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(54) DEVICE AND METHOD FOR CONTINUOUS TREATMENT OF A FOOD PRODUCT

(57) A device and process for continuous treatment of a food product that uses the device having: a tubular chamber (1) which has a first conduit (101) as an inlet for the food product and a second conduit (102) as an outlet for the food product, to maintain the food product pressurized from the first conduit (101) to the second conduit (102); a circulation circuit (121) for thermal fluid in the tubular chamber (1) between a first inlet (11) for thermal fluid and a first outlet (12) for thermal fluid; a malaxing mechanism (30) inside the tubular chamber (1) to malax the food product, which has a rotating shaft (301) and a plurality of blades (300) along the rotating shaft (301), the rotating shaft (301) being parallel to a longitudinal axis of the tubular chamber (1).

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Description

Field of the invention

[0001] The invention falls within the field of machinery and methods for treatment of semi-finished products in the food industry. More specifically, it falls within the field of machinery which comprises heat exchangers and malaxing mechanisms and in the field of heat exchange and malaxing methods for said products.

Background of the invention

[0002] In the case of olive oils, the need to make the current extraction process of virgin and extra-virgin olive oil even more dynamic, as well as the trend of searching for the best possible quality for final products, makes it necessary to look for new alternatives to the weak points of the processes and equipment used, and malaxing the olive paste is one of the most conflictive points in these processes. In known methods it involves a loss of time in the processing cycle and a reduction in the quality of the final product.

Description of the invention

[0003] The invention proposes, as an alternative, a device and process for continuous treatment of a food product that, although when applied to olive oil production it has similar results with regard to oil extraction, enables many other conditioning variables of the olive paste to be controlled and managed, thereby increasing the quality of the final product and also reducing the time the process takes and at a lower cost, both in the installation and in energy consumption.

[0004] Thus, malaxing the olive paste in accordance with the invention substitutes traditional malaxing while at the same time providing the same benefits and added values to this part of the process.

[0005] The invention reduces the malaxing time from the traditional 60-90 minutes to a fourth of that time for productions of 100,000 kg/day, this being the time the product takes to complete the entire circuit, from the grinding mill to the decanter.

[0006] The temperature variation in the device of the invention may be done both positively and negatively, that is to say, the temperature of the olive paste may be increased to improve the extractability thereof, and the temperature may be decreased when necessary, for example during hot months, in order to obtain a better quality of the Extra-Virgin Olive Oil (EVOO).

[0007] The invention enables a reduction of traditional coadjuvants, such as microtalc and water, to be achieved.

[0008] Another advantage of the device of the invention is that it enables a controlled atmosphere to be created, in which the process is carried out.

[0009] Additionally, using the device of the invention in the production of oil improves the traditional process with regard to the quality of EVOO without interfering in the amount of oil obtained.

[0010] One aspect of the invention relates to a device for continuous treatment of a food product. By continuous treatment it is meant a process without an interruption, in other words, the food product is subjected to the treatment in a continuous manner, without the need to interrupt the treatment to complete it. The device for the continuous treatment of the food product comprises:

- a tubular chamber which comprises a first conduit as an inlet for the food product and a second conduit as an outlet for the food product, the tubular chamber being configured to maintain the food product pressurized from the first conduit to the second conduit;
- a circulation circuit for thermal fluid in the tubular chamber between a first inlet for thermal fluid and a first outlet for thermal fluid;
- a malaxing mechanism within the tubular chamber to malax the food product, comprising a rotating shaft and a plurality of blades along the rotating shaft, the rotating shaft being parallel to a longitudinal axis of the tubular chamber.

[0011] In accordance with the structure of the treatment device, it is shown that continuous treatment implies that the product goes through the tubular chamber from the first conduit to the second conduit in an uninterrupted fashion while the process is being carried out. In other words, the device of the invention enables this treatment to be carried out without any standstills.

[0012] In accordance with other features of the invention:

- The rotating shaft is configured to rotate at a speed comprised between 20 and 70 rpm.

Brief description of the drawings

[0013] As a complement to the description, and for the purpose of helping to make the features of the invention more readily understandable, in accordance with a practical embodiment thereof, said description is accompanied by a set of figures constituting an integral part thereof, which by way of illustration and not limitation represent the following:

Figure 1 is an elevation view of an embodiment of the device of the invention.
Figure 2 is a perspective view of an embodiment of the device of the invention, wherein the inner portion of the upper subchamber may be seen.
Figure 3 is a perspective view of an embodiment of the device of the invention.
Figures 4, 5 and 6 are graphs wherein the temperature (°C) is represented on the y-axis and the time in hours (h) is represented on the x- axis to show the heat exchange process of the invention. Figures 4, 5 and 6 illustrate the process for three samples: T1, T2 and T3.

