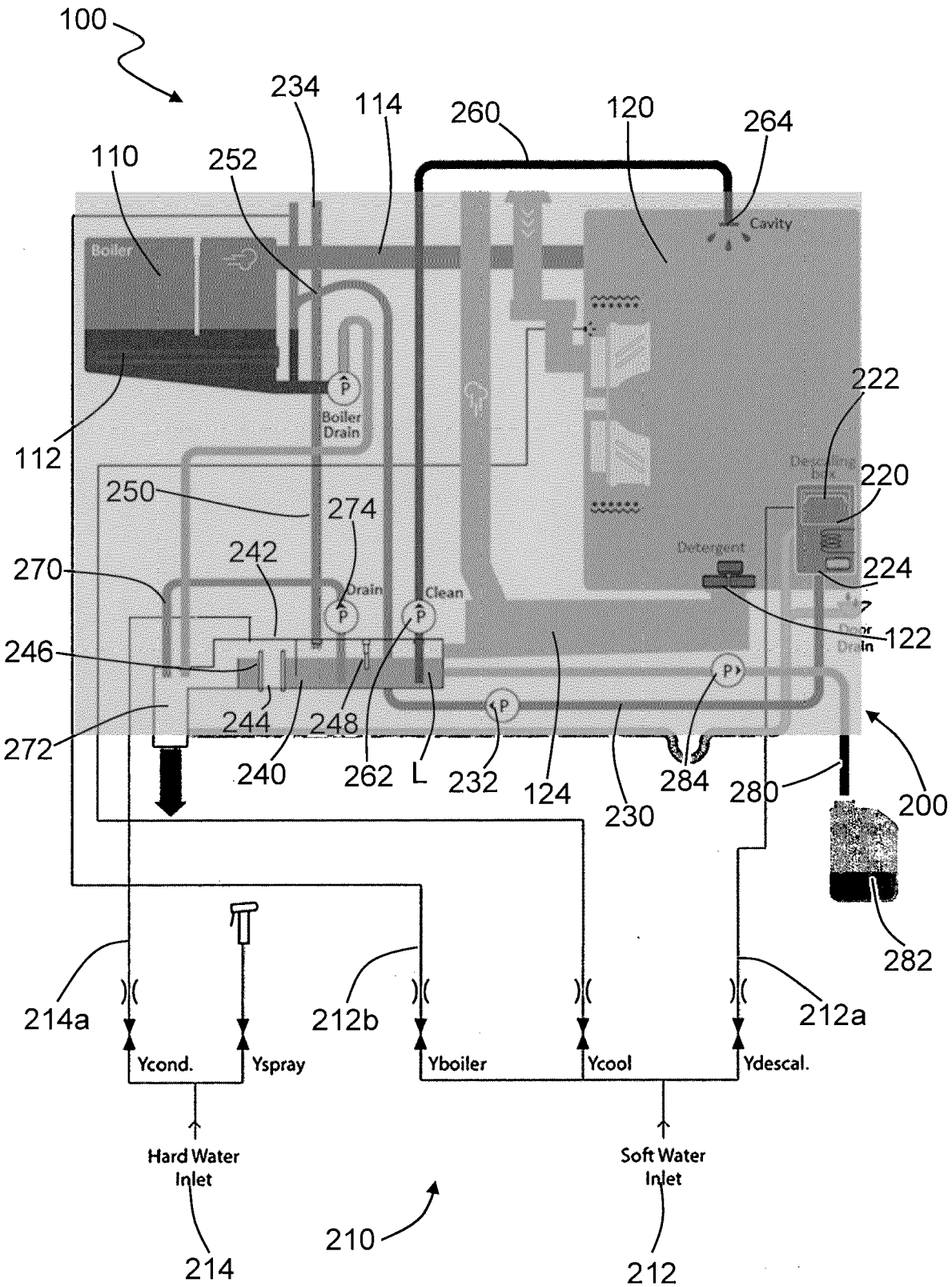
100
234
114
260
120
264
110
252
Cavity
Boiler
Boiler Drain
112
222
220
250
274
242
Detergent
224
270
Drain
Clean
122
246
244
248
272
240
262
L
232
124
230
284
280
200
282
214a
212b
212a
Ycond.
Yspray
Yboiler
Ycool
Ydescal.
Hard Water Inlet
Soft Water Inlet
210
214
212

FIGURE 1

Europäisches Patentamt
European Patent Office
Office européen des brevets

# EUROPEAN SEARCH REPORT

Application Number
EP 23 31 5370

## 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<br>Y | DE 20 2013 012917 U1 (HANNING ELEKTRO WERKE GMBH & CO KG [DE])<br>3 January 2022 (2022-01-03)<br>* paragraphs [0004], [0027], [0030]; figure 1 * | 1-7,9,10<br>8 | INV.<br>F24C15/32<br>F24C14/00 |
| Y | DE 10 2006 010460 B4 (RATIONAL AG [DE])<br>25 February 2016 (2016-02-25)<br>* paragraph [0055]; figure 1 * | 8 | |
| A | EP 3 702 678 B1 (ELECTROLUX PROFESSIONAL SPA [IT]) 21 December 2022 (2022-12-21)<br>* figure 7 * | 9 | |
| | | | TECHNICAL FIELDS SEARCHED (IPC)<br>F24C |

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| The Hague | 27 February 2024 | Jalal, Rashwan |

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 23 31 5370

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.

27-02-2024

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| DE 202013012917 U1 | 03-01-2022 | NONE | |
| DE 102006010460 B4 | 25-02-2016 | DE 102006010460 A1 | 06-09-2007 |
| | | WO 2007098732 A2 | 07-09-2007 |
| EP 3702678 B1 | 21-12-2022 | NONE | |