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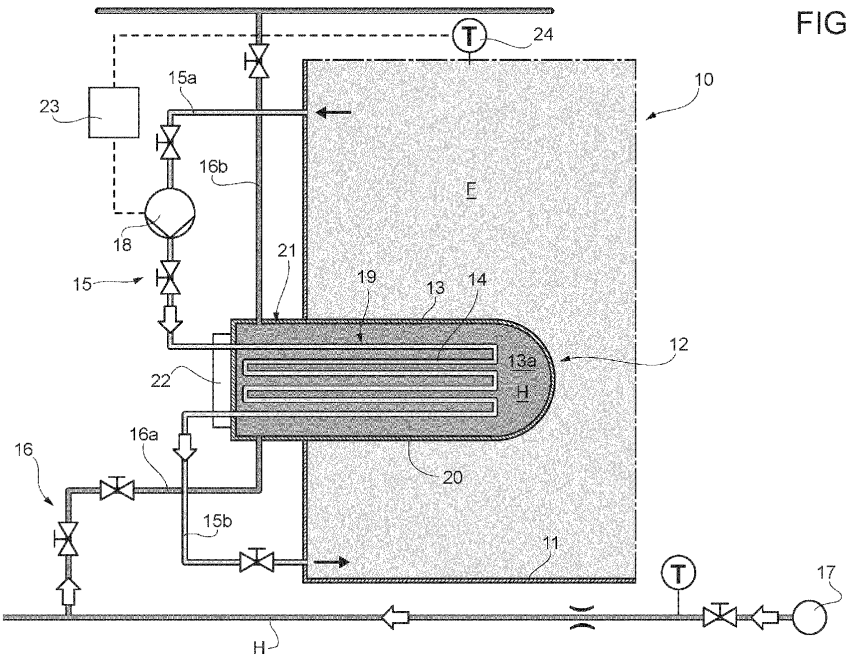
(54) WASHING MACHINE FOR WASHING EMPTY CONTAINERS ADAPTED TO BE FILLED WITH A POURABLE PRODUCT

(57) There is described a washing machine (1) configured to wash empty containers (2) adapted to be filled with a pourable product, comprising: at least one cleaning bath (10) including a tank (11) configured for holding a cleaning fluid (F); a conveyor device (4) configured to convey a sequence of said containers (2) along a washing path (P) which extends through said tank (11) ; a heat exchanger (12) configured to heat the cleaning fluid (F) contained in the tank (11) by means of heat exchange between the cleaning fluid (F) and a heating fluid (H); the heat exchanger (12) comprising an outer casing (13), internally delimiting an exchange chamber (13a), and an inner tubing (14) at least partially enclosed within the casing (13) and extending through the exchange chamber (13a); the exchange chamber (13a) is configured to be fed with the heating fluid (H) and the tubing (14) is configured to be fed with the cleaning fluid (F) from the tank (11), so that a heat exchange is established between the heating fluid (H) in the exchange chamber (13a) and the cleaning fluid (F) within the tubing (14).

FIG. 2



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Description

TECHNICAL FIELD

[0001] The present invention relates to a washing machine for washing (and cleaning) empty containers adapted to be filled with a pourable product, preferably a pourable food product.

BACKGROUND ART

[0002] Washing machines are known which are configured for washing and cleaning containers (usually used containers which have been emptied from the pourable product they are adapted to contain) upstream of a filling machine and a labelling machine, in which the containers are respectively filled with the pourable product and labelled with respective labels.

[0003] An example of washing machine is known from EP-A-2727660 in the name of the same Applicant.

[0004] A typical washing machine of the above type essentially comprises:

- a washing tunnel;
- a looped chain conveyor advancing the containers from an inlet station to an outlet station along a washing path which extends inside the washing tunnel;
- a feeding system for feeding containers to be treated to the chain conveyor; and
- a plurality of consecutive treatment zones arranged between the inlet station and the outlet station and through which the chain conveyor advances the containers.

[0005] In detail, the chain conveyor comprises a plurality of beams, which are fed at the inlet station by the feeding system with respective rows of containers.

[0006] In greater detail, each beam comprises a plurality of aligned pockets organized in respective rows, each pocket being configured to receive one container to be treated at a time, to convey such container from the inlet station to the outlet station through the washing tunnel and along the washing path, and to deliver the respective washed container at the outlet station.

