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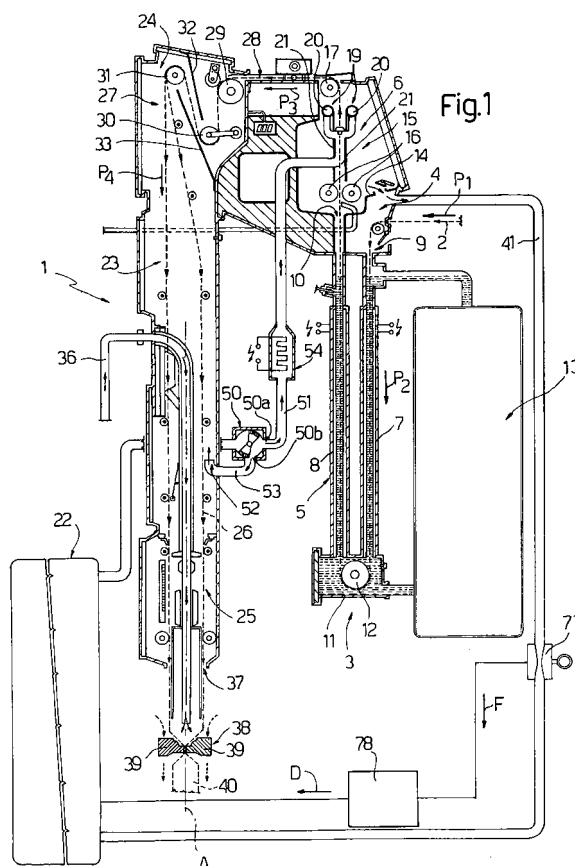
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(54) **Air processing circuit for a sterilizing unit for sterilizing sheet packaging materials for packaging pourable food products, and sterilizing unit featuring such a circuit**

(57) There is described an air processing circuit (22) for feeding sterile air to an aseptic environment (27) of a sterilizing unit (3) for sterilizing sheet packaging materials (2) for packaging pourable food products. The circuit (22) has an intake conduit (41) for drawing air for processing from the aseptic environment (27); a delivery conduit (42) for feeding processed sterile air to the aseptic environment (27); a compressor (43) having an inlet (44) and an outlet (45) connected to the intake conduit (41) and the delivery conduit (42) respectively; purifying means (46, 47) for separating undesired particles from the air drawn from the aseptic environment (27); flow measuring means (77) for measuring the flow circulating along the circuit (22); and control means (78) for varying at least one operating parameter of the circuit (22) as a function of the measured flow.



Description

[0001] The present invention relates to an air processing circuit for a sterilizing unit for sterilizing sheet packaging materials for packaging pourable food products; the present invention also relates to a sterilizing unit for sterilizing sheet packaging materials for packaging pourable food products, and featuring such a circuit.

[0002] Machines for packaging pourable food products, such as fruit juice, wine, tomato sauce, pasteurized or long-storage (UHT) milk, etc., are known, on which packages or packs are formed from a continuous tube of packaging material made from a longitudinally sealed web.

[0003] The packaging material has a multilayer structure comprising a strong, stiff base layer, which may comprise a layer of fibrous material, such as paper, or material such as mineral-filled polypropylene. The base layer is covered on both sides with layers of heat-seal plastic material, such as polyethylene film, and, in the case of aseptic packages for long-storage products, such as UHT milk, the packaging material comprises a layer of oxygen-barrier material, such as aluminium or ethyl vinyl alcohol (EVOH) foil, which is superimposed on a layer of heat-seal plastic material, and is in turn covered with another layer of heat-seal plastic material defining the inner face of the package eventually contacting the food product.

[0004] To produce the above packages, the web of packaging material is unwound off a reel and fed through a sterilizing unit, in which it is typically sterilized by immersion in a bath of liquid sterilizing agent, such as a concentrated hydrogen peroxide and water solution.

[0005] More specifically, the sterilizing unit comprises a bath filled, in use, with the sterilizing agent, into which the web is fed continuously. The bath conveniently comprises two parallel vertical branches connected at the bottom to define a U-shaped path long enough to allow enough time to treat the packaging material. For effective, relatively fast treatment, thus enabling a reduction in the size of the sterilizing chamber, the sterilizing agent must be maintained at a high temperature, e.g. of around 70°C.

[0006] The sterilizing unit also defines an aseptic environment connected to the outlet of the bath, and in which the web of packaging material is dried and subsequently folded and sealed longitudinally to form a vertical tube, which is then filled continuously with the food product for packaging.