[0014] The device of the invention comprises the following elements:

1	Tubular chamber 1
101	First conduit
102	Second conduit
121	Circulation circuit
11	First inlet
12	First outlet
30	Malaxing mechanism
301	Rotating axis
300	Blades
131	First oxygen sensor
132	Second oxygen sensor
141	Oxygen inlet
110	First temperature measurement means
120	Second temperature measurement means
111	Third temperature measurement means
112	Fourth temperature measurement means
1A	First tubular subchamber
1B	Second tubular subchamber
1120	Fifth temperature measurement means
1112	Sixth temperature measurement means
20	Second inlet
161	First NIR sensor
162	Second NIR sensor
170	Torque sensor
152	Viscometer
31	Revolution counter

Description of an embodiment of the invention

[0015] Figure 1 shows an embodiment of the device of the invention which comprises in the interior thereof a circulation circuit (121) of a thermal fluid which exchanges heat with the product to be treated, a conduit for the passage of the product and a malaxing mechanism (30). The thermal fluid may be service water.

[0016] In an embodiment of the invention, the device shown in figure 1 is a device for fast olive paste preparation installed between the mill and the decanter.

[0017] Given the current problems with regard to this aspect in traditional malaxing, it is necessary to design different methods for the preparation of olive paste prior to the decanting stage. In effect, in traditional malaxing there is an interruption in the extraction process of virgin olive oil, which cannot be continuous because of a malaxing stage in a tub tank at room pressure, which after a malaxing period is emptied. Traditional malaxing also leads to a reduction in the quality of the oil obtained, since in the malaxing stage in an open tub, oxidation of the olive paste takes place, which causes a degradation of the oil obtained.

[0018] The malaxing process of the invention reduces the transition time between milling and decanting, since the device of the invention enables the temperature of the paste to be adapted, as well as the coalescence of the oil in a

completely dynamic form. The device of the invention also enables a reduction in the amount of coadjuvants used in comparison with the amount required in traditional treatments of adding water or microtalc to facilitate extraction. Coalescence is the possibility by which two or more materials merge into a single body, which in olive oil production refers to the union of small olive oil drops to form other larger and more easily extractable drops.

[0019] Furthermore, in addition to the classical functions of traditional malaxing, the malaxing of the invention enables certain factors to be controlled which earlier, due to the difficulty and cost of the installations, used to be highly complicated and almost restricted to laboratory tests. Inside the malaxing device of the invention it is possible to work in a controlled atmosphere, enabling the amount of oxygen inside the device of the invention to be known and managed.

[0020] Another parameter to control is the rotational speed of the internal malaxing mechanism which, along with oxygen control, enables the viscosity of the olive paste to be adapted until an optimal level for separation in the decanter. Viscosity is also related to olive oil extraction: by achieving a decrease in the viscosity through an optimized control of temperature and malaxing, extractability increases.

[0021] All these additional parameters not only affect the extractability of the product but are also highly beneficial to the quality of the same. By managing the temperature and mechanical speed, the phenolic compounds are optimized, while the volatile compounds may be better limited within the controlled atmosphere. The olive oil is divided into majority components (basically phenolic compounds which are triglycerides and make up 99% of the weight of the oil) and minority volatile components (more than 200 components which differentiate the oil and provide healthy characteristics).

[0022] The device of the invention shown in figure 2 comprises modules three meters long which may be coupled in order to achieve a suitable size for the necessary production, both in series and in parallel, in order to optimize the space available in the oil mill.

[0023] Constructively the device of the invention is designed taking two facets into consideration. A first facet, related to temperature control, and a second facet, related to the malaxing of the product to be treated.

[0024] In accordance with an embodiment of the invention considering the first facet, the one dedicated to temperature control, the device comprises a floodable chamber through which thermal fluid circulates. In accordance with an embodiment of the invention, the thermal fluid is climatizing water, at a higher or lower temperature, depending on whether the operative function is to add or subtract heat from the product to be treated.

[0025] In accordance with an embodiment of the invention considering the second facet, the one dedicated to the malaxing of the product to be treated, the rotating malaxing mechanism (30) is in contact with an olive paste. This facet of the invention related to the malaxing is focused, on the one hand, on malaxing the product in order to achieve a homogenous temperature and, on the other hand, by means of the malaxing motion, on helping reduce the viscosity, favoring the coalescence of the oil.

Temperature variation:

[0026] The temperature variation is produced by means of heat exchange through convection and conduction between the thermal fluid and the product to be treated.

[0027] In a preferred embodiment, the thermal fluid is water and the product to be treated is olive paste. By means of the device of the invention, the temperature of the olive paste may be increased or decreased through heat exchange between the olive paste and water.

[0028] In accordance with a preferred embodiment of the invention, water circulates through an outer portion of the tubular chamber (1) in counterflow, that is to say, in an opposite direction to that of the circulation of the product to be treated, which is the olive paste in this embodiment. In accordance with this embodiment, the circulation circuit (121) is arranged in an outer portion of the tubular chamber (1).

[0029] The water temperature is controlled depending on the temperature of the olive paste at the outlet of the device by means of an electrovalve device which enables the variation of the water temperature and, in turn, of the temperature of the product to be treated (the olive paste). In the case in which heat is to be applied to the water, the hot water electrovalve remains open until the treated product reaches the set temperature. Once this temperature is reached, this electrovalve stops actuating and enables the recirculation of water inside the tubular chamber (1) until said temperature is lowered and the electrovalve is again connected, adding hot water until reaching the set temperature once again.

