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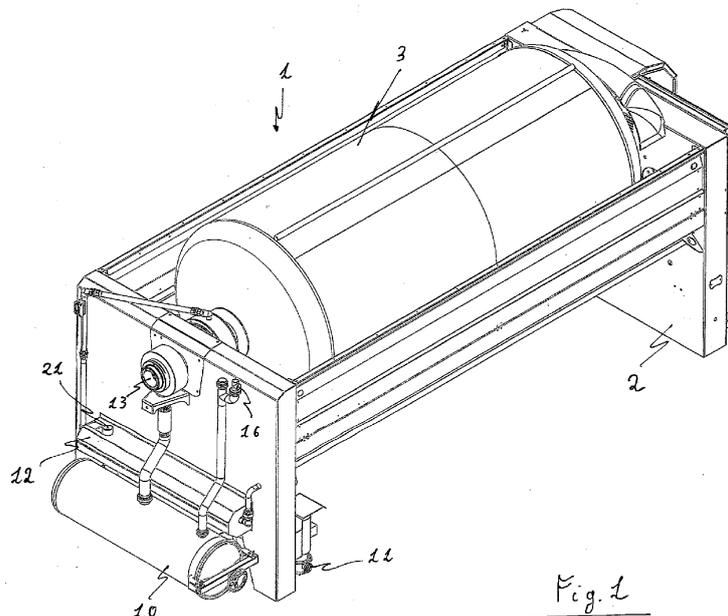
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(54) **APPARATUS FOR THE PRESSING OF VEGETABLE PRODUCTS IN CONTROLLED INERT ATMOSPHERE EQUIPPED WITH MOLECULAR SEPARATOR DEVICE FOR SELF-PRODUCTION OF INERT GAS**

(57) Apparatus for the pressing (1) of vegetable products in controlled inert atmosphere equipped with molecular separator device for the self-production of inert gas including a pressing tank (3), suitable for executing the separation of the liquid fraction of a vegetable product contained therein and internally provided with a deformable membrane (4) separating a pressure chamber (5) from a pressing chamber (6), said membrane being de-

formable for pressure difference in the chambers (5, 6) and wherein the pressing chamber (6) is suitable for receiving the vegetable product to be treated and for operating in inert atmosphere, wherein the inert gas for the working in inert atmosphere is generated by a molecular separator device (12) with which the apparatus for the pressing (1) is properly equipped.



EP 3 825 111 A1

Description

[0001] This invention relates to an apparatus for the pressing of vegetable products in controlled inert atmosphere equipped with molecular separator device for the self-production of inert gas.

[0002] The innovation has particular but not exclusive application in the industrial sector of the production and marketing of apparatuses for the pressing of vegetable products, in particular of apparatuses for the pressing of vegetable products in controlled inert atmosphere which are widely intended to be used in the food domain and in general in the industry of production and marketing of apparatuses suitable for allowing the pressing of vegetable products which are aimed at the extraction of their juices and musts, in particular in the oenology domain.

Prior art

[0003] Particularly in the food domain there is the need to treat vegetable products, such as mainly fruits or grapes, so as to extract the musts for the purpose of proceeding to their further processing for the preparation of drinkable beverages mainly for consumption. Mainly, even if not exclusively, in the oenology domain the need to execute a pressing of the collected grapes which is suitable for preserving as much as possible the quality of the extracted musts constitutes a phase of considerable importance in the domain of the procedure which leads to the vinification of said musts themselves, said phase being able to considerably influence the final result of the following processing which the extracted must undergoes, considering the circumstance that during the extraction phase of the musts the fact of ensuring the greater preservation possible of the organoleptic characteristics of the extracted must is of essential importance. Because of the mentioned need to preserve the organoleptic characteristics of the extracted musts, as for what is of interest, there are apparatuses for the pressing of vegetable products which are actuated to operate the extraction of juices or musts in controlled inert atmosphere in order to avoid, or at least to reduce significantly, undesired phenomena of oxidative degradation which may contaminate said juices or musts during the pressing procedure in case, during said pressing procedure itself, they are exposed to the contact with the oxygen of the atmospheric air. In this way, during the pressing procedure the fact of providing the replacement of the air contained in the pressing chamber with inert gases, such as usually nitrogen or carbon dioxide, has allowed to strongly limit all the drawbacks due to the oxidative degradation which would have otherwise been triggered by the presence of oxygen in the pressing chamber. In pressing apparatuses presently known, among the different methods used for allowing to carry out the extraction of musts in inert atmosphere, the bipartition is known between throwaway methods and recovery methods, in which in the first method, the throwaway method, the inert gas intro-

duced in the pressing chamber is successively intended to be expelled from it without being recovered for successive pressing cycles as instead it happens in the pressing apparatuses which execute the recovery method. A specific characteristic of the pressing method and apparatuses providing that the inert gas used is introduced in a throwaway manner is that it has to include different apparatuses for the generation of inert gas or the help of storage devices of inert gas such as, for example, nitrogen cylinders, with the relative disadvantages due on the one hand to the considerable cost of the current plants for generating inert gas or to the need to provide the refill and/or replacement of the cylinders of inert gas. On the other side, in the methods and in the apparatuses providing the recovery of the inert gas introduced in the apparatus for the execution of the pressing cycle, the use is provided of a known quantity of inert gas which is introduced and extracted from the pressing chamber by means of the use of the pressing membrane of the pressing chamber of the apparatus for the pressing. Usually in said solutions of apparatuses for the pressing using the recovery treatment method with inert gas, the use is provided of an inflatable chamber through which said recovery of the inert gas can take place, in short realizing a closed circuit within which said inert gas transits. The solutions of pressing apparatuses making it possible to recover the inert gas have some drawbacks linked to their own structuring among which the one due to the size of the inflatable element and to the possibility that contaminating substances may remain in the circuit consequently contaminating the treated product.

[0004] With particular reference to the technical domain of the invention, different solutions of apparatuses for the pressing of vegetable products can be also found in the patent literature. Among the solutions found in prior art the following are reported:

D1: ITTV910030 (U1) (VELO SPA)
 D2: RU2378358 (MEKHUZLA)
 D3: AU2005211517 (PROVENZALE)
 D4: IT102015000063588 (PULEO srl)

[0005] D1 synthetically describes a solution of pneumatic press of the type with membrane in particular for the pressing of grapes and includes a substantially horizontal drum which is partially holed and supported in a revolving way by a support frame. The drum is filled with grapes and is internally provided with an impermeable and deformable membrane, which, for the effect of the action of a fluid under pressure introduced in the drum, executes the pressing of the grapes, with consequent must which exits from the holes of the drum. The support frame is essentially composed of a first hollow portion, a wall which supports one end of the drum and a second hollow portion protruding with respect to the first hollow portion and communicating with it. A part of said second hollow portion supports the other end of the drum.

