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(71) Applicants and
(72) Inventors: **YILDIRIM, Nihat** [TR/TR]; Gaziantep Universitesi, Makina, Muhendisligi Bolumu, Gaziantep / Turkey, 27310 Gaziantep (TR). **GOGUS, Fahrettin** [TR/TR]; Gaziantep Universitesi, Makina, Muhendisligi Bolumu, Gaziantep / Turkey, 27310 Gaziantep (TR). **KAPUCU, Sadettin** [TR/TR]; Gaziantep Universitesi, Makina, Muhendisligi Bolumu, Gaziantep / Turkey, 27310 Gaziantep (TR).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: **ARSLAN, Onur** [TR/TR]; Gaziantep Universitesi, Makina, Muhendisligi Bolumu, Gaziantep / Turkey, 27310 Gaziantep (TR).

(74) Agent: **ERTEM, Berkem**; 4ERTEM Marka Patent Danismanlik, Tunalı Hilmi Caddesi NO:50/17 KAVAKLIDERE, 06660 Ankara (TR).

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(54) Title: A PERCOLATION UNIT FOR THE EXTRACTION OF HIGH QUALITY OIL FROM OLIVE AND OLIVE LIKE OILY FRUITS

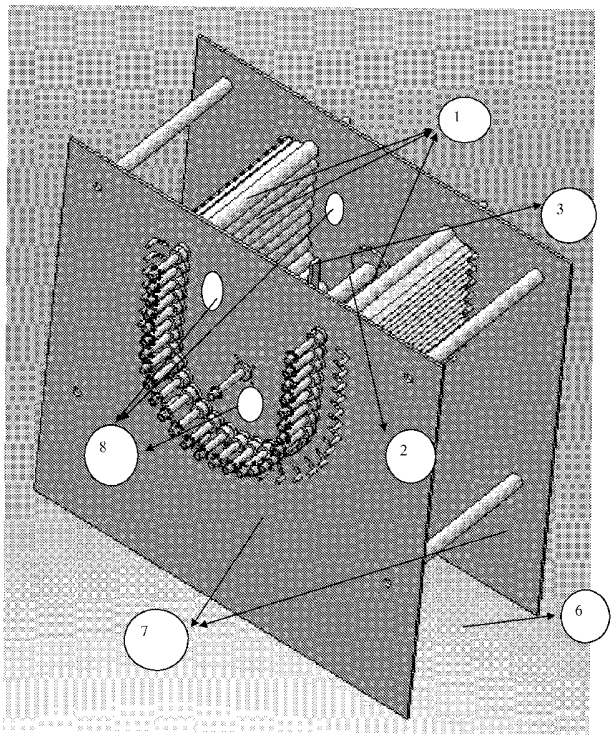

Figure 1

(57) Abstract: This invention is about an extraction unit which is designed to obtain/extract oil continuously from the prepared paste of olive and olive like oily fruits. The separation yield is improved by means of the principles of adherence of liquids to the solid surfaces, surface tension differences of liquids (oil and water), and capillary effect together. Multiples of rotating percolating cylinders are used to percolate (let the free oil adhere to the surface) through the paste continuously. By doing so, the separation yield is increased by increasing the percolation surface of the whole system. Use of rotating cylinders for percolation of oil, the capillary effect of the narrow gap/distance between the rotating cylinders and performing all these processes (both mixing and extraction) in the mixing tank are the main ideas of this invention. The cylinder surfaces, covered by the free oil percolated from the paste via contact surfaces and also due to the capillary effect of narrow passages in between, are cleaned by scrapers at the outer sides of the tank and thus the free oil of paste is extracted as high quality oil.

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Declarations under Rule 4.17:

— *as to the identity of the inventor (Rule 4.17(i))*

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

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— *with international search report (Art. 21(3))*

— *with amended claims and statement (Art. 19(1))*

DESCRIPTION

A PERCOLATION UNIT FOR THE EXTRACTION OF HIGH QUALITY OIL FROM OLIVE AND OLIVE LIKE OILY FRUITS

State of the Art

There are some conventional systems such as press and centrifuge/decanter used both for the extraction of oil from oily fruits such as olive and for the separation of liquid phase from a mixed phase of solid and liquid. In addition to these, Sinolea system developed especially for the production of high quality olive oil is patented (Sinolea: European Patent No. 0252025®, Munich, 2 January 1991. Property of Rapanelli Co., Foligno, Italy) and this system, because of its working principle, is known to produce higher quality oil compared to the others.

Moving plate compression press, the first one in chronological order, has either horizontal or vertical plates which move towards each other and the paste or mixture between them is compressed. Liquid phase is thus separated from the solid and starts to flow out. Upon removing the maximum amount of liquid phase from the mixture, the pomace left is removed from the press. The pressing process is repeated with the fresh mixture or paste and this process of discontinuous loading-pressing-unloading continues till the whole lot of paste is finished.

Despite the fact that the system is partially automated by mechanizing the loading process it is still a batch system because of the intermittent plate movements and idle time during the loading and unloading of paste and pomace.