[0007] More precisely, each beam is discharged of the respective washed containers at the outlet station and then is conveyed along a return path back to the inlet station, where it receives new empty containers to be washed.

[0008] Typically, according to the advancing direction of the containers along the washing path and inside the washing tunnel, the treatment zones comprise, in sequence: a prewash zone, a cleaning zone and a rinsing zone.

[0009] The prewash zone and the cleaning zone comprise, each, at least one cleaning bath defined by respective tanks which are filled with washing chemical agents and through which the containers are advanced.

[0010] The rinsing zone comprises several rinsing baths filled with rinsing liquid and/or ejecting devices for directing sprinkles of rinsing liquid toward the containers.

[0011] In light of the above, the at least one cleaning bath of the cleaning zone comprises a tank which is apt to be filled with a detergent cleaning solution or fluid, typically in liquid state.

[0012] In general, the containers need to be treated through the cleaning zone for a relatively long time and at relatively high temperatures in order to be effectively deprived from the most encrusted dirt mounds, especially the ones heavily sedimented at the bottom of the containers themselves.

[0013] Hence, the liquid cleaning solution has to be heated and maintained at a predetermined temperature for the entire duration of the washing process.

[0014] To this end, the cleaning bath of the cleaning zone further comprises a heater for heating the cleaning solution.

[0015] Generally, the heater is a heat exchanger, whereby heating fluid (such as purified water or water vapor) is circulated to exchange heat with the cleaning solution.

[0016] In the known embodiments, the heat exchanger is arranged within the tank and therefore directly immersed in the cleaning solution. For example, the heat exchanger has a tube bundle and such tube bundle is immersed in the cleaning solution within the tank and is directly lapped by the cleaning solution. This configuration ensures an optimal heat exchange between the heating fluid and the cleaning solution, since the thermal exchange is quite high.

[0017] Although the known washing machines are functionally valid, the Applicant has observed that they are still open to further improvement, in particular as per the maintenance thereof.

[0018] In fact, in order to perform cleaning and/or maintenance operations on the heat exchanger, the respective tank has to be emptied from the cleaning solution. Given the usual size of the known washing machines, the emptying of the tank can be quite time consuming. Moreover, a large storage container is needed to stock the cleaning solution in the meantime, or the entire cleaning solution has to be thrown away, which results in increased overall costs.

[0019] For these reasons, external heat exchangers have been proposed, which are arranged outside of the respective tanks. However, this results in an increased encumbrance within the machine, since a suitable space has to be provided for housing the heat exchanger. This also results in a far more complicated and cumbersome architecture of the machine.

DISCLOSURE OF INVENTION

[0020] It is therefore an object of the present invention

to provide a washing machine for washing containers which is designed to meet the above-mentioned needs in a straightforward and low-cost manner.

[0021] This object is achieved by a washing machine as claimed in the appended independent claim 1. Preferred embodiments of the present invention are laid down in the appended dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a schematic lateral view, partially sectioned, and with parts removed for clarity of a washing machine according to the invention; and
Figure 2 is a larger-scale, schematic sectioned partial view, with parts removed for clarity, illustrating a hydraulic scheme of part of the washing machine of Figure 1.

BEST MODE FOR CARRYING OUT THE INVENTION

[0023] With reference to Figure 1, number 1 indicates as a whole a washing machine configured to wash empty containers 2 adapted to be filled with a pourable product, preferably a pourable food product, such as beer, wine, water, juice, soft drinks, milk or the like.

[0024] In particular, containers 2 are defined by respective empty bottles (for example, returnable glass bottles) intended to be filled with the pourable product.

[0025] Washing machine 1 comprises:

- a washing tunnel 3 into which empty containers 2 are fed and accordingly washed; and
- a conveyor device 4 configured to convey a plurality of containers 2 along a washing path P in an advancement direction.

[0026] Preferably, the conveyor device comprises a looped chain conveyor 4 (of the type known and only schematically shown) for advancing containers 2 along washing path P inside washing tunnel 3, so as to convey containers 2 from one end of the tunnel 3 to the other end along a general direction D, preferably horizontal with respect to gravity.

[0027] In detail, chain conveyor 4 may be of the type described in WO-A-2020119958 and comprises:

- a pair of elongated chains (not shown) parallel to path P and parallel to one another; and
- a plurality of successive conveying beams 5 (laterally shown), which extend between the chains in a transversal and, more in detail, orthogonal manner to the chains and path P.