[0030] Moreover, the flow of the water may be adjusted by means of three-way valves, enabling more or less flow depending on the needs. The water flow is adjusted based on the heat exchange required to increase or decrease the exchanged heat, according to the needs of the process. The adjustment is done by means of three-way valves and control means of the extraction plant or of the device for the treatment of the product. If it is necessary to cool the olive paste, the process is the same, only with the cooling fluid, the water, at a lower temperature than the olive paste.

[0031] To enable the temperature transfer to the entire olive paste, the motion of the olive paste inside the tubular chamber (1) is forced to have a component in a transverse direction, increasing the amount of olive paste in contact with the heated/cooled surface.

[0032] To increase the efficiency of the heat transfer and achieve quicker temperature variations, the tubular chamber

(1) is externally isolated to avoid heat loss to the environment and enable the maximum use of heat energy.

Homogenization of the product to be treated:

[0033] The homogeneity and coalescence of the product to be treated is achieved through the malaxing mechanism (30), which has rotating parts in the tubular chamber (1) of the device of the invention.

[0034] These rotating parts consist of a shaft (301) actuated by a motoreductor and equipped with blades (300) alternately arranged along the shaft (301). The blades (300) are arranged inclined with respect to the shaft (301) in order to facilitate a motion of the product through an axial component and also to radially drive the product to be treated in order to facilitate the malaxing of the same.

[0035] By means of frequency variators the rotational speed of the shaft (301) may be modified, producing a more or less powerful malaxing according to the needs at any time.

[0036] To increase the possibilities of tailoring the olive paste, and by means of connections in the first conduit (101), traditional olive coadjuvants may be added, such as water and micro talc, by means of a second inlet (20). The device and process of the invention enable the amount of additives to be reduced, which translates to lower costs.

[0037] With regard to adding water, the amount necessary depends on the moisture present in the olive when it arrives at the mill, but through achieving a much more optimized malaxing of the olive batter, the device and method of the invention enable the proportion of water to be injected to be reduced if necessary.

[0038] There is significant improvement in quality by having more control over the oxidation variables that intervene in the process. By means of the device and process of the invention the amount of O2 in the olive batter may be controlled and thereby prevent it from affecting the oil obtained. This advantage is particularly noteworthy for the production of high-end oils, since contact with O2 inside the equipment can be minimized, which results in fruitier and more aromatic oils and, therefore, more minority components which differentiate these oils and increase their quality.

[0039] Moreover, oxygen may also be introduced through an oxygen inlet (141) if necessary.

Controls:

[0040] The controls that may be carried out apart from the traditional ones are:

- Temperature control of the thermal fluid, which may be service water: the installed probes enable the instantaneous temperature of the thermal fluid to be known. According to the embodiment of the invention, these probes are installed in the first inlet (11), made up of first temperature measurement means (110) in the intermediate zone, between the first tubular subchamber (1A) and the second tubular subchamber (1B), made up of fifth temperature measurement means (1120), and in the first outlet (12), made up of second temperature measurement means (120).
- Temperature control of the product: just as with the thermal fluid, the temperature of the product is measured at each relevant point of the installation, enabling the temperature of the thermal fluid to be adapted based on these parameters. Therefore, in accordance with the embodiment of the invention, the device of the invention comprises:
    - third temperature measurement means (111) configured to measure a temperature of the product to be treated in the first conduit (101);
    - fourth temperature measurement means (112) configured to measure a temperature of the product to be treated in the second conduit (102);
    - sixth temperature measurement means (1112) configured to measure a temperature of the product to be treated between the first tubular subchamber (1A) and the second tubular subchamber (1B);
- *Near-Infrared* (NIR) control at the inlet and outlet of the product to measure the fat content and moisture: by means of this measurement the amount of water to be added to the paste may be determined. *Fourier Transform Near-Infrared* (FT-NIR) spectroscopy measures the interaction of near infrared light of a sample in all of the wave lengths in that spectral range, generating a chemical fingerprint, also called spectrum. This resulting NIR spectrum shows the absorption bands mainly from the C-H, N-H and O-H groups, making the NIR spectroscopy the first choice for analyzing organic materials such as oily seeds and edible oils. Therefore, in accordance with the embodiment of the invention, the device of the invention comprises:
    - a first NIR sensor (161) configured to measure a fat content and a degree of moisture in the first conduit (101);
    - a second NIR sensor (162) configured to measure a fat content and a degree of moisture in the second conduit (102).
- Oxygen Control: inserted in the feeding and outlet conduits of the product. The amount of oxygen may be measured

and varied as needed. Therefore, in accordance with the embodiment of the invention, the device of the invention comprises:

- a first oxygen sensor (131) configured to measure an amount of oxygen in the first conduit (101);
- a second oxygen sensor (132) configured to measure an amount of oxygen in the second conduit (102);
- an oxygen inlet (141) configured to enable an introduction of oxygen in the first conduit (101);

- Torque control in the motoreductors which actuate the rotating shaft (301) to know the state of viscosity during the entire process by means of a torque sensor (170).
- Viscosity control by means of a viscometer (152): the product is controlled at the outlet of the tubular chamber (1), obtaining the state of the final product.
- Rotational speed control of the malaxing mechanism (30) by means of a revolution counter (31).