[0006] D2 synthetically describes a solution of a meth-

od for treating bunches of grapes able to allow to execute the extraction of the juice from them in which the bunches of grapes to be treated are intended to be loaded in the treatment apparatus by means of an appropriate conveyor of the type with cochlea to be then treated by means of execution of a pressing which takes place by means of a pneumatic press following which the must so obtained is collected in an appropriate container in which the must is cooled by means of the action of a cooler, where the must so treated is successively sent to a sedimentation chamber. After a provided sedimentation phase the deposit is intended to be separated and removed and the remaining must to be refrigerated to be brought to the fermentation temperature and brought to fermentation in fermentation basins until the complete fermentation of sugars and then the fermented must is pumped into the storage tank. During the active fermentation phase the fermentation smokes and carbon dioxide produced are discharged from the fermentation container by means of the cover of the upper door of the smoke condenser where the smokes condense, said smokes including carbon dioxide and an aqueous alcoholic mixture, the carbon dioxide being intended to be compressed by means of a two-stage compressor to be then cooled by means of refrigerating means, said carbon dioxide so treated being then filtered by means of a three-stage filter of which the first is intended to be suitable for removing the vapour and alcohol residues by means of filtering means with filter with pores of 1 μm , the other filters, one of which with activated carbon, absorbing the rest of the impurities being equipped with pores of 0.2 μm , the carbon dioxide so purified being reused in the plant.

[0007] D3 synthetically provides a solution of apparatus and a method for extracting liquids from a mixture of solids and liquids or from a mixture of liquids and gases where in a preferred execution solution the proposed invention is particularly suitable for allowing the extraction of must from grapes, fruits and similar and especially to allow the wine extraction from a mass of fermentation products such as fermented grapes and in which said extraction is carried out in a two-stage apparatus able to carry out said extraction, said apparatus including:

a deformable body able to receive the mixture of product to be treated and in which said deformable body is equipped with deformable walls;
 means for, relative to the external pressure, reducing the pressure inside said deformable body, which pressure-reducing means are provided in communication with said deformable body;
 means through which the passage is allowed of the treated product, in which the pressure-reducing means induce said deformable walls to shrink in order to compress said product mixture to be treated forcing the passage of the treated product through said transit means.

[0008] In D4 a solution is described of apparatus and

relative method able to force the passage and the recovery of an inert gas, used inside a pressing tank of a press suitable for pressing vegetable products, where said pressing tank is provided with two zones, separated by a membrane, which are respectively a pressing zone or chamber, containing both said inert gas and said vegetable products to be pressed, and a pressure zone or chamber where air is blown or sucked, respectively by a compressor and/or by a blower, in which said forced passage of said inert gas, from said pressing zone or chamber, containing said vegetable products to be pressed by means of said pressure zone or chamber, towards an accumulation tank, during the whole loading and pressing process of said vegetable products, is obtained in a forced way, by means of at least one compressor, in such a way as to obtain the constant purification of said inert gas itself, through the filters, the dryer and the filters, which are connected to the circuit of said compressor and to said accumulation tank and in which before the pressing of said vegetable products, said apparatus is saturated with the execution in sequence of the following operative Phases:

Phase 1: the vent valve opens and contextually said compressor is started to allow, by means of the membrane, the exit of all the air which is in said pressing zone or chamber;

Phase 2: said vent valve closes and said blower is activated which carries out a suction action of the residual air, which could still be present between said membrane and the circuit of said press;

Phase 3: the valve for introduction of said inert gas is opened and, contextually, said blower executes the vacuum in said pressure zone or chamber, allowing the following introduction of said inert gas, coming from at least one cylinder, where, said introduction occurs for pressure difference and not for the movement of said membrane;

Phase 4: once the saturation pressure is reached of the system in the overall circuit of said apparatus, said introduction valve is closed, making said apparatus saturated with said inert gas.

Drawbacks

[0009] All the known solutions of apparatuses for the pressing of vegetable products of prior art have deficiencies and limits which result in consequent disadvantages.

[0010] A first limitation involving all the known solutions of apparatuses for the pressing of vegetable products, particularly executing working cycles in inert atmosphere, in the opinion of the applicant, relates to the detected circumstance for which said solutions are limited by the dependence on external systems with limited capacity of inert gas supply also in the case of apparatus for the pressing which includes systems for recycling and/or accumulation of the inert gas which systems however do not appear as optimized.

[0011] A second limitation involving all the known solutions of apparatuses for the pressing of vegetable products, particularly executing working cycles in inert atmosphere, in the opinion of the applicant, relates to the detected circumstance for which said solutions, because of their structuring, do not allow to obtain a fast saturation of the pressing environment and furthermore they do not allow to easily carry out a pressurization in inert atmosphere of the pressing environment suitable for increasing the draining speed of the liquid fraction of the treated vegetable product.

[0012] Another limitation of the current known solutions of apparatuses for the pressing of vegetable products of prior art, particularly executing working cycles in inert atmosphere, in the opinion of the applicant, relates to the detected circumstance for which because of their structure it is substantially not possible to operate said apparatuses for the pressing also beyond the periods of use for the pressing for the production of inert gas for other purposes, furthermore, the apparatuses for the pressing of prior art particularly designed for the execution of the cycles in inert atmosphere, being unsuitable for constituting a hybrid system also able to carry out pressing cycles in the absence of inert gas.

[0013] On the whole, from these introductive considerations, it can be understood that the identification of alternative solutions is certainly of prime importance.

[0014] Aim of this invention is also to avoid the above-mentioned drawbacks.

Summary of the invention

[0015] This and other aims are reached by the present invention according to the characteristics of the appended claims solving the problems described by means of an apparatus for the pressing (1) of vegetable products in controlled inert atmosphere equipped with molecular separator device for the self-production of inert gas comprising a pressing tank (3), suitable for operating the separation of the liquid fraction of a vegetable product contained therein and internally provided with a deformable membrane (4) separating a pressure chamber (5) from a pressing chamber (6), said membrane being deformable for pressure difference in the chambers (5, 6) and wherein the pressing chamber (6) is suitable for receiving the vegetable product to be treated and for operating in inert atmosphere, where the inert gas for the working in inert atmosphere is generated by a molecular separator device (12) with which the apparatus for the pressing (1) is properly provided.

Aims and advantages

[0016] In this way, through the considerable creative contribution the effect of which constitutes an immediate technical progress, multiple advantages are achieved.

[0017] A first advantageous aim of the innovative solution object of the present invention is to obtain an ap-

paratus for the pressing of vegetable products in controlled inert atmosphere equipped with molecular separator device for the self-production of inert gas which, with respect to the solutions of apparatuses for the pressing of vegetable products presently known, thanks to the molecular separator device it is provided with, allows to obtain on machine a production of inert gas with unlimited capacity in such a way as to considerably optimize the pressing cycles in inert atmosphere.

[0018] A second advantageous aim of the innovative solution object of the present invention is to obtain an apparatus for the pressing of vegetable products in controlled inert atmosphere equipped with molecular separator device for the self-production of inert gas by means of which, if compared to the solutions of apparatuses for the pressing of vegetable products presently known, allows to obtain an availability of inert gas able to satisfy all the working cycles in inert atmosphere without the need to turn to systems of recycling and/or accumulation of the inert gas.

