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(71) Applicant: **Godoy Varo, José Luis**
17244 Cassa de la Selva (Girona) (ES)

(72) Inventor: **Godoy Varo, José Luis**
17244 Cassa de la Selva (Girona) (ES)

(74) Representative: **Gislon, Gabriele et al**
Torner, Juncosa i Associats, S.L.
c/ Bruc, 21
08010 Barcelona (ES)

(54) CORK-DECONTAMINATION METHOD AND INSTALLATION COMPRISING A VIBRATING DEVICE

(57) The invention relates to a cork-decontamination method and installation comprising a vibrating device. The inventive method consists in subjecting cork pieces to be decontaminated to a controlled vibration and performing the following phases in a combined or alternating manner, namely:

a) bringing the cork into contact with an aqueous liquid inside a first tank and generating a vacuum therein under a temperature control;
b) letting the soaked cork to stand or rest; and
c) eliminating the absorbed liquid which contains pollutant substances.

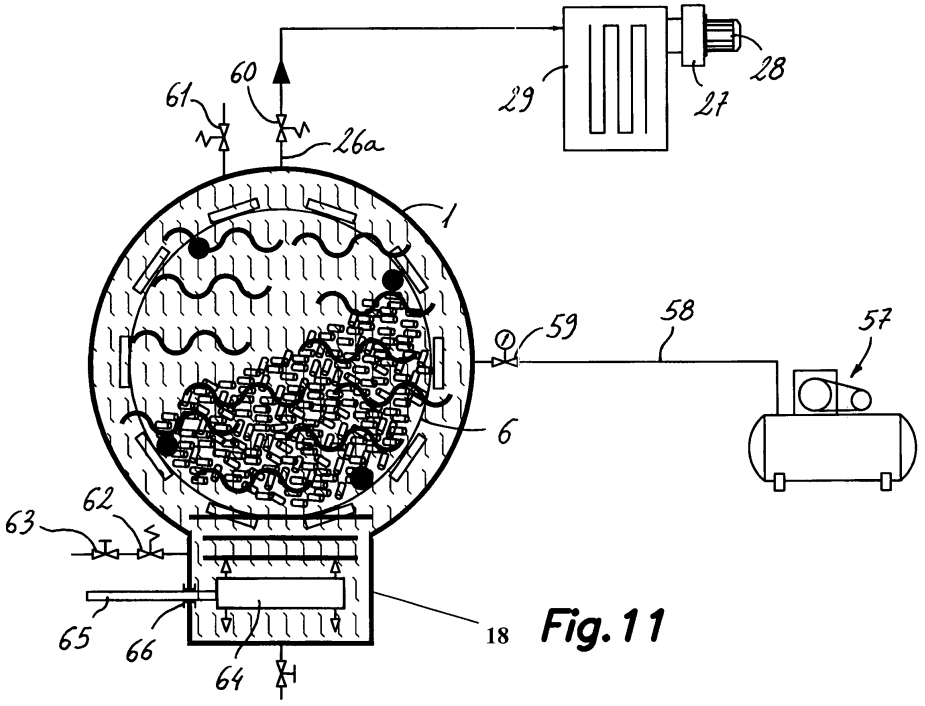


Fig. 11

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Description

Field of the Invention

[0001] The present invention relates to a cork decontamination method, mainly for that cork used in the form of stoppers or derivatives thereof for bottled products of the viticultural sector, for the purpose of eliminating olfactory and gustatory defects that the cork transmits to said products, due to the presence of microorganisms, spores, molds and compounds of the organochlorine family generally and mainly 2,4,6-trichloroanisole (TCA) and other chlorinated derivatives.

[0002] The invention also relates to an installation for implementing the process, herein referred to as PURIFICORK ® according to several embodiments, particularly integrating a vibrating device.

Background

[0003] Cork is a substrate suitable for a large number of microorganisms and specifically, their presence in stoppers usually causes olfactory and gustatory alterations in bottled viticultural products.

[0004] As it is furthermore very difficult to detect this defect ahead of time, high losses occur in this sector due to consumer rejection.

[0005] This problem is widely known in bottled wines as "bouchonnée" (corked-spiled wine) to define with this French word an unpleasant cork odor mainly caused by the presence in the wine of TCA (trichloroanisole). The mentioned term "bouchonnée" also encompasses the cases in which unpleasant cork and wet earthy (geosmin) flavors or a chlorinated aroma (trichloroanisole) which may remind one of moldy smells, are conferred to the wine. TCA, a chlorinated derivative which has affected corks made from cork oaks chemically treated against pests or which have been subjected to acid rain stages, is noticeable with just 4 nanograms per liter. To minimize these problems, the solutions in the state of the art have been to try to store the corks in dry conditions before the bottling process.

[0006] It is very difficult to decontaminate the cork 100% with current techniques.

[0007] To solve this problem, treating the cork with chemicals such as hydrogen peroxide and ozone has been proposed, but complete decontamination has not been obtained because said processes do not provide an absolute guarantee that they will eliminate the microorganisms, and specifically TCA organochlorines, the latter being the main causes of unwanted odors and tastes in the cork.

[0008] Several examples illustrating different treatments in this field are cited below.

[0009] European patent application EP-A-853533 describes a cork item decontamination treatment based on contacting the cork with an aqueous solution of hydrogen peroxide and then with an aqueous solution of a catalase and a final drying step.

[0010] Patent document US 4,693,757 describes a cork item decontamination treatment based on consecutive washings in alkaline aqueous solutions of different concentrations and compositions, including hydrogen peroxide, and drying with possible centrifuging.

[0011] Patent document US 5,098,447 describes a cork item decontamination treatment based on washing in alkaline aqueous solution of hydrogen peroxide in the presence of ultraviolet radiation.

[0012] Patent document US 6,152,966 describes a cork item decontamination treatment based on applying phenol oxidizing enzymes.

[0013] Patent document ES 2 051 405 describes a method and an apparatus for deodorizing cork which comprises supplying steam to generate a flow of steam to said cork in a container with a temperature of 100° C to 130 °C.

[0014] Patent document ES 2 006 879 relates to an apparatus for washing, bleaching and drying cork stoppers in a single cycle comprising a casing housing a receiving drum for receiving the stoppers to be treated, which is perforated, rotational and provided with doors, comprising a spray assembly for spraying said stoppers integrating fixed spraying pipes installed inside the rotating drum and a drying assembly provided with hot air outlets from inside and from the outside of said rotating drum.

[0015] European patent application EP 1 108 507 describes a method applied to cork products for their decontamination comprising an airtight tank in which cork is introduced, which remains immersed in a liquid, and the application of successive pressure increasing and pressure reducing cycles.

[0016] Patent application WO 2004/004995, belonging to the same applicant of the present invention, describes a process of decontaminating cork and making same more flexible and an installation comprising a stage for bringing the cork into contact with an aqueous liquid for a predetermined time period inside an airtight tank where the cork remains immersed in said fluid under pressure conditions exceeding atmospheric pressure and under 7 atmospheres, followed by a stage for drying said cork.

[0017] The object of the present invention is to provide an alternative decontamination process to those mentioned in the preceding background and which, in relation to the last two cited documents, is particularly less aggressive for the cork that is being treated.

Description of the Invention

[0018] The invention consists of a cork decontamination method provided for eliminating microorganisms, spores, moldy parts, contaminating gases and mainly compounds of the organochlorine family including 2,4,6-trichloroanisole (TCA), TCP, PCP and other chlorinated derivatives and consisting of subjecting cork pieces to

be decontaminated to a controlled vibration generally at a constant frequency for a predetermined time period.

[0019] According to the invention it is provided, as well as the application of said vibration and in a supplementary or alternating manner, at least one cycle comprising immersing the cork in an aqueous liquid where it remains a specific time period, followed by a resting step during which there can be carried out pressurization-depressurization or depressurization-pressurization cycles as well as additional spraying of the cork with liquid and preferably operating at a temperature exceeding room temperature inside airtight tanks. The liquid used, generally water, does not have necessarily to be treated.

[0020] According to a first aspect of the invention, a process is provided to decontaminate cork pieces such as stoppers, for example, which is based on subjecting said cork pieces to a controlled vibration for a predetermined time.

[0021] Vibrations with frequencies comprised between 1Hz and 50 Hz are generally used, although it is preferable to work within a range of frequencies from 50 Hz to 200 Hz and even higher frequencies. It has also been provided to operate carrying out a treatment cycle in which different frequencies are used during different time periods.

[0022] In one embodiment the mentioned vibration is obtained from the application of mechanical waves impinging directly or indirectly on the mass of cork pieces which are immobilized or retained to a certain extent in a medium such as a liquid or gaseous fluid. Said retention of the cork pieces to a certain extent can be suitably obtained by immersing the cork pieces in a fluid with a density degree that limits their mobility. In one embodiment variant, said dense medium is an aqueous liquid at a temperature of less than 99°C. In another variant said dense medium is a gaseous fluid chosen from a group comprising air, saturated air or steam, or CO_2.

[0023] According to another embodiment of the method being described, said immobilization is obtained by arranging the cork pieces in a structure in which they are held by mechanical means, and subjecting the whole of said structure to vibration. The operation will generally be carried out in a controlled environment to regulate the removal of pollutant substances.

[0024] In another embodiment of the method according to the invention the cork pieces are arranged inside an airtight tank in a liquid or gaseous fluid, additionally carrying out at any point of the application of said vibratory energy at least one cycle comprising a step for applying pressure exceeding atmospheric pressure followed by a controlled vacuum.

[0025] In an embodiment of the invention means have been provided to provide relative movement of the mechanical wave generating source during treatment with respect to the group of cork pieces.

[0026] According to a second aspect of the method according to the invention, carrying out one or more cycles is proposed, each of which cycles comprises at least two of the following steps:

a) bringing the cork, either in its natural state or its derivatives, into contact with said aqueous liquid, inside a first tank, and generating a vacuum therein under a temperature control;
b) letting the soaked cork to stand; and
c) eliminating the absorbed liquid containing unwanted dissolved substances from inside the cork

The application of mechanical waves according to the previous description is carried out in any of said steps a) or b).

[0027] According to the invention step c) comprises a cork drying process intended to obtain moisture levels which are at least less than 6% in the cork mass, which drying process is carried out under vacuum with controlled heat energy supply.

[0028] Containers made of a stable material, for example stainless steel, will preferably be used to implement the process. Other containers could be used for step b), for example, containers having inert inner surfaces and which are not necessarily airtight.

[0029] The first step a) is carried out by means of immersing said cork in the mentioned liquid or by spraying, continuously or by alternating said cork treatment conditions (e.g. spraying with pauses). The duration of this step is variable, depending on the degree of contamination of the cork, but a minimum of 30 minutes has been found to be appropriate, and in any case a time of less than 1 hour.

[0030] The term spraying used herein encompasses any pneumatic or hydraulic spraying or sprinkling system, or air spraying or atomization spraying system.

[0031] A vacuum with a controlled intensity is generated in said step a) preferably inside the tank. To that effect, pressure values comprised between 200 and 10 mbar have been considered preferable in the tests that have been conducted, although other values with a lower vacuum intensity, for example 500 mbar, would also be appropriate. Once a desired treatment value has been reached (the duration of said preparatory step will depend on the flow capacity provided by the vacuum pump used), the mentioned reduced pressure is held constant for less than 30 minutes and generally for a time period of about 15 minutes. A cycle can be applied in which the pressure progressively decreases between two values of the range mentioned during the time (for example 30 minutes) of this step a). This reduced pressure causes the air bubbles trapped in the pores of the cork mass to escape towards the exterior, whereby facilitating the entrance of the liquid intended for decontamination, such that the mentioned liquid effectively penetrates the cork.

[0032] According to a preferred version of the process, in mentioned step a) or the operation for bringing said cork into contact with a liquid, heat energy is additionally supplied, causing the liquid contained in said airtight tank to heat.

[0033] In a preferred embodiment of the invention, the heat energy supply generates in the mentioned tank a temperature exceeding room temperature, although temperatures of about 30°C, combined with different reduced pressure values provide suitable results, always according to the degree of contamination of the cork. It has been provided to make the temperature evolve generally approximately between 30°C and 40°C.

[0034] The liquid used in step a), in normal use conditions is filtered, dechlorinated water, and preferably including treating substances or additives with notable surface-active and/or surfactant properties to increase the absorption of liquid by the cork and to thus allow greater dissolution of the pollutant substances.

[0035] Products with surface-active and/or surfactant properties which are preferably low in foam and/or anti-foaming agents are preferred.

[0036] In one embodiment the liquid used in said step a) incorporates at least one product having surfactant properties along with at least another product having surfactant, anti-foaming properties.

[0037] A liquid can alternatively be used further incorporating a chemical additive such as glycerin.

[0038] Several of said additives can evidently be used in combination, according to the type of treatment to be carried out.

