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(54) **A unit for sterilizing a web of packaging material for a machine for packaging food products**

Einheit zum Sterilisieren einer Verpackungsmaterialbahn für eine Maschine zum Verpacken von Lebensmittelprodukten

Unité pour la stérilisation d'une toile de matériau d'emballage pour une machine prévue pour le conditionnement de produits alimentaires

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Description

[0001] The present invention relates to a unit for sterilizing a web of packaging material for a machine for packaging food products.

[0002] As is known, many food products, such as fruit juice, UHT milk, wine, tomato sauce, etc., are sold in packages made of sterilized sheet packaging material.

[0003] A typical example of this type of package is the parallelepiped-shaped package for liquid or pourable food products known as Tetra Brik Aseptic (registered trademark), which is made by folding and sealing laminated strip packaging material.

[0004] The packaging material has a multilayer structure substantially comprising a base layer for stiffness and strength, which may be defined by a layer of fibrous material, e.g. paper, and a number of layers of heat-seal plastic material, e.g. polyethylene film, covering both sides of the base layer.

[0005] In the case of aseptic packages for long-storage products, such as UHT milk, the packaging material also comprises a layer of gas- and light-barrier material, e.g. aluminium foil or ethyl vinyl alcohol (EVOH) film, which is superimposed on a layer of heat-seal plastic material, and is in turn covered with another layer of heat-seal plastic material forming the inner face of the package eventually contacting the food product.

[0006] As is known, packages of this sort are produced on fully automatic packaging machines, on which a continuous tube is formed from the web-fed packaging material. The web of packaging material is unwound off a reel and fed through a sterilizing unit, where it is sterilized, e.g. by immersion in a chamber of liquid sterilizing agent, such as a concentrated solution of hydrogen peroxide and water.

[0007] The web is then fed into an aseptic chamber where the sterilizing agent is evaporated by heating. The web is then folded into a cylinder and sealed longitudinally to form in known manner a continuous vertical tube, which in effect forms an extension of the aseptic chamber. The tube of packaging material is filled continuously with the food product by pouring and then fed to a form-and-seal unit, where it is gripped between pairs of jaws which seal the tube transversely to form pillow packs. The pillow packs are then separated from one another by cutting the seal joining each two adjacent packs, and are conveyed to a final folding station where they are folded mechanically into the finished shape.

[0008] More specifically, the sterilizing unit comprises a chamber containing the sterilizing agent, and into which the web is fed continuously. The sterilizing chamber conveniently comprises two parallel vertical branches connected at the bottom to define a U-shaped path long enough with respect to the travelling speed of the web to allow enough time to treat the packaging material.

[0009] For effective, relatively fast treatment, e.g. in about 7 seconds, to reduce the size of the sterilizing chamber, the sterilizing agent must be maintained at a high temperature, e.g. of around 73°C.

[0010] Being covered with a layer of heat-seal plastic material, normally polyethylene, the faces of the web of packaging material are completely impermeable to the sterilizing agent. Along the edges of the web, however, the layer of fibrous material is exposed, and tends to soak up the sterilizing agent. This is known in the trade as "edge wicking" (edge absorption), and remains within acceptable limits providing the web is only kept for a short time inside the sterilizing chamber, as is the case during normal operation of the machine.

[0011] If for any reason the machine is stopped, however, the sterilizing chamber must be emptied immediately. Otherwise, the edges of the layer of fibrous material soak up the sterilizing agent, and edge wicking of a few millimetres in width inevitably impairs subsequent longitudinal sealing of the web to form the tube of packaging material as described above.

[0012] In other words, in the event the machine is stopped, the sterilizing agent is drained rapidly into a normally double-walled hold tank. The inner walls define an inner shell of the tank containing the sterilizing agent, and the outer walls form an outer shell of the tank defining, with the inner shell, a normally air-filled gap which provides for thermally insulating the sterilizing agent.

[0013] Following stoppage, and particularly when restarting the machine after a short stoppage, normally of no more than 15-20 minutes, edge wicking tends to occur anyway, despite emptying the sterilizing chamber.

[0014] Careful study of the phenomenon has identified several causes, foremost of which are:

- the porosity of the fibrous material, which, however, can only be reduced so far for paper manufacturing cost reasons;
- hydrostatic pressure, which is also difficult to reduce, on account of the height of the U-shaped sterilizing chamber depending on the necessary processing time, and only being reducible by altering the architecture of the sterilizing unit, thus complicating the system as a whole; and
- the temperature of the sterilizing chamber during the stoppage, and of the sterilizing agent when fed back into the chamber.

[0015] As regards the latter, in particular, a difference of even only a few degrees between the temperature of the chamber during the stoppage and the temperature of the sterilizing agent fed back into the chamber has been found to produce severe edge wicking. In conventional machines, this difference in temperature is caused by the tendency of the emptied sterilizing chamber to increase in temperature, on account of the inevitable delay in response of the thermostatic control to the reduction in heat absorption caused by emptying the chamber: the temperature inside the chamber is therefore normally around at least 80°C. As a result, the residual sterilizing agent on the walls of the chamber and in the packaging

material tends to evaporate, thus producing a saturated-vapour condition of the chamber, so that the pores of the layer of fibrous material contain a saturated air/vapour mixture.

[0016] When liquid sterilizing agent is fed into the chamber, at a temperature inevitably lower than that inside the sterilizing chamber (due to dissipation, the temperature of the sterilizing agent fed back into the sterilizing chamber is at best a few degrees lower than that of the sterilizing agent inside the sterilizing chamber when the machine was arrested), the temperature of the web, and therefore of the air/vapour mixture in the pores, is reduced. This reduction has a practically negligible effect on the air, which undergoes a contraction in volume of only a few percent, but has a very serious effect on the vapour, which recondenses and so assumes a much smaller volume in the liquid state. This drastic reduction in volume has the effect of "sucking" the sterilizing agent into the pores of the fibrous material layer, which is the major cause of edge wicking.

[0017] By way of a solution to the problem, which is less serious during prolonged stoppages, due to evaporation of the residual liquid sterilizing agent and a reduction in relative humidity inside the sterilizing chamber, sterilizing units have been devised, in which, before being fed into the sterilizing chamber, the sterilizing agent is heated by circulating it through a heating circuit comprising a countercurrent heat exchanger using water as the operating fluid.

[0018] More specifically, the water is fed to the heat exchanger by a circulating pump having an inlet connected to the water mains and an outlet connected to an electric resistor heater interposed between the pump and the exchanger. A compressed air/water tank, for compensating the pressure of the heating circuit, and a maximum pressure valve are branch-connected to a fill conduit in turn connecting the water mains to the pump.

[0019] Packaging machines of the above type are used widely and satisfactorily in a wide range of food industries, and performance of the sterilizing unit, in particular, is such as to ensure a wide margin of safety as regards regulations governing aseptic packages and the permitted amount of residual sterilizing agent.

[0020] Some needs are felt within the industry, however, for further improvements, particularly as regards:

- the efficiency and speed of the heat transfer to the sterilizing agent;
- the reduction of complexity and cost of the sterilizing unit;
- the independence of the heating circuit from the running of the water system (it should be observed that possible missing of water from the water mains may determine burning of the resistor heater of the heating circuit); and
- the reduction of the sterilizing chamber filling time, in order to further reduce possible risks of edge wicking during restart of production after stoppage of the packaging machine.

[0021] US 6,638,476 discloses a unit for sterilizing a web of packaging material, as defined in the preamble of claim 1.