[0019] Another advantageous aim of the innovative solution object of the present invention is to obtain an apparatus for the pressing of vegetable products in controlled inert atmosphere equipped with molecular separator device for the self-production of inert gas by means of which, with respect to the solutions of apparatuses for the pressing of vegetable products presently known, allows to significantly reduce the times of saturation of the pressing environment and, by means of the pressurization of the environment in inert atmosphere, to increase the draining speed of the liquid fraction of the treated vegetable product.

[0020] An additional advantageous aim of the apparatus for the pressing of vegetable products in controlled inert atmosphere equipped with molecular separator device for the self-production of inert gas of the innovative solution object of the present invention is to allow the operativeness of the apparatus for the pressing also beyond the periods of use intended for the pressing, allowing the production of inert gas for other purposes, furthermore said apparatus for the pressing of the invention turning out to be suitable for constituting a hybrid system able to execute pressing cycles also in the absence of inert gas.

[0021] Another advantageous aim of the apparatus for the pressing of vegetable products in controlled inert atmosphere equipped with molecular separator device for the self-production of inert gas of the innovative solution object of the present invention is to allow the possibility to connect the apparatus for the pressing to external equipment for generation of compressed air avoiding the need to prepare an on-machine compressor, the apparatus for the pressing of the innovative solution being further advantageously actuated integrating on-machine filtering and treatment devices of compressed air which allow to prepare the apparatus for the use with external equipment for generation of compressed air.

[0022] An additional advantageous aim of the appa-

tus for the pressing of vegetable products in controlled inert atmosphere equipped with molecular separator device for the self-production of inert gas of the innovative solution object of the present invention is to have the possibility to use the same compression unit for feeding the pressure chamber as well as for feeding the molecular separator device in the generation of inert gas.

[0023] These and other advantages will appear in the following detailed description of some preferred embodiments with the aid of the enclosed schematic drawings whose execution details are not to be considered limitative but only illustrative.

Content of the drawings

[0024]

Figure 1 shows a three-quarter overall view from above of the apparatus for the pressing of vegetable products in controlled inert atmosphere equipped with molecular separator device for the self-production of inert gas of the inventive solution object of the present invention in a view in which the molecular separator is visible;

Figure 2 shows a three-quarter overall view from above of the apparatus for the pressing of vegetable products in controlled inert atmosphere equipped with molecular separator device for the self-production of inert gas of the inventive solution object of the present invention in a view in which the drive and control unit and the air filtering group are visible;

Figure 3 shows a working scheme of the apparatus for the pressing of vegetable products in controlled inert atmosphere equipped with molecular separator device for the self-production of inert gas of the inventive solution object of the present invention.

Practical realization of the inventive solution

[0025] Referring with no limitation also to the content of the drawings of the representations of figures from 1 to 3, an apparatus is described for the pressing of vegetable products in controlled inert atmosphere equipped with molecular separator device for the self-production of inert gas, in which the apparatus for the pressing (1) of the innovative solution object of the invention provides a load-bearing structure (2), which last can be also provided with wheels to facilitate the movement, which load-bearing structure (2) itself is intended to be opportunely actuated for the purpose of allowing the advantageous support and anchorage of the devices and contrivances which functionally form the apparatus for the pressing (1), said support and anchorage to the load-bearing structure (2) of the devices and contrivances which form the apparatus for the pressing (1) taking place in a known way and by means of the use of anchorage and/or engagement means of known type. More in detail as represented in figures from 1 to 3, the pressing apparatus

(1) of the innovative solution object of the present invention includes a pressing tank (3) of known type being internally equipped with a membrane (4), particularly said membrane (4) being intended to be made of food non-toxic plasticized fabric or anyway in known material with similar functional characteristics and said membrane (4) being opportunely and in a known way engaged to the internal wall of the pressing tank (3).

[0026] The membrane (4) with which the apparatus for the pressing (1) is provided, is intended to be deformable, in the execution example described and preferably, but not necessarily, also being dimensionally prearranged to allow, in a known way, to get close almost in adhesion to at least part of the internal wall of the pressing tank (3) which, by means of the membrane (4) itself is divided into a pressure chamber (5) and into a pressing chamber (6). More in detail, as particularly represented in figure 3, it is provided that both the pressure chamber (5) and the pressing chamber (6), by means of the membrane (4), are chambers with variable volume according to the deformation movements given to the membrane (4) itself in consequence of the operating phases to which it is driven. The pressing tank (3), which in the described example is preferably horizontally arranged, is actuated in a known way for the purpose of allowing the extraction of the liquid fraction of the vegetable product in consequence of the push under pressure exerted by the membrane (4) on the vegetable product to be pressed within the pressing chamber (6). The pressing tank (3) itself, for said purpose of allowing the extraction of the liquid fraction from the treated vegetable product, is intended to be equipped with known holed and/or channelled devices suitable for allowing the separation and the draining of the liquid fraction of the treated vegetable product. By way of example said holed and/or channelled devices can consist of a known wall equipped with holed longitudinal small channels to which said membrane (4) is opposed or other equivalent of known type and with which the pressing tank (3) is provided for said purpose of cooperating with the membrane (4) for the separation of the liquid fraction of the treated vegetable product.

[0027] It is further provided that the pressing tank (3) is opportunely actuated, in a known way, to both allow the loading of the vegetable product to be treated and allow to carry out the discharge of the fractions obtained of the vegetable product after the treatment process and also to possibly allow the access for preparation and/or maintenance purposes. The pressing apparatus (1) of the innovative solution object of the invention, is intended to further comprise air extraction and/or blowing means such as a blower (7) suitable for opportunely moving an airflow inside the pressing tank (3) in at least the pressure chamber (5), said apparatus for the pressing (1) being further equipped with a filtering group (8) of known type provided with known filtering devices and suitable for allowing to carry out at least the filtering of the compressed air which is introduced into the pressure chamber (5) from an air compression unit (9) of known type which last, in

the execution example described as particularly shown in figure 3, is provided to be external to the apparatus for the pressing (1) even though it is indifferently possible that the air compression unit (9) be a piece of equipment of the apparatus for the pressing (1) itself. Furthermore, the apparatus for the pressing (1) of the inventive solution is intended to be equipped with at least one must tank (10) which is opportunely placed in communication with the pressing chamber (6) of the pressing tank (3), within which must tank (10) the liquid fraction of the treated vegetable product is made to flow, said must tank (10) being intended to be opportunely provided with level sensors (24, 25) of known type suitable for allowing the detection at least of a minimum level and of a maximum level of the must contained inside the must tank (10) in such a way as to allow to determine the appropriate moment for the activation and the deactivation of a must pump (11) conveniently connected to the must tank (10) and suitable for allowing that, all or part of, the must contained in the must tank (10) flows to a storage tank external to the apparatus for the pressing (1).