[0039] After the mentioned first step a) of generating a reduced pressure, or depression, in the container atmosphere which allows a first removal of gases, including pollutant substances, a subsequent recovery must be carried out at ambient pressure, which should be carried out gradually so as to prevent the structure of the cork from collapsing.

[0040] A slight overpressure can also be applied, which overpressure is preferably gradual, of about 0.5-0.9 bar, to improve liquid absorption.

[0041] Step a) is in fact a cycle itself and can be repeated as many times as desired.

[0042] It has also been provided that when said step a) is being carried out, the cork is kept in contact with the liquid environment while said liquid is filtered, purified or changed one or more times, providing a new fluid for the purification.

[0043] Subsequently and to allow the dissolution of the pollutant substances in the absorbed liquid, step b) involves leaving the cork to rest, or stand, generally after emptying the tank or extracting the cork therefrom. This operation can be carried out in the same tank, or in supplementary tanks or enclosures that are not necessarily airtight, or in a combination of both, a temperature control being advisable, less than 100°C, preferably around 65°C (with a plus or minus 5°C differential), and operating with forced or not forced ventilation to facilitate the removal of gases, including the pollutant substances. A rest or standing of no less than 4 hours is advisable, but the rest would preferably have to last approximately 12 hours for sufficiently satisfactory results.

[0044] In order to reach said temperature of step b) the heat energy supply to the cork has been provided from walls of a rotating container or drum, having perforated walls or walls with openings housing said cork, located inside the mentioned first tank. Said heat energy supply can be by radiation of a heat-transfer fluid or by insufflating with a hot fluid, or by a combined action of both means. Heat energy can alternatively or simultaneously also be supplied from an inner area of the mentioned container (for example from a fixed pipe, supported by rotary joints at their ends), compatible with the rotation of the container.

[0045] According to the principles of this invention during step b) for resting or standing which is carried out inside an airtight tank, pressurization and depressurization cycles have been provided, and even the addition of gases under pressure such as CO_2 or ozone together with one or more ventilation steps intercalated in said cycles or vacuum cycles or a combination of several of said cycles or steps. Said step b) can also be carried out at atmospheric pressure.

[0046] The pressure variations that the cork is subjected to during this step b) are preferably carried out gradually.

[0047] It has also been found to be appropriate to intercalate in this step b) wetting steps by means of the additional supply of a liquid, controlled by evaporation, spraying or a combination of both. Said fluid shall be advantageously provided at a temperature that is equivalent to room temperature which the cork is in said step b) for resting or standing.

[0048] According to the proposal of this invention, it has also been provided to replace the liquid used in steps a) and b) at any point of the process, once or several times.

[0049] The main elimination of the pollutant substances, such as compounds of the organochlorine family and others, will be carried out when the absorbed liquid containing the dissolved substances is extracted.

[0050] This operation in step c) can be carried out by means of evaporation or drying the cork. The greater the drying of the cork, the greater the elimination of pollutant substances will be. This is why the cork should be left at moisture levels of less than 6%. Said drying process is preferably carried out under vacuum and with controlled heat energy supply.

[0051] It must be observed that if the cork is inside an airtight tank at a temperature of the order of 65°C as previously indicated, during step b), connecting the tank to a vacuum pump will immediately generate a drying process. In any case, step c) applies methodologies that are generally known in the field and the method according to the invention is essentially defined by the previous steps a) and b), although a final step c) for drying is required in connection with the previous steps, having several particularities that are described below.

[0052] It will then be necessary to correct the cork to normal moisture values. For recovery to an acceptable moisture level which may be around 6% for later use or

handling, a subsequent correction is advisable, which correction can be carried out in known stabilization rooms or in the same treatment tank or in other auxiliary ones, such as by means of spraying a liquid and additionally under vacuum.

[0053] An additional step (in fact, a sub-step of step c)) has been provided to that effect in which the degree of moisture of the cork is corrected by forced means or leaving the cork to naturally absorb moisture by itself in a controlled environment.

[0054] According to a preferred embodiment of such object, and for the correction of the degree of moisture or hydration, the invention proposes adding fluid, preferably water (liquid and/or steam) with and/or without additives, distilled water with or without additives being even more preferred, glycerin being used as one of the additives. The process will advantageously work with a controlled jet pressure and under vacuum.

[0055] For greater uniformity in the treatment of corks, it is appropriate to have means for stirring or agitating said corks in one or all of the steps of the process, especially during the wetting and drying processes.

[0056] In view of the results, an elimination of pollutant substances of from 80% to 98% has been found according to the cases, said elimination being obtained in a shorter time period with respect to the typical time period of other treatments such as those referred to in the background section.

Brief Description of the Drawings

[0057] The invention will be better understood from the detailed description of an embodiment in reference to the attached drawings, in which:

Figures 1 to 4 are schematic side views of a suitable installation for carrying out a cork decontamination method according to an embodiment of the present invention;

Figures 5 and 6 are schematic sectional views of the installation of Figure 1;

Figures 7 and 8 are respectively a schematic side view and a schematic cross-sectional view showing an alternative variant of the installation of Figure 1;

Figure 9 is a schematic side view of another embodiment of an installation of the present invention suitable for carrying out a step of the decontamination method including pressure cycles;

Figure 10 is a schematic side view of a variant of the embodiment of Figure 9;

Figure 11 is a schematic side view of another embodiment of an installation of the present invention suitable for carrying out another step of the decontamination method including vibration;

Figure 12 is a schematic side view of another embodiment of an installation of the present invention suitable for carrying out the steps of the decontamination method including vibration and pressure cycles, which are shown in Figures 9 and 11 combined;

Figure 13 is a schematic isometric view of another embodiment of part of an installation of the present invention for carrying out another step of the decontamination method including vibration;

Figure 14 is a schematic plan view of the part of the installation of Figure 13; and

Figures 15 and 16 are schematic detail views showing in a more detailed manner means for holding the cork in the part of the installation shown in Figures 13 and 14.

Detailed Description of Several Embodiments

[0058] First in reference to Figures 1 to 5, such figures show an installation for cork decontamination comprising an autoclave tank 1 having a substantially cylindrical configuration and arranged horizontally (other orientations, such as vertical, are also possible). The mentioned autoclave tank 1 has an opening at one end, and a cover 2 is movably assembled such that it can have an open position (Figure 1), in which the cover 2 is separated from the opening of the autoclave tank 1 to provide access therethrough, and a closed position (Figure 2), in which the cover 2 is coupled to the opening of the autoclave tank 1, closing it in an airtight manner. To mechanically carry out operations to open and close the autoclave tank 1, the cover has fixed thereto a motor 3 coupled to a gear wheel 4 which meshes with a stationary rack 5. Activation of the motor 3 in either direction allows moving the cover 2 between its open and closed positions.

[0059] A basket or container 6 is joined to the cover 2 with a loading and unloading door 7 provided with a moving leaf that can be open to introduce cork in the mentioned container 6 and to extract it, and closed to retain the cork inside the container 6. The container 6, including the door 7, is provided with an outer wall with holes which allow the passage of liquid and/or steam. One end of the container 6 farthest from the cover 2 is supported by means of wheels 9 adapted to run on guides 8 arranged inside and along the autoclave tank 1. Therefore, when the motor 3 is activated to move the cover 2 in the operations for opening and closing the autoclave tank 1, the container 6 moves together with the cover 2 to be introduced in and extracted from the autoclave tank 1. When the cover 2 is in the open position (Figure 1), the container 6 is completely outside the autoclave tank 1, and when the cover 2 is in the closed position (Figure 2), the container 6 is completely inside the autoclave tank 1, which is closed in an airtight manner.

[0060] Furthermore, the ends of the container 6 are assembled on bearings in the cover 2 and in a structure incorporating the wheels 9 such that the container 6 can rotate with respect to a horizontal axis substantially aligned with a central axis of the autoclave tank 1. A motor 10 is installed in an outer part of the cover 2 and coupled to make the container 6 rotate in both directions inside the autoclave tank 1. Fixed internally to the wall of the

container 6 there are generating strips 33 (Figures 5 and 6), projecting inwardly from such container 6, adapted to agitate and stir the cork (in the form of stoppers in the figures) inside the container 6 as the container rotates. On an outer side of the wall of the container 6 a pipe coil 11 is arranged so as to conduct a heat-transfer fluid. Ends of the mentioned coil 11 are connected to a two-way rotary joint 12 assembled at the inner end of the axis of the container 6, and said rotary joint 12 is connected in turn, through pipes, to inlet and outlet ports 13 fixed to an outer part of the cover 2.

[0061] Alternatively (example not shown in the drawings), said basket or container can incorporate in its perimeter one or more welded rings the function of which is to fit and be supported in freely rotating wheels coupled to the structure supporting the same container. Said container thus has other support points while it rotates and this confers it greater stiffness, which is especially important for the case of long containers.

[0062] In another embodiment the walls of said container will be carried out, at least in part, from said pipe with duly spaced sections.

[0063] To facilitate automation of the operations for loading and unloading the cork into container 6, the installation comprises a loading hopper 23, with an outlet located on the door 7 of the container 6 when the door is in an upper area of the container 6 and the cover 2 is in the open position, and an unloading hopper 24 having an inlet located under the door 7 of the container 6 when the door is in a lower area of the container 6 and the cover 2 is in the open position.

[0064] As is shown in Figures 2 to 4, the installation includes a reservoir for a heat-transfer fluid 14 connected to a heating boiler 15 through a pipe. Arranged inside said boiler 15 there are heating means including, for example, electric resistors. The boiler 15 has an inlet and an outlet which are connected through pipes, respectively, to the mentioned inlet and outlet ports 13 existing in the cover 2. Arranged in one of said pipes there is a pump 16 to circulate the heat-transfer fluid coming from the boiler 15 through the inlet port 13 and the rotary joint 12 towards the coil 7 existing in the container 6, and again through the rotary joint 12 and the outlet port 13 towards the boiler 15 to be heated again. The mentioned pipes connecting the boiler 15 with the inlet and outlet ports 13 have flexible or extendible portions 17 to adapt to the movements of the cover 2.

[0065] Formed in a lower area of the autoclave tank 1 there is a tray 18 adapted to contain a treatment liquid. The mentioned tray 18 is communicated at the upper part with the inner cavity of the autoclave tank 1. Arranged outside the autoclave tank 1 there is a tank 19 having an inlet connected to a supply source for supplying said treatment liquid and an outlet connected to a preheating boiler 20 through a pipe. Arranged inside said boiler 20 there is a preheating device, such as, for example, electric resistors. The boiler 20 has an outlet and an inlet connected through pipes, respectively, to an inlet and an outlet of the tray 18, and arranged in one of said pipes there is a pump 21 to circulate the treatment liquid coming from the boiler 20 through the respective outlet and inlet towards the tray 18, and again through the outlet of the tray 18 towards the boiler 20 to be heated again.

[0066] Arranged inside the tray 18 there are additional heating means, such as, for example, electric resistors 22, which can additionally heat the treatment liquid inside the tray 18, and accordingly, inside the autoclave tank 1, until reaching a suitable temperature. The tray 18 further has a draining outlet 25 connected through a valve to a drain pipe to remove the treatment liquid from inside the tray 18.

[0067] Arranged in an upper area of the autoclave tank 1 there are several inlet and outlet ports 26 through which fluids can be added to the inside the autoclave tank 1 or through which steam can be removed therefrom. As is shown in Figures 2 to 4, one outlet port 26a of said inlet and outlet ports 26 is connected through a pipe to a vacuum pump 27 (preferably a liquid ring pump with or without a gas ejector, to reach vacuum pressure values within the indicated values range) actuated by a motor 28 to create a low relative pressure inside the autoclave tank 1. A capacitor 29 is installed at the inlet of the vacuum pump 27 to prevent steam from entering from inside the autoclave tank 1 to the vacuum pump 27. The mentioned capacitor 29 can be dispensed with if a liquid ring pump is used given the features thereof because such pump allows handling steam and gases without affecting its mechanism, even though the vacuum levels provided by these pumps are around 33 mbar.

[0068] Optionally, longitudinally arranged inside the autoclave tank 1 there is a series of tubes 30 (Figures 1, 4 and 6) located so as to be around the container 6 when the container is inside the autoclave tank 1. Each of said tubes 30 is equipped with a plurality of spray or sprinkling nozzles 31 distributed throughout same. The mentioned tubes 30 are connected with the tray 18 by means of pipes 32 (Figure 6) forming a circuit equipped with a pump (not shown) actuated by a motor to externally spray the container 6 with treatment liquid coming from the tray 18. Even though Figure 6 shows the mentioned pipes 32 forming the circuit in the outer part of the autoclave tank 1, such pipes could be arranged inside the autoclave tank 1 with an equivalent result. The tubes 30 have been omitted in Figures 2 to 5 for greater clarity.