[0022] It is an object of the present invention to provide a sterilizing unit, designed to meet at least one of the above needs in a straightforward, low-cost manner.

[0023] According to the present invention, there is provided a sterilizing unit as claimed in claim 1.

[0024] Some preferred, non-limiting embodiments of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a schematic view in perspective of a sterilizing unit, which does not form part of the present invention;
Figure 2 shows a larger-scale view in perspective of a heating device for heating a sterilizing agent used in Figure 1 sterilizing unit;
Figure 3 shows a vertical section of Figure 2 heating device;
Figure 4 shows a schematic view in perspective of a sterilizing unit in accordance with an embodiment of the present invention;
Figure 5 shows a schematic view in perspective of a sterilizing unit in accordance with another embodiment of the present invention; and
Figure 6 shows a schematic view in perspective of a sterilizing unit in accordance with a further embodiment of the present invention.

[0025] Number 1 in Figure 1 indicates as a whole a sterilizing unit adapted to sterilize a web 2 of packaging material for a packaging machine (of the known type described above) for producing sealed packages (not shown) of food products, in particular pourable or liquid food products, such as pasteurized or UHT milk, fruit juice, wine, etc.

[0026] Web 2 may also be used for packaging food products that are pourable when producing packages, and sets after packages are sealed. One example of such a food product is a portion of cheese, that is melted when producing packages, and sets after packages are sealed.

[0027] Web 2 is fed in known manner, not shown, to unit 1 off a reel, so as to be sterilized before being formed into a succession of sealed packages of food products. The form, fill, and seal operations performed in known manner on web 2 (as described above) downstream from unit 1 do not form part of the present invention, and are referred to here purely for the sake of clarity.

[0028] Web 2 has a multilayer structure and comprises a base layer for stiffness and strength, which may be made of fibrous material, e.g. paper or mineral-filled polypropylene material, and a number of layers of heat-seal plastic material, e.g. polyethylene film, covering both sides of the base layer.

[0029] In the case of aseptic packages for long-storage

products, such as UHT milk, web 2 also comprises a layer of gas-barrier material, e.g. aluminium foil or ethyl vinyl alcohol (EVOH) film, which is superimposed on a layer of heat-seal plastic material, and is in turn covered with another layer of heat-seal plastic material eventually contacting the food product.

[0030] With reference to Figure 1, unit 1 substantially comprises a U-shaped sterilizing chamber or bath 3 containing a hot liquid sterilizing agent. Chamber 3 is defined by two vertical, respectively inlet and outlet, channel-shaped branches 4, 5 having respective top openings 6, 7 and connected to each other at the bottom by a bottom portion 8.

[0031] By way of example, Figure 1 shows a number of horizontal rollers for guiding web 2 through branches 4, 5 and bottom portion 8 of chamber 3, and more specifically: an input roller 9 close to top opening 6 of branch 4, an output roller 10 close to top opening 7 of branch 5, and a return roller 11 housed inside bottom portion 8 of chamber 3.

[0032] Inside chamber 3, web 2 therefore describes a U-shaped path, the length of which depends on the travelling speed of web 2, and is such as to keep the packaging material long enough inside the sterilizing agent.

[0033] Chamber 3 forms part of a sterilizing agent control circuit 15 also comprising:

- a sterilizing agent hold tank 16;
- a conduit 17 extending between tank 16 and bottom portion 8 of chamber 3 for filling/draining the latter;
- a pump 18 immersed in tank 16 and powered by an electric motor 19; and
- a feed conduit 20 connecting pump 18 to an intermediate section of conduit 17 via a valve 21 so as to divide conduit 17 into a bottom drain portion 22, leading to tank 16 via a valve 23, and a top drain/fill portion 24, leading to bottom portion 8 of chamber 3.

[0034] Tank 16 provides for topping up chamber 3 to make up the loss in sterilizing agent caused by the wet outgoing web 2, and for holding the sterilizing agent when draining chamber 3, e.g. in the event of any stoppage of the packaging machine.

[0035] Tank 16 is connected by respective taps 12a, 12b to two different drain conduits 13a, 13b for sampling and changing the sterilizing agent respectively.

[0036] Valve 21 is preferably a two-way, two-position, normally-open type, but with a flow on/off member (not shown) allowing leakage in the closed position (restricted flow condition) to compensate, as stated, for inevitable sterilizing agent losses in chamber 3 during the production cycle. For this purpose, a commercial valve is sufficient, with a suitably sized hole formed in the on/off member.

[0037] Valve 23 is also preferably a two-way, two-position, normally-open type for safety reasons, to allow draining of chamber 3 in the event of a malfunction of the electric system.

[0038] In view of the above, conduit 20 and portion 24 of conduit 17 define a feed line F extending from tank 16 to bottom portion 8 of sterilizing chamber 3 and which can be activated selectively to feed the latter with the sterilizing agent, whilst the whole conduit 17 defines a drain line D which can be activated selectively to drain the sterilizing agent from the sterilizing chamber 3. In other words, in the specific embodiment shown in Figure 1, drain line D and feed line F have a part in common defined by portion 24 of conduit 17.

[0039] Circuit 15 also comprises a recirculating conduit 25 connecting tank 16 to a known overflow (not shown) formed in the top of inlet branch 4 of chamber 3 to determine the maximum sterilizing agent level in chamber 3.

[0040] Unit 1 further comprises a system (known per se and not shown) for controlling the temperature of the sterilizing agent in sterilizing chamber 3 through heating the walls of branches 4, 5.

[0041] Unit 1 also comprises a device 26 (please see in particular Figures 2 and 3) for heating the sterilizing agent before it is fed into chamber 3.

[0042] Device 26 substantially comprises electric heating means 30 and a heat exchanger 31 arranged in contact with heating means 30 and defining a serpentine-shaped passage 32 for the sterilizing agent.

[0043] In particular, heat exchanger 31 is preferably made of stainless steel and is defined by a box-shaped plate, i.e. a box element having a thickness strongly smaller than the other sizes; as clearly shown in Figure 2, heat exchanger 31 is completely closed from the outside and has an inlet 33 for receiving the sterilizing agent to be heated and an outlet 34 for feeding the heated sterilizing agent to control circuit 15.

[0044] More specifically, in the embodiment of Figure 1, inlet 33 of heat exchanger 31 is connected, through a conduit 27, to a portion of conduit 20 interposed between valve 21 and tank 16, whilst outlet 34 is connected, through a conduit 28, to recirculating conduit 25.

[0045] Heat exchanger 31 is arranged in the vertically-oriented configuration shown in Figures 2 and 3, wherein its thickness extends parallel to a horizontal direction, and inlet 33 is located at a lower position than outlet 34; more specifically, heat exchanger 31 is delimited by a bottom wall 35, a top wall 36, a front wall 37, a rear wall 38, and a pair of thin side walls 39, 40.

[0046] Heat exchanger 31 is provided internally with diverting means 41 delimiting, together with walls 35-40, serpentine-shaped passage 32 for the sterilizing agent; in the solution depicted in Figures 2 and 3, diverting means 41 comprise:

- a first series of baffles 42 extending substantially parallel to a horizontal direction from side wall 39 towards side wall 40, and leaving a small-sized gap 43 with the latter;
- a second series of baffles 44 of the same type of baffles 42, each of them extends substantially parallel to a horizontal direction from side wall 40 to-

wards side wall 39, leaves a small-sized gap 45 with the latter, and is vertically interposed between a pair of relative baffles 42; and

- a third series of baffles 46 of limited length, inclined with respect to the horizontal direction and each located close to a relative gap 43, 45.