[0028] Innovatively, the apparatus for the pressing (1) for the purpose of allowing the execution of working cycles in inert atmosphere, is equipped with a molecular separator device (12), of known type, said molecular separator device (12) being suitable for allowing the production of nitrogen starting from an air flow under pressure, generated by the air compression unit (9) which air flow under pressure itself is forced into said molecular separator device (12) by means of which it is possible to obtain the production of nitrogen necessary for the apparatus for the pressing (1) to carry out working cycles in inert atmosphere. More in detail, the molecular separator device (12) with which the apparatus for the pressing (1) is equipped, is intended to be of the type suitable for allowing the production of nitrogen preferably in a purity range between 95% and 99.9%, the nitrogen production being able to be potentially of unlimited capacity. In the execution example described, the molecular separator device (12) is of known type being based on the technology of selective permeation according to which each gas has its own characteristic permeation speed according to the capacity to dissolve and spread through a membrane, in such a way that said molecular separator device (12) is provided to be preferably of the type with hollow fibre membrane. In this way, said molecular separator device (12), with which in the embodiment described the apparatus for the pressing (1) of the inventive solution is equipped, is intended to be preferably of the passive-technology type being without moving parts, the same molecular separator device (12) being actuated in such a way as to allow that following the entry of compressed air in the inlet duct with which it is provided, the same air flow is forced to go through an appropriate hollow fibre separating membrane, the latter possibly being also of the asymmetric type, contained within an appropriate casing body axially provided at the ends with an inlet duct and with an exit duct, as well as with an appropriate dis-

charge element, said casing body being suitable not only for protecting the fibres of the separating membrane, but also for opportunely channelling the flow of the incoming compressed air. In this way, as known, the compressed airflow entering the molecular separator device (12) is forced to flow through the hollow fibres of the separating membrane which are made in such a way as to allow the separation of gases forming the mixture consisting of the air under pressure allowing that almost all the high-speed permeation gases, such as oxygen and carbon dioxide, permeate the wall of the membrane towards the outside of the fibres to be expelled at atmospheric pressure through the discharge element with which the molecular separator device (12) is provided, while almost all the low permeation speed gases go through the fibres of the separating membrane until they are expelled, at a pressure greater than the atmospheric pressure, from the exit duct with which the casing body of the molecular separator device (12) is provided allowing the channelling for the use in the working cycle in inert atmosphere of the apparatus for the pressing (1).

[0029] Furthermore it is provided that for the purpose of allowing the entry of the product to be treated into the pressing chamber (6) of the pressing tank (3) for the treatment in inert atmosphere, said pressing tank (3) itself is equipped with a pneumatic sleeve loading valve (13) communicating with the pressing chamber (6). As shown in the working schematic representation of Figure 3, moreover, the apparatus for the pressing (1) of the inventive solution object of the present invention is opportunely accompanied respectively: with valves, regulating devices, transducing devices, sensors and any other device of known type suitable for allowing the functioning for the execution of pressing cycles in inert atmosphere by means of movement of said membrane (4), to this aim the same devices being functionally arranged and connected according to prior art. Furthermore, for the purpose of allowing the driving, the handling and the control of the devices with which the apparatus for the pressing (1) of the inventive solution is provided, it is intended to be opportunely equipped with a drive and control unit (14) actuated with devices of known type, with programmable logic controller and, in the execution example described and preferably, provided with a tactile screen for the control setting by the operator and the monitoring of at least some of the phases of the working cycle, which drive and control unit (14) can be also equipped with known visual and/or acoustic signalling devices for the signalling of possible detected operating anomalies and the signalling of any other event of the working cycle which during the factory setting has been considered as necessary. The drive and control unit (14) is intended to be, in a known way, in signal communication for the drive and the control at least of the electric motors, of the cycle sensors and of the servo-controlled valves with which the apparatus for the pressing (1) is provided, everything according to prior art. Furthermore, for the purpose of allowing the collection of the liquid fraction, must, of the

treated vegetable product, in case the apparatus for the pressing (1) is operated in a working mode which does not provide that the pressing takes place in inert atmosphere or also for the purpose of allowing the collection of the washing liquid, it is provided that the apparatus for the pressing (1) of the inventive solution is equipped with an open collection basin (15), of known type, placed below an appropriate discharge duct with which the pressing tank (3) is provided, said collection basin (15) being also possibly translatable.

[0030] Operationally, it is provided that the working cycle in controlled inert atmosphere that the apparatus for the pressing (1) of the innovative solution object of the present invention is able to carry out, takes place, respectively, in at least: one initial saturation phase; a loading phase of the product and a pressing phase of the product. With reference to the initial saturation phase, it refers to a phase anticipating the subsequent treatment phases since it allows to prepare the apparatus for the pressing (1) in such a condition as to be able to conveniently carry out the loading of the vegetable product to be treated in inert atmosphere. Referring to the scheme of figure 3, the start of the initial saturation phase is given by the simultaneous opening of the vent valve (16), of the butterfly pneumatic type, suitably communicating with the must tank (10) which last is in turn suitably in communication with the pressing chamber (6) of the pressing tank (3), as well as with a first compressed air interception valve (17), of the ball pneumatic type, which is suitably connected to the compression unit (9) in such a way as to allow the passage of the compressed air flow produced by said air compression unit (9) itself, which compressed air flow, by means of a suitable duct, is introduced into the pressure chamber (5) of the pressing tank (3). The flowing of the air flow under pressure inside the pressure chamber (5) forces the expansion of the membrane (4) which last will be forced to deform until it occupies the entire volume of the pressing chamber (6) compatible with the maximum spread allowed to the membrane (4) itself. The described spreading of the membrane (4) in turn forces the exit, from the vent valve (16), of the air contained in the pressing chamber (6). As a consequence of reaching a preset pressure level in the pressure chamber (5), which pressure level is detected by a first transducer device (18) suitably in communication with the pressure chamber (5), the first compressed air interception valve (17) is driven to close, thus stopping the flow of compressed air to the pressure chamber (5). In the execution example described, it is provided that the closure of the first compressed air interception valve (17) is driven when the pressure level of 0.3 bars is reached (18) in the pressure chamber (5) detected by said first transducer device. Following the closure of the first compressed air interception valve (17), also the vent valve (16) is driven to close and following said closure a pneumatic valve (19), suitably interposed in communication between the pressure chamber (5) and the blower (7) is driven to open and also the blower (7) is activated

at programmed intervals in such a way as to allow the expulsion of the compressed air in the pressure chamber (5).

