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(54) **OLIVE PASTE MIXER AND OLIVE PRESSING PLANT**

(57) Mixer (10) for olive paste (9) comprising an open top container (1) through which the olive paste (9) flows and provided with a lid (1F); an actuator (2) configured to advance and mix the olive paste (9) in the container (1); a heat exchanger (3) arranged on a lower portion (1C) of the container (1) and placed in thermal communication with the interior (1D) of the container (1) to exchange heat with the olive paste (9) through a lower wall (1f) of the container (1); at least one air injector (4) configured to ejected air at a predetermined temperature into the container (1), the at least one air injector (4) is arranged and oriented so that the air ejected from the injector (4) flows over a free surface of the olive paste (9) that flows into the container (1).

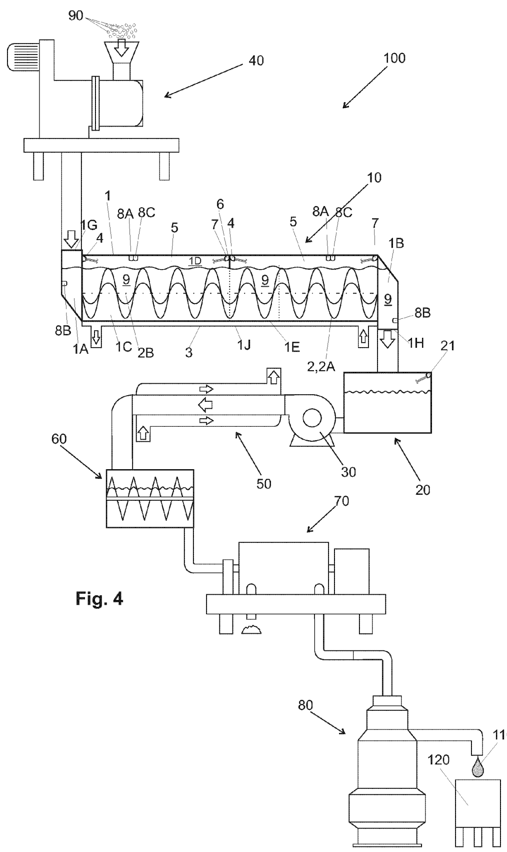

Fig. 4

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Description

TECHNOLOGY SECTOR

[0001] The present invention relates to the olive oil production sector and in particular to machinery for enhancing the aromas and flavours of the oil after pressing the olives.

BACKGROUND ART

[0002] A traditional olive pressing plant comprises a crusher 40 into which olives 90 enter and an olive paste comes out which, in turn, enters a malaxer 60, as illustrated in Fig.1. The olive paste also passes through a separator 70 and into a clarifier 80, from which olive oil 110 comes out collected in a container 120.

[0003] The temperature of the olive paste overheats in the crusher 40, for this reason it is preferable to crush cold olives, for example during the night or by cooling them in cold rooms, and/or to cool the olive paste using a heat exchanger 55.

[0004] An example of a process for cooling the olive paste after pressing is described in the patent EP3059298A1. This solution aims to reduce the degradation of phenolic components and increase the formation of volatile components that affect the aroma. Nonetheless, in this solution, the olive paste that comes out of the crusher is pumped into a tube exchanger with the aim of rapidly cooling the olive paste without however oxygenating it, because only the olive paste flows through the tubes. The lack of oxygenation on the one hand reduces the formation of peroxides while on the other hand it reduces the intensity of the volatile compounds and therefore the more intense aromas in the oil.

[0005] To partially solve this problem, it is known to use a tube heat exchanger of the type described in the patent EP3622833A1, which comprises a tube in which the olive paste flows and in which oxygen can be inserted. However, this solution does not allow the development of optimal aromas from the olive paste. In fact, the olive paste is pumped at high pressure into the tube which, consequently, is full and has no headspace, thus an air zone that is required for the development of lipoxygenase.

[0006] Finally, the oxidation process must be able to be interrupted when the oxygenation obtained is sufficient for the desired perfume and aroma objectives. In this regard, it is known from document EP2596707 to crush the olives or knead the olive paste in a controlled atmosphere. In the equipment described in this document, the oxygen that naturally dissolves in the olive paste during pressing is inactivated thanks to the introduction of inert gases. In this way, the oxidative phenomena on the unsaturated fat acids and on the polyphenolic substances of the olive paste are limited or eliminated. In reality, differently from what is described in this document, to obtain an oil rich in aroma and flavour, the oxidative phenomena must be controlled and not suppressed or limited.

[0007] A further solution is known from the technical paper entitled " Development of a prototype malaxer to investigate the influence of oxygen on extra-virgin olive oil quality and yield, to define a new design of machine". This document describes the importance of having a headspace above the olive paste and blowing oxygen into the olive paste via the malaxer shaft used to mix the olive paste. This solution does not suggest blowing cold or cool air over the top surface of the olive paste. This solution does not even describe an enclosure equipped with an openable lid that allows complete inspection of the same.

[0008] Furthermore, none of the known solutions allows the machinery which mixes the olive paste to be cleaned completely and thoroughly. Known solutions in fact comprise closed ducts in which water is flown to clean them. In this way, however, the ducts are never clean enough and the olive paste that remains in the pipes can contaminate or degrade the olive paste processed subsequently.

SUMMARY

[0009] A first object of the present invention is to solve the aforementioned drawbacks of the prior art by means of an olive paste mixer comprising: an inspectable container through which the olive paste flows between one end of the container and the other; an actuator configured to advance and mix the olive paste in the container; a liquid heat exchanger arranged on a lower portion of the container and placed in thermal communication with the interior of the container to exchange heat with the olive paste through a lower wall of the container; at least one air injector configured to eject purified air into the container so that the air flows over the olive paste flowing into the container. The container is open at the top, and comprises a lid for closing the container. The lid is configured to allow full access to the inside of the container when the lid is opened. The at least one injector is arranged and oriented so that the air expelled from the injector flows on the free-surface surface of the olive paste. The mixer thus conceived allows to oxygenate most of the olive paste that passes through it. In fact, the free surface of the olive paste is completely touched by the air jet, thus creating a greater exchange surface. Furthermore, the injection of fresh air into the mixer allows to oxygenate the olive paste and at the same time to cool it. The at least one injector is located in the headspace. The injection of air directly from the upper portion of the container prevents the at least one injector from being clogged by the olive paste. Furthermore, this positioning allows the air to be expelled so that it invests the entire free-surface surface of the olive paste. The air introduced is at a lower temperature than the temperature of the olive paste, and therefore allows a cooling of the olive paste which faces the head space. The portion of olive paste that is not hit by the jet of fresh air is in any case cooled by the walls cooled by the heat exchanger placed in thermal contact with the mixer container. The actuator, in addition to advancing the olive paste towards the mixer outlet, allows to remix the paste and bring the paste near the bottom of the container to the surface and vice versa. Since the container can be inspected by opening the lid, the container can be easily examined and cleaned by an operator. The possibility of being able to carry out a deep cleaning of the container allows to remove all the olive paste residues that could contaminate or degrade the subsequently processed olive paste. The operator who carries out the cleaning is able to see the inside of the container and therefore understand whether it is clean or not.