[0007] More specifically, in the aseptic environment, the web is treated to eliminate any residual sterilizing agent, the amount of which permitted in the packaged food product is governed by strict regulations (the maximum amount permitted being in the region of a fraction of a part per million).

[0008] The above treatment normally comprises a preliminary operation, whereby the drops on the packaging material are removed mechanically, and sterile-air dry-

ing.

[0009] Preliminary removal of the drops may be performed, for example, by means of a pair of squeeze rollers conveniently located close to the inlet of the aseptic environment; the packaging material is fed between the rollers and comes out still covered with a film of sterilizing agent, but with no macroscopic drops.

[0010] Drying may be performed using air knives directed onto the opposite faces of the web of packaging material, supplied with sterile air, and for evaporating any leftover traces of sterilizing agent.

[0011] Before leaving the aseptic environment, the web is folded into a cylinder and sealed longitudinally to form a continuous vertical tube in known manner. The tube of packaging material, in effect, forms an extension of the aseptic environment, and is filled continuously with the pourable food product, and then fed to a (transverse) form-and-seal unit for forming the individual packages, and in which the tube is gripped and sealed between pairs of jaws to form pillow packs.

[0012] The pillow packs are separated by cutting the sealed portions between the packs, and are then fed to a final folding station where they are folded mechanically into the finished form.

[0013] The sterile air used to dry the web of packaging material circulates in a closed circuit, along which it is processed continuously to eliminate the residual sterilizing agent removed from the web, and any other impurities, such as paper dust, produced in particular by mechanical drying of the web.

[0014] The air processing circuit substantially comprises an intake conduit, for drawing air for processing from the aseptic environment; a delivery conduit for feeding the processed sterile air back into the aseptic environment; a compressor having an inlet and an outlet connected to the intake conduit and delivery conduit respectively; and purifying means located both up- and downstream from the compressor to eliminate undesired substances from the air fed to the delivery conduit.

[0015] More specifically, the purifying means substantially comprise a washing device located upstream from the compressor, and which directs a jet of wash fluid, usually water, onto the air for processing, so as to cool the air and so condense the sterilizing agent vapour in the air. The purifying means also comprise a separating device located downstream from the compressor to separate the liquid particles from the air stream eventually fed into the aseptic environment. The separating device normally comprises a filter allowing the air through but not the liquid particles, which gather into drops which drip into a catch area from which they are later drained.

[0016] The air processing circuit also comprises a heater located downstream from the separating device to heat and sterilize the processed air before it is fed into the aseptic environment.

[0017] Packaging machines of the type described above are used widely and satisfactorily in a wide range of food industries to produce aseptic sealed packages

from a web of packaging material. Performance of the sterilizing units of such machines, in particular, ensures ample compliance with regulations governing sterility of the packages.

[0018] Within the industry, however, a need for further improvement is felt, particularly as regards the possibility of the amount of air circulating, in use, inside the aseptic environment being less than desired, owing to obstructions along the processing circuit caused, for example, by clogging of the separating device filter and/or the formation of lime scale in the washing device.

[0019] Variations in flow are currently monitored using a flow meter located between the separating device and the heater. Below a predetermined flow value, the machine is stopped and the component parts causing the obstruction are cleaned and/or replaced. This is a fairly painstaking job and, besides involving frequent stoppage of the machine, still fails to ensure the predetermined amount of air inside the aseptic environment is maintained constant between one machine stop and the next.

[0020] Moreover, known sterilizing units of the type described above fail to provide for optimizing sterile-air flow at the various operating stages of the packaging machine, which are substantially three:

- machine sterilizing stage, prior to commencing package production;
- package production stage;
- final production stage.

[0021] The above stages call for widely differing amounts of air in the aseptic environment. For example, a much smaller amount of air is required at stages involving no web feed than at the actual production stage. The impossibility of optimizing sterile-air flow at the various operating stages of the packaging machine therefore results in unnecessary energy consumption.

[0022] It is an object of the present invention to provide an air processing circuit, for a sterilizing unit for sterilizing sheet packaging materials for packaging pourable food products, designed to eliminate the aforementioned drawbacks typically associated with known air processing circuits in a straightforward, low-cost manner.

[0023] According to the present invention, there is provided an air processing circuit for feeding sterile air to an aseptic environment of a sterilizing unit for sterilizing sheet packaging materials for packaging pourable food products, said circuit comprising:

- an intake conduit for drawing air for processing from said aseptic environment;
- a delivery conduit for feeding processed sterile air to said aseptic environment;
- a compressor having an inlet and an outlet connected to said intake conduit and said delivery conduit respectively;
- purifying means for separating undesired particles from the air drawn from said aseptic environment;

and

- flow measuring means for measuring the flow circulating along said circuit;

and being characterized by comprising control means for varying at least one operating parameter of said circuit as a function of the measured said flow.