[0047] Each baffle 42, 44 is delimited, at the top, by a ramp-shaped surface 47 rising in the sterilizing agent flow direction; in a completely analogous way, bottom wall 35 has a ramp-shaped inner surface 48 also rising in the flow direction.

[0048] In this way, during the flow through heat exchanger 31, the sterilizing agent is lowerly in contact with ramp-shaped surfaces 47, 48, i.e. it contacts lower ramp-shaped parts (47, 48) of the walls delimiting serpentine-shaped passage 32.

[0049] The above-described baffles 42, 44, 46 define serpentine-shaped passage 32 as consisting of a plurality of C-shaped portions joined to each other.

[0050] This kind of configuration of baffles 42, 44, 46 allows to avoid formation of overheated sterilizing agent pockets within heat exchanger 31.

[0051] Heating means 30 comprise a pair of electrically-powered heating carpets 51 maintained in close contact under pressure with respective opposite walls 37, 38 of heat exchanger 31. In particular, the sandwich structure defined by heat exchanger 31 and heating carpets 51 is maintained pressed by a plurality of pairs of clamping bars 52 acting on the opposite heating carpets 51 through the interposition of respective foamed polymeric sheets 53, preferably made of silicone.

[0052] More precisely, bars 52 of each pair extend parallel to walls 36, 37, 38 of heat exchanger 31, have opposite ends laterally protruding from the sandwich structure formed by heat exchanger 31, heating carpets 51 and foamed polymeric sheets 53, and are connected to each other, at their opposite ends, by respective transversal screws 54.

[0053] Unit 1 operates as follows.

[0054] When cold-starting, chamber 3 is empty, and all the sterilizing agent is inside tank 16.

[0055] Pump 18 is turned on to pump a large amount of sterilizing agent, e.g. 50 l/min, through heating device 26.

[0056] At this stage, valve 21 is closed, but, as stated, allows a small amount of leakage (a few liters/min) to portion 24 of conduit 17, and therefore along feed line F (restricted flow condition). Valve 23 is open, so chamber 3 is not filled until the best production cycle-start conditions are achieved. In the meantime, the walls of branches 4, 5 of sterilizing chamber 3 are heated.

[0057] The cycle-start conditions are, for example, 72°C for the walls of sterilizing chamber 3, and 75°C for the sterilizing agent in tank 16 (fill temperature). In which case, sterilizing chamber 3 and web 2 being dry, there is practically no risk of edge wicking.

[0058] At the start of the cycle, valve 21 is opened, and valve 23 is closed, so sterilizing chamber 3 is filled rapidly with sterilizing agent; after which, valve 21 is closed.

[0059] During normal operation of the packaging machine, the sterilizing agent is maintained at a minimum temperature of 73°C in both sterilizing chamber 3 and tank 16. If either one of these temperatures falls below the predetermined threshold value, a heating cycle is activated by means of the system controlling the temperature of the walls of branches 4, 5 and heating device 26, respectively.

[0060] Pump 18 is run continually to maintain a continuous flow through heating device 25 and continuous leakage of conveniently a few liters/minute of sterilizing agent through valve 21, to compensate for the loss in sterilizing agent from sterilizing chamber 3 caused, as stated, by the wet outgoing web 2, and to keep the bottom portion 8 of sterilizing chamber 3 and feed line F hot. Surplus sterilizing agent overflows from sterilizing chamber 3, and flows along recirculating conduit 25 back into tank 16.

[0061] In the event of stoppage of the packaging machine, valve 23 is opened immediately to drain the sterilizing agent rapidly from sterilizing chamber 3 into tank 16.

[0062] In the event of a short stoppage of less than 15-20 minutes, sterilizing chamber 3 is cooled to below operating temperature, and simultaneously the sterilizing agent is heated to the fill temperature (e.g. 75°C).

[0063] Sterilizing chamber 3 is cooled by turning off the system heating the walls of branches 4, 5, and blowing in sterile air at a lower temperature than that of sterilizing chamber 3.

[0064] The sterilizing agent is heated by electric heating carpets 51 of heating device 26.

[0065] The above conditions are achieved rapidly, normally in less than a minute, and ensure an acceptable degree of edge wicking at the next start-up. In fact, cooling sterilizing chamber 3 and preheating the sterilizing agent to a higher temperature prevents condensation of the steam inside sterilizing chamber 3 when chamber 3 is filled.

[0066] In the light of the above, unit 1 permits to achieve the following advantages.

[0067] First of all, thanks to the use of electric heating carpets 51 and plate heat exchanger 31, the produced heat is directly transferred to the sterilizing agent, without passing through an intermediate operating fluid, so reducing thermal losses and increasing efficiency of heat transfer. In this way, also the speed of heat transfer can be increased: in fact, in addition to allow a direct heating of the sterilizing agent, so avoiding to heat an intermediate medium in turn designed to transfer its heat to the sterilizing agent, heating carpets 51 can be heated to temperatures higher than the water boiling point (100°C), point that could not be reached in the case of the water/sterilizing agent heat exchanger since steam and bubbles may interfere with the normal water circulation.

[0068] Moreover, this solution allows to eliminate all

the components of the water circuit (pump, valves, etc.), so avoiding maintenance thereof and reducing complexity and cost of sterilizing agent control circuit 15.

[0069] Last but not least, the very compact and thin structure of heating device 26 allows a strong reduction of the overall bulk of control circuit 15.

[0070] Figure 4 shows an embodiment, indicated as a whole by 1', of a sterilizing unit in accordance with the present invention, and which is described below only insofar as it differs from unit 1, and using the same reference numbers for parts identical or corresponding to those already described.

[0071] Unit 1' differs from unit 1 by the fact that outlet 34 of heat exchanger 31 is connected, through conduit 28, to portion 24 of conduit 17, i.e. to feed line F, instead of recirculating conduit 25. It is therefore evident that leakage of sterilizing agent through valve 21 in the closed condition is useless in this case, and therefore valve 21 may be replaced with a two-way, two-position, normally-open commercial valve 21' having no hole formed in the on/off member.

[0072] In use, when valve 23 is in the open condition, the sterilizing agent flow exiting from outlet 34 of heating device 26 is recirculated into tank 16 through drain line D.

[0073] This particular solution allows to achieve the following results:

a) when valve 21' is open and valve 23 is closed to perform filling of sterilizing chamber 3, all the sterilizing agent delivered by pump 18 is fed to this chamber, i.e. there is no fraction of the pumped flow which is recirculated into tank 16;
b) during the production cycle (both valves 21' and 23 closed), the sterilizing agent just heated by heating device 26 is immediately delivered to sterilizing chamber 3, instead of being first recirculated to tank 16 and then delivered to chamber 3.

[0074] In this way, it is possible, on the one hand, to obtain a reduction of the filling time of sterilizing chamber 3, so further reducing possible risks of edge wicking during restart of production after stoppage of the packaging machine, and, on the other hand, to further increase thermal efficiency of control circuit 15.

[0075] Figure 5 shows another different embodiment, indicated as a whole by 1" , of a sterilizing unit in accordance with the present invention, and which is described below only insofar as it differs from unit 1', and using the same reference numbers for parts identical or corresponding to those already described.