[0028] Specifically, each beam comprises a row of pockets 6 (laterally shown) aligned orthogonally to path P and configured to receive corresponding containers 2.

[0029] In such a manner, containers 2 carried by a corresponding beam 5 are aligned orthogonally to path P and housed inside the respective pockets 6, individually.

[0030] Washing machine 1 comprises also a feeding system 7 of the known type (only schematically shown in Figure 1) for feeding a sequence of empty containers 2 along direction D and at an inlet station I of washing tunnel 3. Expediently, containers 2 are fed by feeding system 7 along direction D arranged in rows orthogonal to path P.

[0031] In use, the most forward containers 2 of each row of containers 2 are transferred by feeding system 7 to the respective pockets 6 of the beam 5 that is travelling at inlet station I.

[0032] Washing machine 1 further comprises an outfeed system 8, which receives rows of cleaned containers 2 from chain conveyor 4 at an outlet station O of washing tunnel 3.

[0033] In view of the above, path P comprises:

- a washing branch P1, which extends from inlet station I to outlet station O and along which containers 2 are advanced by chain conveyor 4; and
- a return branch P2, which extends from outlet station O to inlet station I and defines a return path along which beams 5 return towards inlet station I after having discharged containers 2.

[0034] According to the aforementioned advancing direction of the containers 2 along path P, washing machine 1 comprises in sequence along washing branch P1:

- a prewash zone C1;
- a cleaning zone C2; and
- a final rinsing zone C3.

[0035] In the present disclosure, for the sake of clarity, terms like "upstream of" and "downstream of" are to be intended throughout the whole description and claims with reference to the advancing direction of the containers 2 along path P.

[0036] The operation of washing machine 1 at the prewash zone C1, cleaning zone C2 and final rinsing zone C3 is well-known, for example from WO-A-2020119958, and therefore will not be described in detail herein.

[0037] Cleaning zone C2 comprises at least one cleaning bath 10, in particular a plurality of cleaning baths 10, in the embodiment shown two successive cleaning baths 10.

[0038] Reference will be made in the following to a single cleaning bath 10. However, the features of such cleaning bath 10 apply to each cleaning bath 10 that may be present in cleaning zone C2.

[0039] Cleaning bath 10 includes a tank 11 which is

configured for holding a cleaning fluid F, such as a detergent chemical solution made of several chemical agents.

[0040] In one embodiment, cleaning fluid F comprises basic aqueous solutions that include, in particular, sodium hydroxide.

[0041] In use, tank 11 is filled with the cleaning fluid F up to a predetermined level.

[0042] Expediently, path P, and in particular washing branch P1, extends through tank 11, so that the containers 2 advanced by it are advanced through cleaning fluid F and are temporarily immersed therein.

[0043] In order to effectively remove dirt from containers 2, cleaning fluid F is brought (and maintained) to a predetermined temperature, for instance between 65°C and 80°C.

[0044] To this end, washing machine 1, and in particular cleaning bath 10, comprises a heat exchanger 12 configured to heat the cleaning fluid F contained in tank 11 by means of heat exchange between cleaning fluid F and a heating fluid H.

[0045] Preferably, heating fluid H is water, in particular purified water.

[0046] In one embodiment, heating fluid H may be water vapor or another heating medium apt to the above aim.

[0047] As schematized in Figure 2, heat exchanger 12 comprises an outer casing 13, internally delimiting an exchange chamber 13a, and an inner tubing 14 at least partially enclosed within casing 13 and extending through exchange chamber 13a.

[0048] In practice, casing 13 defines an outer mantle of heat exchanger 12.

[0049] According to the preferred and non-limiting embodiment shown, tubing 14 includes a tube bundle and casing 13 defines a shell of heat exchanger 12, so that heat exchanger 12 is a shell-and-tube heat exchanger.

[0050] Alternatively, tubing 14 may include a single duct zigzagging within exchange chamber 13a (i.e. a heating "serpentine" tube).

[0051] According to an aspect of the present invention, exchange chamber 13a is configured to be fed with heating fluid H and tubing 14 is configured to be fed with cleaning fluid F from the tank 11, so that a heat exchange is established between the heating fluid H in exchange chamber 13a and the cleaning fluid F within tubing 14.

[0052] In practice, in use, the cleaning fluid F contained in tank 11 is circulated within tubing 14 and heating fluid H is circulated within exchange chamber 13a.

[0053] In other words, exchange chamber 13a only receives heating fluid H and is fluidly isolated from tank 11.