Total processing capacity of press changes between 300 and 1000 kg/h and the pressing duration lasts around 15-30 minutes. The pressure applied to the mixture in the direction of the press movement starts from zero and increases up to around 200-400 bar incrementally. Paste is exposed to the maximum pressure for certain duration (5-10 min.). Plates are then moved back to reduce pressure quickly to zero to remove the pomace from the pres.

Even if it is not advised, in some cases the pomace is pressed second time with hot water (around 80-90° C) application for further extraction of any oil remained in the pomace. Nevertheless, this affects the quality of oil negatively. The first drained oil during the first pressing process is always the best quality. If this oil is mixed with the oil extracted in the further pressing operation, either in the presence of hot water or high pressure applications, its quality gets worse.

In this type of systems, paste needs to be prepared/mixed for 20-50 minutes prior to the pressing process. Because system is a batch type and loading, pressing and unloading processes take longer time, labor hence pressing costs are high and processing capacity is relatively low. However, the initial investment required is relatively low.

On the other hand, chronologically, continuous and low labor methods have been investigated as an alternative to eliminate the disadvantages of pressing systems and the systems such as decanter using the principle of centrifugal force have been developed for the separation purposes. However, this type of system also needs certain duration (20-50 min.) of mixing the paste prior to the separation process.

Paste after mixing process is fed in decanter continuously while solid and liquid phases separate and flow out of the system continuously. The separation principle of these systems is based on the fact that different phases/components of the mixture having different densities, including both solid and liquid phases, will be forced differently under the same centrifugal effect thus causing different displacements of different phases. In mixtures where densities of the phases are so close to each other or the ratio of different phases in weight or volume are not in proper ranges a difficulty may arise in effective separation of the phases. In such cases, especially in olive oil separation, either additional warm/hot water or the separated black water of the paste is fed into the decanter along with the paste for a better separation performance. This, however, is likely to affect the quality of the oil being separated.

In decanter system, it is not possible to separate the oil from the paste as first class, second class or as extra virgin because of the continuity and high speed processing of the system. Oil obtained by decanter, therefore, is at a medium quality compared to the cold press oil which is obtained with no water addition and at a relatively low temperature. However, decanter systems have a larger capacity (1000-3000 kg/h) than presses because of continuity and high speed of the process but require much larger initial investment cost due to the technology and equipments involved.

Decanter systems need to maintain an acceleration of 1500g to 3000g in olive paste for an efficient separation of oil. Decanters should have a rotational speed of 2500rpm to 3500rpm for a drum diameter of 40-50 cm to obtain the required accelerations and this may cause dynamic problems at such high speeds and diameters. The technology and equipments used to eliminate or avoid such problems do increase the investment and operating costs and also require more qualified personnel.

Sinolea system, specifically developed for high quality oil production, is in the market as a third system even if it is not an outstanding alternative to other systems because of its low capacity and yield. In this system, the paste is again mixed in a malaxing tank for certain duration (20-50 minutes) after the crushing process as in other systems. Then, the malaxed paste is transferred to another tank which is equipped with special blades for the separation of oil. The blades placed at the bottom and sides of the tank are forced to move in and out of the paste continuously. The free oil droplets adhering onto the surface of the blades inside the tank are carried outside the tank through very small gaps and then drop down usually because of the gravitational force and the forward movement of the blades into the tank through the same small gaps. However, the separation yield is usually low (%30-50%) because of factors such as uncontrolled (passive) cleaning of knife surfaces to sweep the oil, and limited total blade surface area compared to the tank surface area. Therefore, it is not a considerable alternative to other systems in the market. In addition, the number of blades used and blade movement mechanism make it quite costly. Sinolea system has a limited use in industry because of these disadvantages and it is preferable mainly in the production of boutique oil. When used in continuous systems, it is usually placed between the malaxing tank and the decanter. However, because of its inherent low yield it becomes necessary to construct it at relatively large scales to equilibrate the system capacity.

When the standard olive oil extraction techniques are considered, it can be said that the oil quality is inversely proportional with time and it decreases with increasing processing time and steps. There is, however, a need for a minimum of malaxation time both to free oil in the cells and to allow phenolic components and similar chemicals of olive to migrate to the oil. Taking into consideration this and

the advantages and disadvantages of the systems mentioned above, it will be logical to say that it is better to separate the oil from the paste during the first step, that is just after the crushing process and during the malaxation step. Nevertheless, in all available systems, the oil separation takes place in a separate tank or system after the malaxation process is performed in malaxing tank. This situation, then, requires other equipments and machines for the separation of oil and also subsidiary machines and elements for the transfer of paste from tank to tank or tank to machine. Whereas, a means of separating oil from the paste by a much simpler method than the existing ones within the available malaxing tank, just at the same time with the malaxation process, will allow both extraction of a higher quality oil in a much shorter time and avoid the need for extra tank or systems.

Detailed Description of the Invention

In this invention, the separation of oil from paste of olive or similar oily plants/fruits is managed in a tank concurrently with the malaxation process. No need is created for a separate tank for oil separation following the malaxation process. The oil from the paste is separated in a shorter time and therefore the negative effects of contact duration of paste with atmospheric air and metal (and likely non-metal) surfaces are reduced.