[0024] The present invention also relates to a unit for sterilizing a sheet packaging material for a packaging machine for packaging pourable food products, said unit comprising:

- a bath containing a sterilizing agent in which said packaging material is advanced continuously;
- an aseptic environment containing sterile air, connected to an outlet of said bath, and housing drying means for removing residual sterilizing agent from said packaging material; and
- an air processing circuit, in turn comprising an intake conduit for drawing air for processing from said aseptic environment; a delivery conduit for feeding processed sterile air to said aseptic environment; a compressor having an inlet and an outlet connected to said intake conduit and said delivery conduit respectively; purifying means for separating particles of sterilizing agent from the air drawn from said aseptic environment; and flow measuring means for measuring the flow circulating along said circuit;

and being characterized by also comprising control means for varying at least one operating parameter of said circuit as a function of the measured said flow.

[0025] A preferred, non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a diagram of a machine for packaging pourable food products and featuring a sterilizing unit in accordance with the teachings of the present invention;

Figure 2 shows a diagram of an air processing circuit of the Figure 1 sterilizing unit.

[0026] Number 1 in Figure 1 indicates as a whole a packaging machine for continuously producing aseptic sealed packages of a pourable food product from a web of packaging material 2 (hereinafter referred to simply as "web 2").

[0027] Machine 1 comprises a sterilizing unit 3, to which web 2 is fed off a reel (not shown) along a path P_1 .

[0028] Sterilizing unit 3 comprises a transition chamber 4, into which web 2 is first fed; a sterilizing bath 5 containing a liquid sterilizing agent, e.g. a 30% solution of hydrogen peroxide (H_2O_2) and water, through which web 2 is fed; and a process chamber 6, in which web 2 is dried, as explained in detail below.

[0029] Bath 5 is substantially defined by a U-shaped conduit filled, in use, with sterilizing agent to a predeter-

mined level. The U-shaped conduit is defined by two vertical, respectively inlet and outlet, branches 7, 8 having respective top openings 9, 10, which respectively define the inlet and outlet of web 2 into and out of bath 5, and communicate respectively with transition chamber 4 and process chamber 6. The two branches 7, 8 are connected at the bottom by a bottom portion 11 of bath 5 housing a horizontal-axis guide roller 12.

[0030] Inside bath 5, web 2 therefore describes a U-shaped path P_2 of such a length as to keep the packaging material long enough inside the sterilizing agent.

[0031] Bath 5 is connected to a sterilizing agent control circuit 13 - known and therefore not shown in detail - and is maintained, in use, at a controlled temperature, e.g. of around 70°C.

[0032] Process chamber 6 is located above transition chamber 4, is separated from it by a partition 14, and houses drying means, indicated as a whole by 15, for removing residual sterilizing agent from web 2.

[0033] Drying means 15 comprise two idle squeeze rollers 16 having parallel horizontal axes, located close to the inlet of process chamber 6, on opposite sides of web 2, and at least one of which is covered with relatively soft material. Squeeze rollers 16 exert pressure on respective opposite faces of web 2 to squeeze the drops of sterilizing agent out and back into bath 5.

[0034] Downstream from squeeze rollers 16, web 2 is diverted onto a horizontal path P_3 by a guide roller 17.

[0035] Drying means 15 also comprise two so-called "air knives" 19 - known and shown only schematically - located on opposite sides of web 2, and each defined by a nozzle 20 for directing an air jet onto a relative face of web 2, and by a wall 21 for guiding the jet, in use, in a direction substantially parallel to, but opposite to the travelling direction of, web 2.

[0036] Nozzles 20 form part of an air processing circuit 22 described in detail below.

[0037] Sterilizing unit 3 also comprises a vertical aseptic chamber 23 or tower, which has a top portion 24 communicating with process chamber 6, and an elongated bottom portion 25, in which web 2 is folded into a cylinder and sealed longitudinally to form a continuous tube 26 of packaging material having a vertical axis A. Aseptic chamber 23 and process chamber 6 together therefore form an aseptic environment 27.

[0038] A narrow-section channel 28, through which web 2 travels, divides aseptic environment 27 into two regions corresponding, in the example shown, to aseptic chamber 23 and process chamber 6 respectively.