[0010] Preferably, the container can comprise an upwardly flared shape to increase the free-surface surface of the olive paste which is invested by the jet of air expelled from at least one injector and therefore the heat exchange between the ejected air and the olive paste.

[0011] In particular, the shape of the container can be flared towards the top. This shape allows for a double effect. First of all, the exchange surface between the air ejected by the injector and the olive paste increases considerably, improving the cooling and oxygenation of the olive paste. After that, a wider container access mouth allows better inspection of the container and therefore better cleaning of the same.

[0012] Advantageously, the predetermined air temperature can be between -5°C and 15°C, preferably between 2°C and 10°C. The jet of air leaving the injector is cold to cool the olive paste. Thanks to the mixer thus conceived, the optimal environmental conditions are reproducible even where the olives reach an early ripening and the ambient temperature during the olive pressing period is higher than 25°C.

[0013] In particular, the container can have an elongated shape and an inlet for receiving the olive paste at one end and an outlet for expelling the olive paste at the opposite end. A container with an elongated shape and opposite inlet and outlet allow the olive paste to flow in a simple way, without employing pipes as known in the state of the art. In this way, the so-called headspace, thus the space between the container and the olive paste increases considerably and with it the heat and gaseous exchange between the olive paste and the ejected air.

[0014] Advantageously, the actuator can comprise a screw conveyor arranged in such a way that its axis of revolution is parallel to a longitudinal development direction of the container. The screw conveyor allows the olive paste to advance towards the mixer outlet and to mix it in order to bring the olive paste that is on the bottom to the surface.

[0015] In particular, the heat exchanger can be arranged between the lower wall of the container and a jacket external to the lower portion of the container. Preferably the liquid flows against the current of the olive paste. Since the upper portion of the container can be inspected and includes a head space, the heat exchanger is arranged in the lower portion of the container, to cool the portion of olive paste which cannot be cooled and oxygenated by the air ejected by the injector.

[0016] Advantageously, the container can be divided into one or more chambers by partitions inside the container arranged transversely to the longitudinal development direction of the container. By dividing the container into several chambers, it is possible to reproduce different temperature, pressure and oxygenation conditions, depending on the desired effect on the olive paste.

[0017] Preferably, the mixer may include a second injector configured to eject carbon dioxide into the container such that the carbon dioxide flows onto the olive paste flowing into the container. If the oxygenation is sufficient for the desired fragrance and flavour objectives, the mixer is designed to be able to control the oxidative process by introducing carbon dioxide into the container. Carbon dioxide is the inert gas which preserves the olive paste better than others. In fact, carbon dioxide, unlike for example nitrogen, does not remove the aromas from the olive paste. Carbon dioxide is in fact naturally produced by the olive paste itself.

[0018] In particular, the mixer can comprise one or more of the following types of sensors: oxygen sensor; temperature sensor; pressure sensor. These sensors allow to control the oxygen/pressure/temperature value present in the container or in its chambers, so as to be able to consequently adjust the predetermined temperature or the flow rate of the air leaving the injector.

[0019] A second object of the present invention is represented by an olive pressing plant comprising at least a mixer in accordance with one or more of the preceding claims, a crusher suitable for crushing the olives and a separator of the liquid phase from the solid one of the olive paste, wherein the mixer is arranged downstream of the crusher and upstream of the separator. The mixer according to the present invention allows to optimize an olive pressing plant. In fact, in a plant of this type the number of malaxers and exchangers required is reduced, as the cooling of the olive paste leaving the crusher is carried out by the mixer and the malaxer can even be eliminated.

[0020] Preferably, the olive pressing plant can also comprise a second container placed downstream of the mixer so that the olive paste leaving the mixer enters the second container directly. Said second container includes a third injector configured to eject carbon dioxide into the second container. This second container allows to interrupt the oxygenation process that took place in the mixer in a sudden way thanks to the use of carbon dioxide in a closed environment.

[0021] Advantageously, the plant can also comprise a pump and a second heat exchanger, preferably of the tube-in-tube type, configured to heat the olive paste leaving the mixer or second container. The olive paste, after the aromas and flavours have been suitably enhanced in the mixer, is pumped into a second exchanger which allows the temperature to increase up to an almost optimal temperature for oil extraction. Heating the olive paste also makes it possible to enhance the spicy and/or bitter taste of the oil when the paste has been suitably deprived of oxygen in the second container or in the mixer.

[0022] In particular, the plant can include a malaxer arranged downstream of the second exchanger and upstream of the separator of the liquid phase from the solid phase of the olive paste, so as to receive the olive paste leaving the second exchanger. In the plant according to the present invention, the malaxer is used as a buffer to stabilize the flow rate of olive paste entering the separator.

[0023] Preferably, the plant can also comprise a clarifier arranged downstream of the separator of the liquid phase from the solid phase of the olive paste and configured to separate the olive oil from the vegetation water.

[0024] A third object of the present invention is represented by an olive pressing method comprising a step of mixing an olive paste comprising the sub-steps of:

- ejecting air at a predetermined temperature into a container so that the air flows over the olive paste;
- mixing the olive paste with an actuator;
- regulating the temperature of the container by means of a heat exchanger and said ejected air. The method thus conceived makes it possible to enhance the flavours and aromas of the oil especially where the olives are pressed in places with high ambient temperatures during the pressing season.

[0025] Preferably, the mixing step may comprise the further sub-phase of ejecting carbon dioxide into the container. The ejection of carbon dioxide avoids stripping, thus the removal of perfumes from the oil.