In this new oil separation system, the separation yield is increased by using the principles of adherence of liquids on the solid surfaces (percolation), differences between surface tension of liquids and capillarity effect all together. Contrary to the reciprocating behaviour of equally spaced and limited number of blades used in Sinolea system, the percolator cylinders which move through the paste by rotating continuously increase the separation yield by increasing the percolation surface in the system. Use of cylinders instead of blades for percolation process, the capillary effect of the narrow distance/gap between the cylinders, removing the oil from percolation cylinders surfaces by adjustable cleaners/scrapers outside the tank and performing all these processes in the malaxing tank during malaxing process are the main ideas of this invention. The rotating cylinder surfaces are covered by oil film because of both percolation through the paste and also capillary effect of narrow gaps. They are then cleaned by edge cleaners/scrapers on outer side of the tank and thus the free oil of paste is obtained as high quality oil. The rotating cylinders and cleaners should be made of or coated with stainless steel, Teflon, polyethylene or such material suitable for the food industry, and shall not react with oil. The thickness of the coating material shall be between 0,01 mm and at maximum %70 of the radius of the cylinders upon finalizing the procedure.

The parts of the new system and its working principle are explained in the following section in reference to the Figures 1-4. The referenced figures are only mentioned in order to example the invention and different variations are envisaged.

Separation of oil from paste takes place in a mixing tank of which the side walls and bottom are constructed as the rotating percolating cylinders (1) (see Figure 1). Percolating cylinders (1) are placed very close to each other to hold the paste within the tank and each one can rotate about its own axis to percolate through the paste (see Figure 2). The system has a malaxing shaft (2) and mixing blades (3) to mobilize the paste continuously, to change the position of paste within the tank and to keep the paste in contact with the rotating cylinders (1) always (see Figure 3). Cleaners/scrapers (4) are used to remove the oil film accumulated on the cylinder surfaces and get the same cylinders ready for the next oil percolation process.

Adjustable narrow gap (5) is left between the rotating cylinders to let oil film out of the tank (see Figure 4). An oil collecting tank (6) can be placed underneath the malaxing tank to store the oil removed from the cylinder surfaces by the cleaners (4). End plates (7) are used to complete (close the ends of) the malaxing tank and to support the rotating cylinders and cleaners. In order to position the rotating cylinders on the end plates and let them rotate roller bearings, ball bearings or journal bearings may be used. The gaps between neighbouring rotating cylinders are adjusted by the movement of two ends of the rotating cylinders in channels structured on the end plates. All of those rotating cylinders may be operated by only one motor or by a group of motors or by individual motors in order to reduce the likely friction or resistance force. The rotating speeds of the cylinders are controlled by the speed of the motors. Likely the speed of malaxing shaft is controlled for operating in different speeds. Openings or ports (8) on end plates allow inlet and outlet of the paste in and out of the malaxing tank for a continuous processing.

The paste of crushed olive or like fruits is mixed by the malaxing shaft (2) and blades (3) within the tank and the paste changes its position in the tank continuously and contacts the rotating cylinders (1). The free oil created by both crushing and malaxing processes comes into contact with the dry/clean surfaces of the rotating cylinders (1). Multiples of rotating cylinders (1) all around the paste allow adherence of the free oil of the paste to clean and dry cylinder surfaces inside the tank. These cylinders (1) covered by a film of oil carry the accumulated oil, through the adjustable narrow gaps (5), out of the tank by rotating about their own axis. Thus, the oil droplets which were within the paste now moves out of the tank through the narrow gaps (5) between the cylinders (1) because of the continuous rotation of the cylinders. The oil is then collected/removed by the adjustable cleaners (4) outside the cylinders (1) and the oil dripping from cleaners (4) is accumulated within a collecting tank (6) underneath the modified malaxing tank. Based on the surface tension differences of oil and the water in the paste, only oil is collected by the rotating cylinder surfaces while water has almost no chance to cling onto the surfaces. This allows separation of the best quality oil from the paste as early as possible before the malaxing process is fully completed.

If these cylinder surfaces are not cleaned outside of the tank, the oil covering the cylinder surfaces will re-enter tank since cylinders rotate. To prevent entrance of the oil back into the tank through the neighbouring gaps, surfaces of the cylinders are cleaned by cleaners (4) on the outer surfaces. The clean surface of the same cylinders rotates further to come into contact with the oily paste again and the same process of being covered by oil and cleaned by the cleaners is repeated continuously. The oil separation process thus continues as long as the malaxing blades mix the paste, the percolating cylinders rotate and are properly cleaned by the cleaners. Surface quality of the percolating cylinders (1) is properly adjusted to perform two basic operations of collecting the oil inside the tank and allowing a good cleaning by the cleaners (4) outside the tank.

Likely solid/paste particle escape through narrow gaps (5) along with the oil is minimized by adjusting the distance/gap (5) between the rotating cylinders, by controlling the direction and speed of the rotation of cylinders (1). Adjustable gap (5) between the cylinders can be set to an optimum to allow mainly oil but minimum paste to pass through.