[0054] To this end, with reference to Figure 2, washing machine 1 comprises:

- a first fluidic circuit 15 configured for circulating cleaning fluid F from tank 11 to heat exchanger 12, through tubing 14, and back into tank 11; and
- a second fluidic circuit 16 configured for circulating heating fluid H from a heating fluid source 17, such as a boiler or a heater, to heat exchanger 12, through exchange chamber 13a.

[0055] In particular, first circuit 15 comprises a suction duct 15a arranged fluidly upstream of heat exchanger 12 and configured for conveying cleaning fluid F to be heated from tank 11 to heat exchanger 12, in particular to tubing 14, and a delivery duct 15b arranged fluidly downstream of heat exchanger 12 and configured for conveying heated cleaning fluid F from tubing 14 back into tank 11.

[0056] Conveniently, first circuit 15 further comprises a pumping device 18 fluidly interposed between suction duct 15a and delivery duct 15b (and in particular between suction duct 15a and tubing 14).

[0057] Similarly, second circuit 16 includes a suction duct 16a fluidly connecting source 17 to exchange chamber 13a, and a delivery duct 16b for conveying heating fluid H out of exchange chamber 13a.

[0058] In light of the above, heat exchanger 12 includes a first exchange interface 19 defined between tubing 14 and exchange chamber 13a.

[0059] In detail, first exchange interface 19 is defined by an outer surface of tubing 14.

[0060] Therefore, washing machine 1 is configured so that heating fluid H exchanges heat with cleaning fluid F via first exchange interface 19.

[0061] Thanks to the configuration of heat exchanger 12 as described above, the operations of maintenance on heat exchanged 12 (and therefore on washing machine 1) are significantly eased and improved, since exchange chamber 13a is fluidly isolated from tank 11 and therefore it is not necessary to empty tank 11 from cleaning fluid F during maintenance operations. At the same time, the configuration of heat exchanger 12 according to the invention highly reduces the risk of clogging, with respect to the known configurations whereby heating fluid H is circulated in the tubing and cleaning fluid F is circulated in the exchange chamber, or with respect to plate-type heat exchangers, which are even more prone to clogging.

[0062] In fact, exchange chamber 13a typically has many interstices and fluid-diverting members (not shown) for liquid mixing and shuffling, which can be easily clogged. For this reason, exchange chamber 13a is rather uncleanable.

[0063] Therefore, circulating heating fluid H (such as purified and/or distilled water) in exchange chamber 13a, instead of cleaning fluid F which is rather dirty and contaminated with impurities, highly reduces the need for cleaning exchange chamber 13a.

[0064] Conversely, the various ducts of tubing 14 are relatively smooth and high in diameter, so they are less prone to clogging.

[0065] Accordingly, a high-performance filtration system upstream of exchange chamber 13a is not necessary, which results in an even more reduced need for

maintenance, increases the overall reliability of washing machine 1 and reduces its costs.

[0066] As per tubing 14 is concerned, a normal-performance filter is sufficient, such as a net-filter with a filtering size smaller than the diameter of the ducts of tubing 14. In this way, overall costs are further reduced.

[0067] According to a further aspect of the invention, heat exchanger 12 is arranged at least partially within tank 11 and extends through tank 11.

[0068] In other words, casing 13 of heat exchanger 12 is at least partially surrounded by cleaning fluid F in tank 11 when, in use, tank 11 contains and holds cleaning fluid F.

[0069] The above configuration is schematized in Figure 2.

[0070] According to the invention, casing 13 separates and fluid-tightly seals exchange chamber 13a from tank 11 and from the cleaning fluid F containable therein (i.e. contained in use therein).

[0071] Thanks to the above, heat exchanger 12 occupies less space in washing machine 1 compared to a fully external heat exchanger arranged outside tank 11.

[0072] Hence, washing machine 1 has a leaner layout and an improved architecture, while at the same time benefitting from the already mentioned easy maintenance, as it is not necessary to empty tank 11 to perform maintenance on heat exchanger 12.

[0073] This leads to energy savings and to savings of cleaning fluid F. Moreover, there is no need for a storage container for temporarily storing cleaning fluid F, as the latter can be maintained in the tank 11.

[0074] Furthermore, heat exchanger 12 according to the invention can be easily retrofitted in the known washing machines 1: in fact, the immersed heat exchangers mentioned in the introductory part of the present description can be easily replaced by heat exchangers 12, without the need for finding an alternative place for them within washing tunnel 3. This makes the layout leaner.