[0076] In particular, unit 1" differs from unit 1' only insofar as a further valve 60", of the same type as valve 21 of unit 1 (i.e. with an on/off member provided with a sized hole to allow, in the closed or restricted flow condition, leakage of few liters/min of sterilizing agent), is arranged along the portion of conduit 17 extending between conduit 28 and sterilizing chamber 3.

[0077] In this case, during the production cycle, valve 60" is maintained in the closed condition (with a continuous leakage of a few liters/minute of sterilizing agent) so allowing a reduction of the sterilizing agent flow recirculated between sterilizing chamber 3 and tank 16.

[0078] Figure 6 shows a further embodiment, indicated as a whole by 1"', of a sterilizing unit in accordance with the present invention, and which is described below only insofar as it differs from unit 1" , and using the same reference numbers for parts identical or corresponding to those already described.

[0079] In particular, unit 1"' differs from unit 1" only in that the further valve 60"', for reducing sterilizing agent flow recirculated between sterilizing chamber 3 and tank 16 during the production cycle, is arranged along conduit 28, which has a smaller section that that of conduit 17; therefore, it is possible to use a valve suitable for operating with flow rates lower than those along conduit 17 and whose cost is consequently smaller than that of valve 60".

[0080] Clearly, changes may be made to the sterilizing units 1', 1", 1'" as described herein without, however, departing from the protective scope defined in the accompanying claims.

Claims

1. A unit (1', 1", 1"') for sterilizing a web (2) of packaging material for a machine for packaging food products, said unit (1', 1", 1"') comprising:

- a sterilizing chamber (3) containing a sterilizing agent;
- conveying means (9, 10, 11) for feeding said web (2) through said sterilizing chamber (3) before the web (2) is formed into a succession of sealed packages of food products;
- a hold tank (16) for said sterilizing agent;
- feed means (F, 18) which can be activated selectively to feed said sterilizing agent from said tank (16) to said sterilizing chamber (3);
- drain means (D, 23) which can be activated selectively to drain said sterilizing agent from a bottom portion (8) of said sterilizing chamber (3) into said tank (16) in the event of stoppage of the packaging machine; and
- a heating device (26) for heating said sterilizing agent before feeding it to the sterilizing chamber (3) ;

characterized in that said heating device (26) has a sterilizing agent inlet (33) and a sterilizing agent outlet (34) both connected to said feed means (F, 18).

2. A unit as claimed in claim 1, wherein said sterilizing agent outlet (34) of said heating device (26) is also connected to said drain means (D, 23).

3. A unit as claimed in claim 1 or 2, wherein said feed means comprise a feed line (F) extending from said tank (16) to said sterilizing chamber (3), and said drain means comprise a drain line (D) extending from said tank (16) to said bottom portion (8) of said sterilizing chamber (3), and wherein said feed line (F) and said drain line (D) can be selectively connected via first valve means (23) to allow the sterilizing agent flow exiting from said heating device (26) to be recirculated into said tank (16).

4. A unit as claimed in claim 3, wherein said feed line (F) and said drain line (D) comprise a feed conduit (20) extending from said tank (16), a drain conduit (22) leading to said tank (16) via said first valve means (23), and a common conduit (24) connecting said feed conduit (20) and said drain conduit (22) to said bottom portion (8) of said sterilizing chamber (3).

5. A unit as claimed in claim 3 or 4, wherein said outlet (34) of said heating device (26) is connected to said sterilizing chamber (3) via said feed line (F) and second valve means (60", 60"') which can be set between a completely open condition and a restricted flow condition.

6. A unit as claimed in any one of the foregoing claims, wherein said heating device (26) comprises electric heating means (30) and a heat exchanger (31) arranged in contact with said heating means (30) and defining a serpentine-shaped passage (32) for said sterilizing agent connecting said inlet (33) and said outlet (34).

7. A unit as claimed in claim 6, wherein said serpentine-shaped passage (32) is defined by a plarality of C-shaped portions joined to each other.

8. A unit as claimed in claim 6 or 7, wherein said serpentine-shaped passage (32) comprises ramp-shaped surfaces (47, 48) lowerly contacting the sterilizing agent flow.

9. A unit as claimed in any one of claims 6 to 8, wherein said heat exchanger (32) comprises a box-shaped plate provided internally with diverting means (41) delimiting said serpentine-shaped passage (32).

10. A unit as claimed in any one of claims 6 to 9, wherein said electric heating means (30) comprise a pair of electrically-powered heating carpets (51) maintained in close contact under pressure with opposite parts of said heat exchanger (31).

Patentansprüche

1. Einheit (1', 1", 1"') zum Sterilisieren einer Bahn (2) von Verpackungsmaterial für eine Maschine zum Verpacken von Lebensmittelprodukten, wobei die Einheit (1', 1", 1"') umfasst:

- eine Sterilisierkammer (3), welche ein Sterilisiermittel enthält;
- Beförderungsmittel (9, 10, 11) zum Zuführen der Bahn (2) durch die Sterilisierkammer (3), ehe die Bahn (2) in eine Folge von versiegelten Verpackungen für Lebensmittelprodukte geformt wird;
- einen Haltetank (16) für das Sterilisiermittel;
- Zuführmittel (F, 18), welche selektiv aktiviert werden können, um das Sterilisiermittel von dem Tank (16) zu der Sterilisierkammer (3) zuzuführen;
- Ablaufmittel (D, 23), welche selektiv aktiviert werden können, um das Sterilisiermittel von einem unteren Bereich (8) der Sterilisierkammer (3) in den Tank ablaufen zu lassen, im Fall eines Anhaltens der Verpackungsmaschine; und
- eine Erwärmungsvorrichtung (26) zum Erwärmen des Sterilisiermittels, ehe es der Sterilisierkammer (3) zugeführt wird;

dadurch gekennzeichnet, dass die Erwärmungsvorrichtung (26) einen Sterilisiermitteleinlass (33) und einen Sterilisiermittelauslass (34) aufweist, welche beide mit den Zuführmitteln (F, 18) verbunden sind.

2. Einheit, wie sie in Anspruch 1 beansprucht wird, wobei der Sterilisiermittelauslass (34) der Erwärmungsvorrichtung (26) auch mit den Ablaufmitteln (D, 23) verbunden ist.

3. Einheit, wie sie in Anspruch 1 oder 2 beansprucht wird, wobei die Zuführmittel eine Zuführleitung (F) umfassen, welche sich von dem Tank (16) zu der Sterilisierkammer (3) erstreckt, und die Ablaufmittel eine Ablaufleitung (D) umfassen, welche sich von dem Tank (16) zu dem unteren Bereich (8) der Sterilisierkammer (3) erstreckt, und wobei die Zuführleitung (F) und die Ablaufleitung (D) selektiv über erste Ventilmittel (23) verbunden sein können, um es dem Sterilisiermittelfluss, welcher aus der Erwärmungsvorrichtung (26) austritt, zu ermöglichen, in den Tank (16) rückgeführt zu werden.

4. Einheit, wie sie in Anspruch 3 beansprucht wird, wobei die Zuführleitung (F) und die Ablaufleitung (D) einen Zuführkanal (20) umfassen, welcher sich von dem Tank (16) erstreckt, einen Ablaufkanal (22), welcher über die ersten Ventilmittel (23) zu dem Tank (16) führt, und einen gemeinsamen Kanal (24), welcher den Zuführkanal (20) und den Ablaufkanal (22) mit dem unteren Bereich (8) der Sterilisierkammer (3) verbindet.