To allow a continuous paste inlet and outlet openings/ports (8) are created on the end plates (7) which support both cylinders (1) and adjustable cleaners (4). The helicoid action of the malaxing blades (3) helps to mix and move the paste along the length of tank from inlet port to outlet port while rotating cylinders remove the free oil from inside to outside of the tank to be collected by the cleaners (4). The unit described here is a modular unit which can be assembled end-to-end or side-by-side to allow larger capacities to be handled.

Construction of the rotating cylinders (1) can be in any form such as side and bottom walls of a conventional horizontal malaxing tank can be replaced by cylinders (1) which help holding the paste within the tank and allow free mixing of the paste by mixing blades (3) and separate the oil from paste. They can also be constructed as the side walls of a vertical malaxing tank or any other tank where they have to be in contact with the paste always and rotate and be cleaned by the cleaners to separate and collect the free oil. Tank hence the cylinders (1) can be set to any required angle with the ground as long as the processes of mixing, percolating and cleaning are performed properly.

Despite a similarity between invention explained here and the patent (Method and apparatus for recovery of spilled oil or other viscous fluid, US2006/0266694 A1) published in 2006 there are basic differences between two cases regarding area of application, type of material processed, the way material is handled and construction of the units. The very first point is that the patent US2006/0266694 A1 covers an area of application, including industrial oil, chemistry, environment etc but not clearly food machinery, whereas present invention covers the area of food machinery processing oily fruits usually. In patent US2006/0266694 A1, basically two fluids, one is spilled or mixed oil and other usually, but not always, water or sea water are separated from each other. Whereas in the present invention, not the spilled oil but the oil naturally present in the fruit paste is separated from not a mix of two liquids but from a mix of two liquids (oil and water) and a solid phase.

Second main difference is that the unit processing the mixture of fluids in patent US2006/0266694 A1 floats or rests on the mixture itself whereas the unit in the present invention covers or includes the mixture within itself.

Third, only one cylinder is used in patent US2006/0266694 A1 to separate the “industrial oil” from a mixture of two or more liquids, while multiples of cylinders, accurately positioned in relation to each other, are used for two purposes as to act as a temporary pot for processing of the fruit paste and also to separate the “edible oil” from a mixture of liquid and solid phases of fruit paste.

Fourth, while the mixture of liquids being processed and the unit processing the mixture in patent US2006/0266694 A1 have to be stable and not mixed except uniform rotation of the cylinders, the solid and liquid mixture processed by the present invention has to be mixed continuously by a mixing blade and the multiples of the cylinders all need to be rotated in correct directions.

Fifth, effect of capillarity between the close positioned multiple cylinders is used to help the percolation effect of the rotating cylinders in present invention whereas only percolation effect of the single rotating cylinder is used in patent US2006/0266694 A1.

Description of the Figures

Figure 1 shows the perspective view of general construction

Figure 2 shows the cross-sectional view of general construction

Figure 3 shows the cross-sectional view of cylinders and cleaners

Figure 4 shows the detailed view of cylinder cleaning mechanism.

Parts mentioned in Figures

1. Rotating (percolating) cylinders
2. Malaxing/mixing shaft
3. mixing blades
4. cleaners/scrapers
5. adjustable gaps
6. collecting tank
7. end walls
8. paste inlet and outlet openings/ports
9. montage channels for cleaners/scrappers

CLAIMS

1. Oil separation unit for extracting edible oil from oily fruit paste by using the principles of oliophilic (adherence of oil to the solid surfaces) and capillary effects, consisting of :
    a. Multiples of rotating percolating cylinders (1)
    b. Malaxing/mixing shaft (2)
    c. mixing blades (3)
    d. cleaners/scrapers (4)
    e. end walls (7) having bearing channels for the cleaners (4) and rotating percolating cylinders (1) and having inlet and outlet ports (8) for continuous paste movement
2. Rotating percolating cylinders as claimed in claim 1 characterized in that, rotating percolating cylinders are positioned in the bearing channels on the end walls and the gaps (5) between the rotating percolating cylinders are adjustable by positioning the rotating percolating cylinders in the channels.
3. Rotating percolating cylinders as claimed in claim 1 characterized in that, the speed and the direction of the multiples of rotating percolating cylinders are adjustable by motor/motors.
4. Rotating percolating cylinders (1) as claimed in claim 1 characterized in that, all the Rotating percolating cylinders (1) are operated by only one motor or groups of motors or by individual motors and the rotating speed of the cylinders are controllable by the speed of the motors.
5. Rotating percolating cylinders (1) as claimed in claim 1 characterized in that, all the Rotating percolating cylinders (1) are operated in the same direction or in opposite direction and the rotating percolating cylinders are to be made of or coated with stainless steel, Teflon, polyethylene or such material suitable for the food industry or a combination of these materials.
6. The cleaners/scrappers as claimed in claim 1 characterized in that, the position and the contact angle to the rotating percolating cylinders (1) are adjustable by the montage channels (9) positioned on the end walls (7)
7. The unit mentioned in claim 1 characterized in that a tank of which walls are made of rotating cylinders (1) and positioned either horizontal or vertical or at any angle to the ground.
8. The malaxing shaft (2) mentioned in claim 1 characterized in that the speed of the malaxing shaft is adjusted by a drive motor and having straight or helical mixing blades (3).