[0075] Advantageously, casing 13 is made of a thermally conductive material.

[0076] In particular, heat exchanger 12 includes a second exchange interface 20 defined between casing 13 and tank 11.

[0077] More in particular, washing machine 1 is further configured so that the heating fluid H in exchange chamber 13a exchanges heat with the cleaning fluid F in tank 11 directly via second exchange interface 20, i.e. directly through casing 13.

[0078] In this way, the efficiency of heat exchange is increased, as heat exchanger 12 exchanges heat with cleaning fluid F both via tubing 14 and via casing 13.

[0079] In addition, energy can be saved as in some cases it may be sufficient to only circulate heating fluid H in exchange chamber 13a without circulating cleaning fluid F in tubing 14.

[0080] As schematized in Figure 2, heat exchanger 12 includes an access portion 21 which protrudes outside of tank 11.

[0081] In particular, casing 13 includes such access portion 21.

[0082] Advantageously, access portion 21 comprises an access door 22 for accessing, and preferably directly accessing, exchange chamber 13a.

[0083] In this way, maintenance operations on heat exchanger 12 are further eased and improved. It is in fact possible to clean exchange chamber 13a simply by emptying it from heating fluid H and by opening access door 22. Moreover, since tubing 14 is fluidly isolated from exchange chamber 13a, cleaning fluid F may be left within tubing 14, resulting in time and energy savings.

[0084] Preferably, washing machine 1 comprises a control unit 23 (of the known type).

[0085] In one embodiment, first circuit 15 includes a temperature sensor 24 for detecting a temperature of cleaning fluid F within tank 11.

[0086] Advantageously, control unit 23 is configured for receiving from the temperature sensor 24 a temperature signal correlated with a detected temperature value of cleaning fluid F, and for controlling pumping device 18 as a function of the temperature signal received.

[0087] In this way, pumping device 18 can be activated only when necessary for circulating cleaning fluid F within tubing 14, thereby resulting in energy savings.

[0088] In one embodiment, washing machine 1 comprises a label extraction unit (only partially shown in Figure 1) which is at least partially arranged within tank 11 and which comprises label detaching means (not shown, such as a high-pressure pump) configured to act on the containers 2 for detaching the labels therefrom and a collection compartment 25 for collecting the detached labels.

[0089] Conveniently, suction duct 15a is fluidly connected with tank 11 in a position outside of the collection compartment 25 for withdrawing therefrom cleaning fluid F to be heated.

[0090] In this way, cleaning fluid F is fed to heat exchanger 12 and through tubing 14 without altering or hindering the operation of the label extraction unit. Also, removed labels are prevented to accidentally enter tubing 14.

[0091] Preferably, delivery duct 15b is fluidly connected to tank 11 in a position within the collection compartment 25 for feeding heated cleaning fluid F at the collection compartment 25.

[0092] The advantages of washing machine 1 according to the present invention will be clear from the foregoing description.

[0093] In particular, thanks to the peculiar configuration of heat exchanger 12, whereby cleaning fluid F is circulated within tubing 14 and heating fluid H is circulated within exchange chamber 13a (i.e. within the mantle of heat exchanger 12), and to its positioning within tank 11, albeit with exchange chamber 13a fluidly isolated from it, maintenance and cleaning operations of heat exchanger 12 are significantly eased and improved.

[0094] Clearly, changes may be made to washing ma-

chine 1 as described herein without, however, departing from the scope of protection as defined in the accompanying claims.

Claims

1. Washing machine (1) configured to wash empty containers (2) adapted to be filled with a pourable product, the washing machine (1) comprising:

   - at least one cleaning bath (10) including a tank (11) configured for holding a cleaning fluid (F);
   - a conveyor device (4) configured to convey a sequence of said containers (2) along a washing path (P) which extends through said tank (11);
   - a heat exchanger (12) configured to heat the cleaning fluid (F) contained in the tank (11) by means of heat exchange between the cleaning fluid (F) and a heating fluid (H);

   the heat exchanger (12) comprising an outer casing (13), internally delimiting an exchange chamber (13a), and an inner tubing (14) at least partially enclosed within the casing (13) and extending through the exchange chamber (13a);
   wherein the exchange chamber (13a) is configured to be fed with the heating fluid (H) and the tubing (14) is configured to be fed with the cleaning fluid (F) from the tank (11), so that a heat exchange is established between the heating fluid (H) in the exchange chamber (13a) and the cleaning fluid (F) within the tubing (14).