[0039] More specifically, as shown in the accompanying drawings, channel 28 extends horizontally along path P_3 of web 2, and connects process chamber 6 to top portion 24 of aseptic chamber 23.

[0040] Channel 28 is sized to produce a predetermined difference in pressure between the two regions or chambers 6, 23, and so force air into channel 28 from the higher-pressure chamber (23) to the lower-pressure chamber (6) to effectively dry web 2. Inside channel 28, the air

therefore flows in the opposite direction to the travelling direction of web 2 along path P_3 .

[0041] As shown in the accompanying drawings, top portion 24 of aseptic chamber 23 houses a number of rollers 29, 30, 31 for guiding web 2 from horizontal path P_3 to a vertical path P_4 parallel to axis A of tube 26. More specifically, roller 29 is powered and located immediately downstream from channel 28; roller 30 is idle and defines a tensioner; and roller 31 is idle and guides web 2 downwards.

[0042] Top portion 24 of aseptic chamber 23 houses two baffles 32, 33 for producing turbulence in the air close to the outlet of channel 28, and so assisting removal of any further sterilizing agent left on web 2.

[0043] Tube 26, formed downstream from roller 31 in known manner not described, is filled continuously with the product for packaging by means of a fill conduit 36, and comes out downwards through a bottom opening 37 in aseptic chamber 23, of which it substantially forms an extension.

[0044] Machine 1 comprises a known transverse form-and-seal unit 38, not shown in detail, in which tube 26 of packaging material is gripped between pairs of jaws 39, which seal tube 26 transversely to form aseptic pillow packs 40 eventually formed by known cutting and folding operations into individual packages.

[0045] With reference to Figures 1 and 2, air processing circuit 22 substantially comprises an intake conduit 41 for drawing air from aseptic environment 27; a delivery conduit 42 for feeding processed sterile air to aseptic environment 27; a compressor 43 having an air inlet 44 and an air outlet 45 connected to intake conduit 41 and delivery conduit 42 respectively; first and second purifying means 46, 47 located up- and downstream from compressor 43 respectively, and for removing undesired particles from the air being processed; and a heater 48 (known and shown only schematically in Figure 2) for heating and sterilizing the air fed to aseptic environment 27.

[0046] More specifically, intake conduit 41 comes out of transition chamber 4, and delivery conduit 42 is connected to an inlet of a three-way distributor 50 having an outlet 50a connected by a conduit 51 to nozzles 20 of air knives 19, and an outlet 50b connected by a conduit 53 to one or more inlets 52 for feeding air into bottom portion 25 of aseptic chamber 23. In normal operating conditions, distributor 50 conveniently feeds 66% of the incoming airflow to aseptic chamber 23, and the remaining 33% to process chamber 6. An electric heater 54 is housed in conduit 51.

[0047] The air fed to aseptic chamber 23 by conduit 53 is at a temperature of about 120°C, while the air fed to process chamber 6 by conduit 51 and heater 54 is at a temperature of about 180-190°C.

[0048] First purifying means 46 comprise a known washing device (so-called "scrubber") 55 for separating particles of sterilizing agent in the form of vapour from the hot air drawn from aseptic environment 27.

[0049] More specifically, washing device 55 (Figure 2) substantially comprises a hollow body 56 located along the downstream end portion of intake conduit 41, upstream from inlet 44 of compressor 43; and feed means 57 for supplying a wash or cooling fluid - in this case, water - and which debouch inside body 56 to direct a jet of water onto the air inside body 56 to condense the sterilizing agent vapour in the air and so separate the vapour from the air.

[0050] More specifically, body 56 is fitted inside with a net 58, onto which the water jet from feed means 57 is sprinkled finely, and which provides for maximizing the air-water contact area to achieve optimum cooling and condensation of the sterilizing agent vapour.

[0051] Feed means 57 substantially comprise a water supply conduit 60 terminating, inside body 56, with a nozzle 61 over net 58.

[0052] Water flow along supply conduit 60 is controlled by a two-way, two-position, ON/OFF solenoid valve 62 in series with conduit 60.

[0053] Supply conduit 60 is also advantageously fitted with a pressure regulator 63 for ensuring a predetermined pressure of the water reaching washing device 55; and a flow switch 64, which generates an alarm signal when flow along conduit 60 falls below a predetermined minimum value.

[0054] Pressure regulator 63 may be appropriately calibrated to the section of nozzle 61 to ensure practically constant water flow through washing device 55, and hence constant air supply to compressor 43.

[0055] Any paper particles in the air from aseptic environment 27 are incorporated in the water flow and subsequently separated as explained below.