[0031] Simultaneously with the opening of said pneumatic valve (19), a second compressed air interception valve (20), suitably in communication with the air compression unit (9), is intended to be driven to open. Following the opening of said second compressed air interception valve (20), the compressed air flow generated by the air compression unit (9) is suitably sent to an air filtering group (8) located downstream of said second compressed air interception valve (20), said air filtering group (8) being of known type and suitable for retaining any possible impurities which may be present in the compressed air flow. After passing through the air filtering group (8), the compressed air flow generated by the air compression unit (9) is intended to be sent to the molecular separator device (12) which separates the component gases in such a way as to expel the residual gases into the atmosphere, by means of an appropriate discharge element (21) based on the Venturi effect, and to generate a flow of nitrogen under pressure coming out of the molecular separator device (12) itself, which flow of gaseous nitrogen is suitably channelled into the pressing chamber (6) and made to flow inside it until a predetermined pressure level is reached, signalled by a second transducer device (22) suitably placed in communication with the must tank (10). Following the detection by the second transducer device (22) of the set pressure level, which last in the execution example described is intended to correspond to a pressure level of 0.00 bars, it is provided that the closure is suitably driven of all the valves of the apparatus for the pressing (1). In the execution example described, the molecular separator (12) is intended to be sized and arranged to obtain an inert gaseous flow such as to saturate at least the pressing chamber (6) in a time which is expected to be less than or equal to 300 seconds. Once, after a short transit of the compressed air flow, the molecular separator (12) is fully operational, it delivers a continuous flow of gaseous nitrogen with set qualitative specifications of gaseous flow rate which are obtained by registering a flow regulating valve (23), in the example with manual adjustment, and in which said flow regulating valve (23) is intended to be placed in a convenient position, in the example described in Figure 3, said flow regulating valve (23) being placed downstream of the molecular separator (12). The described reaching of the saturation pressure in the apparatus for the pressing (1) of the inventive solution, determines the end of the initial saturation phase and allows the apparatus for the pressing (1) itself to be in the conditions suitable for allowing the subsequent loading phase of the product to be treated.

[0032] The end of the saturation phase determines the possibility to start the loading phase of the product to be treated in an inert atmosphere, which last, in the execution example described, provides a type of axial loading of the vegetable product, which loading is made by

means of a suitable loading pump, of known type, with which last itself the apparatus for the pressing (1) is preferably provided. In order to allow the loading of the vegetable product to be treated, it is provided that both the loading valve (13), placed at the entrance of the pressing chamber (6), and the vent valve (16) are simultaneously driven to open. Following the described opening of said loading valves (13) and vent valves (16), the loading pump is allowed to introduce the vegetable product to be treated, by way of example grapes, inside the pressing chamber (6). As a consequence of the introduction of the vegetable product to be treated into the pressing chamber (6), a volume substitution will be made between the loaded vegetable product and the inert gas, nitrogen, which is contained inside the pressing chamber (6) and which is forced to flow through the vent of the vent valve (16). During the loading process a pressurized flow of inert gas, nitrogen, is active, which is produced by the molecular separator (12) which is activated, thus facilitating the draining of the liquid portion of the loaded vegetable product, said incoming flow of inert gas in the pressing chamber (6) being intended to be automatically modulated, at least in time and volume, based on set parameters. The liquid volumetric percentage of the vegetable product introduced during the loading is collected in the must tank (10) which last itself is equipped with at least one minimum level sensor (24) and one maximum level sensor (25) in such a way that the reaching of a predetermined level inside the must tank (10) drives the start of the must pump (11) together with the opening of the must discharge valve (26) which is intended to be of the butterfly pneumatic type and it is interposed between the must tank (10) and the must pump (11). Following the described discharge, the discharged liquid product is sent to a storage tank external to the apparatus for the pressing (1). The loading phase ends with the manual intervention of the operator, who determines the load of the pressing chamber (6), or alternatively by means of the intervention of known types of pressure switches with which the apparatus for the pressing (1) is conveniently equipped in order to detect the reached filling of the pressing chamber (6), which pressure switches are placed in signal communication with the drive and control unit (14) in order to drive the interruption of the product loading.

[0033] Following the completion of the described phase of loading of the vegetable product to be treated, the pressing phase of the vegetable product contained within the pressing chamber (6) can be carried out. Referring to the scheme in figure 3, the start of the pressing phase of the vegetable product is given by the simultaneous opening of the vent valve (16) as well as of the first compressed air interception valve (17), so that the flow of compressed air generated by the compression unit (9), penetrating into the pressure chamber (5) consequently puts under pressure the membrane (4) of the pressing tank (3) in such a way that the mechanical pressing action performed by the membrane (4) on the vege-

table product allows the extraction of the liquid fraction of the loaded vegetable product. Said pressing phase of the vegetable product takes place right from the start in a pressurized inert atmosphere in such a way as to guarantee a functional easiness of draining towards the must tank (10) of the liquid fraction of the treated vegetable product, this also by means of the direct connection between the volumes of the pressing chamber (6) and the must tank (10). During the pressing phase, the flowing into the must tank (10) of the liquid fraction of the vegetable product contained in the pressing chamber (6) determines that, by activating said level sensors (24, 25) with which the must tank (10) is provided, reaching a predetermined level inside the must tank (10) drives the start of the must pump (11) together with the activation of the must discharge valve (26). Once the preset pressure level in the working process is reached in the pressure chamber (5) and once said pressure level is detected by the first transducer device (18) with which the pressure chamber (5) is equipped, it is provided that by means of the closure command of the first compressed air interception valve (17) the pressure chamber (5) is kept in a condition of static pressure maintenance for a preset period of time. Furthermore, it is provided that during said period of static maintenance of the pressure level in the pressure chamber (5), the second compressed air interception valve (20) is driven to open, thus allowing the flow of compressed air generated by the compression unit (9) to flow through the filtering group (8) and through the molecular separator (12) so that the latter can generate a flow of inert gas, nitrogen, whose qualitative specifications are determined by the adjustment of the flow regulating valve (23). In this way, the flow of inert gas generated by the molecular separator device (12) is sent inside the pressing chamber (6) to generate an appropriate pressure differential suitable for facilitating an optimal draining of the liquid fraction of the treated vegetable product. During said maintenance period, the mode of introduction of inert gas, nitrogen, inside the pressing chamber (6) is intended to be controlled and timed by the drive and control unit (14). At the end of the time established for said maintenance period, it is provided that the activation of the blower (7), of the pneumatic valve (19) and the second compressed air interception valve (20) is simultaneously driven, so that consequently to the activation of the blower (7) the extraction of air from the pressure chamber (5) is allowed, said extraction of air from the pressure chamber (5) itself continuing until a predetermined level of negative pressure is reached, in the example corresponding to -0.15 bars, inside the pressure chamber (5) signalled by the first transducer device (18). Subsequently, the driven opening of the second compressed air interception valve (20), through the activation of the circuit which includes the molecular separator (12), allows the introduction of pressurized nitrogen inside the pressing chamber (6) simultaneously with the negative pressure inside the pressure chamber (5) generated by the suction of the blower (7) which is kept

active. Both the maintenance of the pressurized nitrogen flow inside the pressing chamber (6) and the activation of the blower (7) generating said negative pressure inside the pressure chamber (5) remain until the moment in which the membrane (4) appears adherent to the internal surface of the pressure chamber (5) which last, in the example, is maintained at a negative pressure of -0.15 bars. At this point, the described pressing phase is intended to be repeated as predefined in the working process with increasing pressure levels.