5. Einheit, wie sie in Anspruch 3 oder 4 beansprucht wird, wobei der Auslass (34) der Erwärmungsvorrichtung (26) mit der Sterilisierkammer (3) über die Zuführleitung (F) und zweite Ventilmittel (60", 60"'), welche zwischen einem vollständig offenen Zustand und einem Zustand eingeschränkten Flusses eingestellt werden können, verbunden ist.

6. Einheit, wie sie in einem der vorhergehenden Ansprüche beansprucht wird, wobei die Erwärmungsvorrichtung (26) elektrische Erwärmungsmittel (30) und einen Wärmetauscher (31) umfasst, welcher in Kontakt mit den Erwärmungsmitteln (30) angeordnet ist und einen serpentinenförmingen Durchlass (32) für das Sterilisiermittel definiert, welcher den Einlass (33) und den Auslass (34) verbindet.

7. Einheit, wie sie in Anspruch 6 beansprucht wird, wobei der serpentinenförmige Durchlass (32) durch eine Vielzahl C-förmiger Bereiche, welche miteinander verbunden sind, definiert ist.

8. Einheit, wie sie in Anspruch 6 oder 7 beansprucht wird, wobei der serpentinenförmige Durchlass (32) rampenförmige Oberflächen (47, 48) umfasst, welche unten mit dem Sterilisiermittelfluss in Kontakt sind.

9. Einheit, wie sie in einem der Ansprüche 6 bis 8 beansprucht wird, wobei der Wärmetauscher (32) eine schachtelförmige Platte umfasst, welche im Inneren vorgesehen ist, mit Umlenkmitteln (41), welche den serpentinenförmigen Durchlass (32) begrenzen.

10. Einheit, wie sie in einem der Ansprüche 6 bis 9 beansprucht wird, wobei die elektrischen Erwärmungsmittel (30) ein Paar elektrisch betriebener Heizmatten (51) umfassen, welche in engem Kontakt unter Druck mit einander gegenüberliegenden Teilen des Wärmetauschers (31) gehalten werden.

Revendications

1. Unité (1', 1", 1"') destinée à stériliser une bande (2) de matériau de conditionnement pour une machine de conditionnement de produits alimentaires, ladite unité (1', 1", 1"') comprenant :

une chambre de stérilisation (3) contenant un agent de stérilisation ;

- un moyen de transfert (9, 10, 11) destiné à délivrer ladite bande (2) à travers ladite chambre de stérilisation (3) avant que la bande (2) ne soit formée en une succession d'emballages scellés de produits alimentaires ;
- un réservoir de stockage (16) destiné audit agent de stérilisation ;
- un moyen d'alimentation (F, 18) qui peut être activé de manière sélective afin de délivrer ledit agent de stérilisation à partir dudit réservoir (16) vers ladite chambre de stérilisation (3) ;
- un moyen de purge (D, 23) qui peut être activé de manière sélective afin de purger ledit agent de stérilisation au niveau de la partie inférieure (8) de ladite chambre de stérilisation (3) vers ledit réservoir (16) dans le cas d'une interruption de la machine de conditionnement ; et
- un dispositif de chauffage (26) destiné à chauffer ledit agent de stérilisation avant de le délivrer dans la chambre de stérilisation (3) ;

caractérisée en ce que ledit dispositif de chauffage (26) comprend une entrée d'agent de stérilisation (33) et une sortie d'agent de stérilisation (34) toutes deux étant raccordées audit moyen d'alimentation (F, 18).

2. Unité selon la revendication 1, dans laquelle ladite sortie d'agent de stérilisation (34) dudit dispositif de chauffage (26) est aussi raccordée audit moyen de purge (D, 23).

3. Unité selon la revendication 1 ou 2, dans laquelle ledit moyen d'alimentation comprend une ligne d'alimentation (F) s'étendant à partir dudit réservoir (16) vers ladite chambre de stérilisation (3), et ledit moyen de purge comprend une ligne de purge (D) s'étendant à partir dudit réservoir (16) vers ladite partie inférieure (8) de ladite chambre de stérilisation (3), et dans laquelle ladite ligne d'alimentation (F) et ladite ligne de purge (D) peuvent être raccordées de manière sélective par l'intermédiaire d'un premier moyen formant vanne (23) afin de permettre la remise en circulation du courant d'agent de stérilisation sortant dudit dispositif de chauffage (26) vers ledit réservoir (16).

4. Unité selon la revendication 3, dans laquelle ladite ligne d'alimentation (F) et ladite ligne de purge (D) comprennent un conduit d'alimentation (20) s'étendant à partir dudit réservoir (16), un conduit de purge (22) conduisant audit réservoir (16) par l'intermédiaire dudit premier moyen formant vanne (23), et un conduit commun (24) reliant ledit conduit d'alimentation (20) et ledit conduit de purge (22) à ladite partie inférieure (8) de ladite chambre de stérilisation (3).

5. Unité selon la revendication 3 ou 4, dans laquelle ladite sortie (34) dudit dispositif de chauffage (26) est raccordée à ladite chambre de stérilisation (3)

par l'intermédiaire de ladite ligne d'alimentation (F) et d'un second moyen formant vanne (60", 60"') qui peut être positionné entre un état entièrement ouvert et un état à débit limité.

6. Unité selon l'une quelconque des revendications précédentes, dans laquelle ledit dispositif de chauffage (26) comprend un moyen de chauffage électrique (30) et un échangeur thermique (31) agencé en contact avec ledit moyen de chauffage (30) et définissant un passage en forme de serpentin (32) pour ledit agent de stérilisation, reliant ladite entrée (33) et ladite sortie (34).

7. Unité selon la revendication 6, dans laquelle ledit passage en forme de serpentin (32) est défini par une pluralité de parties en forme de C reliées les unes aux autres.

8. Unité selon la revendication 6 ou 7, dans laquelle ledit passage en forme de serpentin (32) comprend des surfaces en forme de rampe (47, 48) entrant en contact en partie inférieure avec le courant d'agent de stérilisation.

9. Unité selon l'une quelconque des revendications 6 à 8, dans laquelle ledit échangeur thermique (32) comprend une plaque en forme de boîte comportant de manière interne un moyen de déviation (41) délimitant ledit passage en forme de serpentin (32).

10. Unité selon l'une quelconque des revendications 6 à 9, dans laquelle ledit moyen de chauffage électrique (30) comprend une paire de tapis chauffants (51) alimentés électriquement, maintenus en contact étroit sous pression avec des parties opposées dudit échangeur thermique (31).