9. A continuous oil separation process for extracting edible oil from oily fruit paste by using the principles of oliophilic (adherence of oil to the solid surfaces) and capillary effect, consisting of the following steps:

    a. Feeding the oily paste through the paste inlet ports,

    b. Mixing the oily paste by mixing blades (3)

    c. Sweeping of oil by the rotating percolating cylinders (1) throughout the mixing process

    d. Removal of the swept oil from rotating cylinders by the cleaners/scrappers in order to have new sweeping surfaces

    e. Allowing a duration of stay between 2 and 60 minutes for the paste to spent within the tank after it enters the tank through inlet port (8)

    f. Outflow of the processed paste (of which some oil is separated) through the paste outlet port (8).

AMENDED CLAIMS
Received by the international bureau on 08 September 2009 (08.09.09) + STATEMENT

CLAIMS

1. Oil separation unit for extracting edible oil from oily fruit paste by using the principles of oliophilic and capillary effects, consisting of :
    a. Multiples of rotating percolating cylinders (1) which constitute the side walls of the mixing tank
    b. Malaxing/mixing shaft (2) located in the mixing tank
    c. mixing blades (3) attached to the mixing/malaxing shaft(2)
    d. cleaners/scrapers (4) located in the outer side of the mixing tank and contacting to the outer surfaces of the percolating cylinders(1)
    e. end walls (7) having bearing channels for the cleaners (4) and rotating percolating cylinders (1) and having inlet and outlet ports (8) for continuous paste movement
2. Rotating percolating cylinders as claimed in claim 1 characterized in that, rotating percolating cylinders(1) are positioned in the bearing channels on the end walls and the gaps (5) between the rotating percolating cylinders are adjustable by positioning the rotating percolating cylinders(1) in the channels.
3. Rotating percolating cylinders(1) as claimed in claim 1 characterized in that, the speed and the direction of the multiples of rotating percolating cylinders(1) are adjustable by motor/motors.
4. Rotating percolating cylinders (1) as claimed in claim 1 characterized in that, all the Rotating percolating cylinders (1) are operated by only one motor or groups of motors or by individual motors and the rotating speed of the cylinders are controllable by the speed of the motors.
5. Rotating percolating cylinders (1) as claimed in claim 1 characterized in that, all the Rotating percolating cylinders (1) are operated in the same direction or in opposite direction and the rotating percolating cylinders are to be made of or coated with stainless steel, Teflon, polyethylene or such material suitable for the food industry or a combination of these materials.
6. The cleaners/scrappers as claimed in claim 1 characterized in that, the position and the contact angle to the rotating percolating cylinders (1) are adjustable by the montage channels (9) positioned on the end walls (7)
7. The unit mentioned in claim 1 characterized in that a tank of which walls are made of rotating cylinders (1) and positioned either horizontal or vertical or at any angle to the ground.
8. The malaxing shaft (2) mentioned in claim 1 characterized in that the speed of the malaxing shaft is adjusted by a drive motor and having straight or helical mixing blades (3).

9. A continuous oil separation process using an apparatus according to claim 1 for extracting edible oil from oily fruit paste by using the principles of oliophilic and capillary effect, consisting of the following steps:

    a. Feeding the oily paste through the paste inlet ports(8),

    b. Mixing the oily paste by mixing blades (3)

    c. Sweeping of oil by the rotating percolating cylinders (1) throughout the mixing process

    d. Removal of the swept oil from rotating cylinders by the cleaners/scrappers in order to have new sweeping surfaces

    e. Allowing a duration of stay between 2 and 60 minutes for the paste to spent within the tank after it enters the tank through inlet port (8)

    f. Outflow of the processed paste of which some oil is separated through the paste outlet port (8).

STATEMENT UNDER ARTICLE 19(1)

The search examiner has briefly explained the deficiencies in the claims regarding the clarity and inventive step as per the article 33(3) PCT. It is clear that search examiner is of the opinion that the in case structural arrangement of the invention and apparatus mentioned in claim 1 and 9 are rendered clear an inventive activity may be acknowledged since D1 to D4 may not prompt the skilled person an *apparatus and/or process as disclosed in the application.*

Current amendments in the claims are therefore regulated or made for overcoming those deficiencies i.e. clarity and structural arrangements of the apparatus.