[0026] Advantageously, the mixing phase can comprise the further sub-phase of regulating the speed of the actuator to vary the contact time of the olive paste with the air at said predetermined temperature. By regulating the advancement speed of the olive paste it is possible to control the quantity of olive paste in the mixer and in its chambers and the contact time of the air flow with the surface of the olive paste.

[0027] In particular, the mixing phase may include the further sub-phase of varying the flow rate of the ejected air to regulate the pressure inside the container. A slight increase in pressure, for example by 0,5 bar, in the container or in one of its chambers allows for an improvement in the dissolvability of the gases in the olive paste.

[0028] Advantageously, the method can comprise the step of overheating the olive paste after the sub-step of ejecting the carbon dioxide into the container. The ejection of carbon dioxide makes it possible not to lose and preserve the aromas of the olive paste. The subsequent overheating of the olive paste makes it possible to reduce the viscosity of the olive paste and therefore facilitate the extraction of the oil and therefore the yield in terms of pressing the olives.

[0029] In particular, the method may include the step of separating the solid phase from the liquid phase of the overheated olive paste. Preferably, the method can also include the step of clarifying the olive oil from the vegetation water. These phases make it possible to obtain the olive oil from the olive paste.

[0030] These and other advantages will become apparent in more detail from the description, given hereinafter, of an embodiment given by way of example and not of limitation with reference to the attached drawings.

DESCRIPTION OF THE DRAWINGS

[0031] In the drawings:

Fig. 1 shows a schematic view of a pressing plant of the known type;
Fig. 2 illustrates a schematic side view in section of an olive paste mixer according to the present invention;
Fig. 3 illustrates a schematic front sectional view of an olive paste mixer according to the present invention;
Fig. 4 illustrates a schematic view of a pressing plant according to the present invention;
Fig. 5 illustrates a top view of an embodiment of the mixer for olive paste according to the present invention;
Fig. 6 illustrates a side view of embodiment of the mixer for olive paste of Fig. 5
Fig. 7 illustrates a sectional view of the olive paste mixer of Fig. 6, according to the plane A-A illustrated in Fig. 6;
Fig. 8 illustrates an axonometric view of a screw conveyor in accordance with a particular embodiment of the present invention.

DETAILED DESCRIPTION

[0032] The following description of one or more embodiments of the invention refers to the attached drawings. The same reference numbers in the drawings identify the same or similar elements. The object of the invention is defined by the attached claims. The technical details, structures or characteristics of the solutions described below can be combined with each other in any way.

[0033] In Figs. 2 and 3, with the reference number 10, a mixer for olive paste is illustrated. The mixer 10 comprises an openable container 1 equipped with an inlet 1G and an outlet 1H arranged at opposite ends of the container itself. The container 1 has an elongated and flared shape. In essence, the cross-sectional shape of container 1 is narrower at the bottom than at the top. In particular, the section of the lower portion 1C of the container 1 has a semi-cylindrical shape, while the section of the upper portion 1L of the container 1 has the shape of a trapezoid or inverted triangle, as shown in Fig. 3. Alternatively, the container 1 can be cylindrical (not shown) or cylindrical at the bottom and squared at the top (not shown). Other shapes of the container 1 are possible.

[0034] The container 1 also comprises an openable lid 1F which allows easy and complete access to the internal space 1D of the container 1. This lid 1F allows the container 1 to be washed and cleaned at the end of each mixing, in a complete and accurate manner. In fact, the shape of the container 1, together with the lid 1F, allows easy access to the entire internal space 1D.

[0035] A heat exchanger 3 is connected to the lower wall 1E of container 1 configured to be in thermal communication with the internal space 1D of container 1 via the lower wall 1E, so as to exchange heat with the olive paste 9 which is located in the lower portion 1C of container 1. In practice, the olive paste 9 which is located at the bottom (lower portion 1C) in container 1 is cooled by heat exchanger 3 which, by cooling the lower wall 1E, allows the olive paste 9 to cool. The conditioning allows the temperature of the olive paste to be stabilized between 19°C and 21°C, so as to favour a better lipoxygenase of the olive paste 9.

[0036] The heat exchanger 3 can be of the tube-in-tube type, as schematized in Figs. 2 and 3. A cooling liquid can flow in the interspace outside the lower wall 1E, for example water, which does not come into contact with the olive paste 9, but allows it to cool through the lower wall 1E. This cavity is made up of an external jacket 1J and a portion of the lower wall 1E of the container 1. The cooling liquid preferably flows counter-current in this cavity with respect to the advancement of the olive paste 9, as schematized in Figs. 2 and 3. Other types of heat exchangers 3 are possible, for example a tube bundle and shell exchanger (not shown).

[0037] Inside 1D of the container 1 there is and acts an actuator 2. The actuator 2 comprises a screw conveyor 2A and a motor 2C for driving the screw conveyor 2A. The screw conveyor 2A rotates, in a known manner, around its axis of revolution 2B, as illustrated in Figs. 2 and 3. The axis of revolution 2B of the screw conveyor 2A is preferably parallel to the longitudinal development of the container 1.

[0038] The screw conveyor 2A can be shaped to move and mix the olive paste 9. In this way, the olive paste 9 not only advances from the inlet end 1A to the outlet end 1B of the container 1, but it is mixed to mix better with the air present in the head space as better described below.

[0039] An olive paste 9 is introduced in the internal space 1D of container 1 via the inlet 1G, as schematized in Fig. 2. The olive paste 9 is mixed with the actuator 2 and at the same time advances towards the outlet 1H of the container from which it comes out for further processing steps, as better described below.

[0040] The olive paste 9 present in the container 1 does not fill it completely, leaving above the free surface of the olive paste 9, thus its free surface which delimits the moving mass at the top, a space which is used to operate a heat exchange and oxygenation, as better described below.

[0041] The container 1 can be divided into several chambers 5 by one or more septa 6 arranged transversely inside 1D of the container 1, as illustrated in Figs. 2, 3 and 4. In particular, the one or more septa 6 are orthogonal to the axis of revolution 2B of the screw conveyor 2A. The septa 6 are shaped in such a way as to allow the rotation of the screw conveyor 2A. In this way, the at least one septum 6 allows to separate the chambers 5 but also to favour the mixing of the air with the olive paste 9. Preferably, the septum 6 has a shape complementary to the internal shape of the upper portion 1L of the container 1 and has a semi-circular excavation within which the screw conveyor 2A rotates, visible in Fig. 6.