FIG. 1

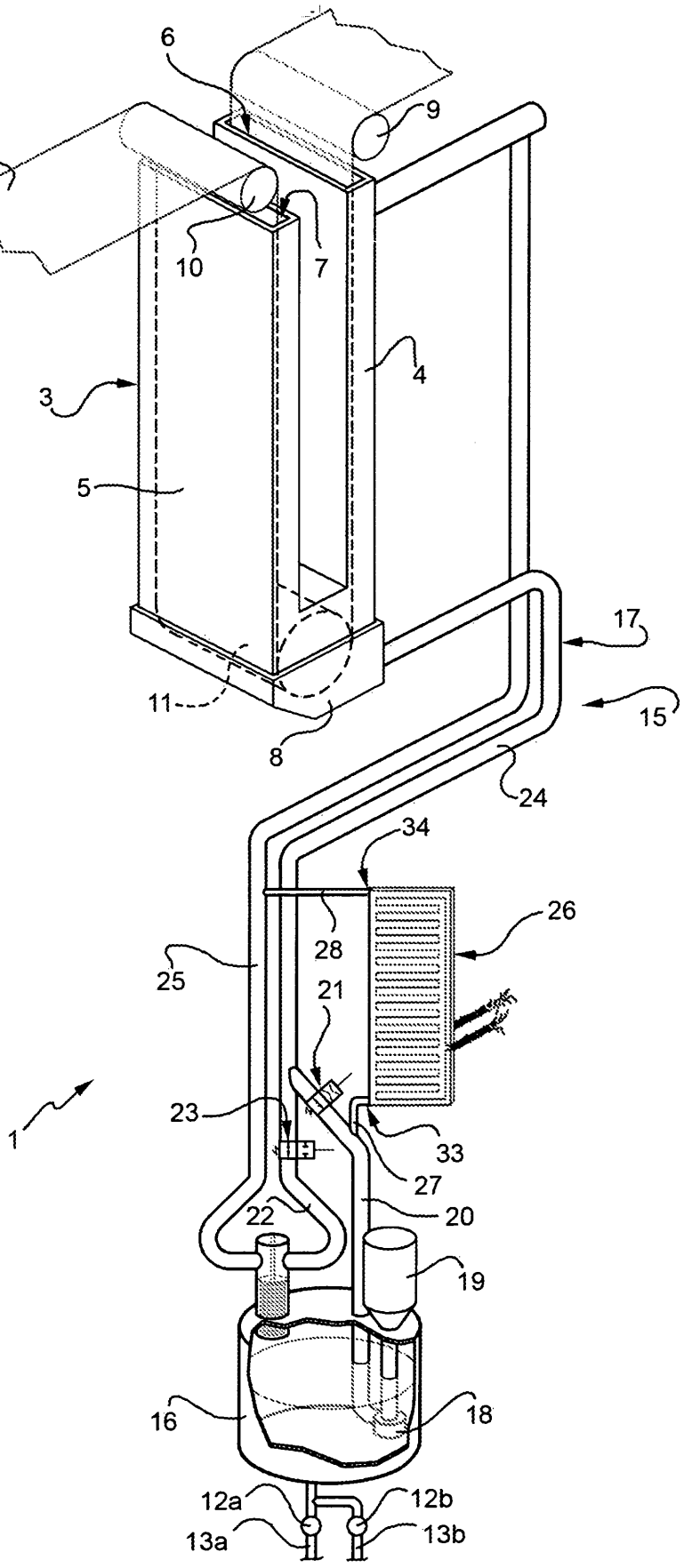
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FIG. 2

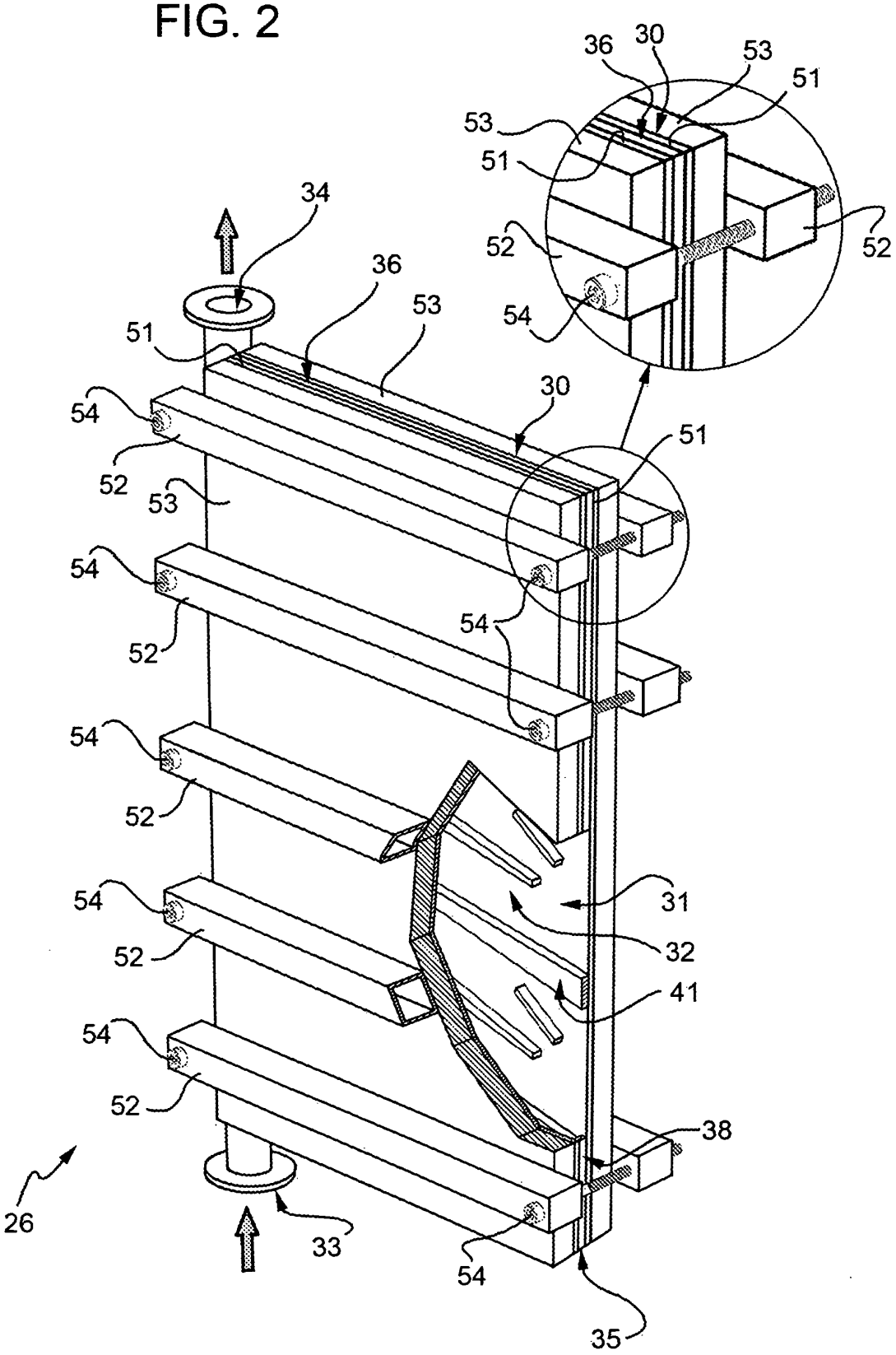
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FIG. 3