Explanations regarding the amendments in Claim 1:

- *Expressions in parenthesis i.e. "adherence of oil to the solid surfaces" is deleted under Rule* 6.2(b) PCT as per the opinions of the search examiner
- *Expressions "which constitute the side walls of the mixing tank" is added at the end of bullet a)* for describing that the side walls are constituting the side walls of the mixing tank. Therefore it is clear that those combination of cylinder mentioned in the description construct the suitable area for mixing is fruit paste.
- Since it was not clear from the reading of the claim itself but mentioned in the description and drawings, the expressions "located in the mixing tank" is added to the end of bullet b) in order to describe where the mixing shaft is placed.
- Since it was not clear from the reading of the claim itself, the expression "attached to the mixing/malaxing shaft(2)" is added in order to clearly state that the mixing blades are attached to the mixing shaft.
- Since it was not clear from the reading of the claim itself but mentioned in the description and drawings, cleaner/scrapers are located at the outer side of the mixing tank as to clean the surfaces of the percolating cylinders keeping the surfaces ready to grasp oil from the fruits. Therefore the expression "located in the outer side of the mixing tank and contacting to the outer surfaces of the percolating cylinders (1)" is added to the end of bullet d) for clarity reasons.

Explanations regarding the amendments in Claim 2 and 3:

Since claim 1 is amended by giving the structural details of the apparatus according to the opinions of the search examiner and as claim 2, 3 is dependent to the claim 1 no material change has been made. Only the number in parenthesis (1) is added after the expression "rotating percolating cylinders" for clarity reasons.

Claim 4, 5, 6, 7, 8 remain unchanged.

Explanations regarding the amendments in Claim 9:

- Expressions in parenthesis i.e. "adherence of oil to the solid surfaces" is deleted under Rule 6.2(b) PCT as per the opinions of the search examiner
- Expression "using an apparatus according to claim 1" is added to the preamble of the claim before "for extracting edible oil....". in order to clarify the subject matter of the claim process
- Figure number "(8)" is added to the end of bullet a) for defining "inlet ports" mentioned in the drawings for clarity reasons.
- Parenthesis given in the bullet f) are deleted under Rule 6.2(b) PCT for clarity reasons.