2. Washing machine as claimed in claim 1, wherein the exchange chamber (13a) is fluidly isolated from the tank (11).

3. Washing machine as claimed in claim 1 or 2, wherein the heat exchanger (12) includes a first exchange interface (19) defined between the tubing (14) and the exchange chamber (13a).

4. Washing machine as claimed in claim 3, wherein the washing machine (1) is configured so that the heating fluid (H) exchanges heat with the cleaning fluid (F) via the first exchange interface (19).

5. Washing machine as claimed in any one of the foregoing claims, and comprising:

   - a first fluidic circuit (15) configured for circulating the cleaning fluid (F) from the tank (11) to the heat exchanger (12), through said tubing (14), and back into the tank (11); and
   - a second fluidic circuit (16) configured for circulating the heating fluid (H) from a heating fluid source (17) to the heat exchanger (12), through said exchange chamber (13a).

6. Washing machine as claimed in any one of the foregoing claims, wherein the heat exchanger (12) is arranged at least partially within said tank (11) and extends through said tank (11).

7. Washing machine as claimed in claim 6, wherein said casing (13) separates and fluid-tightly seals the exchange chamber (13a) from the tank (11) and from the cleaning fluid (F) containable therein.

8. Washing machine as claimed in claim 6 or 7, wherein the casing (13) is made of a thermally conductive material.

9. Washing machine as claimed in claim 8, wherein the heat exchanger (12) includes a second exchange interface (20) defined between the casing (13) and the tank (11).

10. Washing machine as claimed in claim 9, wherein the washing machine (1) is configured so that the heating fluid (H) exchanges heat with the cleaning fluid (F) in the tank (11) directly via the second exchange interface (20).

11. Washing machine as claimed in claim 6, wherein the heat exchanger (12) includes an access portion (21) which protrudes outside from the tank (11).

12. Washing machine as claimed in claim 11, wherein the access portion (21) comprises an access door (22) for accessing said exchange chamber (13a).

13. Washing machine as claimed in any one of the foregoing claims, wherein the tubing (14) includes a tube bundle and the casing (13) defines a shell of the heat exchanger, so that the heat exchanger (12) is a shell-and-tube heat exchanger.

14. Washing machine as claimed in claim 5, and comprising a control unit (23);

   wherein the first fluidic circuit (15) includes a pumping device (18) for pumping the cleaning fluid (F) from the tank (11) into the tubing (14) of the heat exchanger (12) and a temperature sensor (24) for detecting a temperature of the cleaning fluid (F) within the tank (11);
   wherein the control unit (23) is configured for receiving from the temperature sensor (24) a temperature signal correlated with a detected temperature value of the cleaning fluid (F), and for controlling the pumping device (18) as a function of the temperature signal received.

15. Washing machine as claimed in claim 5, wherein the first fluidic circuit (15) includes a suction duct (15a) fluidly upstream of the heat exchanger (12), a delivery duct (15b) downstream of the heat exchanger (12) and a pumping device (18) fluidly interposed between the suction duct (15a) and the delivery duct (15b) ;

the washing machine (1) further comprising a label extraction unit at least partly arranged within the tank (11), the label extraction unit comprising label detaching means configured to act on the containers (2) for detaching the labels therefrom and a collection compartment (25) for collecting the detached labels;
and wherein the suction duct (15a) is fluidly connected with the tank (11) in a position outside of the collection compartment (25) for withdrawing therefrom cleaning fluid (F) to be heated.