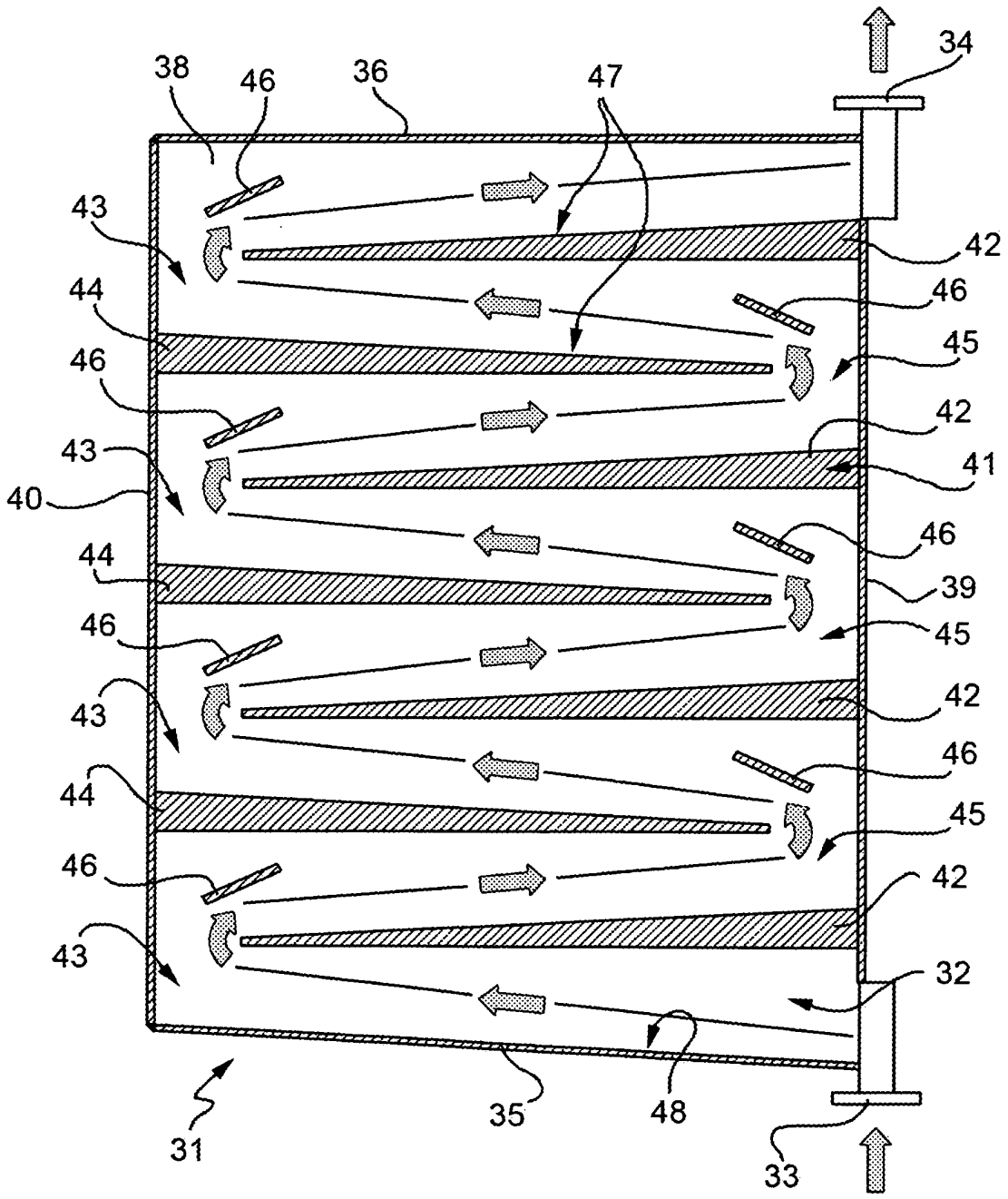
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FIG. 4

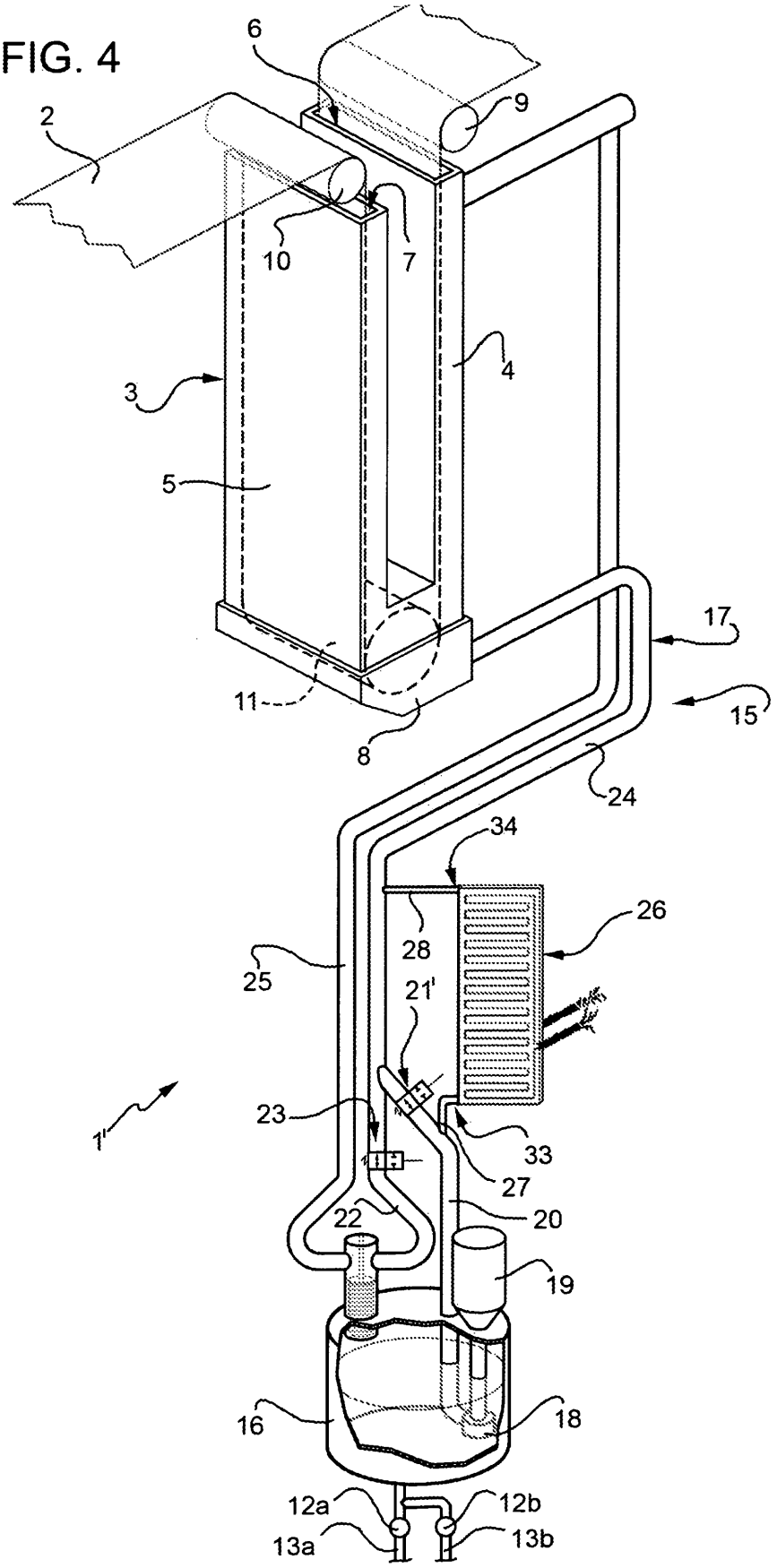
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FIG. 5