[0034] Furthermore, as shown in the scheme of Figure 3, the apparatus for the pressing (1) of the innovative solution object of the present invention is also provided for functional purposes with:

- a first pressure regulator (27), of electronic type, for regulating the pressure of the air going out of the air compression unit (9) on the delivery line to the molecular separator device (12), said pressure regulator (27) being placed upstream of the air filtering group (8) and being functional for regulating the compressed air flow entering the molecular separator device (12);
- a second pressure regulator (28), of manual type, for regulating the pressure of the air going out of the air compression unit (9) on the delivery line of compressed air to the pressure chamber (5), said pressure regulator (27) being placed downstream of the first compressed air interception valve (17) and upstream of a first safety valve (29), of mechanical type, which is intended to be suitably placed in connection with the pressure chamber (5) of the pressing tank (3);
- a second safety valve (30), of mechanical type, which is intended to be placed downstream of the molecular separator device (12) and upstream of the flow regulating valve (23);
- a first nonreturn valve (31) placed on the inert gas line going out of the molecular separator device (12), said first nonreturn valve being placed downstream of the flow regulating valve (23);
- a second nonreturn valve (32) placed on the inert gas line upstream of the pressing chamber (6);
- a third safety valve (33) suitably in connection with the must tank (10);
- a pneumatic butterfly valve (34) placed downstream of the collection basin (15) and upstream of the must pump (11), suitable for allowing the discharge of said collection basin (15).

[0035] As shown in the scheme of Figure 3, the apparatus for the pressing (1), in the execution example described, is structured in a scheme which starting from an air compression unit (9) provided outside the apparatus for the pressing (1) itself, comprises two circuits of which a first circuit which includes the following devices, arranged in sequence in an order which goes from upstream to downstream:

- the first compressed air interception valve (17);
- the second pressure regulator (28);
- the first safety valve (29),
- the pressure chamber (5) of the pressing tank (3);
- the first transducer device (18).

[0036] Furthermore, between the second pressure regulator (28) and the first safety valve (29) said first circuit is intercepted by the pneumatic valve (19) in connection with the blower (7).

[0037] The second circuit which originates from the air compression unit (9), as shown in the scheme of Figure 3, includes the following devices, arranged in sequence in an order which goes from upstream to downstream:

- the second compressed air interception valve (20);
- the first pressure regulator (27);
- the air filtering group (8);
- the molecular separator device (12) which last comprises the discharge element (21);
- the second safety valve (30);
- flow regulating valve (23);
- first nonreturn valve (31);
- second nonreturn valve (32);
- the pressing chamber (6) of the pressing tank (3).

[0038] Furthermore, as shown in the scheme of Figure 3, the apparatus for the pressing (1) is equipped with a must tank (10) equipped with a minimum level sensor (24) and with a maximum level sensor (25) wherein said must tank (10) is placed in communication with said second circuit and is connected to a circuit comprising the third safety valve (33); the second transducer device and the vent valve (16). Furthermore, the must tank (10) is connected to a discharge circuit comprising the must discharge valve (26) downstream of which there is the must pump (11) which last is in turn connected to a discharge circuit which includes the pneumatic butterfly valve (34) and the collection basin (15), in which a first discharge circuit (35) is provided between the must pump (10) and the must discharge valve (26) and a second discharge circuit (36) is provided between the must pump (10) and the pneumatic butterfly valve (34).

45 NOMENCLATURE

[0039]

- (1) apparatus for the pressing
- (2) load-bearing structure
- (3) pressing tank
- (4) membrane
- (5) pressure chamber
- (6) pressing chamber
- (7) blower
- (8) air filtering group
- (9) air compression unit
- (10) must tank

- (11) must pump
- (12) molecular separator device
- (13) loading valve
- (14) drive and control unit
- (15) collection basin 5
- (16) vent valve
- (17) first compressed air interception valve
- (18) first transducer device
- (19) pneumatic valve
- (20) second compressed air interception valve 10
- (21) discharge element
- (22) second transducer device
- (23) flow regulating valve
- (24) minimum level sensor
- (25) maximum level sensor 15
- (26) must discharge valve
- (27) first pressure regulator
- (28) second pressure regulator
- (29) first safety valve
- (30) second safety valve 20
- (31) first nonreturn valve
- (32) second nonreturn valve
- (33) third safety valve
- (34) pneumatic butterfly valve
- (35) first discharge circuit 25
- (36) second discharge circuit

Claims

1. Apparatus for the pressing (1) of vegetable products in controlled inert atmosphere equipped with molecular separator device for the self-production of inert gas including a pressing tank (3) arranged to allow the draining of the liquid fraction of the treated vegetable product and internally provided with a membrane (4) separating the pressure chamber (5) from the pressing chamber (6) and wherein said membrane (4) is suitable for deforming following the pressure change inside at least one of the two chambers (5, 6), where the pressing tank (3) is arranged to allow the loading of the vegetable product to be treated inside the pressing chamber (6) and is functionally connected to inlet means for compressed air and inert gas, to means for the extraction of the air and to a must tank (10) for the collection of the liquid fraction of the vegetable product being treated and wherein the apparatus for the pressing (1) is provided with valves, sensors, transducer devices and with a drive and control unit (14), the whole functionally arranged to allow the execution of the working phases **characterised in that** it includes at least one molecular separator device (12) with unlimited capacity able to deliver at least one pressurised flow of inert gas at least in the pressing chamber (6). 30
2. Apparatus for the pressing (1) of vegetable products in controlled inert atmosphere equipped with molec- 35
- ular separator device for the self-production of inert gas according to the previous claim **characterised in that** the molecular separator device (12) is of the type with passive technology being without moving parts and it is able to generate an inert gas flow whose purity degree is between 95% and 99.9%. 40
3. Apparatus for the pressing (1) of vegetable products in controlled inert atmosphere equipped with molecular separator device for the self-production of inert gas according to at least one of the previous claims **characterised in that** the apparatus for the pressing (1) is equipped with at least one flow regulating valve (23) by means of which it is possible to regulate the qualitative specifications of gas flow rate of the inert gas generated by the molecular separator device (12). 45
4. Apparatus for the pressing (1) of vegetable products in controlled inert atmosphere equipped with molecular separator device for the self-production of inert gas according to at least one of the previous claims **characterised in that** the apparatus for the pressing (1) includes at least: 50
 - a blower (7);
 - an air filtering group (8);
 - a must tank (10) equipped with at least one minimum level sensor (24) and with at least one maximum level sensor (25);
 - a must pump (11);
 - a loading valve (13);
 - a vent valve (16);
 - a first compressed air interception valve (17);
 - a first transducer device (18);
 - a pneumatic valve (19);
 - a second compressed air interception valve (20);
 - a discharge element (21);
 - a second transducer device (22);
 - a flow regulating valve (23);
 - a must discharge valve (26).
5. Apparatus for the pressing (1) of vegetable products in controlled inert atmosphere equipped with molecular separator device for the self-production of inert gas according to at least one of the previous claims **characterised in that** the apparatus for the pressing (1) is able to accomplish at least one saturation phase, with inert atmosphere in at least the pressing chamber (6), wherein the saturation phase provides at least: 55
 - the simultaneous opening of the vent valve (16) and of a first compressed air interception valve (17) in communication with the pressure chamber (5) and connected to an air compression unit (9) which is simultaneously activated and deter-

mines, by means of the expansion of the membrane (4), the exit of the air contained in the pressing chamber (6);

- the closure of the vent valve (16) and of the first compressed air interception valve (17) upon reaching a preset pressure level in the pressure chamber (5) detected by a first transducer device (18) in communication with the pressure chamber (5), obtaining the opening of an interposed pneumatic valve (19) in communication between the pressure chamber (5) and the blower (7) which last is activated at programmed intervals so as to allow the expulsion of the compressed air in the pressure chamber (5);

- and wherein simultaneously with the opening of said pneumatic valve (19), the opening is driven of a second compressed air interception valve (20), in communication with the air compression unit (9) and with the air filtering group (8), by opening the circuit which introduces compressed air into the molecular separator device (12) which generates an inert gas flow which is under pressure channelled inside the pressing chamber (6) and made to flow inside it until a predetermined pressure level is reached signalled by a second transducer device (22) in communication with the must tank (10), wherein following the activation of said second transducer device (22) the closure is driven of all the valves of the apparatus for the pressing (1).