[0042] The chambers 5 make it possible to reproduce different environmental conditions in the head space of the container 1, as better explained below. Alternatively, it is possible to arrange several mixers 10 in cascade with one another with different operating conditions. However, this solution (not shown) implies higher costs than the solution with several chambers 5 in the same mixer 10.

[0043] The container 1 comprises in its interior 1D an air injector 4 configured to eject air at a specific temperature. The injector 4 is arranged and oriented so that the air flow leaving the injector 4 touches the free-surface surface of the olive paste 9 which flows into the container 1.

[0044] The jet of air leaving injector 4 is a jet of cold air, thus with a temperature between -5°C and 15°C, preferably between 2°C and 10°C. These temperature values allow the olive paste 9 which comes from the crusher 40 to be cooled and oxygenated, as shown in Fig. 4. The temperature of the olive paste 9 when it comes out of the crusher 40 is a function of the ambient and conservation temperature of the olives. In warm regions, i.e. where the ambient temperature is higher than 25°C during the olive pressing period, the temperature at the outlet of the crusher 40 risks exceeding 27°C (temperature limit for obtaining extra virgin olive oil). For this reason, in these places, it is necessary to cool the olive paste 9 to enhance the aromas of the oil, in order to maintain the temperature of the paste between 19°C and 21°C and guarantee the lipoxygenase, i.e. the enzymatic process of formation of volatile compounds by oxidation. Depending on the temperature of the olive paste 9 at the inlet of the mixer 10, the temperature of the air delivered by the injector 4 will be more or less cold to achieve the aforementioned optimal temperature range for the lipoxygenase. Furthermore, the oxygen supplied with the ejection of air into container 1 allows the lipoxygenase process to start. In fact, an optimal lipoxygenase requires oxygen, head space for the development of perfumes, and a stabilized temperature between 19°C and 21°C. Outside this temperature range, longer aromatic structures develop and are less pleasant to the sense of smell and taste.

[0045] In order to monitor the temperature of the olive paste 9, a temperature sensor 8B is arranged near the inlet 1G of the mixer 10 and a further temperature sensor 8B' is arranged near the outlet 1H of the mixer 10. The temperature sensors 8B, 8B' are configured to detect the temperature inside the olive paste 9, therefore they remain in contact with the latter. By monitoring the two temperature values detected by the sensors 8B, 8B' it is possible to regulate the temperature of the air expelled from the injector 4. With the same temperature values of the olive paste 9 it is also possible to regulate the temperature inside the heat exchanger 3. In this way, it is possible to decrease or increase the temperature of the olive paste 9 in order to obtain said optimal condition for the lipoxygenase.

[0046] The air expelled from the injector 4 is previously filtered by a filter (not shown) configured to eliminate waste and bacteria potentially capable of altering the characteristics of the olive paste 9. For example, a HEPA filter can be used.

[0047] Once the lipoxygenase process is achieved, the olive paste 9 has achieved the desired aromas. These aromas are then confirmed downstream of the pressing system, by tasting and laboratory analysis of the oil 110 obtained from said olive paste 9. In order to block the oxidative enzymatic activities which alter the aromas and prevent them from volatilizing, the olive paste 9 can be inertized by a jet of carbon dioxide expelled from a second injector 7. The ejection of carbon dioxide also allows the increase of polyphenols and therefore of the nutritional values. The second injector 7, like the first injector 4, is configured to invest the upper surface of the olive paste 9 which faces the head space of the container 1.

[0048] The container 1 of Fig. 2 comprises three chambers 5, while that of Fig.4 comprises two chambers 5. The number of chambers 5 can be even higher. Each chamber 5 comprises an air injector 4 and/or a second carbon dioxide injector 7. The chambers 5 are used to avoid having to purchase and install multiple mixers 10 and arrange them in cascade to each other. The chambers 5 in fact reproduce conditions similar to those which occur inside a single chamber mixer. The olive paste 9 longitudinally crosses the chambers 5 and the septa 6 separate the head spaces of the various chambers 5. In this way, for example, air at 2°C can be ejected into the first chamber 5 of Fig. 2, air at 10°C can be ejected into the second chamber 5 and only carbon dioxide into the third chamber 5. Since the gap between the screw conveyor 2A and the septa 6 is minimal, the olive paste 9 which advances in each chamber 5 tends to fill this gap, isolating or almost isolating a chamber 5 from the neighbouring one.

[0049] In order to monitor the oxygenation of the headspace the mixer 10 comprises one or more oxygen sensors 8A. In the event that the container 1 is divided into several chambers 5, one or more of these chambers comprise an oxygen sensor 8A, as illustrated in Figs. 2 and 4.

[0050] In the mixer 10 the pressure in the head space of the container 1 or in the chambers 5 is also monitored, as illustrated in Figs. 2 and 4. The pressure value is important for understanding the dissolvability of the gases in the olive paste 9, in particular due to the fact that the olive paste 9 has a large volume of air and/or carbon dioxide above the free surface of the olive paste 9. In the tubes of known heat exchangers, the olive paste it completely fills the tubes and there is no headspace, therefore there is no dissolution of gases in the olive paste.

[0051] In Figs. 5, 6 and 7 a particular embodiment of the present invention is illustrated. In this embodiment, the lid 1F is hollow inside and the air flows through this cavity. The air then escapes from a plurality of holes made in the lower wall of the lid 1F, as illustrated in Fig. 7, to have a uniform distribution of the air on the free surface of the olive paste 9. There are three lids 1F in the mixer 10 of Figs. 5, 6 and 7, and each one covers a respective chamber 5. Each lid is fluidly connected to an independent air cooling/heating system (not shown), therefore the temperature of the air flowing in each lid can have different flow rate and temperature.

[0052] The screw conveyor 2A has no central axis, as better illustrated in Fig.8. To stiffen the scroll 2A and avoid bending in its intermediate portion, a plurality of support elements 2D are arranged between adjacent portions of the spiral of the scroll 2A. The support elements 2D are angularly spaced apart from each other, preferably by 120°. In addition to limiting the bending of the screw conveyor 2A, the support elements 2D make it possible to improve the mixing of the olive paste 9 when the screw conveyor 2A rotates.

[0053] The inlet 1G and outlet 1H of the mixer 1 point downwards. A motor 2C drives the actuator 2, thus the screw conveyor 2A, to move the olive paste from the inlet 1G to the outlet 1H.

[0054] For the elements of the mixer 10 of this embodiment not explicitly described, reference should be made, for reasons of conciseness, to what has been described above.