[0069] Figures 7 and 8 show a variant of the installation for cork decontamination according to the present invention in which the spraying or sprinkling device is installed inside the container 6 for greater effectiveness in the spraying of the cork contained therein. To that end, the motor 10 for actuating the rotation of the container 6 is coupled to the axis of the container 6 by means of a belt drive 34 for the purpose of leaving this end of the axis free for the installation of a coupling 35 connected to a stationary tube 36 longitudinally arranged in the upper part of the inside of the container 6. The ends of the container 6 are assembled by means of bearings to rotate

on said stationary tube 36, which is equipped with a plurality of spray or sprinkling nozzles 37 distributed throughout the same. In the example shown in Figure 7, the coupling 35 of the stationary tube 36 is connected by means of a pipe provided with a flexible or extensible portion 38 to a spraying liquid container 39.

[0070] In an alternative embodiment of the invention, at least one second coil pipe (not shown in the drawings) with outlet holes distributed throughout the same and preferably oriented towards the inside the container, through which a fluid such as steam, pressurized hot air, etc, can be dispensed, has been provided in addition to the heating coil 11.

[0071] Figure 9 shows another embodiment of an installation for cork decontamination according to the present invention comprising, similar to the embodiment described above in relation to Figures 1 to 5, an autoclave tank 1 inside which there is arranged a basket or container 6 with perforated walls containing a load of cork, in this case in the form of cork stoppers. The autoclave tank 1 is adapted to be filled with a fluid medium, such as an aqueous liquid. In Figure 9, the aqueous liquid covers the container 6 and the stoppers float freely, being concentrated in the upper part of the container 6. A pressure cycle generating device 40 comprises a chamber 42 which is connected with the inside of the autoclave tank 1 through a pipe 41. A piston 43 is arranged to be moved inside said chamber 42 in opposite directions under the actuation of a motor 44 and a mechanical drive, such as for example a screw 45 coupled to a nut 46, for the purpose of applying one or more pressure cycles, in which each cycle comprises a step for applying pressure exceeding atmospheric pressure followed by a step for applying pressure close to atmospheric pressure.

[0072] A pressurized container 47 is communicated with the inside the autoclave tank 1 through a pipe 48. A non-return valve 49 is placed in said pipe 48. The aqueous liquid contained in the pressurized container 47 is at a constant pressure, for example, 0.2 bar above atmospheric pressure. The mentioned non-return valve 49 allows transferring fluid from the pressurized container 47 to the autoclave tank 1 only when the pressure inside the second one is less than the pressure inside the first one. This assures a minimum pressure in the autoclave tank 1 during the low pressure steps that is equal to the pressure of the pressurized container 47. During the high pressure steps, the pressure inside the autoclave tank 1 may reach values of up to 10 bar. Arranged in an upper part of the autoclave tank 1 there is a purger 50 adapted to purge gases or steam from inside the autoclave tank 1.

[0073] A pressure sensor 52 is arranged to detect the pressure inside the autoclave tank 1. Said pressure sensor 52 is connected to control means 51, which in turn are connected to control the operation of the motor 44 of the pressure cycle generating device 40 according to signals received from the pressure sensor 52 and to stored programming instructions.

[0074] Figure 10 shows a variant of the embodiment of Figure 9, in which the autoclave tank 1 and the container 6 are like those described above in relation to Figures 1 to 5 and Figure 9. Here, the pressure cycle generating device 40 comprises a lung tank 53 which is communicated with the inside of the autoclave tank 1 through a pipe 54. This lung tank 53 is open, whereby the aqueous liquid contained therein is at atmospheric pressure. Arranged in the mentioned pipe 54 there is a reversible hydraulic pump 55 that can pump liquid from said lung tank 53 to the autoclave tank 1 and from the autoclave tank 1 to the lung tank 53. Arranged in the pipe 54, between said reversible hydraulic pump 55 and the autoclave tank 1, there is a pilot-operated valve 56 to assure that the pressure will be kept inside the autoclave tank 1 during the steps in which the reversible hydraulic pump 55 is stopped.

[0075] Herein arranged there is also a pressure sensor 52 to detect the pressure inside the autoclave tank 1 and control means (not shown) to control the operation of the reversible hydraulic pump 55 of the pressure cycle generating device 40 according to signals received from the pressure sensor 52 and from stored programming instructions. The pressures inside the autoclave tank 1 range between 0.2 bar above atmospheric pressure during the low pressure steps and 10 bar during the high pressure steps. Arranged in an upper part of the autoclave tank 1 there is a purger 50 adapted to purge gases or steam from inside the autoclave tank 1.

[0076] Figure 11 shows another embodiment of an installation for cork decontamination according to the present invention comprising, similar to the embodiment described above in relation to Figures 1 to 5 and Figure 9, an autoclave tank 1 inside which there is arranged a basket or container 6 with perforated walls containing a load of cork, for example in the form of cork stoppers. In this case the autoclave tank 1 is adapted to be filled with a gaseous fluid, such as, for example, air, steam, CO_2 gas, among others. This embodiment incorporates means for carrying out pressure cycles in combination with vibration cycles.

[0077] To increase the pressure of the gaseous fluid contained in the autoclave tank 1 there is arranged a compressed air generator 57 communicated with the inside of the autoclave tank 1 through a pipe 58 and a pressure regulating valve 59. As in the embodiment described above in relation to Figures 1 to 5, arranged in the upper part of the autoclave tank 1 there is an outlet port 26a connected through a pilot-operated valve 60, through a pipe, to a vacuum pump 27 actuated by a motor 28 to create a relative low pressure, i.e. a controlled vacuum, inside the autoclave tank 1. A capacitor 29 is installed at the inlet of the vacuum pump 27 to prevent an inlet of gaseous fluid coming from the inside of the autoclave tank 1 to the vacuum pump 27. Arranged in the upper part of the autoclave tank 1 there is another outlet port provided with another pilot-operated valve 61 to completely depressurize the autoclave tank 1. Arranged in a lower part of the autoclave tank 1 there is an inlet-

outlet port provided with a pilot-operated valve 62 followed by a manual valve 63. This pilot-operated valve 62 can be opened and closed in combination with operating steps of the compressed air generator 57 under orders from control means for the purpose of keeping a predetermined pressure exceeding atmospheric pressure inside the autoclave tank 1 during high pressure cycles. Similarly, pilot-operated valve 62 can be opened and closed in combination with operating steps of the vacuum pump 27 under orders from said control means for the purpose of keeping a predetermined pressure of less than atmospheric pressure inside the autoclave tank 1 during low pressure cycles.

[0078] Arranged in a tray 18 formed in a lower area of the autoclave tank 1 there is a vibrating device 64 connected to a power supply 65 through an opening in said tray 18 provided with n airtight seal 66. The mentioned vibrating device 64 can be of one of the several types of vibration generating or oscillating devices available on the market and said power supply can be of different types, such as, for example of electrical, hydraulic or pneumatic power. A cork decontamination method according to the present invention can be applied by means of this embodiment, comprising immersing the cork pieces in a gaseous fluid and subjecting them to at least one of the following cycles: high pressure cycles, the pressure exceeding atmospheric pressure; vacuum cycles; and vibration cycles; or a combination thereof. The vibration cycles comprise subjecting cork pieces to a controlled vibration with a frequency within the frequency range of 1 to 200 Hz, although frequencies exceeding 200 Hz, or even ultrasonic frequencies, are not discarded. The frequency of the vibrations generated by the vibrating device 64 can be adjusted by device adjustment means or by regulating the supply of power through the power supply 65.

[0079] Now in reference to Figure 12, said figure shows another embodiment of the installation of the present invention. This Figure also shows an autoclave tank 1 inside which there is arranged a basket or container 6 with perforated walls containing a load of cork, for example in the form of cork stoppers, analogously to the embodiment described in relation to Figures 1 to 5 and Figure 9.

[0080] In this embodiment, the autoclave tank 1 is adapted to be filled with a liquid, such as an aqueous liquid, to substantially cover the container 6, and with a gaseous fluid, such as air, steam, or CO_2, filling the remaining space above the level of the liquid. The stoppers float freely, being concentrated in the upper part of the container 6. This embodiment includes a pressure cycle generating device 40 analogously to the one described above in relation to Figure 9, where a chamber 42 is connected to the inside of the autoclave tank 1 through a pipe 41, and a piston 43 is arranged to move inside said chamber 32 in opposite directions under the actuation of a motor 44 and a mechanical drive 45, 46. Here, as in the embodiment of Figure 9, there is arranged a pressurized tank 47 communicated with the inside of the autoclave tank 1 through a pipe 48 in which a non-return valve 49 is placed. The aqueous liquid contained in the pressurized container 47 is at a constant pressure, for example, 0.2 bar above atmospheric pressure. Therefore, this pressure cycle generating device 40 in combination with the pressurized tank 47 and the non-return valve 49 is able to apply one or more pressure cycles, where each cycle comprises a step for applying pressure exceeding atmospheric pressure followed by a step for applying pressure close to atmospheric pressure. The pressures inside the autoclave tank 1 range between 0.2 bar above atmospheric pressure during the low pressure steps and 10 bar during the high pressure steps.

[0081] This embodiment of Figure 12 further includes a vacuum pump 27 actuated by a motor 28 and connected through a pipe and a pilot-operated valve 60 to an outlet port 26a arranged in the upper part of the autoclave tank 1 where the gaseous fluid is located to create a low relative pressure in the gaseous fluid which is located inside the autoclave tank 1, analogously to that described in the embodiment of Figure 11. Here a capacitor 29 is also installed at the inlet of the vacuum pump 27 to prevent an inlet of gaseous fluid coming from inside the autoclave tank 1 to the vacuum pump 27. The vacuum pump 27 can be used to accelerate the removal of gases or steam from inside the autoclave tank 1. For a conventional gas or steam purge from the inside the autoclave tank 1, arranged in the upper part of the autoclave tank 1 there is another outlet port provided with another pilot-operated valve 61.

[0082] This embodiment further includes a vibrating device 64 installed in a tray 18 formed in a lower area of the autoclave tank 1. Analogously to that described above in relation to Figure 11, the vibrating device 64 is connected to an electric, hydraulic or pneumatic power supply 65 through an opening in said tray 18 provided with an airtight seal 66.

[0083] A cork decontamination method can be carried out according to the present invention by means of this embodiment of Figure 12, comprising subjecting cork pieces immersed in a liquid, such as an aqueous liquid, to at least one of the following cycles: high pressure cycles with the pressure exceeding atmospheric pressure; pressure cycles with the pressure close to atmospheric pressure; vacuum cycles and vibration cycles; or a combination thereof.

[0084] In relation to Figures 13 to 16 a device is described below to apply vibrations to cork pieces, preferably in the form of cork stoppers, which device forms part of an installation for cork decontamination according to another embodiment of the present invention. Figure 13 shows a container structure 67 formed by walls 68 defining a plurality of elongated compartments 69, each of which is adapted to loosely house a stack or a row of cork stoppers 70. As can best be seen in Figure 14, the mentioned walls 68 can be formed from a plurality of metallic profiles, or profiles of any other material that is strong enough, joined to one another to form crosslinked

lines of compartments 69, like a matrix. However, a person skilled in the art would think of other ways to build the compartments 69 of the container structure 67 without departing from the scope of the present invention. Figures 15 and 16 individually show one of said compartments 69 formed by walls 68. It will be observed that the compartments 69 do not necessarily have to have their sides completely closed, on the condition that side openings are narrow enough to prevent the passage of the cork stoppers 70 therethrough.

[0085] Arranged inside each of the mentioned compartments 69 there is an inflatable sleeve 71, and each of the inflatable sleeves 71 is connected through a system of pipes 72 to a pressurized fluid source (not shown), such as, for example, a conventional compressed air generator. A pilot-operated valve 73 is arranged to allow the passage of pressurized fluid through said system of pipes 72 towards the inflatable sleeves 71 to inflate the inflatable sleeves 71, to retain the pressurized fluid inside the inflatable sleeves 71, or to allow draining them, whereby the inflatable sleeves 71 can be changed, by means of controlling said pilot-operated valve 73, between an inflated state (shown in Figure 16) and a deflated state (shown in Figure 15).

[0086] When each of the mentioned inflatable sleeves 71 is in its deflated state (shown in Figure 15), it is adjacent to the corresponding row of cork stoppers 70 sharing with them a space inside the corresponding compartment 69, and allowing certain movement of the cork stoppers 70 inside the compartment 69. When the mentioned inflatable sleeves 71 are in the deflated state shown in Figure 5, the cork stoppers 70 can be easily loaded into and unloaded from the compartment 69 of the container structure 67. When the cork stoppers 70 have been loaded, forming rows inside the compartments 69, pressurized fluid is provided through the pilot-operated valve 73 and system of pipes 72 to the inside of the inflatable sleeves 71, thus making the inflatable sleeves 71 to adopt their inflated state (shown in Figure 16). In this inflated state, the increased volume of the inflatable sleeves 71 presses the cork stoppers 70 of the corresponding row against the walls 68 of the corresponding compartment 69, immobilizing the cork stoppers 70 inside the compartment 69 in contact with the walls 68.