6. Apparatus for the pressing (1) of vegetable products in controlled inert atmosphere equipped with molecular separator device for the self-production of inert gas according to at least one of the previous claims **characterised in that** the apparatus for the pressing (1) is able to accomplish at least one loading phase of the vegetable product in the pressing chamber (6) in inert atmosphere, wherein the loading phase of the vegetable product provides at least the at least temporary activation of the molecular separator device (12) for the production of a pressurised inert gas flow at least in the pressing chamber (6).

7. Apparatus for the pressing (1) of vegetable products in controlled inert atmosphere equipped with molecular separator device for the self-production of inert gas according to at least one of the previous claims **characterised in that** the apparatus for the pressing (1) is able to accomplish at least one pressing phase in inert atmosphere of the vegetable product contained in the pressing chamber (6) wherein the pressing phase of the vegetable product provides at least the at least temporary activation of the molecular separator device (12) for the production of a pressurised inert gas flow at least in the pressing chamber (6).

8. Apparatus for the pressing (1) of vegetable products in controlled inert atmosphere equipped with molecular separator device for the self-production of inert gas according to at least one of the previous claims **characterised in that** the molecular separator device (12) is included in a circuit which takes from the air compression unit (9) to the pressing tank (3) and includes, downstream of the air compression unit (9), in sequence respectively at least:

- a compressed air interception valve (20);
- a pressure regulator (27);
- an air filtering group (8);
- a molecular separator device (12);
- a safety valve (30);
- a flow regulating valve (23);
- a nonreturn valve (31).

9. Apparatus for the pressing (1) of vegetable products in controlled inert atmosphere equipped with molecular separator device for the self-production of inert gas according to at least one of the previous claims from 1 to 4 **characterised in that** the apparatus for the pressing (1) is able to also accomplish all the working phases in non-inert atmosphere.