FIG. 1

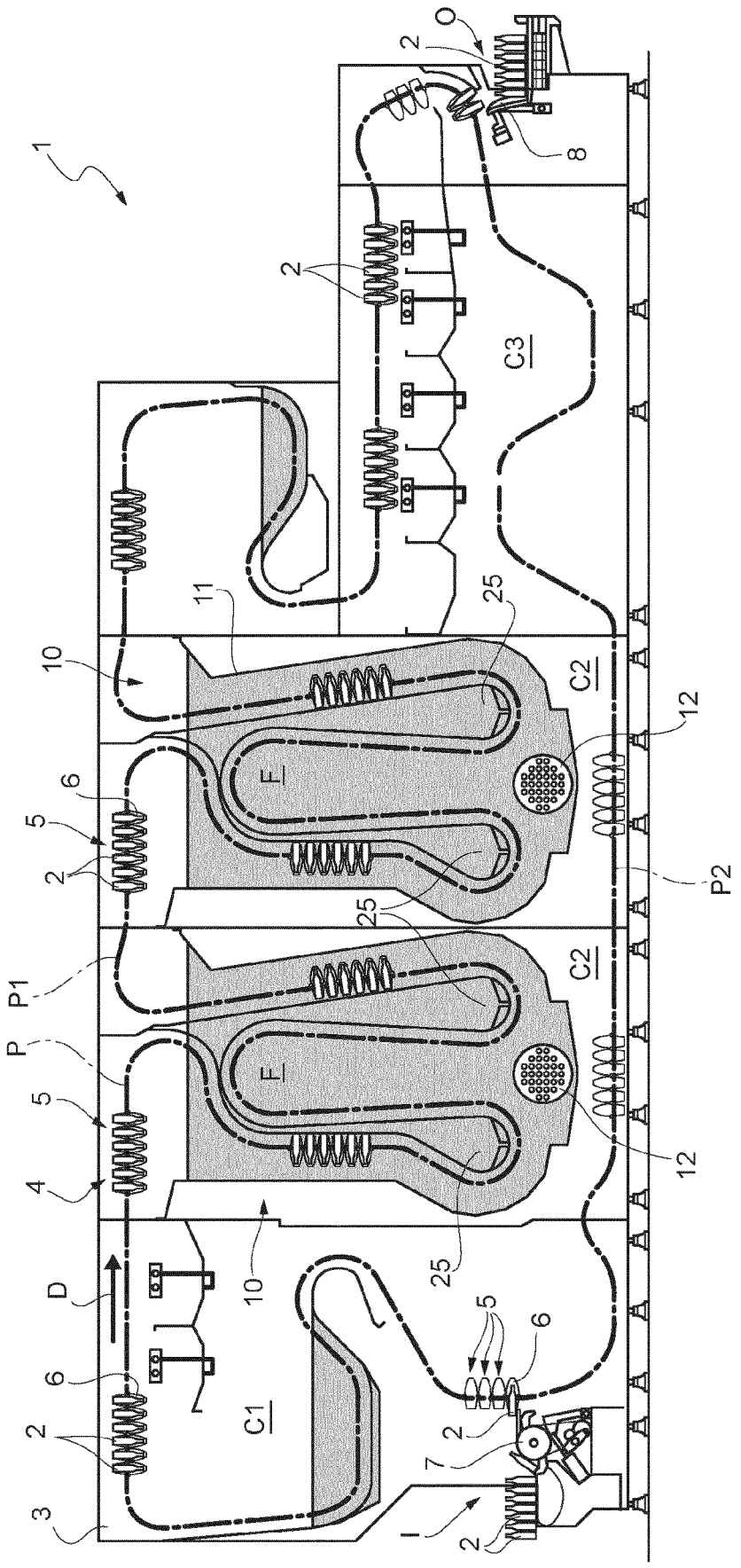
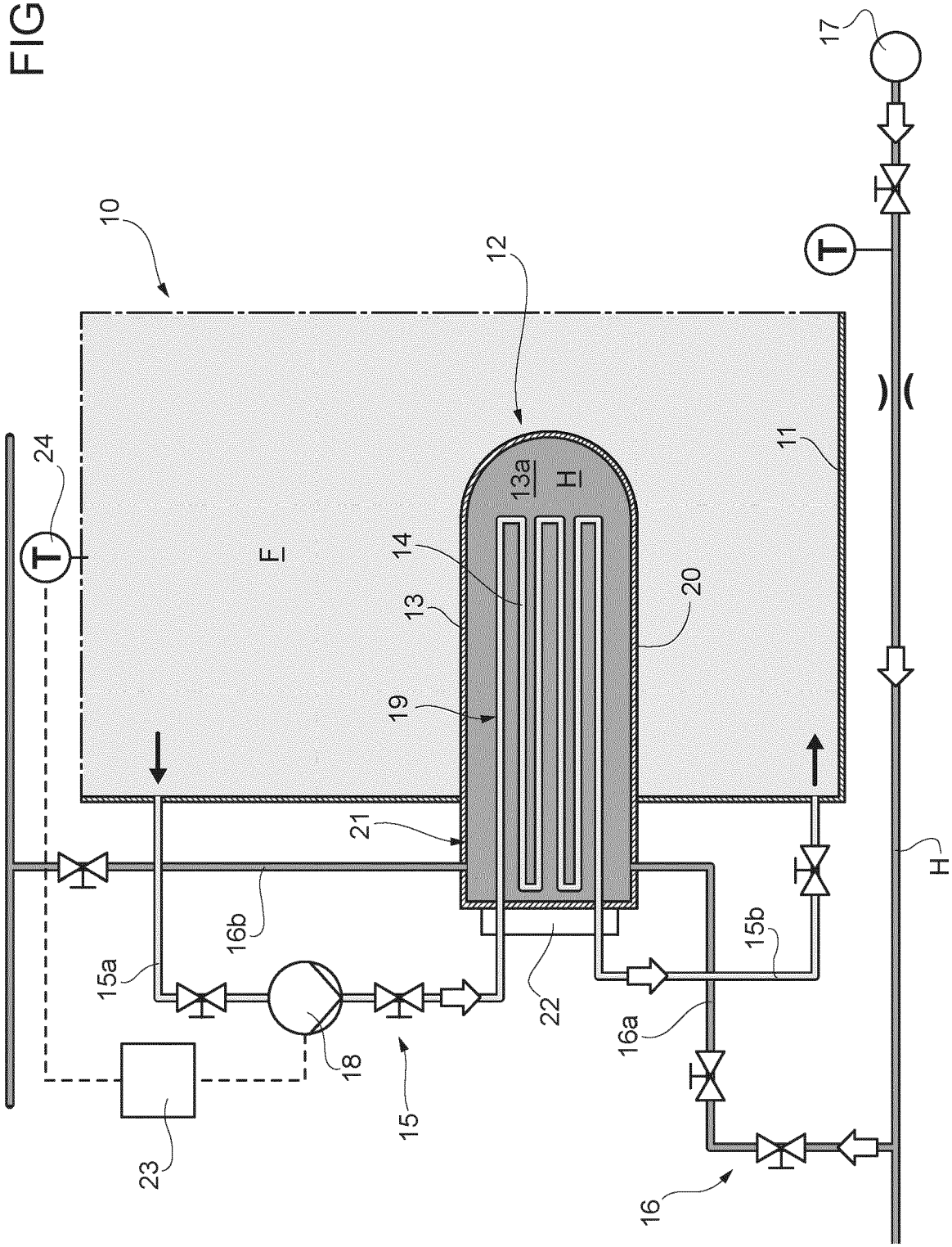