[0087] Joined to the walls 68 of one side of the container structure 67 there is a plate 74 on which there is assembled a vibrating device 75, which can be one of several types of vibration generating or oscillating devices available on the market fed by an electric, hydraulic or pneumatic power source, or another source. The vibrations generated by the vibrating device 75 are transmitted by said plate 74 to the group of walls 68 forming the container structure 67, and they are in turn transmitted by the walls 68 to the cork stoppers 70 while the latter are kept in contact with the walls 68 by the inflatable sleeves 71 in their inflated state. The vibrating device 75 or the installation includes means for regulating the frequency of such vibrations, which will generally be within the frequency range of 1 to 200 Hz, although frequencies exceeding 200 Hz or even ultrasonic frequencies are not discarded. In any case, the chosen frequency will be the frequency most suitable for causing the air bubbles trapped in the pores of the cork mass to escape, taking with them pollutant gases such as TCA, initially present in said air bubbles.

[0088] The container structure 67 of the embodiment of Figures 13 to 16 can be used directly in the surrounding atmosphere or as a container enclosed in a receptacle, such as the autoclave tank 1 of the preceding embodiments, for the purpose of immersing the cork pieces in a decontaminating liquid, gas or steam, in which case, the vibrations further contribute to facilitating the effective entrance of the liquid, gas or steam intended for the decontamination to the inside of the pores of the cork. Furthermore, the container structure 67 housed inside an autoclave tank 1 can be used in combination with the pressure cycle generating device 40 described in the embodiments shown in Figures 9, 10 and 12 and/or with the vacuum pump 27 described in the embodiments shown in Figures 1 to 5, 11 and 12.

[0089] The method according to the invention consists, according to the preceding description, of arranging the cork to be treated in a container or basket with holes allowing the passage of the liquid. The basket with the cork is introduced in an airtight tank, such as an autoclave. Both the basket and tank in this case are made of stainless steel.

[0090] The container is filled with water and the surface-active and/or surfactant additives to completely cover the basket with the cork.

[0091] The addition of surface-active agents and surfactants favors the penetration of liquid inside the cork. One of these additives is glycerin. Its main advantage is that it is a natural substance for being used in foods, and that it is already found naturally in cork and in wine.

[0092] To improve the performance of the system, the liquid bath is maintained at a temperature of about 30°C by means of heat supply.

[0093] The autoclave is closed in an airtight manner and a vacuum is generated in the atmospheric part of the inside of the autoclave by means of a vacuum pump through a valve for such purpose.

[0094] The vacuum is applied up to approximate values of 30 mbar, which vacuum is maintained for about 20 minutes.

[0095] This vacuum causes a first extraction of gases, including pollutant substances, and the absorption of liquid by the cork is favored.

[0096] Then the pressurization or pressure recovery is carried out inside the autoclave to normal atmospheric pressure values. During this pressurization step, the liquid is forced to enter into the cork. This step is carried out gradually for about 5 minutes so as to not cause the cork to collapse due to the quick increase of the external pressure.

[0097] This pressurization process does not have to

stop upon reaching normal atmospheric pressure values but rather may continue up to overpressure values such as 1 bar by means of supplying compressed air. This must also be done gradually for about 20 minutes. Once the process has ended, in order to open the autoclave it is necessary to match up the internal and external pressures of the autoclave.

[0098] All or part of the described process for favoring the absorption of liquid by the cork can be repeated.

[0099] The cork is removed from the liquid environment, taking the basket with the cork out of the autoclave or draining the liquid therefrom, and the cork is left to rest or stand so as to allow the liquid with additives that has been absorbed to spread therein and dissolve the pollutant substances. This rest is carried out at temperatures of about 40-60°C though temperatures of up to 80°C can be reached. The upper band of temperatures within this range is preferred because it prevents the proliferation of microorganisms.

[0100] To increase the amount of liquid absorbed by the cork, the cork can be sprayed with liquid during the rest step at the previously described temperatures.

[0101] When reusing the liquid in a closed circuit for spraying the cork, it is appropriate to have liquid filtration, purification or replacement methods. If said closed circuit is not installed, it is sufficient to simply prevent the cork from making contact with the contaminated liquid which could drain off.

[0102] During this rest step, an additional application of gases, such as CO_2, ozone or another gas, has also been provided so as to thus obtain better penetration and optimize the dissolution of the pollutant substances with the fluid of the cork pieces, this combination of fluid and gas giving optimal results. Ventilation of the container during the period that the gases are applied will be dispensed with.

[0103] Although lower rest times give considerable decontamination results and longer times give better results, a good compromise between time and performance is between 8-12 hours.

[0104] During this rest step b) it is appropriate to maintain ventilation, whether it is forced or not, to prevent the gases giving off from accumulating and contaminating the cork. Generally, pressurization and depressurization cycles have further been provided which provide in the end an additional extraction of the pollutant substances.

[0105] During the rest time the pollutant substances have been dissolving in the liquid absorbed by the cork.

[0106] It should be pointed out that by applying the principles of this invention it has been seen that when the method is carried out, said cork can be subjected to an elaboration or treatment operation between any of the mentioned steps and generally before the last drying step c). In other words, taking into account that a cycle may comprise, for example, several steps a) followed by one or more steps b), after a first of said steps, the cork can, for example, be machined, for example sliced, laminated, die-cut or perforated. Once said operation has ended, the cork can be subjected to a second step a) and then the cycle can continue. Said operation can alternatively be carried out after a cycle comprising a) + b) and end with step c), or another step a) can be carried out. This would provide advantages relating to the actual operation to be carried out on the cork as the cork is softer and/or more flexible.

[0107] In the next step the liquid with the dissolved pollutant substances is extracted. This process can be carried out with drying by means of techniques known in the art, such as drying in a perforated rotary drum under a hot air jet.

[0108] Alternatively, drying by thermal vacuum has been tested, as has vacuum freeze drying, with satisfactory results. In fact, any drying method that does not make the cork loose its properties is valid.

[0109] The higher the degree of drying the greater is the amount of pollutant substances eliminated from the cork.

[0110] These very low moisture levels in the cork mean that for later handling and treatments in the production stages, the degree of moisture in the cork must be corrected to normal levels of 4% to 8% so that it does not loose its properties. This can be done by means of techniques already known in the art. Liquid spraying under vacuum can also be applied, which accelerates this process and allows obtaining suitable results.

[0111] It is recommended that the liquid to be used in the final wetting for stabilizing the cork is water, distilled water, being able to add additives such as glycerin.

[0112] In each of the steps of the process the cork or the container in which they are located can be agitated and/or stirred to assure greater uniformity in the application on all the cork.

[0113] In another application example during the rest step, in addition to applying temperature pressure is applied (less than 4 bar) for example by means of injecting compressed air into the container, reducing the time needed for the liquid to penetrate the cork. This variant is recommended for granulated cork.

[0114] In another application example during the rest step, the application of temperature is useful to heat water (at temperatures of less than 100°C), a hot and humid atmosphere being generated inside the tank, allowing the cork to acquire a higher degree of moisture and therefore creating a greater capacity to dissolve the pollutant substances.

[0115] A combination of the preceding proposed examples is also possible.

[0116] In these cases, it is also possible to carry out periodical purges to renew the atmosphere inside the container and prevent the accumulation of pollutant gases.

[0117] In relation to the pressure needed inside the treatment container, such pressure can be obtained from pneumatic or hydraulic pressure, and a vacuum pump or an aspiration of the liquid will be carried out to reduce the pressure.

Claims

1. A cork decontamination method intended to remove from the cork different substances causing unwanted odors and tastes, **characterized by** subjecting cork pieces to be decontaminated to a controlled vibration with a frequency of at least 1 Hz.

2. A method according to claim 1, **characterized in that** said vibration is comprised in a frequency range of 1 to 50 Hz.

3. A method according to claim 1, **characterized in that** the mentioned vibration is comprised in a frequency range of 50 to 200 Hz.

4. A method according to claim 1, **characterized in that** the mentioned vibration is of a frequency exceeding 200 Hz.

5. A method according to any one of claims 1 to 4, **characterized in that** vibrations with different frequency ranges are combined during different treatment time periods.

6. A method according to any one of claims 1 to 5, **characterized in that** said vibration is obtained from applying mechanical waves.

7. A method according to any one of claims 1 to 6, **characterized in that** the mentioned cork pieces are immobilized or retained to a certain extent during treatment in a medium.

8. A method according to claim 7, **characterized in that** said immobilization is obtained by arranging the cork pieces in housings held by mechanical means.

9. A method according to claim 7, **characterized in that** said mechanical means providing immobilization are organized in a structure which is subjected to vibration as a whole.

10. A method according to claim 7, **characterized in that** said retention of the cork pieces to a certain extent is obtained by immersing the cork pieces in a fluid with a density degree that limits their mobility.

11. A method according to claim 10, **characterized in that** said cork pieces are arranged inside an airtight tank, and **in that** at any point of the application of said vibratory energy, at least one cycle is furthermore carried out comprising a step for applying pressure exceeding atmospheric pressure followed by a controlled vacuum.

12. A method according to claim 10, **characterized in that** said dense medium is an aqueous liquid at a temperature of less than 99°C.

13. A method according to claim 12, consisting of one or more cycles, each of which comprises at least two of the following steps:

    a) bringing the cork, either in its natural state or its derivatives, into contact with said aqueous liquid, inside a first tank, and generating a vacuum therein under a temperature control;
    b) letting the soaked cork to stand; and
    c) eliminating the absorbed liquid containing unwanted dissolved substances from inside the cork

    wherein said application of mechanical waves is carried out in any of said steps a) or b).

14. A method according to claim 13, **characterized in that** said step c) comprises a cork drying process intended for obtaining moisture levels which are at least less than 6% in the cork mass, which drying process is carried out under a vacuum with a controlled heat energy supply.

15. A method according to claim 10, **characterized in that** said dense medium is a gaseous fluid chosen from a group comprising air, saturated air or steam or CO_2.

16. A method according to claim 13, **characterized in that** said step b) comprises removing the cork from the liquid environment of step a) and carrying out an additional supply of a liquid, controlled by evaporation, spraying or a combination of both.

17. A method according to claim 13, **characterized in that** said standing step b) is carried out under atmospheric pressure.

18. A method according to claim 13, **characterized in that** said standing step b) comprises one or more vacuum cycles.

19. A method according to claim 13, **characterized in that** said standing step b) comprises one or more cycles in which overpressure and a vacuum are combined with one or more ventilation steps.

20. A method according to claim 13, **characterized in that** said step b) is carried out with a controlled temperature of less than 100°C.

21. A method according to claim 7, **characterized in that** a relative movement of the mechanical waves generating source is provided during treatment, with respect to the group of the cork pieces.

22. A method according to claim 10, **characterized in that** said cork pieces are arranged inside an airtight tank, and **in that** at any point of the application of said vibratory energy, at least one oscillation between pressure values exceeding atmospheric pressure are further carried out, from a first low value close to atmospheric pressure, to a high value exceeding atmospheric pressure or vice versa.

23. A method according to claim 22, **characterized in that** the range of pressure values exceeding atmospheric pressure of said oscillation is between 0.2 and 10 Kg/cm^2.

24. A method according to claim 22, **characterized in that** said pressure exceeding atmospheric pressure is less than 10 Kg/cm^2 and said vacuum is in the order of up to 1 mbar.

25. A method according to claim 10, **characterized in that** said cork pieces are arranged inside an airtight tank, and **in that** at any point of the application of said vibratory energy, at least one oscillation is further carried out between pressure values close to atmospheric pressure and a vacuum level.

26. A method according to any one of the previous claims, **characterized in that** a mass formed by the cork pieces during any one of the treatment steps is stirred/agitated and moved.

27. A method according to claim 22, **characterized in that** said cork pieces are arranged inside a pressurized airtight tank, and **in that** at least one controlled ventilation opening is opened during the treatment.

28. A method according to claim 13, **characterized in that** said liquid is water and **in that** it incorporates treating substances or additives with notable surface-active and/or surfactant properties.

29. A method according to claim 13, **characterized in that** the liquid used in steps a), b) is replaced at any point of the process, once or several times.

30. A method according to claim 13, **characterized in that** said overpressure conditions are obtained by hydraulic pumping of a liquid or by injecting a gas under pressure.

31. A method according to claim 10, **characterized in that** the mentioned mechanical waves can be generated in a different medium from the one in which the cork pieces are immersed, providing an arrangement for the transfer of vibratory energy from one medium to another.

32. A cork decontamination installation including an airtight tank (1) and means for inserting and extracting cork pieces from the tank (1), **characterized by** comprising at least one vibration generating device to provide vibratory energy to the cork pieces or to a liquid or gaseous fluid in which the cork pieces may be immersed.

33. An installation according to claim 32, **characterized in that** said means for inserting and extracting comprise a container or drum (6) with at least one loading opening and door, able to contain and retain the cork allowing the passage of fluids there through, which container (6) is held such that it can rotate and/or oscillate in a controlled manner, installed inside said tank (1).