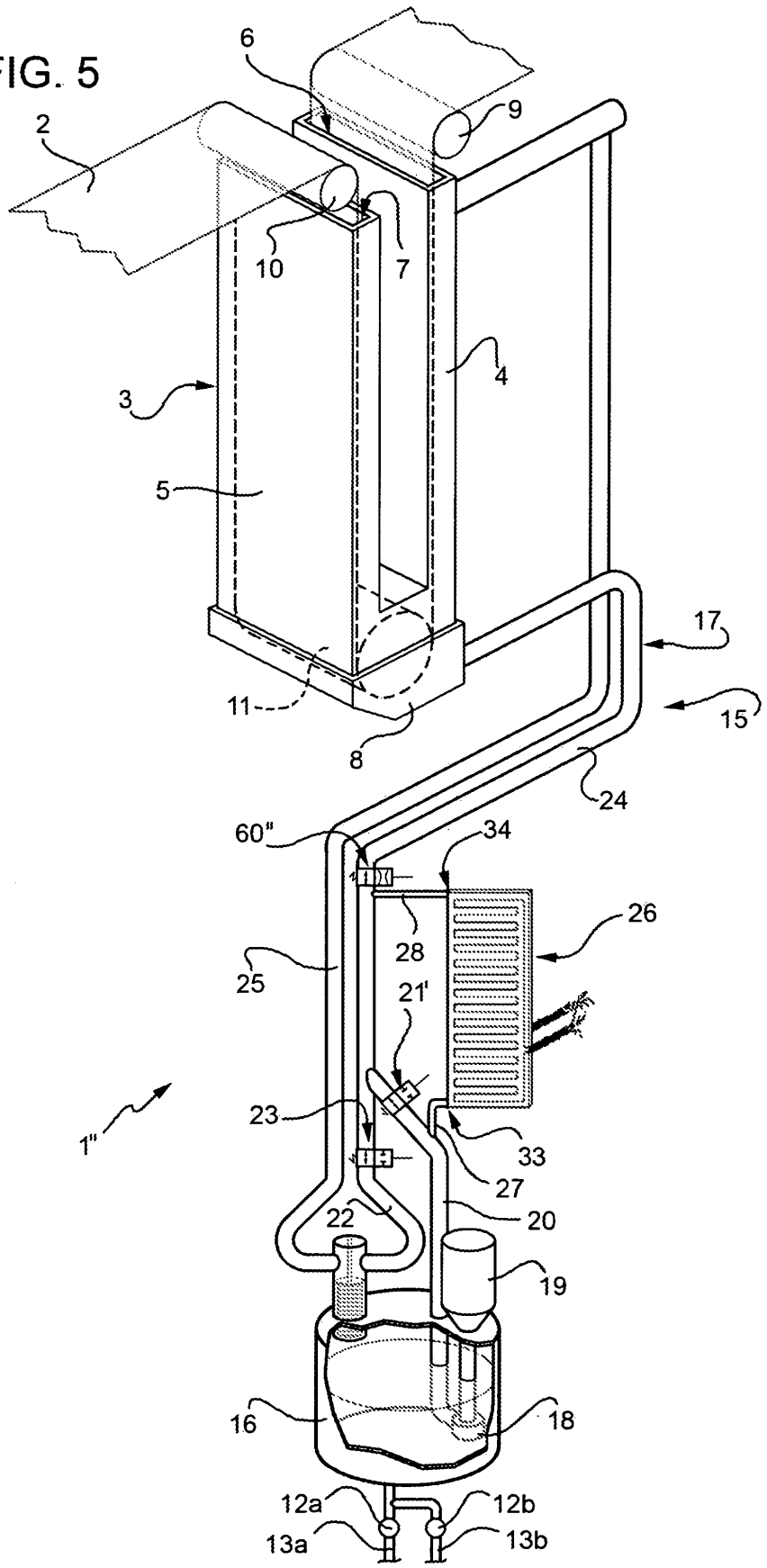
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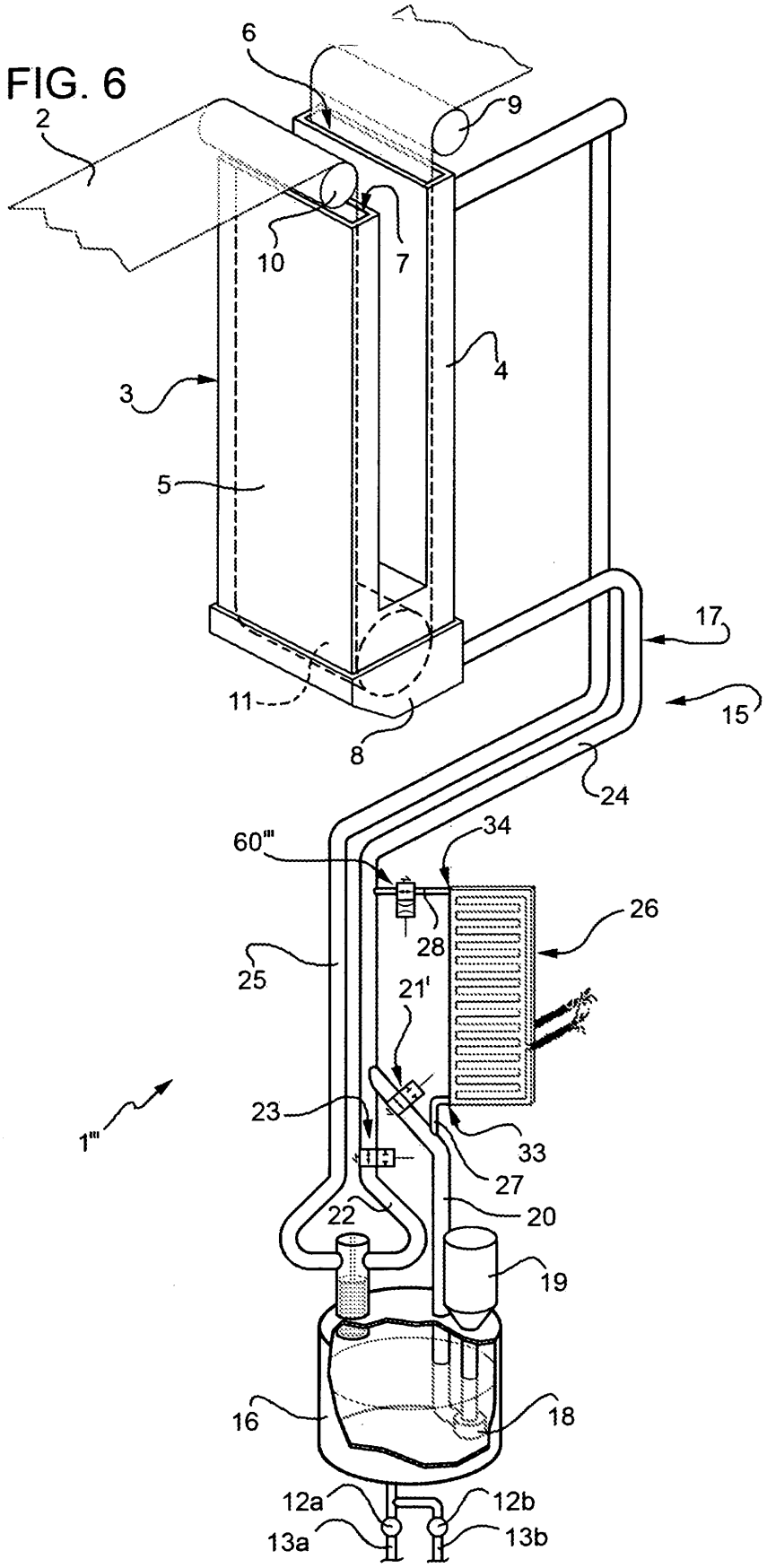
FIG. 6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12b
13a
13b

REFERENCES CITED IN THE DESCRIPTION

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