[0056] The compressor 43 employed is preferably a known water ring compressor, which is described below only as necessary for a clear understanding of the present invention.

[0057] More specifically, compressor 43 (Figure 2) substantially comprises a casing 65 inside which, when compressor 43 is running, a water ring (not shown) rotates and acts as an air pumping fluid. More specifically, a rotor (not shown) is fitted eccentrically inside casing 65, and has a number of radial cavities, which are filled with water over part of the angular travel of the rotor, and are almost empty over the remainder. This alternate filling and emptying of the rotor cavities produces an air pumping effect. Part of the water follows the air out of compressor 43, while more water is fed continually to compressor 43 by washing device 55.

[0058] Second purifying means 47 comprise a separating device 66 for separating the water and liquid sterilizing agent particles from the air from compressor 43.

[0059] Separating device 66 comprises a hollow body 67, through which the air from compressor 43 flows, and which is fitted inside with an air-water, or more specifically an air-liquid, separating filter 68.

[0060] More specifically, as shown in Figure 2, separating device 66 divides delivery conduit 42 into two sep-

arate branches 70, 71, a first (70) of which connects outlet 45 of compressor 43 to separating device 66, and a second (71) of which connects separating device 66 to distributor 50 and, hence, to aseptic environment 27.

[0061] Body 67 is cylindrical with opposite open tapered ends 72, 73, one (72) of which, located at the top in use, is connected to branch 71 of delivery conduit 42, while the opposite, bottom, end (73) is connected to a drain conduit 74 for draining off the separated liquid. Branch 70 of delivery conduit 42, on the other hand, debouches laterally inside body 67, beneath filter 68.

[0062] Bottom end 73 of body 67 of separating device 66 always contains a minimum level of liquid, which acts as a seal to prevent air escaping. A float 75 controls opening/closing of a shutter 76 acting on the inlet of drain conduit 74. When the separated-liquid level rises, float 75 moves shutter 76 into the open position to drain off the liquid at the bottom of body 67; and, when the liquid level falls, float 75 closes shutter 76.

[0063] Air processing circuit 22 advantageously also comprises a flow measuring device or flow meter 77 located along intake conduit 41, and which generates a flow signal F related to the amount of flow issuing from aseptic environment 27 and flowing along intake conduit 41; and an electronic control unit 78 receives flow signal F, and generates a control signal D to vary at least one operating parameter of compressor 43, e.g. rotor speed, as a function of flow signal F.

[0064] In actual use, after being sterilized by immersion in bath 5, web 2 is fed into process chamber 6, where it first passes through squeeze rollers 16 to mechanically remove the drops of sterilizing agent from web 2.

[0065] Next, web 2 is first swept by sterile-air jets from air knives 19, and then diverted by roller 17 along path P_3 to channel 28.

[0066] Along channel 28, a strong air current flows over, thus effectively drying, web 2. The very narrow section of channel 28, on the one hand, increases the effectiveness of the air current on web 2, and, on the other, produces a drastic fall in pressure between aseptic chamber 23 and process chamber 6, thus increasing the force of the air stream flowing over web 2.

[0067] At the outlet of channel 28, any remaining sterilizing agent is removed from web 2 by the turbulence in the air in the region of baffles 32 and 33.

[0068] Web 2 is then folded into a cylinder and sealed longitudinally to form tube 26, which is filled continuously with the pourable food product from conduit 36, and is gripped and sealed transversely by jaws 39 to form a succession of packs 40.

[0069] Air processing circuit 22 draws air continuously from transition chamber 4 and process chamber 6, cleans it of residual sterilizing agent and any other impurities, such as paper particles, and heats and sterilizes it before feeding it back into aseptic environment 27.

[0070] Flow meter 77 continuously measures air flow along intake conduit 41, and generates flow signal F; on the basis of which, control unit 78 continuously adapts

the rotor speed of compressor 43 to compensate for any reduction in flow caused by partial obstruction, e.g. by lime scale, of net 58 of washing device 55 and/or of filter 68 of separating device 66 and/or of heater 48. In particular, the rotor speed of compressor 43 is increased to ensure constant air flow to aseptic environment 27.

[0071] Before reaching inlet 44 of compressor 43, the air drawn from aseptic environment 27 flows through washing device 55, where it comes into contact with water sprinkled finely through net 58, and is cooled; and any particles of sterilizing agent in vapour form condense and mix with the water.