34. An installation according to claim 32, **characterized in that** it incorporates heat energy supply means associated to at least one of the walls of the mentioned container (6).

35. An installation according to claim 34, **characterized in that** said energy supply means consist of a pipe (11) as a coil extending along the inner side wall of said container (6), through which pipe (11) an externally heated heat-transfer fluid circulates, which fluid passes through a rotary joint (12) installed in one of the rotation supports of said container (6).

36. An installation according to claim 34, **characterized in that** said energy supply means consist of a pipe as a coil extending along the wall of said container, through which pipe an externally heated fluid circulates, which fluid passes through a rotary joint installed in one of the rotation supports of said container, said pipe having a plurality of outlet holes distributed throughout the same and oriented towards the inside of the container.

37. An installation according to claim 33, **characterized in that** strips (33) fixed to the inner wall of the container (6) have been provided for agitating the cork pieces when said container (6) rotates.

38. An installation according to claim 33, **characterized in that** the container (6) which rotates and contains the corks is coupled to a closing cover (2) of the container (6) and **in that** a motor (10) has been provided to rotate the container (6), which motor (10) is arranged in the outer part of said cover (2).

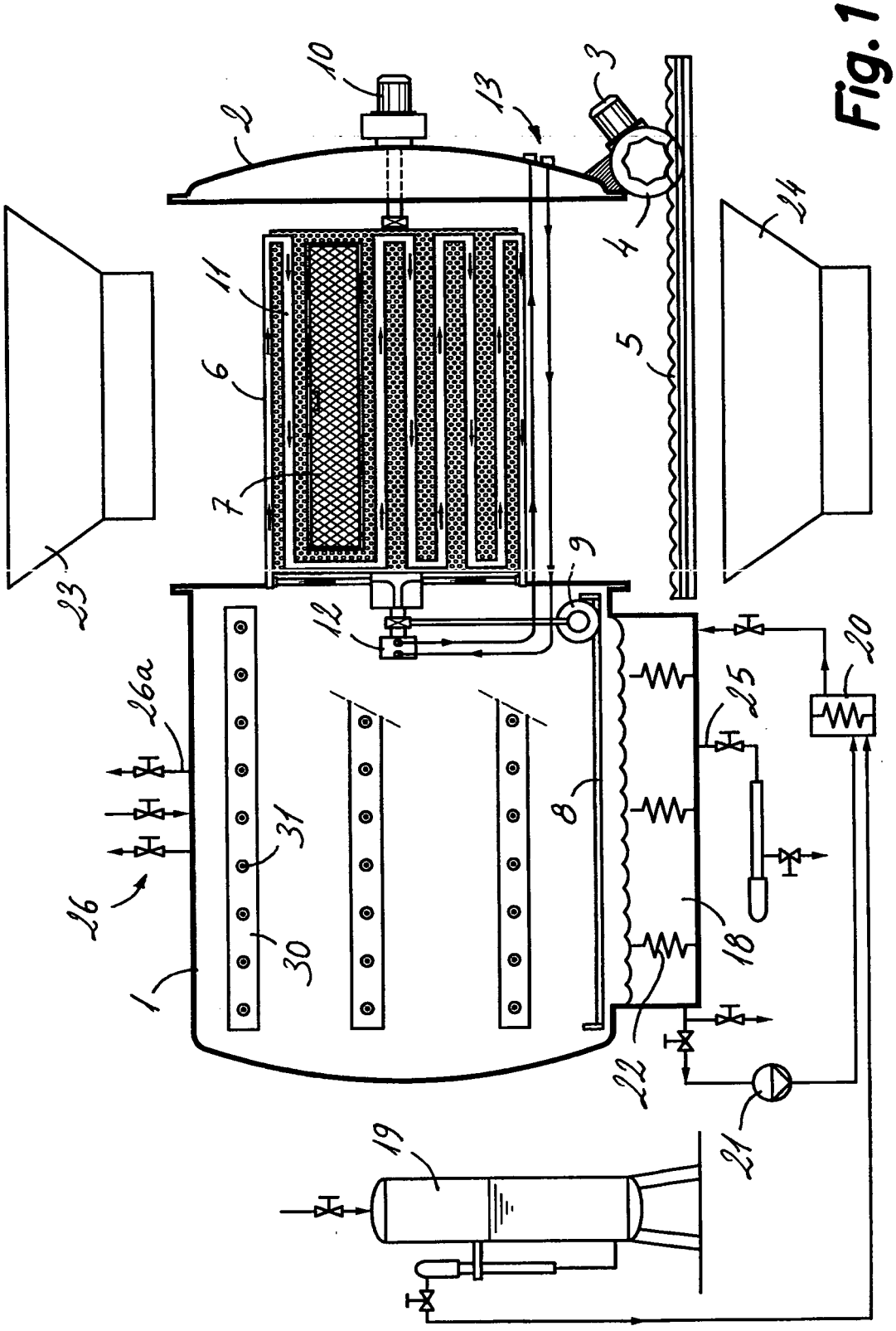


Fig. 1

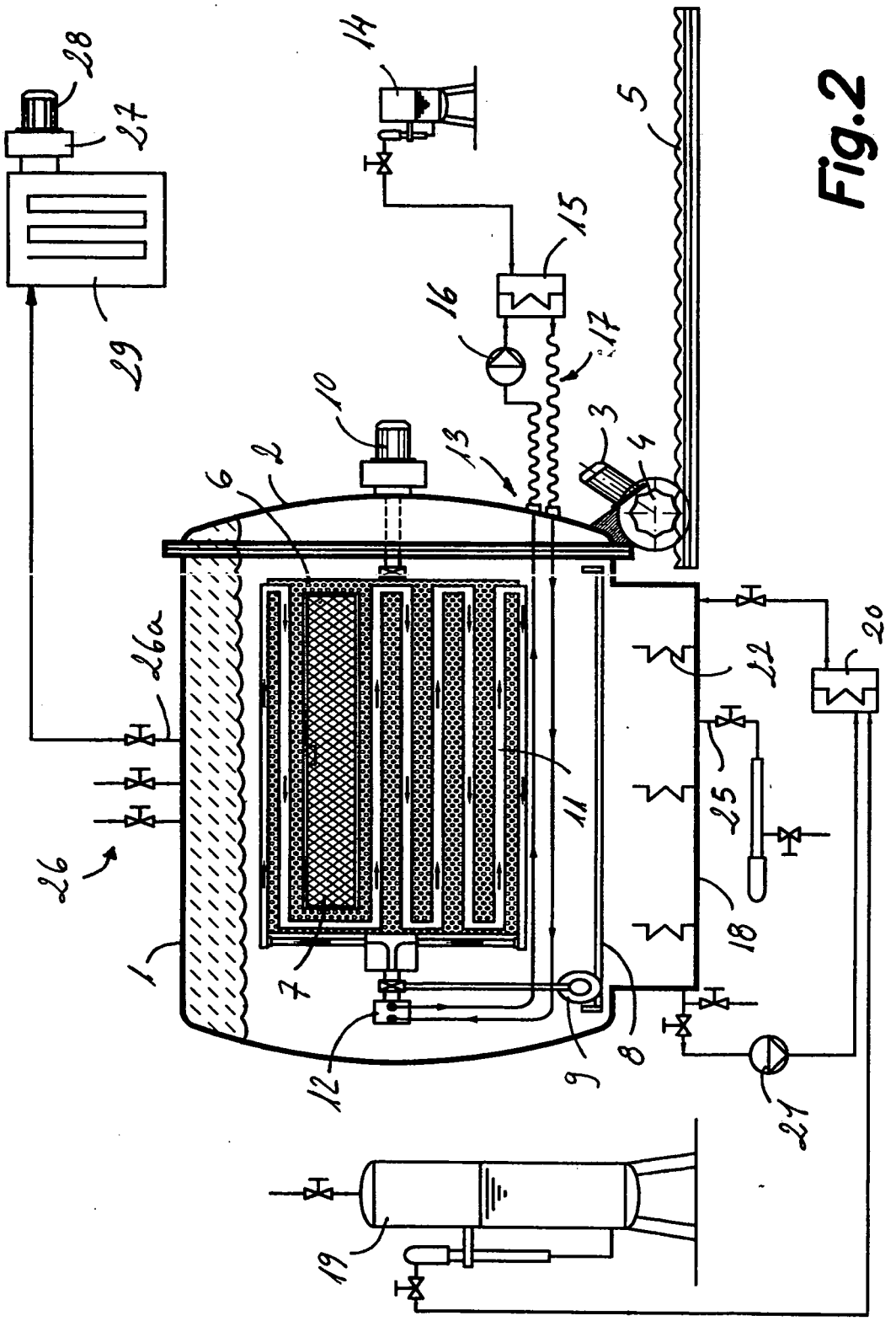


Fig.2

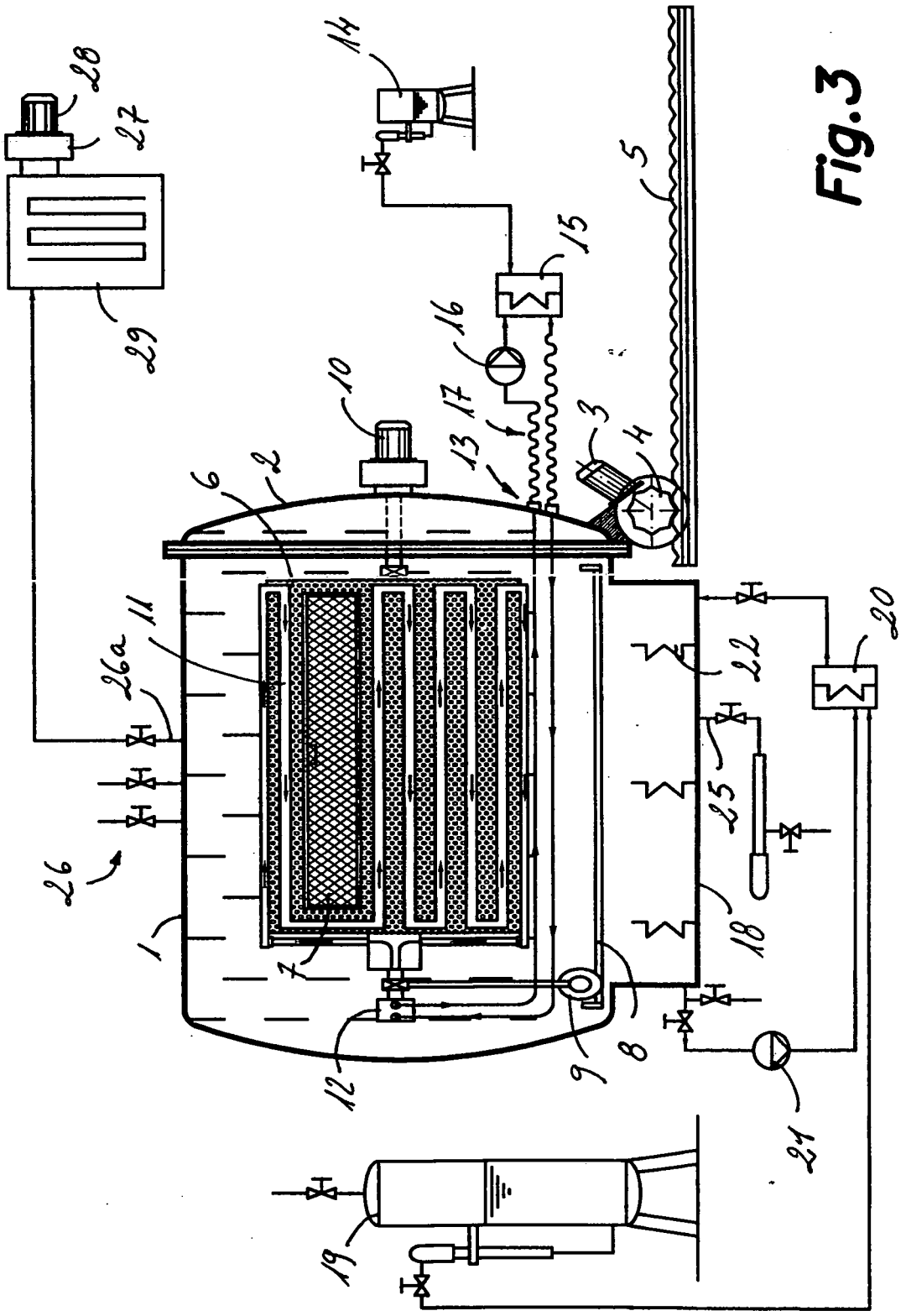


Fig.3

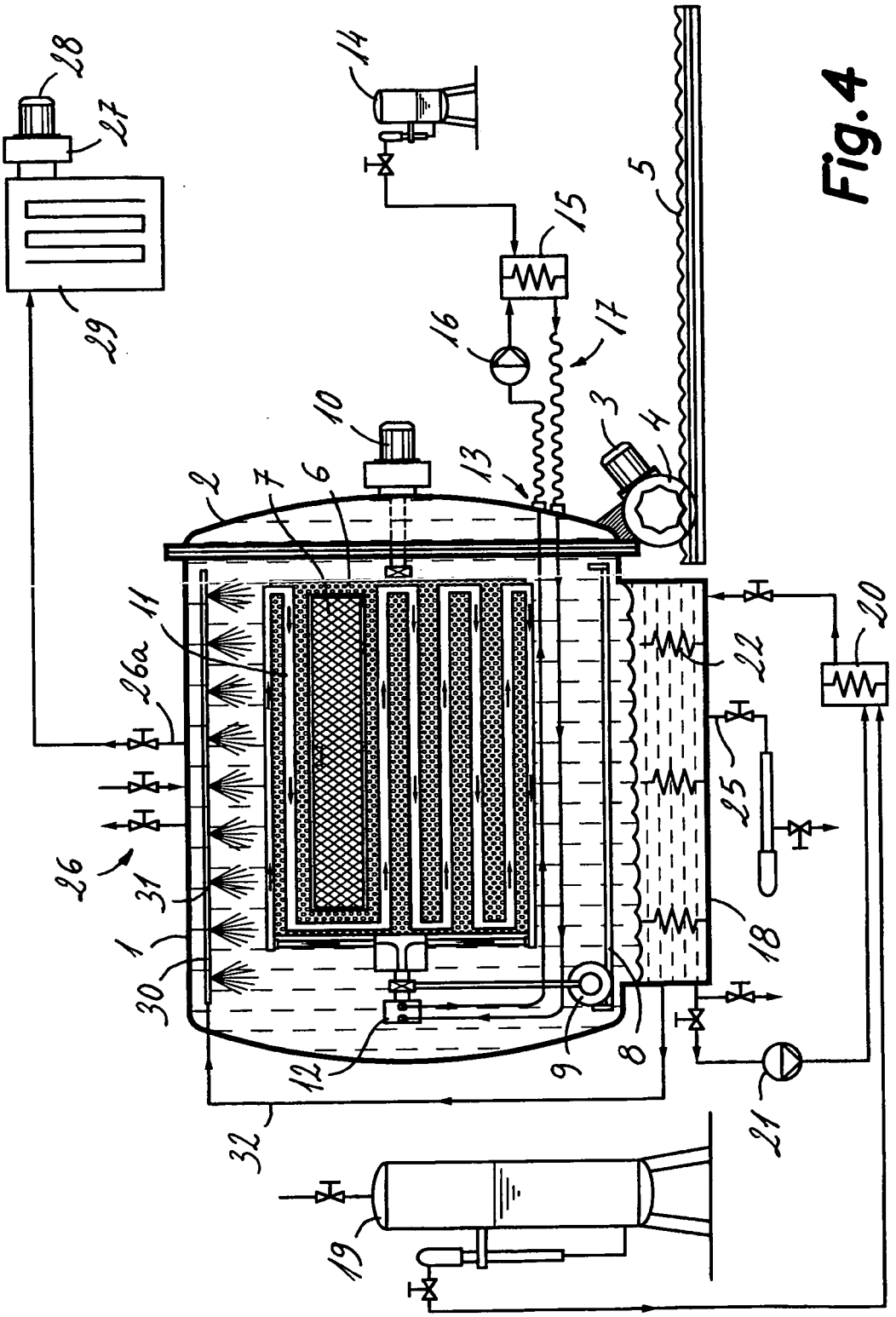