[0041] Figure 3 shows the points of location of the different sensors and inlets of the elements.

[0042] As was previously mentioned, in specific embodiments of the invention, the food product is olive paste and the thermal fluid is water.

Cleaning system:

[0043] Additionally, cleaning equipment may be adapted in-situ, otherwise known as cleaning in place (CIP), to guarantee the cleaning of the installation, avoiding contamination of the next batches of olives. explanation This in-situ cleaning, or CIP, enables an installation to be cleaned without disassembling any of the equipment or tubing.

[0044] Cleaning is carried out by means of circulating warm water and warm chemical solutions though the equipment or tubing which is in contact with the products. The physical, chemical and bacteriological action thereof eliminates dirt and microorganisms on the surfaces.

Installation and Process:

[0045] In the embodiment in which the product to be treated is olive paste, the device of the invention is inserted between the mill and the decanter inside the oil mill. Feeding is carried out by a lobe pump to give continuity to the olive paste and is carried out at the lower portion of the device of the invention, where heat is exchanged in counterflow with the thermal fluid, which may be water, to achieve the set temperature. The outlet of the treated product is through the upper portion of the malaxing device.

[0046] If more meters for malaxing are needed to meet production requirements, additional segments may be added, coupled in series or in parallel, depending on the space available in the oil mill, the segments being fixed by means of a bench which provides stability to the structure.

[0047] With regard to the outlet of the product and the feeding to the decanter, it is not necessary for any other elements to intervene, since the thrust of the lobe pump that feeds the device of the invention is able to drive the paste to the decanter.

[0048] In other words, the device for the continuous treatment of a food product is configured to be installed downstream the pump means to move the food product through the first conduit (101) of the tubular chamber (1) and through the second conduit (102) directly to a decanter.

Description of the process

[0049] In an embodiment of the invention, the process consists of heating the milled paste of olives with the pits that comes out of the grinder so that it arrives to the mixer at the correct temperature. This part of the process is common in methods for obtaining olive oil.

[0050] The heating time negatively affects the quality of the product and, by means of an embodiment of the device of the invention, this time is reduced by using a heat exchanger provided with a rotating malaxing mechanism (30) to provide heat in a range approximately from 17 to 27°C, a flow of 4,000 kg/h with hot sanitary water. Additionally, the device of the invention also enables the malaxing time to be reduced.

[0051] In an embodiment of the invention, the speed of the blades, adjustable through the variator, is between 20 and 30 rpm, although in the device of the invention this speed can reach up to 70rpm.

[0052] In an embodiment of the invention, wells are installed for temperature probes at the inlet to the first subchamber (1A), at the outlet of the first subchamber (1A) and at the outlet of the second subchamber (1B).

[0053] In an embodiment of the invention, the diameter of the first conduit (101) of the connection between the first subchamber (1A) and the second subchamber (1B) and the second conduit (102) is 5" or 127mm in order to have a similar product speed in the connections and in the subchamber (1A, 1B).

[0054] In an embodiment of the invention, the inlet of the product to be treated into the tubular chamber (1) is done through the lower portion of the exchanger.

Oil mill test

[0055] During the 2016/2017 season, malaxing tests were carried in an oil mill. The test consisted of a comparison between the malaxing of the invention and a traditional malaxing, focusing on the amount of extra-virgin oil obtained in both cases.

[0056] The elements used in the study were the traditional elements for the extraction of virgin olive oil:

Hammer mill.
The malaxing device of the invention which comprises modules to form a treatment length of 12 meters.
Traditional vertical axis mixer (3000 kg)
GEA Westfalia VCC-458-08-30 decanter
Vertical centrifuge VSD-25-02-007

[0057] The study was carried out with the maximum similarity for both processes, carrying out an homogenization of the olive batches, production in the decanter, separation in the centrifuge, as well as adding water and other elements that influence in the separation.

[0058] The two similar batches were processed, one intended to be malaxed in accordance with the invention and another for traditional malaxing, of 12341kg and 12461kg, respectively. During the process, different samples were taken to be subsequently analyzed in the laboratory, which are included in Tables 1 and 2. Each sample was taken in a period of 1 hour (T1, T2 y T3), in addition to a sample mixture of others taken at intervals of 15 minutes with the following results:

Table 1. Results of the samples analyzed during the process with malaxer of the invention

MALAXER OF THE INVENTION					
	INLET	T1	T2	T3	MIXTURE
MOISTURE (%)	51.4	64.1	62.4	64.4	62.15
GMS (%)	44.89	8.76	9.72	9.03	9.66
GMH (%)	21.81	3.15	3.65	3.23	3.66
kg processed	12341			EFFICIENCY (%)	74.46
kg of oil obtained	2005			YIELD (%)	16.24

Table 2. Results of the samples analyzed during the process with a traditional malaxer

TRADITIONAL MALAXER					
	INLET	T1	T2	T3	MIXTURE
MOISTURE (%)	50.96	64.82	64.31	63.73	63.83
GMS (%)	44.84	8.53	8.94	7.61	8.38
GMH (%)	21.98	3	3.19	2.76	3.03
kg processed	12461			EFFICIENCY (%)	75.8
kg of oil obtained	2077			YIELD (%)	16.66

[0059] Where:

GMS: Olive paste fat content of a dry extract, without moisture.
GMH: Olive paste fat content of a moist extract, with moisture.