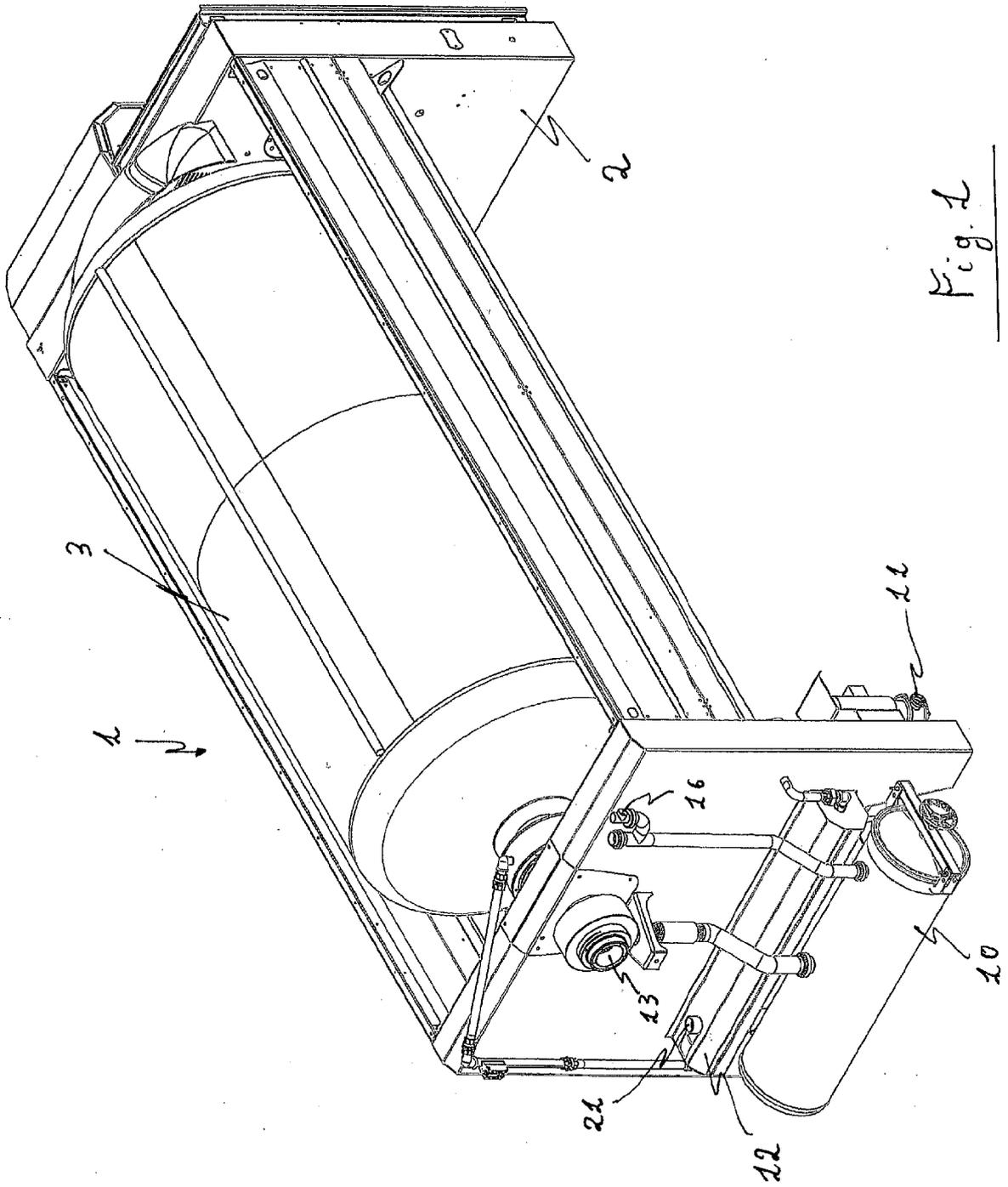


Fig. 2

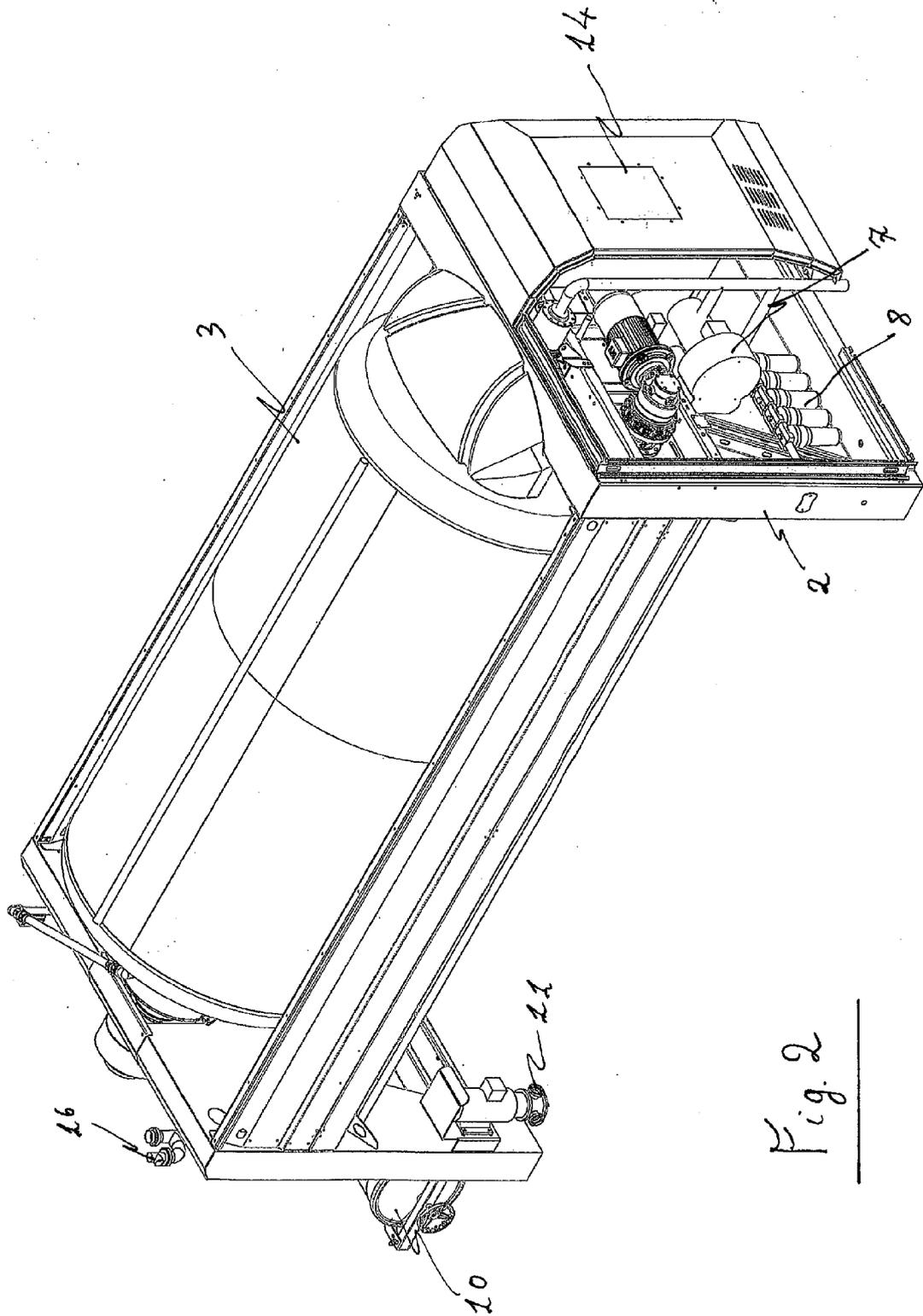


Fig. 2

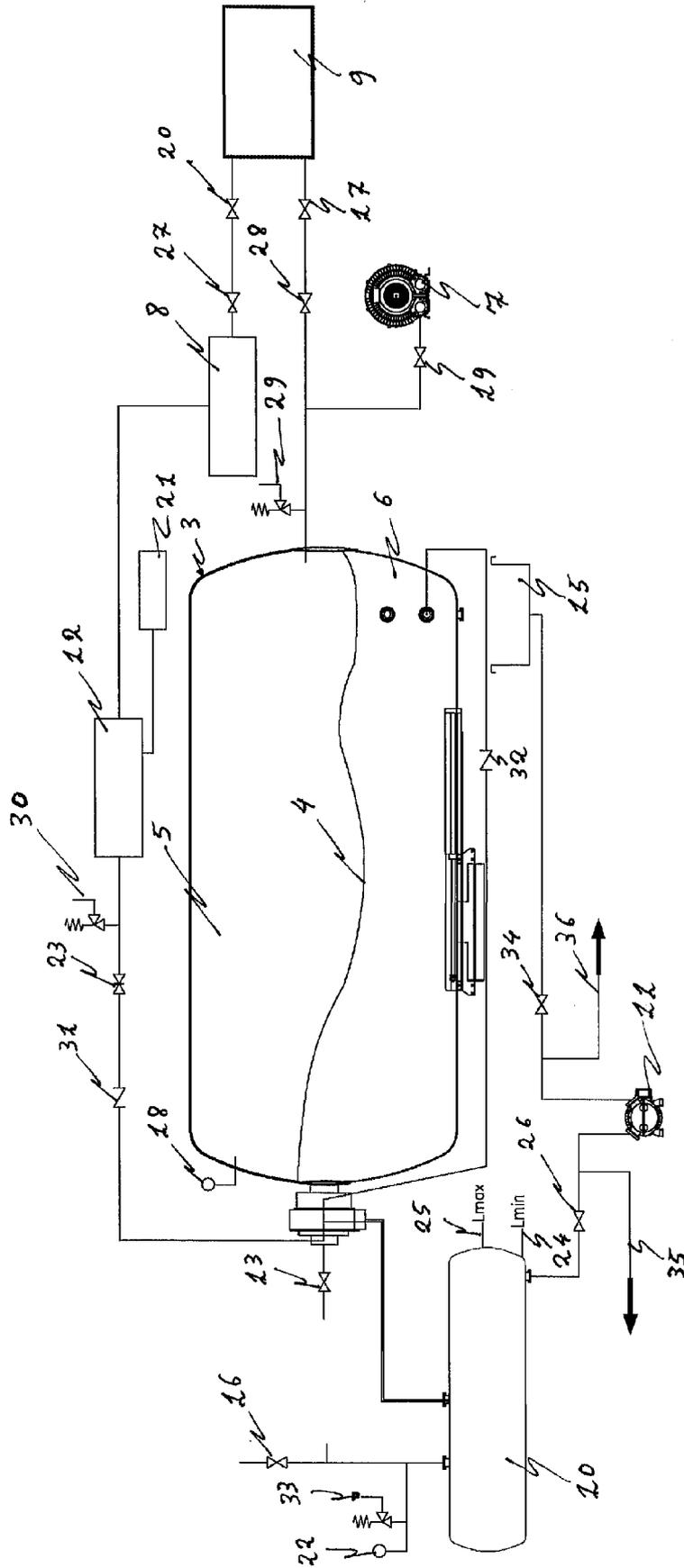


Fig. 3



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