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Fig.4

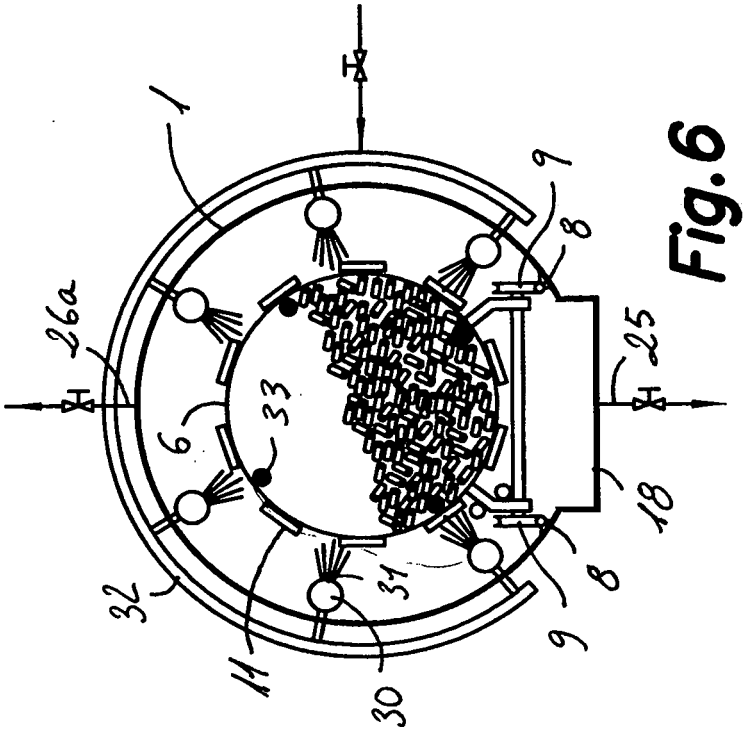


Fig.6

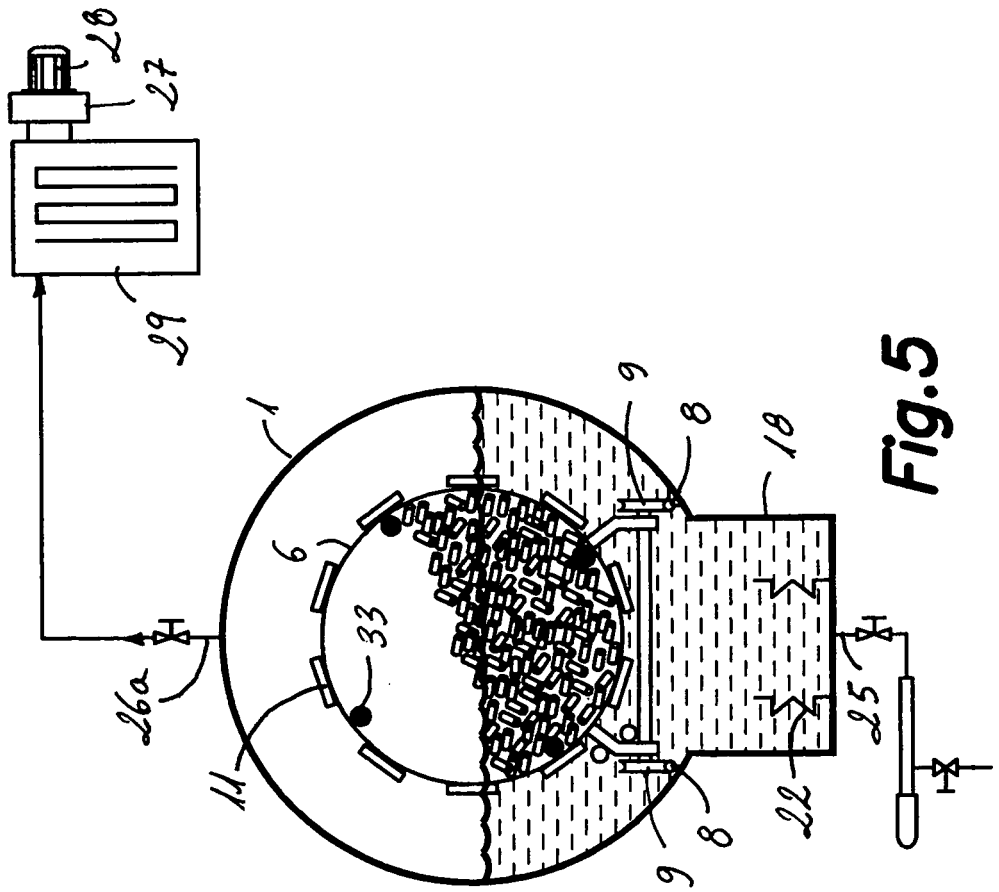


Fig.5

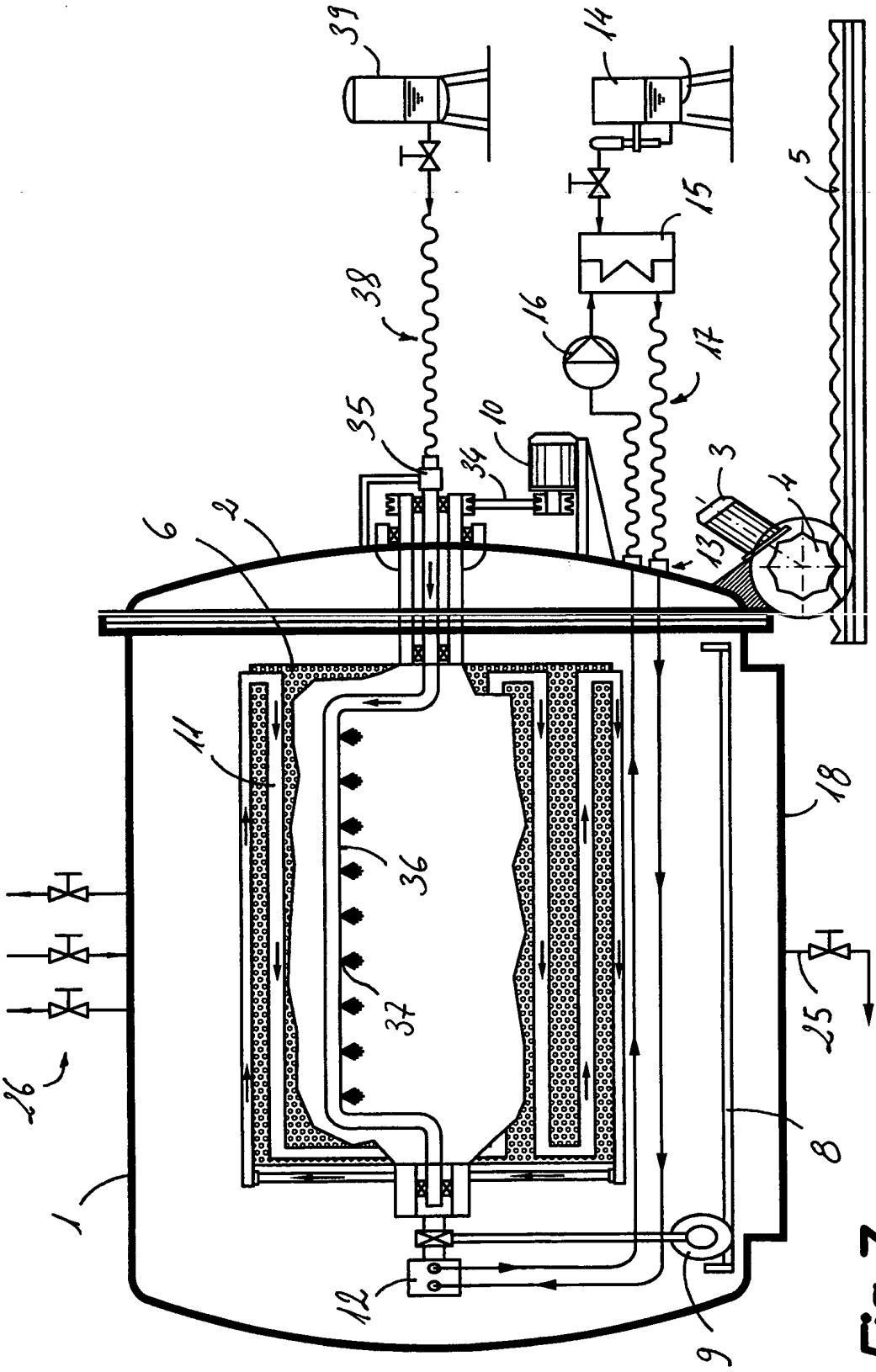


Fig.7

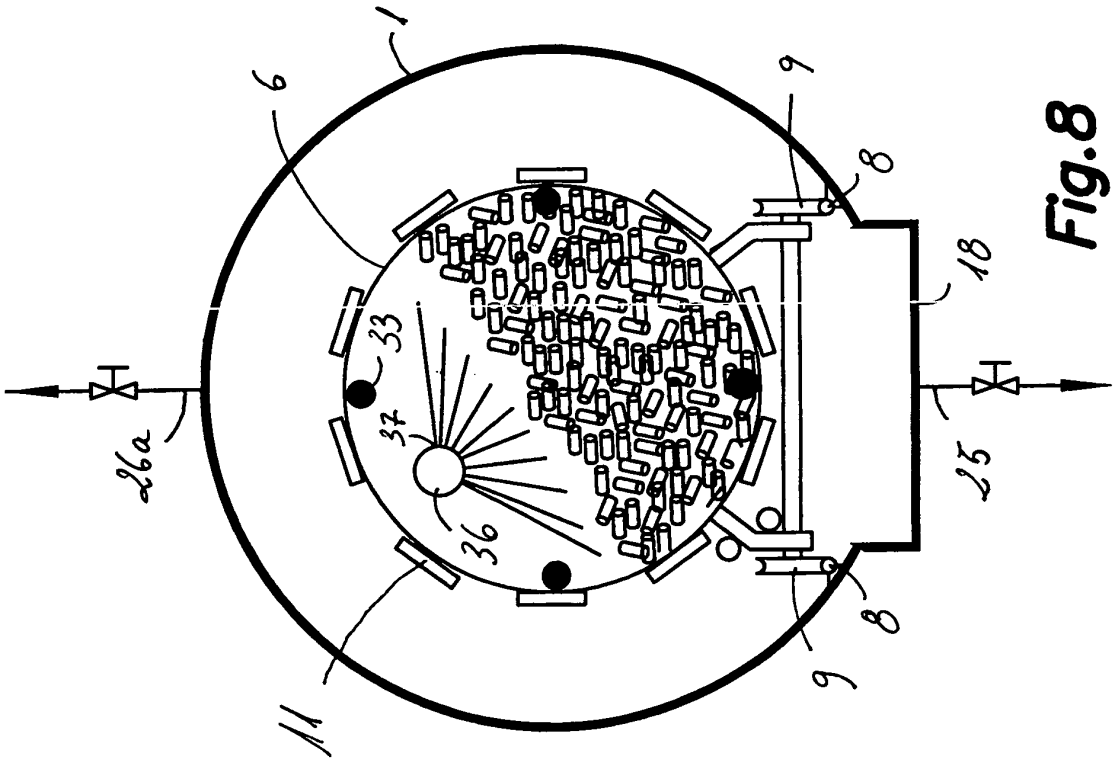


Fig.8

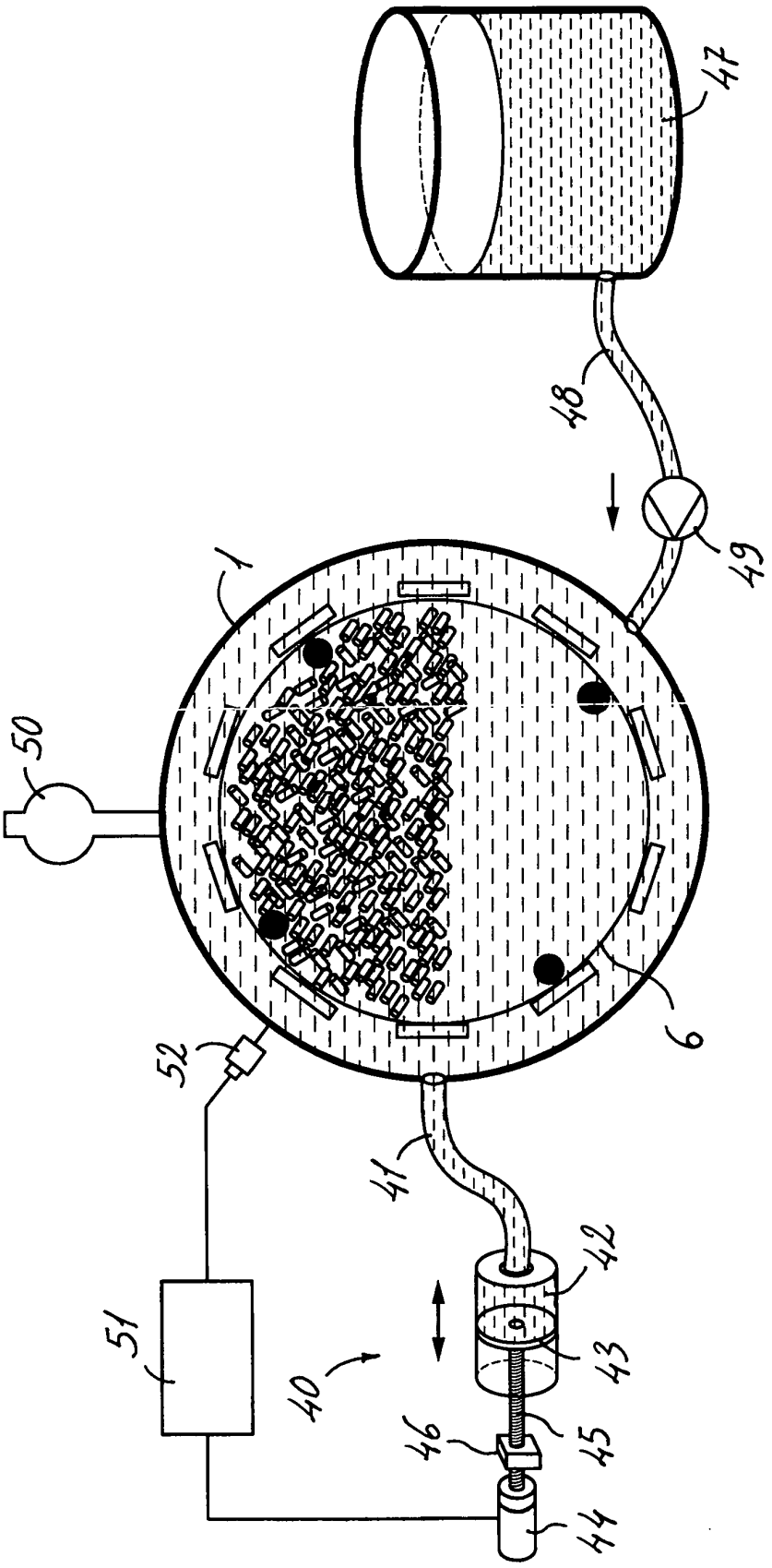


Fig.9

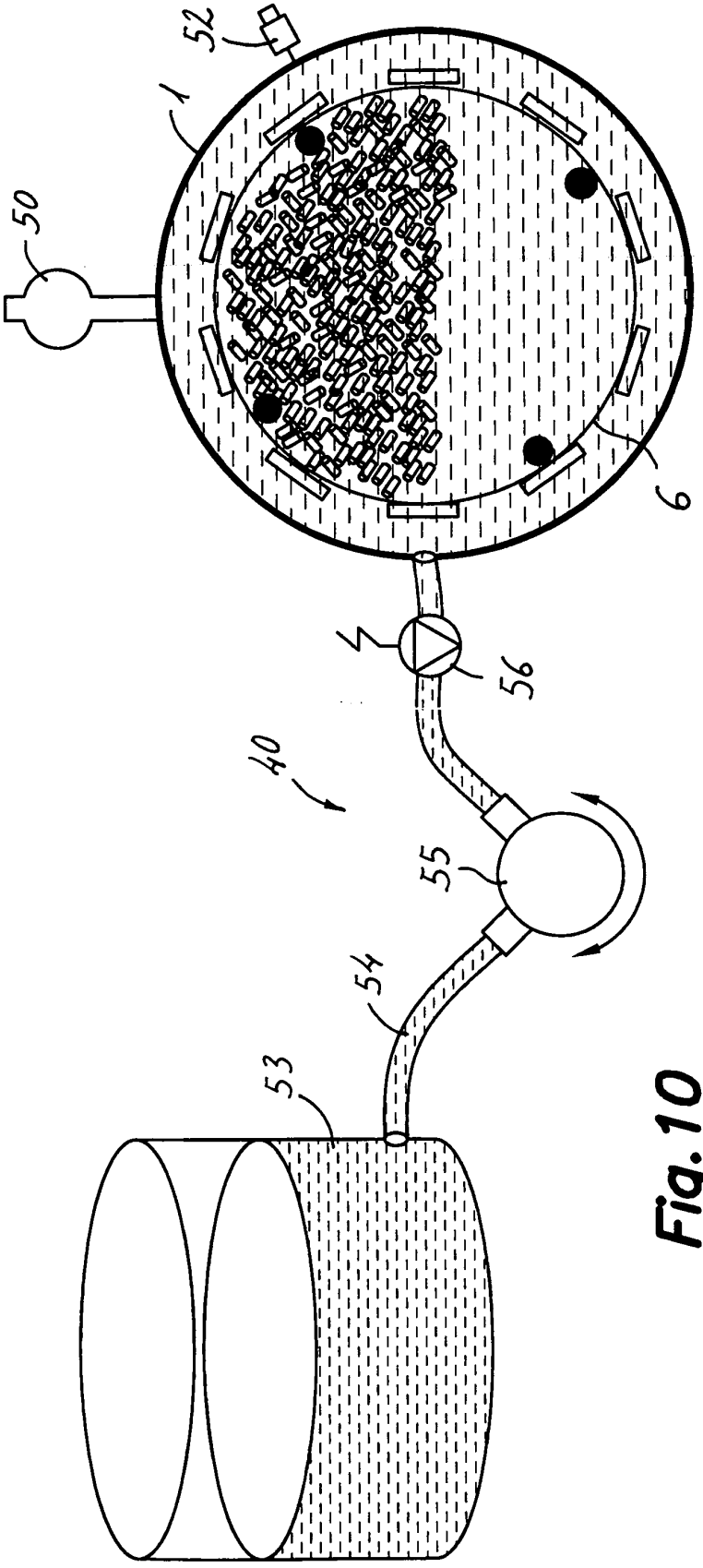


Fig. 10

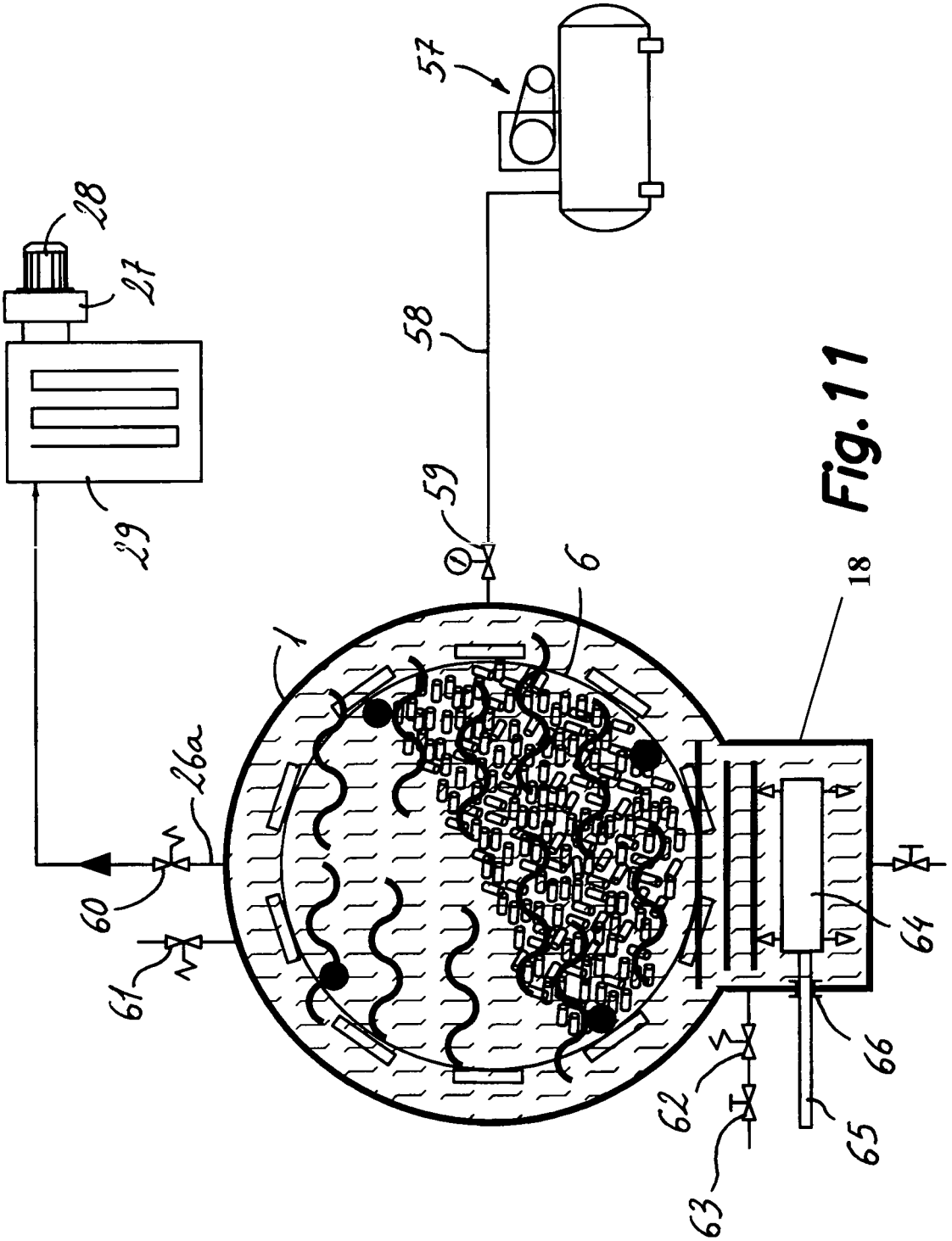


Fig.11

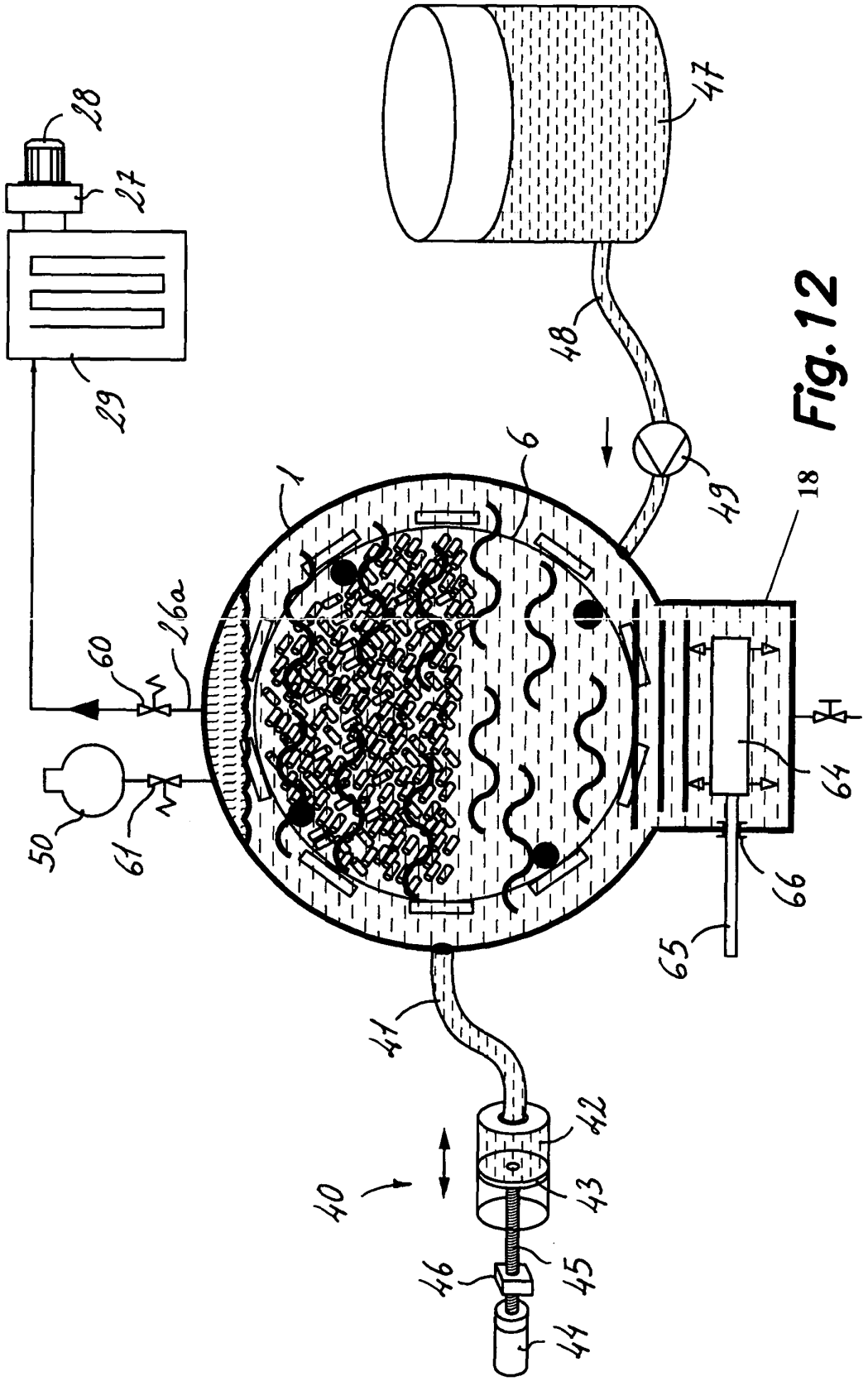


Fig.12

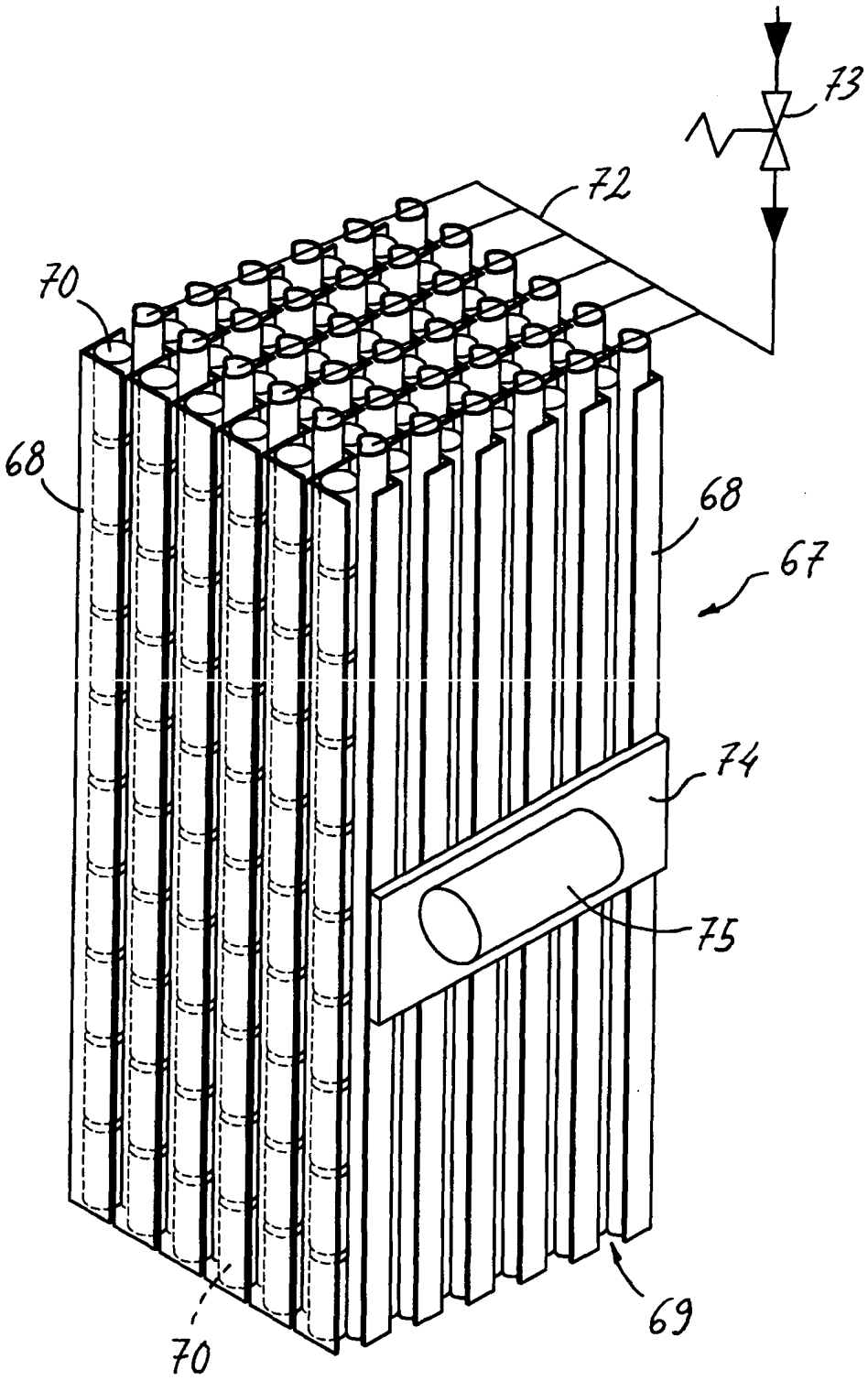


Fig. 13

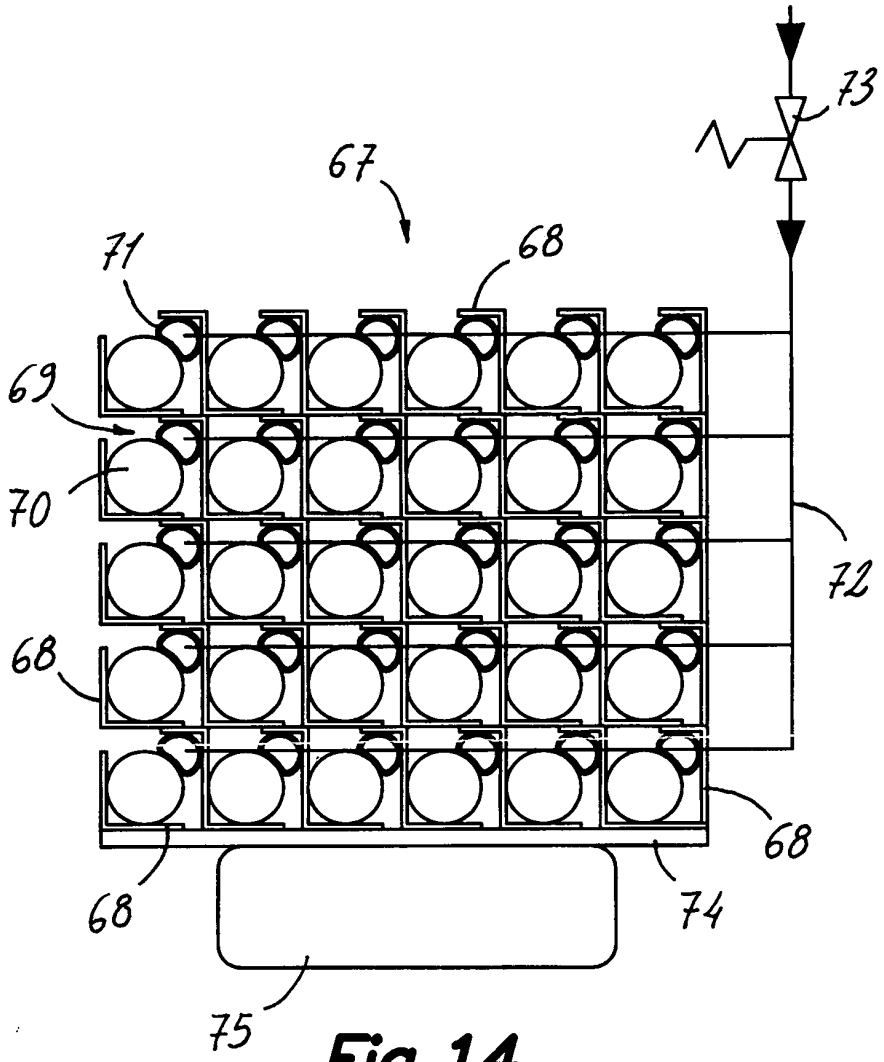


Fig. 14

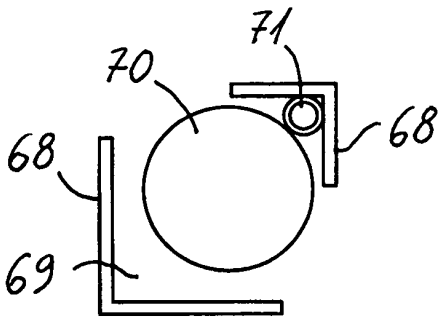


Fig. 15

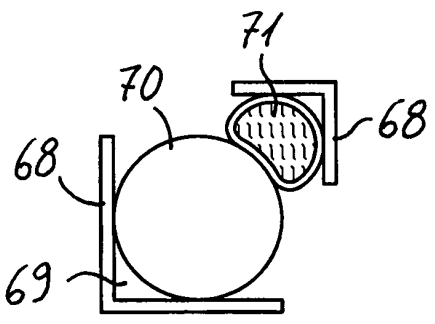


Fig. 16

INTERNATIONAL SEARCH REPORT

International application No.
PCT/ ES 2006/000073

A. CLASSIFICATION OF SUBJECT MATTER

IPC 8 : *B27K 7/00* (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 8 : B27K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CIBEPAT,EPODOC,PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB-258086A (JENSEN) 16.09.26 page 2	1, 32
A	ES-2006879A (PEY) 16.05.89 The whole document	13, 33-34, 38
A	ES-2051405A (SUNTORY) 16.06.94 The whole document	13, 33-34
A	ES-2155290A (PRODUTOS Y MAQUINARIA DEL CORCHO, S.A.L.) 01.05.01 The whole document	13, 33-34, 38
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A	EP-1108507A (AMORIM) 20.06.01 The whole document	13
A	WO-2004004995A (GODOY) 15.01.04 page 5	13,17
A	FR-2639282A (EGBA S.A.) 25.05.90 The whole document	13, 33-34, 38

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 May 2006 (30.05.06)	12 June 2006 (12.06.06)
Name and mailing address of the ISA/ S.P.T.O.	Authorized officer
Facsimile No.	Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International Application No
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