[0055] The mixer 10 is normally used in a plant 100 for pressing the olives 90, such as the one illustrated in Fig. 4. This type of plant 100 in fact maximizes the effects achieved by the mixer 10 in terms of aromas and flavours. In the following, the terms "upstream" and "downstream" are relative terms which refer to the direction of flow of the olive paste 9 in the plant 100.

[0056] As already mentioned, a crusher 40 is arranged upstream of the mixer 10. The crusher 40 is preferably directly connected to the mixer 10, so that the olive paste 9 produced by the olives 90 through the crusher 40 enters the mixer 10 without intermediate steps.

[0057] After pressing, the olive paste 9 enters the mixer 10 which cools it and oxygenates it in order to bring out the perfumes and smells of the oil 110 which will come out of the system 100. The mixer 10 has the characteristics and advantages described above.

[0058] Downstream of the mixer 10 there is a second container 20 into which the olive paste 9 coming out of the mixer 10 enters without any intermediate passage.

Preferably, the connection between the outlet 1H of the mixer 10 and the second container 20 is realized via a pipe, so as to avoid any contact with the ambient air, as shown in Fig. 4. The second container 20 comprises a third injector 21 configured to eject carbon dioxide into the second container 20, in order to inertize the olive paste 9 coming out of the mixer 10. The second container 20 can be optional.

[0059] Downstream of the second container 20, or of the mixer 10, there is a second heat exchanger 50, which heats the olive paste 9. The olive paste 9 is taken from the second container 20, or from the mixer 10, by means of a pump 30, which pushes the olive paste 9 through the second heat exchanger 50, as illustrated in Fig. 4. The olive paste 9 is preferably heated by about 10°C, until it reaches a temperature between 26°C and 27°C. At this temperature the phenolic substances of the olive paste increase 9 thus emphasizing the spicy and bitter flavours of the oil. The previously enhanced perfumes do not volatilize because the olive paste 9 has been inertized by carbon dioxide and the second heat exchanger 50 has no head space in which the perfumes could dissolve. The second heat exchanger 50 is preferably of the tube-in-tube type as illustrated in Fig. 4. The oil paste 9 flows in the inner tube and a hot liquid flows in the outer tube. The hot liquid flows preferably against the current with respect to the olive paste 9.

[0060] The combination of the mixer 10, which cools and oxygenates the olive paste 9, with the inerting system, which blocks the oxidative process of the olive paste 9 via the second injector 7 of the mixer 10 or the third injector 21 of the second container 20, and with the second exchanger 50, which heats the olive paste 9, allows the aromas and flavours of the oil 110 to be enhanced as desired.

[0061] A malaxer 60 is arranged downstream of the second exchanger 50, as shown in Fig. 4. The malaxer 60 is of the known type and is not further described here. The malaxer 60 is used as a buffer to stabilize the flow rate of olive paste 9 before the separation of the oil 110 from the olive paste 9. The malaxer 60 can be optional in the pressing plant 100 of the present invention. Furthermore, since the olive paste 9 is already heated by the second exchanger 50, the residence time of the olive paste 9 in the malaxer 60 is shorter. Since the process downstream of the malaxer 60 is discontinuous, while the one upstream of the malaxer 60 is continuous, the fact of decreasing the residence time of the olive paste 9 in the malaxer 60 makes the pressing process faster, minimizing its discontinuity.

[0062] The pressing plant 100 further comprises a separator 70. The separator 70 is of a known type and is not further described here. The separator 70 is arranged downstream of the second exchanger 50 or of the malaxer 60, as illustrated in Fig. 4, and is configured to separate the liquid phase from the solid phase of the olive paste 9.

[0063] The pressing plant 100 also includes a clarifier 80 arranged downstream of the separator 70. The clarifier 70 is of a known type and is configured to separate the olive oil 110 from the vegetation water contained in the olives 90. The olive oil 110 thus pressed, it is stored in special containers 120.

[0064] The pressing plant 100 thus conceived allows implementing a method of pressing the olives 90 with an innovative mixing phase of the olive paste 9 which comprises the sub-phases of ejecting air into a closed container 1 at a predetermined temperature via one or more injectors 4, mixing the olive paste 9 via an actuator 2, and regulating the temperature of the container 1 via a heat exchanger 3. The method therefore provides for cooling the olive paste 9 in two ways, thus by cooling the container 1 and ejecting fresh air into the container 1. In this way, a better oxygenation of the olive paste 9 is also obtained.

[0065] The mixing step also includes the step of ejecting carbon dioxide into container 1 or into a second container 20 to inertize the olive paste 9. The olive paste 9 is rendered inert by varying the flow rate of the carbon dioxide ejected by the second injector(s) 7.

[0066] In order to be able to adjust the operating parameters of the mixer 1, the method also provides for the possibility of adjusting the speed of the actuator 2 and the flow rate of the ejected air. In this way, by varying the speed of the actuator, it is possible to change the residence time of the olive paste 9 in the container 1 and therefore the contact time of the olive paste 9 with the cooled air. On the other hand, by varying the flow rate of the air ejected into container 1, since this is closed, it is possible to vary the pressure inside it.

[0067] After the aforementioned inerting sub-phase of the olive paste 9, the method provides for the step of overheating the inerted olive paste 9 to bring out its bitterness and spiciness.

[0068] Finally, the method provides for the step of separating the solid phase from the liquid phase of the overheated olive paste 9 and the further step of clarifying the liquid phase to separate the olive oil 110 from the vegetation water.

[0069] The method thus conceived makes it possible to enhance the flavours and aromas of the 110 oil regardless of the ambient temperature in which the pressing is performed.

[0070] The pressing method according to the present invention allows to optimize the olfactory and gustatory properties of the olive oil 110 by varying at least one of the mixing parameters in the mixer 1 and in particular at least one of: the rotation speed of the actuator 2; the temperature of the air ejected by injector 4, the temperature in the heat exchanger 3 and therefore the temperature of container 1, the flow rate of the air ejected by injector 4, the carbon dioxide rate ejected by the second injector 7. If, for example, the pressed oil 110 is not perfumed enough, it is possible to increase the air flow rate and lower its temperature. If, on the other hand, the aromas are too intense, it is possible to increase the flow of carbon dioxide. Otherwise, it is possible to adjust the speed of the actuator 2 to increase the exposure time of the olive paste 9 to the jet of cold air.