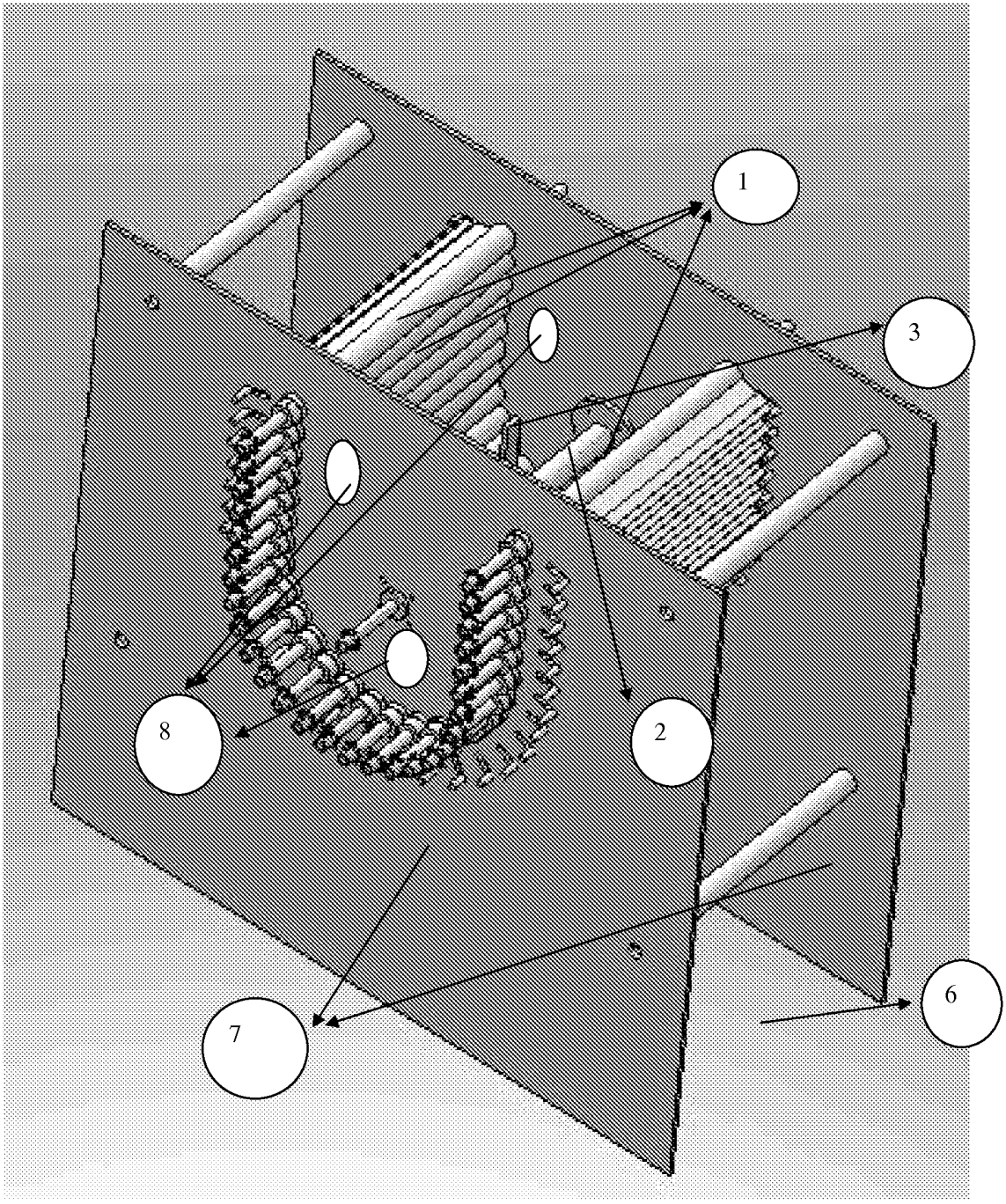

Figure 1

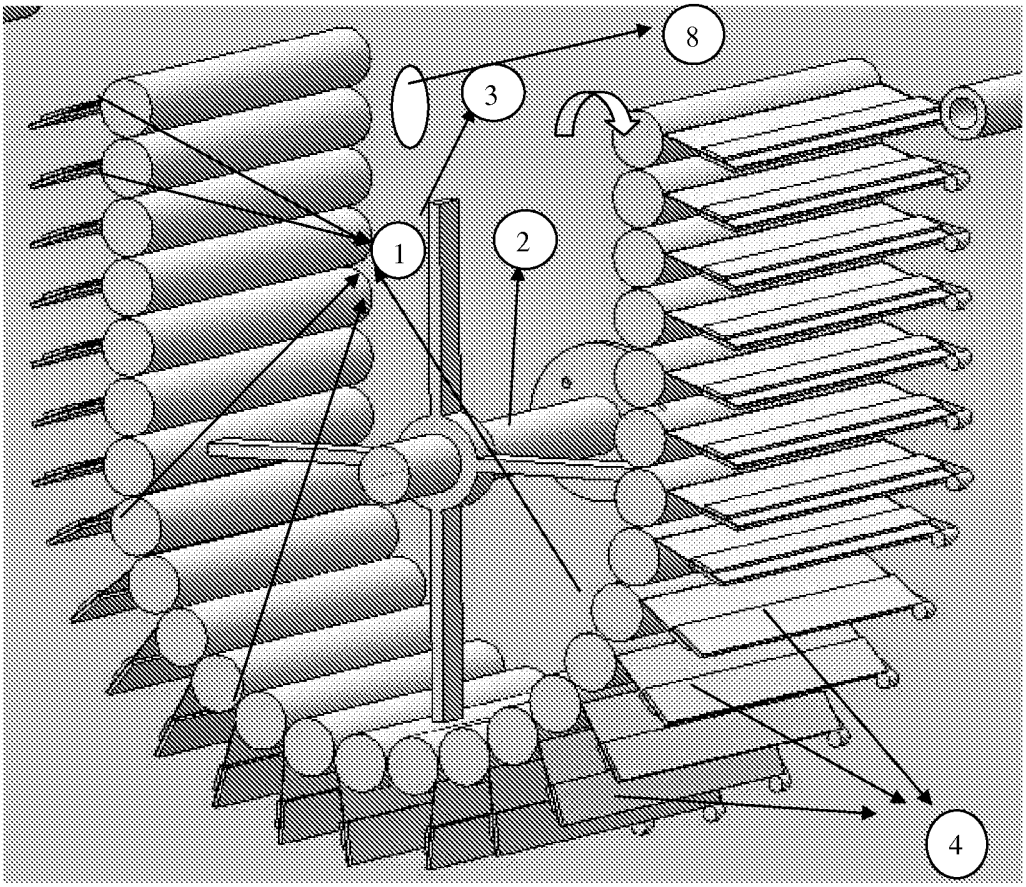

Figure 2

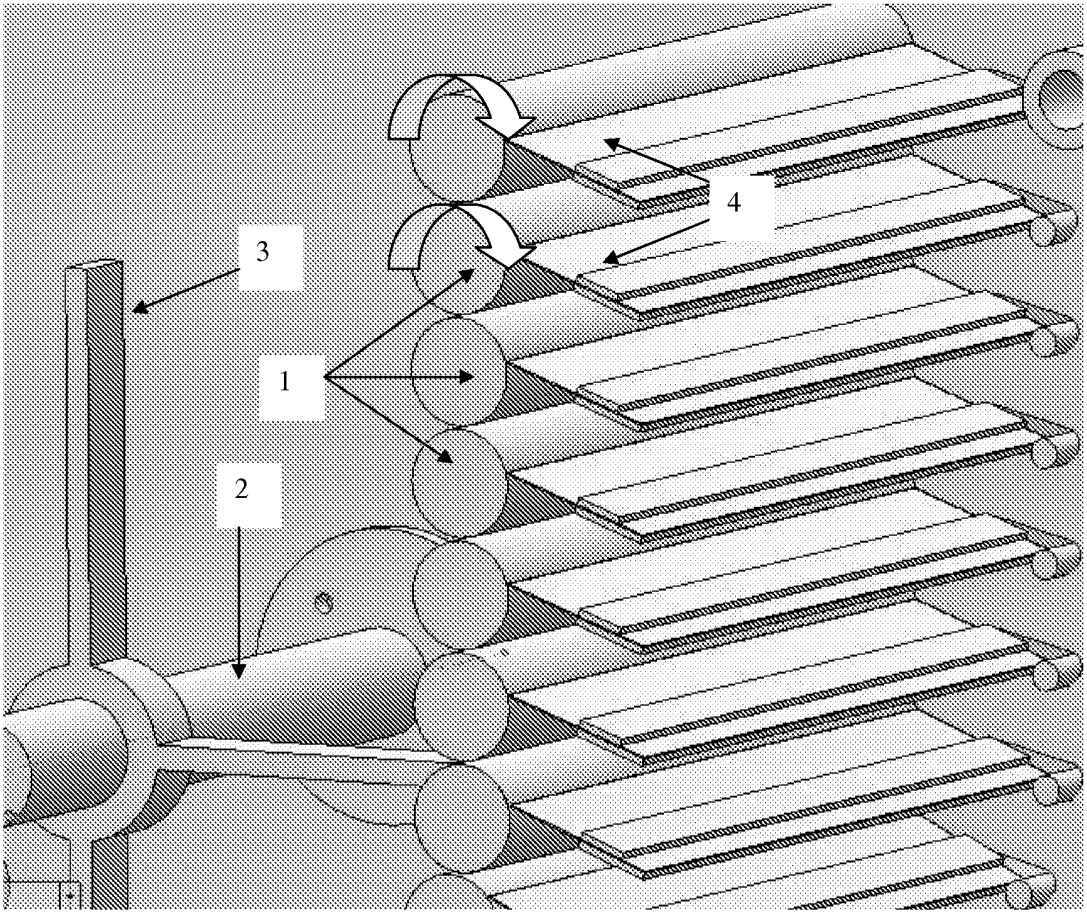

Figure 3

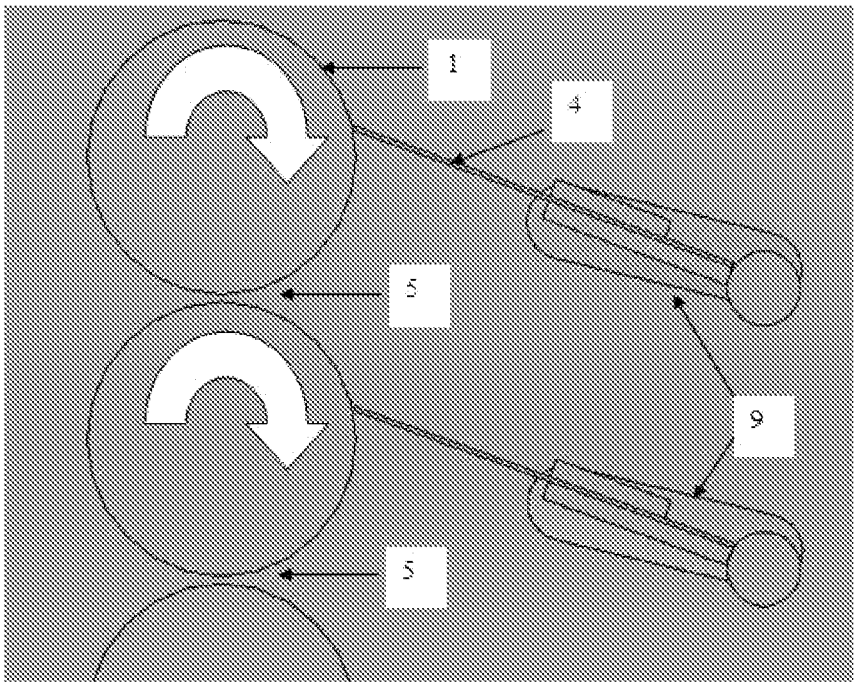

Figure 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2009/051490

A. CLASSIFICATION OF SUBJECT MATTER
INV. C11B1/10 B30B9/00 B01D29/44

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
C11B B30B B01D

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3 642 605 A (CHENEL FRANCOIS ET AL) 15 February 1972 (1972-02-15) the whole document	
A	US 5 107 757 A (OHSHITA TAKAHIRO [JP] ET AL) 28 April 1992 (1992-04-28) the whole document	
A	US 2 987 988 A (PABLO ROBLEDANO) 13 June 1961 (1961-06-13) the whole document	
A	GB 201 190 A (ALFRED EDWIN CULLEY) 27 July 1923 (1923-07-27) the whole document	

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
29 July 2009	06/08/2009

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Roider, Josef

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2009/051490

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3642605 A	15-02-1972	BE 709812 A	30-05-1968
		CH 475033 A	15-07-1969
		DE 1642882 A1	29-04-1971
		ES 349704 A1	01-10-1969
		FR 1533226 A	19-07-1968
		FR 1533227 A	19-07-1968
		FR 93740 E	09-05-1969
		GB 1216021 A	16-12-1970
		LU 55338 A1	08-05-1968
		NL 6801082 A	25-07-1968
US 5107757 A	28-04-1992	AU 6836087 A	28-07-1987
		WO 8704114 A1	16-07-1987
US 2987988 A	13-06-1961	NONE	
GB 201190 A	27-07-1923	DE 431723 C	16-07-1926
		FR 570589 A	03-05-1924