[0060] As can be deduced from the tables, the potential of the malaxing of the invention is very high with regard to oil

extraction, similar results being obtained in both cases.

[0061] With regard to the temperature transfer in both tests, the graphs in figures 4, 5 and 6 show the temperature variation between the heating water and the olive paste. It is clear that an effective temperature exchange is produced when feeding with hot water in T1 and T3 and that in T2 this exchange is maintained during the period of recirculation of the service water in a time that amounts to a fourth of the time used in a traditional mixer.

Claims

1. Device for continuous treatment of a food product, **characterized in that** it comprises:

   - a tubular chamber (1) which comprises a first conduit (101) for entrance of the food product and a second conduit (102) for exit of the food product, configured to maintain the food product under pressure from the first conduit (101) to the second conduit (102);
   - a circulation circuit (121) for thermal fluid in the tubular chamber (1) between a first inlet (11) for thermal fluid and a first outlet (12) for thermal fluid;
   - a malaxing mechanism (30) inside the tubular chamber (1) to malax the food product, which comprises a rotating shaft (301) and a plurality of blades (300) along the rotating shaft (301), the rotating shaft (301) being parallel to a longitudinal axis of the tubular chamber (1).

2. Device for continuous treatment of a food product according to claim 1, **characterized in that** the rotating shaft (301) is configured to rotate at a speed comprised between 20 and 70 rpm.

3. Device for continuous treatment of a food product according to any of claims 1-2, **characterized in that** it comprises:

   - a first oxygen sensor (131) to measure an amount of oxygen in the first conduit (101);
   - a second oxygen sensor (132) to measure an amount of oxygen in the second conduit (102);
   - an oxygen inlet (141) to enable an introduction of oxygen in the first conduit (101);

4. Device for continuous treatment of a food product according to any of claims 1-3, **characterized in that:**

   - the circulation circuit (121) is made up of a floodable chamber in the tubular chamber (1).

5. Device for continuous treatment of a food product according to any of claims 1-4, **characterized in that** the tubular chamber (1) is configured so that the thermal fluid and the food product circulate in counterflow.

6. Device for continuous treatment of a food product according to any of claims 1-4, **characterized in that** the first inlet (11), the first outlet (12), the circulation circuit (121), the first conduit (101) and the second conduit (102) are arranged in the tubular chamber (1) so that the thermal fluid and the food product circulate in counterflow.

7. Device for continuous treatment of a food product according to any of claims 1-6, **characterized in that** the circulation circuit (121) is arranged on an outer portion of the tubular chamber (1).

8. Device for continuous treatment of a food product according to any of claims 1-7, **characterized in that** it comprises:

   - first temperature measurement means (110) configured to measure a temperature of the thermal fluid in the first inlet (11);
   - second temperature measurement means (120) configured to measure a temperature of the thermal fluid in the first outlet (12);
   - third temperature measurement means (111) configured to measure a temperature of the food product in the first conduit (101);
   - fourth temperature measurement means (112) configured to measure a temperature of the food product in the second conduit (102);

9. Device for continuous treatment of a food product according to any of claims 1-8, **characterized in that** the tubular chamber (1) comprises:

   - a first tubular subchamber (1A);

- a second tubular subchamber (1B) arranged in series with the first tubular subchamber (1A);
- fifth temperature measurement means (1120) configured to measure a temperature of the thermal fluid between the first tubular subchamber (1A) and the second tubular subchamber (1B);
- sixth temperature measurement means (1112) configured to measure a temperature of the food product between the first tubular subchamber (1A) and the second tubular subchamber (1B).

10. Device for continuous treatment of a food product according to any of claims 1-8, **characterized in that** it comprises a second inlet (20) configured to enable a supply of additives to the tubular chamber (1).

11. Device for continuous treatment of a food product according to any of claims 1-10, **characterized in that** the blades (300) are placed inclined with respect to the rotating shaft (301).

12. Device for continuous treatment of a food product according to any of claims 1-11, **characterized in that it** comprises:

- a first NIR sensor (161) configured to measure a fat content and a degree of moisture in the first conduit (101);
- a second NIR sensor (162) configured to measure a fat content and a degree of moisture in the second conduit (102).

13. Device for continuous treatment of a food product according to any of claims 1-12, **characterized in that** it comprises a motoreductor to actuate the rotating shaft (301) and a torque sensor (170) to measure an actuator torque of the motoreductor.