[0071] The method of pressing the olives 90 according to the present invention further comprises the step of separating the solid phase from the liquid phase of the heated olive paste 9, and preferably also the step of clarifying the olive oil 110 from the vegetation water.

[0072] In conclusion, it is clear that the invention thus conceived is susceptible to numerous modifications or variations, all covered by the invention; moreover all the details can be replaced by technically equivalent elements. In practice, the quantities may be varied according to technical requirements.

Claims

1. Mixer (10) for olive paste (9) comprising:

- an open top container (1) through which the olive paste (9) flows, the container (1) comprises a lid (1F) configured to close the open top container (1) and, if it is opened, to allow a complete access inside (1D) of the container (1);
- an actuator (2) configured to advance and mix the olive paste (9) in the container (1);
- a heat exchanger (3) arranged on a lower portion (1C) of the container (1) and placed in thermal communication with the interior (1D) of the container (1) to exchange heat with the olive paste (9) through a lower wall (1E) of the container (1);
- at least one air injector (4) configured to ejected air at a predetermined temperature into the container (1), the at least one air injector (4) is arranged and oriented so that the air ejected from the injector (4) flows over a free surface of the olive paste (9) that flows into the container (1).

2. Mixer (10) according to claim 1, wherein the container (1) has an upward flared shape.

3. Mixer (10) according to any of the preceding claims, wherein the predetermined air temperature is between -5°C and 15°C, preferably between 2°C and 10°C.

4. Mixer (10) according to any one of the preceding claims, wherein the container (1) has an elongated shape comprising an inlet (1G) for receiving the olive paste (9) at one end (1A) and an outlet (1H) to expel the olive paste (9) at the opposite end (1B).

5. Mixer (10) according to any one of the preceding claims, wherein the actuator (2) comprises a screw conveyor (2A) arranged so that its rotation axis (2B) is parallel to a longitudinal development direction of the container (1).

6. Mixer (10) according to any one of the preceding claims, wherein the heat exchanger (3) is a liquid exchanger arranged between the lower wall (1E) of the container (1) and a jacket (1J) external to the lower portion (1C) of the container (1) to exchange heat only the lower portion (1C) of the container (1), preferably the liquid flows counter-current with respect to the olive paste (9).

7. Mixer (10) according to any one of the preceding claims, wherein the container (1) is divided into several chambers (5) by one or more septa (6) transversely arranged inside the container (1) with respect to the longitudinal development direction of the container (1).

8. Mixer (10) according to any one of the preceding claims, comprising a second injector (7) configured to eject carbon dioxide into the container (1) so that the carbon dioxide flows over the olive paste (9) flowing into the container (1).

9. Mixer (10) according to any one of the preceding claims, comprising one or more of the following types of sensors:

- oxygen sensor (8A);
- temperature sensor (8B, 8B');
- pressure sensor (8C).

10. Olive pressing plant (100) comprising at least a mixer (10) according to one or more of the preceding claims, a crusher (40) suitable for crushing the olives (90) and a separator (70) of the liquid phase from the solid phase of the olive paste (9), wherein the mixer (10) is arranged downstream of the crusher (40) and upstream of the separator (70).

11. Olive pressing plant (100) according to claim 10, further comprising a second container (20) arranged downstream of the mixer (10) so that the olive paste (9) coming out of the mixer (10) enters directly into the second container (20), wherein said second container (20) comprises a third injector (21) configured to eject carbon dioxide into the second container (20).

12. Olive pressing plant (100) according to claim 10 or 11, further comprising a pump (30) and a second heat exchanger (50), preferably of the tube-in-tube type, configured to heat the olive paste (9) coming out of the mixer (10) or the second container (20), preferably the plant (100) comprises a malaxer (60) arranged downstream of the second exchanger (50) and upstream of the separator (70) for separating the liquid phase from the solid phase of the olive paste (9), so as to receive the olive paste (9) coming out of the second exchanger (50).

13. Olive pressing plant (100) according to any one of claims 10 to 12, further comprising a clarifier (80) arranged downstream of the separator (70) for separating the liquid phase from the solid phase of the olive paste (9) and configured for separate the olive oil (110) from the vegetation water.

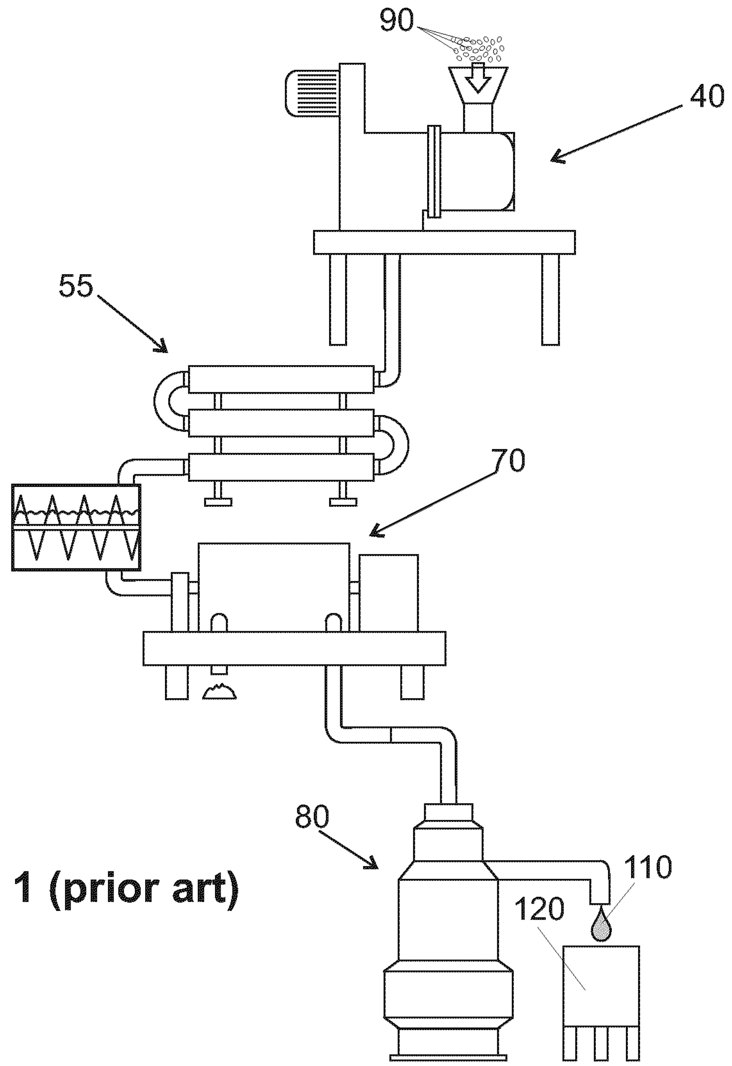


Fig. 1 (prior art)