FIG. 2



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EUROPEAN SEARCH REPORT

Application Number
EP 23 19 9104

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 A	US 2 617 435 A (KESSLER FREDERICK P) 11 November 1952 (1952-11-11) * abstract *; figure 1 * * column 3, line 42 - column 4, line 75 * -----	1-5,13, 15 6-12,14	INV. B08B9/24 ADD. B08B9/30
X A	DE 42 12 433 A1 (HOLSTEIN & KAPPERT MASCHF [DE]) 21 October 1993 (1993-10-21) * abstract *; figures * * column 2, line 20 - column 3, line 5 * -----	1-5,13, 15 6-12,14	
X A	US 4 512 811 A (BINNIG RUPERT [DE] ET AL) 23 April 1985 (1985-04-23) * abstract *; figure 1 * * column 4, line 25 - column 5, line 44 * -----	1-5,13, 15 6-12,14	
A	DE 195 02 272 A1 (KRONSEDER MASCHF KRONES [DE]) 1 August 1996 (1996-08-01) * abstract *; figures * * column 2, line 28 - column 3, line 38 * -----	6-10	

TECHNICAL FIELDS SEARCHED (IPC)
B08B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	14 March 2024	Plontz, Nicolas

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 23 19 9104

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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14-03-2024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2617435 A	11-11-1952	NONE	
DE 4212433 A1	21-10-1993	NONE	
US 4512811 A	23-04-1985	BE 896058 A	01-07-1983
		DE 3207225 A1	08-09-1983
		FR 2522317 A1	02-09-1983
		IT 1166415 B	29-04-1987
		JP S58171389 A	08-10-1983
		NL 8300747 A	03-10-1983
		US 4512811 A	23-04-1985
DE 19502272 A1	01-08-1996	NONE	

EPO FORM P0459

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

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 2727660 A **[0003]**
- WO 2020119958 A **[0027] [0036]**