[0072] The air, together with the liquid particles, then reaches compressor 43, the pumping action of the ring of water of which feeds it along delivery conduit 42 to be fed back into aseptic environment 27. At separating device 66, the air is then forced through filter 68, while the liquid particles form into drops which drip and collect inside bottom end 73 of body 67. Here, when the liquid level rises, float 75 moves shutter 76 into the open position to let the collected liquid out along drain conduit 74. The fall in the liquid level closes shutter 76, so that a minimum amount of liquid is always present inside bottom end 73 of separating device 66 to act as a seal.

[0073] The purified air flow from separating device 66 then flows through heater 48, where it is heated and sterilized before reaching distributor 50 and being fed by conduit 53 into bottom portion 25 of aseptic chamber 23, and by conduit 51 and heater 54 to nozzles 20 of air knives 19 in process chamber 6.

[0074] The advantages of sterilizing unit 3 and air processing circuit 22 according to the present invention will be clear from the foregoing description.

[0075] In particular, by providing flow meter 77 upstream from compressor 43, along intake conduit 41, and connecting the flow meter to the control unit 78 controlling compressor 43, the speed of compressor 43 can be adjusted continuously to compensate for any in-service fall in the air supply to aseptic environment 27.

[0076] Moreover, the amount of air circulating in aseptic environment 27 can also be adapted to the speed of web 2 and to the various operating stages of packaging machine 1. More specifically, using the flow measurement as a process parameter, the speed of compressor 43 can be adjusted to reduce air supply to aseptic environment 27 at the operating stages of packaging machine 1 requiring a smaller amount of air, i.e. at the machine sterilizing stage prior to commencing package production, and at the final production stage, thus saving energy, particularly at the air heating and sterilizing stages.

[0077] Clearly, changes may be made to sterilizing unit 3 and air processing circuit 22 as described and illustrated herein without, however, departing from the scope defined in the accompanying Claims.

[0078] In particular, as a function of flow signal F generated by flow meter 77, control unit 78 may act instead on circuit 22 components other than compressor 43 to vary process operating parameters governing sterile-air

supply to aseptic environment 27. For example, control unit 78 may act on a modulating valve, located along circuit 22, to adjust the fall in pressure along the intake line or delivery line of compressor 43.

Claims

1. An air processing circuit (22) for feeding sterile air to an aseptic environment (27) of a sterilizing unit (3) for sterilizing sheet packaging materials (2) for packaging pourable food products, said circuit (22) comprising:

- an intake conduit (41) for drawing air for processing from said aseptic environment (27);
- a delivery conduit (42) for feeding processed sterile air to said aseptic environment (27);
- a compressor (43) having an inlet (44) and an outlet (45) connected to said intake conduit (41) and said delivery conduit (42) respectively;
- purifying means (46, 47) for separating undesired particles from the air drawn from said aseptic environment (27); and
- flow measuring means (77) for measuring the flow circulating along said circuit (22);

and being **characterized by** comprising control means (78) for varying at least one operating parameter of said circuit (22) as a function of the measured said flow.

2. A circuit as claimed in Claim 1, **characterized in that** said operating parameter is an operating parameter of said compressor (43).

3. A circuit as claimed in Claim 2, **characterized in that** said operating parameter is the speed of said compressor (43).

4. A circuit as claimed in any one of the foregoing Claims, **characterized in that** said compressor (43) is a liquid ring compressor.

5. A circuit as claimed in any one of the foregoing Claims, **characterized in that** said flow measuring means (77) are located along said intake conduit (41).

6. A circuit as claimed in any one of the foregoing Claims for eliminating undesired particles in vapour form from the air drawn from said aseptic environment (27), **characterized in that** said purifying means (46, 47) comprise feed means (57) for supplying a jet of wash fluid onto the air for processing to condense said undesired particles.

7. A circuit as claimed in Claim 6, **characterized in**

that said feed means (57) for supplying the wash fluid comprise a supply conduit (60), and a pressure regulator (63) located along said supply conduit (60).