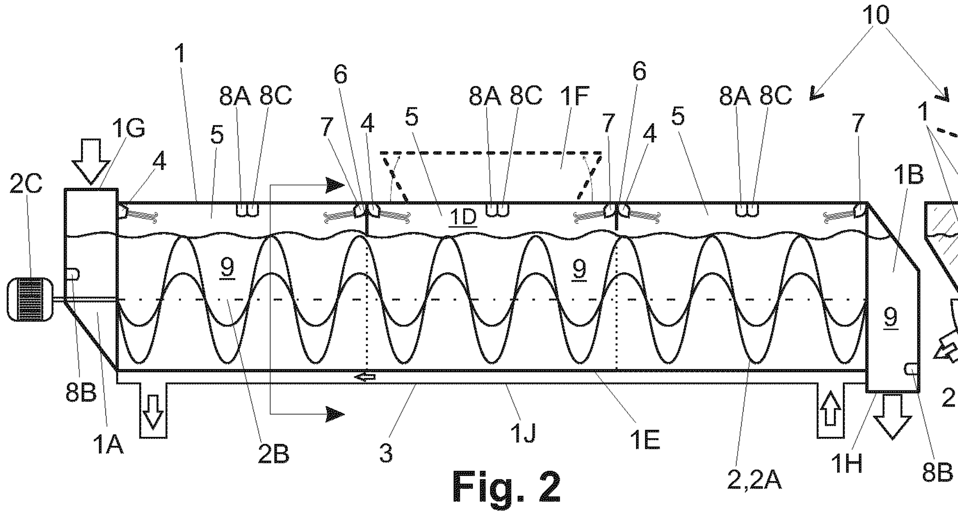


Fig. 2

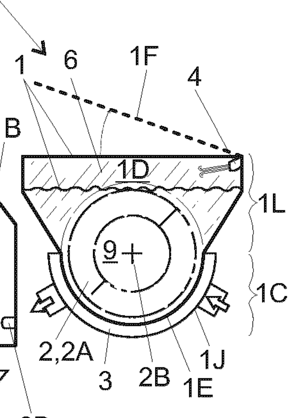
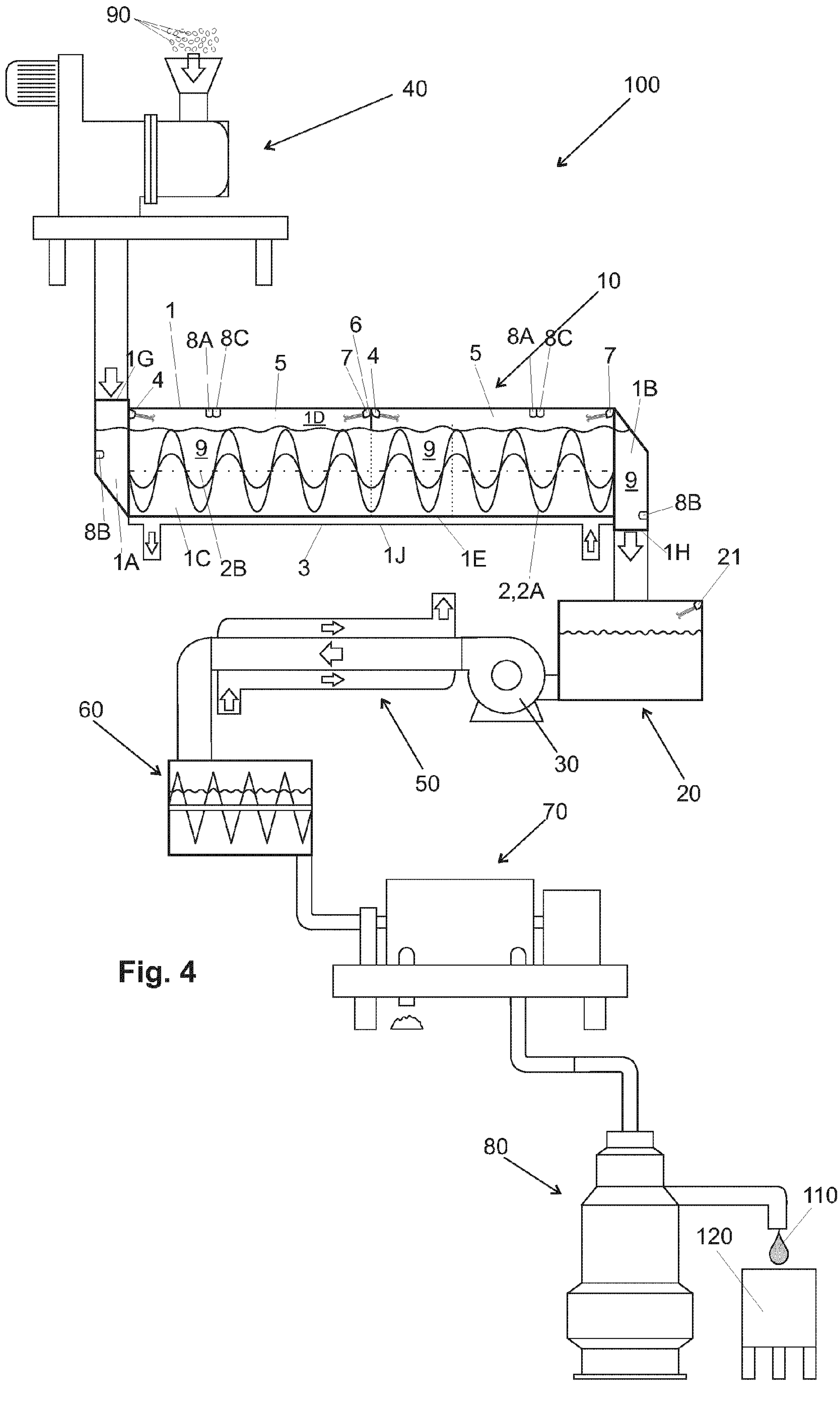


Fig. 3


90
40
100
10
1
8A
8C
6
8A
8C
7
4
5
5
7
1G
4
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1D
9
9
9
8B
8B
1A
1C
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70
80
110
120