14. Device for continuous treatment of a food product according to any of claims 1-13, **characterized in that it** comprises a viscometer (152) to measure a viscosity of the food product in the second conduit (102).

15. Device for continuous treatment of a food product according to any of claims 1-14, **characterized in that** it comprises a revolution counter (31) to measure a rotational speed of the malaxing mechanism (30).

16. Device for continuous treatment of a food product according to any of claims 1-15, **characterized in that** it is configured to be installed downstream of the pump means to move the food product through the first conduit (101) of the tubular chamber (1) and through the second conduit (102) to a decanter.

17. Process for continuous treatment of a food product in a device according to any of claims 1-16, **characterized in that** the thermal fluid is water.

18. Process for continuous treatment of a food product according to claim 17, **characterized in that** the food product is olive paste.

19. Process for continuous treatment of a food product according to claim 18, **characterized in that** it comprises adding additives which comprise coadjuvants for olive oil.

20. Process for continuous treatment of a food product according to claim 19, **characterized in that** the additives comprise water and microtalc.

21. Process for continuous treatment of a food product according to claim 20, **characterized in that** the microtalc is added in a proportion comprised between 0.15% and 0.5% in weight.

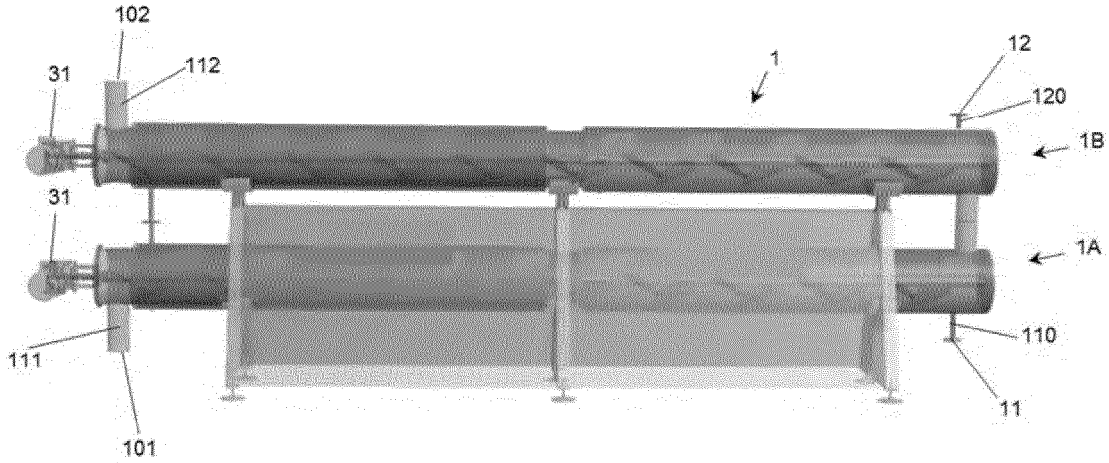

FIG. 1

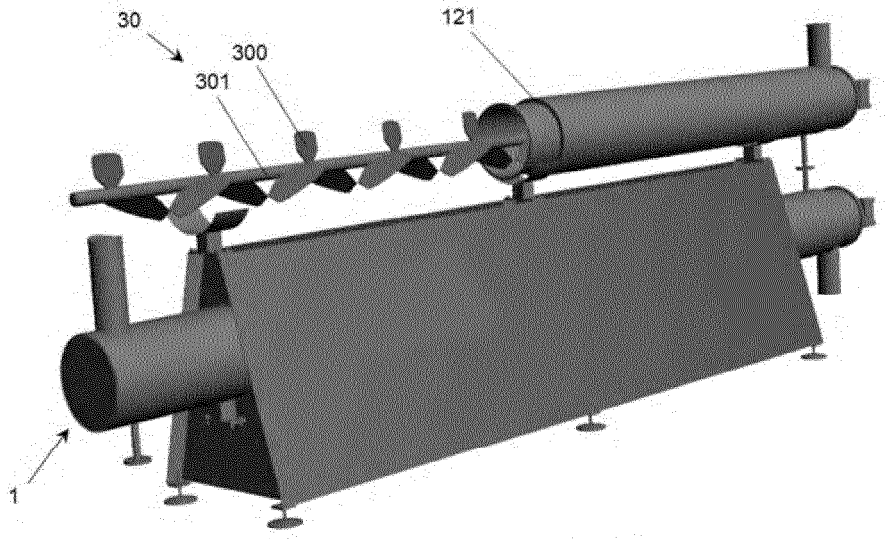

FIG. 2

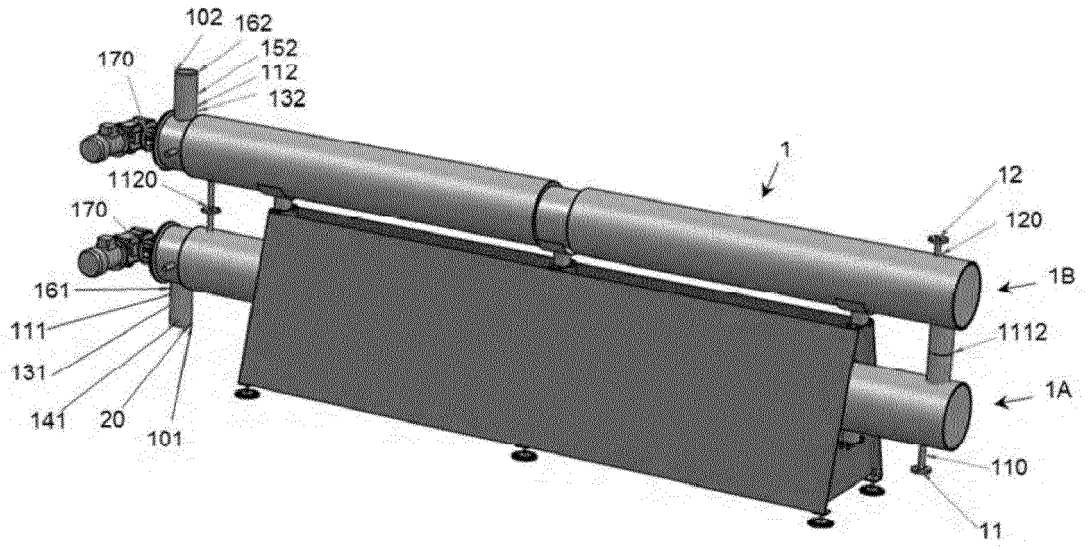
102
162
152
112
132
170
1120
170
161
111
131
141
20
101
1
12
120
1B
1112
1A
110
11

FIG. 3

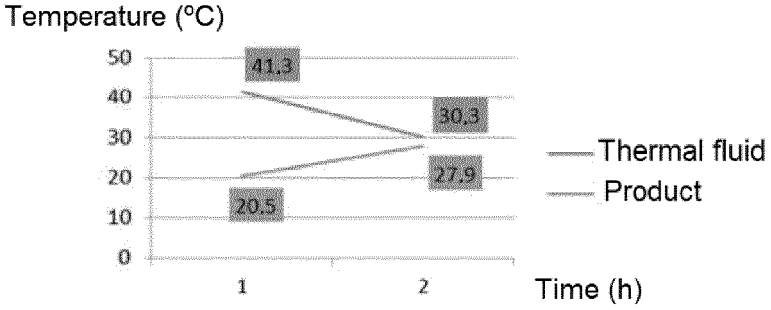
Temperature (°C)
50
40
30
20
10
0
41.3
30.3
27.9
20.5
1
2
Time (h)
Thermal fluid
Product

FIG. 4

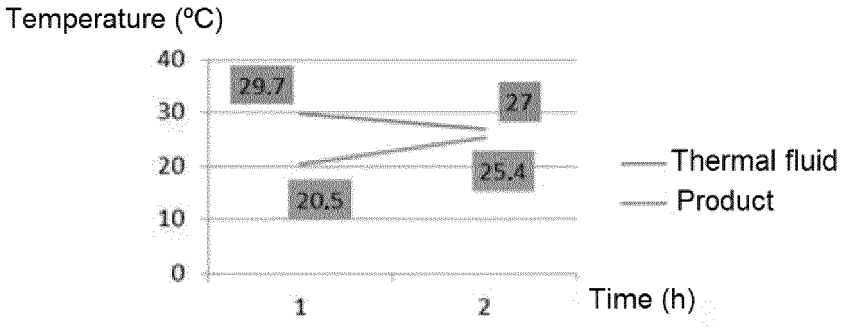
Temperature (ºC)
40
30
20
10
0
29.7
27
25.4
20.5
1
2
Time (h)
Thermal fluid
Product

FIG. 5

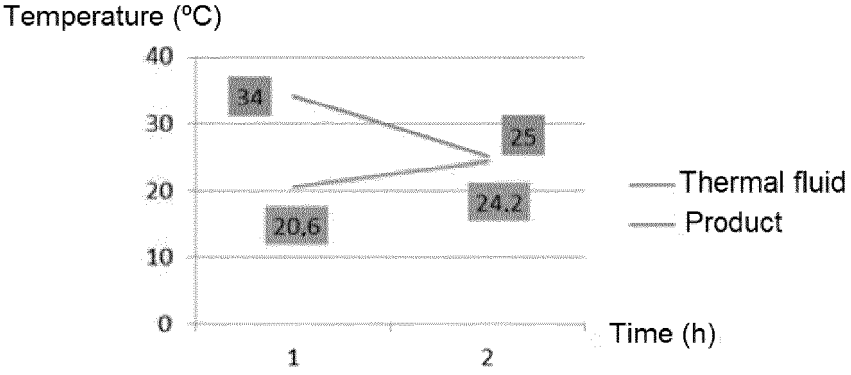
Temperature (ºC)
40
30
20
10
0
34
25
24.2
20.6
1
2
Time (h)
Thermal fluid
Product

FIG. 6

INFORME DE BÚSQUEDA INTERNACIONAL

Solicitud internacional Nº
PCT/ES2017/070294

A. CLASIFICACIÓN DEL OBJETO DE LA SOLICITUD
INV. A23N1/02 C11B1/06
ADD.

De acuerdo con la Clasificación Internacional de Patentes (CIP) o según la clasificación nacional y CIP.