8. A circuit as claimed in Claim 7, **characterized in that** said feed means (57) also comprise a flow switch (64) located along said supply conduit (60) and for generating an alarm signal when flow along the supply conduit (60) falls below a predetermined minimum value. 5
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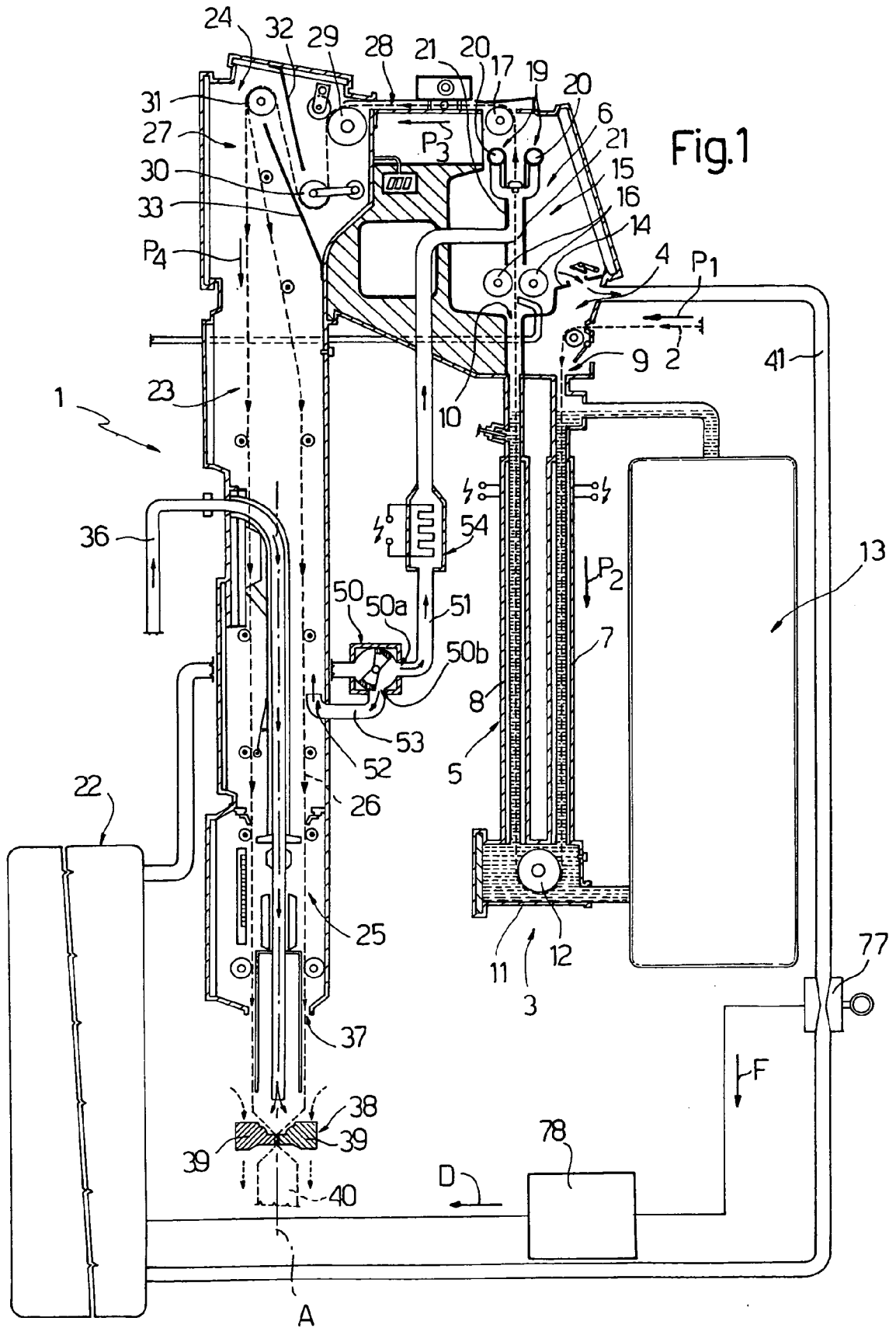
9. A circuit as claimed in any one of Claims 6 to 8, **characterized in that** said purifying means (46, 47) comprise separating means (66) for separating said liquid particles from the air being processed. 15

10. A unit (3) for sterilizing a sheet packaging material (2) for a packaging machine (1) for packaging pourable food products, said unit (3) comprising : 20
 - a bath (5) containing a sterilizing agent in which said packaging material (2) is advanced continuously;
 - an aseptic environment (27) containing sterile air, connected to an outlet (10) of said bath (5), and housing drying means (15) for removing residual sterilizing agent from said packaging material (2); and 25
 - an air processing circuit (22), in turn comprising an intake conduit (41) for drawing air for processing from said aseptic environment (27); a delivery conduit (42) for feeding processed sterile air to said aseptic environment (27); a compressor (43) having an inlet (44) and an outlet (45) connected to said intake conduit (41) and said delivery conduit (42) respectively; purifying means (46, 47) for separating particles of sterilizing agent from the air drawn from said aseptic environment (27); and flow measuring means (77) for measuring the flow circulating along said circuit (22); 30
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and being **characterized by** also comprising control means (78) for varying at least one operating parameter of said circuit (22) as a function of the measured said flow. 45