Fig. 4

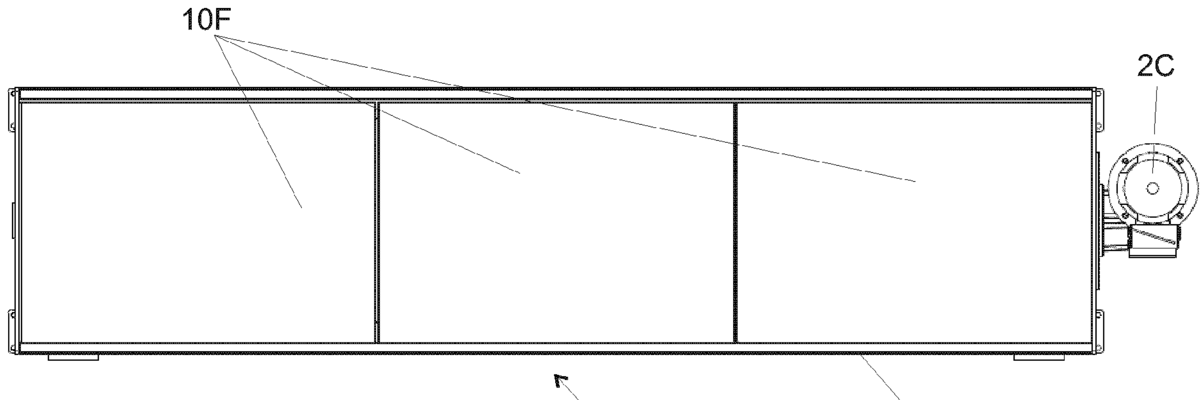

Fig. 5

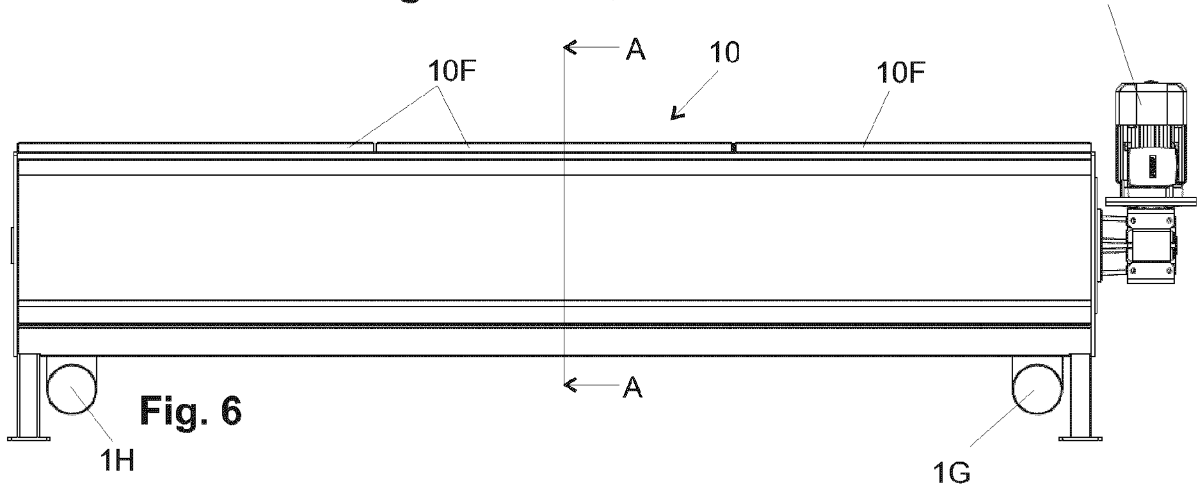

Fig. 6

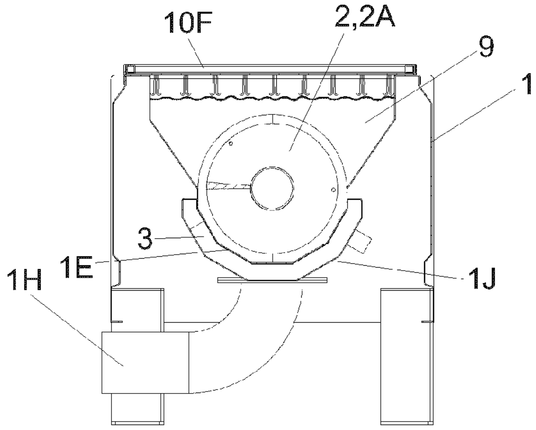

Fig. 7

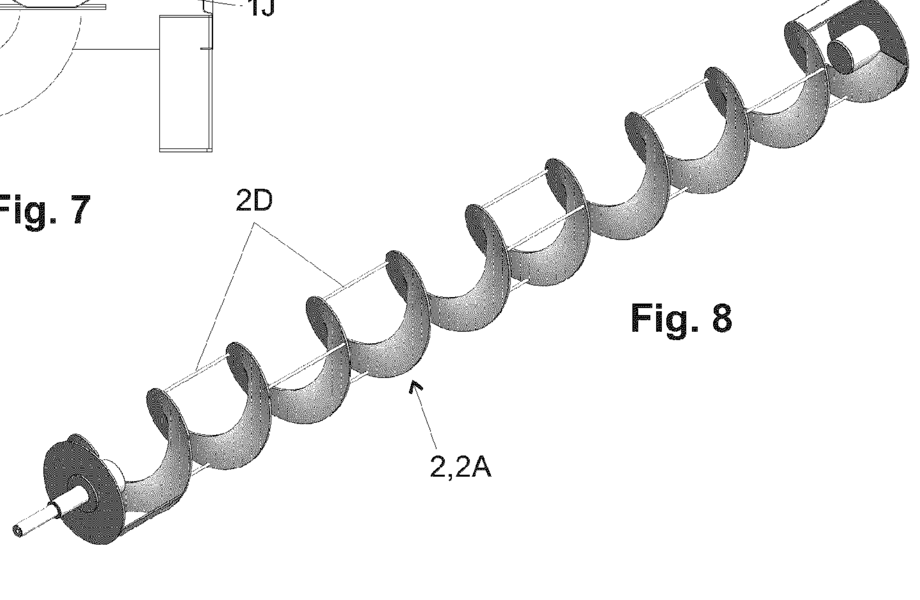

Fig. 8

European Patent Office

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Place of search	Date of completion of the search	Examiner
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