B. SECTORES COMPRENDIDOS POR LA BÚSQUEDA

Documentación mínima buscada (sistema de clasificación seguido de los símbolos de clasificación)
A23N C11B

Otra documentación consultada, además de la documentación mínima, en la medida en que tales documentos formen parte de los sectores comprendidos por la búsqueda

Bases de datos electrónicas consultadas durante la búsqueda internacional (nombre de la base de datos y, si es posible, términos de búsqueda utilizados) EPO-Internal

C. DOCUMENTOS CONSIDERADOS RELEVANTES

Categoría*	Documentos citados, con indicación, si procede, de las partes relevantes	Relevante para las reivindicaciones Nº
X A	US 4 746 464 A (MANGE CHRISTIAN [FR] ET AL) 24 de mayo de 1988 (24.05.1988) figura 1 columna 3, línea 33 - columna 4, línea 43 columna 6, línea 48 - línea 61 columna 7, línea 47 - línea 60 -----	1,2,4-8, 10,11, 13-15,17 3,9,12, 16,18-21
X A	WO 2009/017389 A2 (MALAYSIAN PALM OIL BOARD [MY]; KANDIAH SIVASOTHY [MY]; BATUMALAI RAMAC) 05 de febrero de 2009 (05.02.2009) página 11, línea 15, - línea 23 página 12, línea 21 - línea 25 figuras 4, 5 ----- -/--	1,2,4-7, 11, 13-15,17 3,8-10, 12,16, 18-21

[X] En la continuación del Recuadro C se relacionan otros documentos

[X] Los documentos de familias de patentes se indican en el Anexo

* Categorías especiales de documentos citados:
"A" documento que define el estado general de la técnica no considerado como particularmente relevante.
"E" solicitud de patente o patente anterior pero publicada en la fecha de presentación internacional o en fecha posterior.
"L" documento que puede plantear dudas sobre una reivindicación de prioridad o que se cita para determinar la fecha de publicación de otra cita o por una razón especial (como la indicada).
"O" documento que se refiere a una divulgación oral, a una utilización, a una exposición o a cualquier otro medio.
"P" documento publicado antes de la fecha de presentación internacional pero con posterioridad a la fecha de prioridad reivindicada.
"T" documento ulterior publicado con posterioridad a la fecha de presentación internacional o de prioridad que no pertenece al estado de la técnica pertinente pero que se cita por permitir la comprensión del principio o teoría que constituye la base de la invención.
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"Y" documento particularmente relevante; la invención reivindicada no puede considerarse que implique una actividad inventiva cuando el documento se asocia a otro u otros documentos de la misma naturaleza, cuya combinación resulta evidente para un experto en la materia.
"&" documento que forma parte de la misma familia de patentes.

Fecha en que se ha concluido efectivamente la búsqueda internacional.	Fecha de expedición del informe de búsqueda internacional
19 de enero de 2018 (19.01.2018)	05 de febrero de 2018 (05.02.2018)
Nombre y dirección postal de la Administración encargada de la búsqueda internacional ISA/EP European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016 Nº de fax	Funcionario autorizado Dimoula, Kerasina Nº de teléfono

Formulario PCT/ISA/210 (segunda hoja) (Enero 2015)

INFORME DE BÚSQUEDA INTERNACIONAL

Solicitud internacional Nº
PCT/ES2017/070294

C (continuación). DOCUMENTOS CONSIDERADOS RELEVANTES

Categoría*	Documentos citados, con indicación, si procede, de las partes relevantes	Relevante para las reivindicaciones Nº
A	EP 2 248 880 A1 (PIERALISI MAIP SOCIETA PER AZI [IT]) 10 de noviembre de 2010 (10.11.2010) párrafo [0046] - párrafo [0052] figura 1	1-21
A	GIOVACCHINO DI L ET AL: "INFLUENCE OF OLIVE PROCESSING ON VIRGIN OLIVE OIL QUALITY", EUROPEAN JOURNAL OF LIPID SCIENCE AND TECHNOLOGY, WILEY VCH VERLAG, WEINHEIM, DE, vol. 104, no. 9/10, 02 de septiembre de 2002 (02.09.2002), páginas 587-601, XP001130399, ISSN: 1438-7697, DOI: 10.1002/1438-9312(200210)104:9/10<587::AID-EJLT587>3.0.CO;2-M todo el documento	1-21

Formulario PCT/ISA/210 (continuación de la segunda hoja) (Enero 2015)

INFORME DE BÚSQUEDA INTERNACIONAL

Información relativa a miembros de familias de patentes

Solicitud internacional Nº

PCT/ES2017/070294

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			WO	2009017389	A2 05-02-2009
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			IT	1394287	B1 06-06-2012

Formulario PCT/ISA/210 (anexo_familia de patentes) (Enero 2015)