11. A unit as claimed in Claim 10, **characterized in that** said operating parameter is an operating parameter of said compressor (43). 50

12. A unit as claimed in Claim 11, **characterized in that** said operating parameter is the speed of said compressor (43). 55



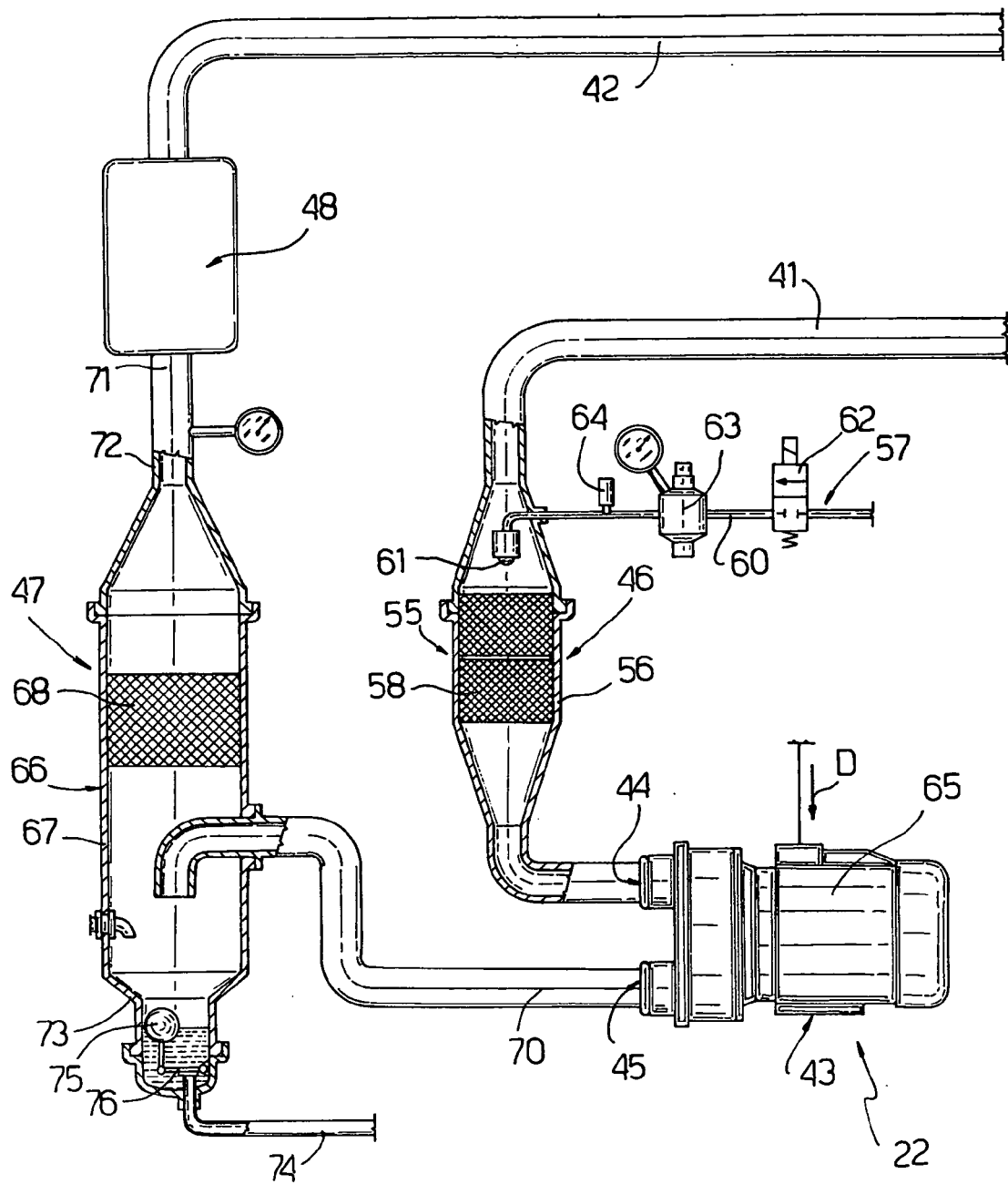


Fig.2



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 42 5879

DOCUMENTS CONSIDERED TO BE RELEVANT			
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 18 May 2006	Examiner Schelle, J
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	

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EPO FORM 1503 03.82 (P04C01)

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

EP 05 42 5879

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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