



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
21.08.2019 Bulletin 2019/34

(51) Int Cl.:
C14B 1/00 (2006.01) **C14B 3/00 (2006.01)**
C14C 3/00 (2006.01)

(21) Application number: **19158295.6**

(22) Date of filing: **20.02.2019**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(72) Inventors:
• **VALLERO, Giacomo**
10080 Oglanico (TO) (IT)
• **BRUGNOLI, Federico**
33170 Pordenone (IT)
• **MAZZOLINI, Mauro**
22074 Lomazzo (CO) (IT)
• **FORNI, Andrea**
22074 Lomazzo (CO) (IT)
• **FERRARI, Federico**
33170 Pordenone (IT)

(30) Priority: **20.02.2018 IT 201800002869**

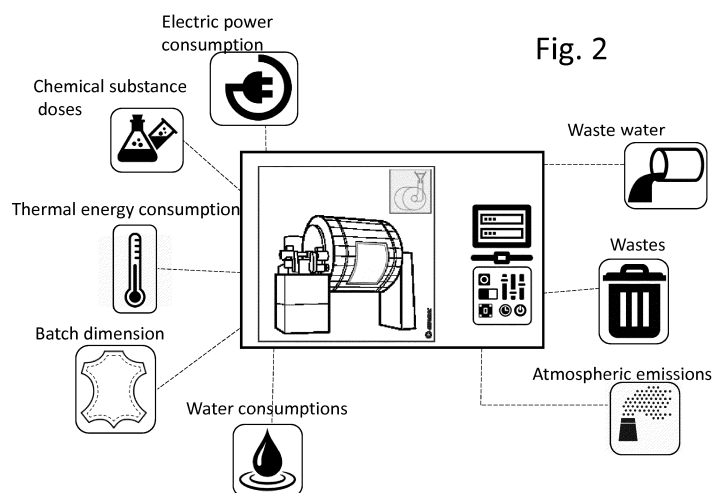
(71) Applicants:
• **Vallero International S.r.l.**
10080 Oglanico (TO) (IT)
• **Synesis Societa'**
Consortile A Responsabilita' Limitata
22074 Lomazzo (CO) (IT)
• **Spin 360 S.r.l.**
33170 Pordenone (IT)

(74) Representative: **Lisa, Elisabetta**
Praxi Intellectual Property S.p.A.
Corso Vittorio Emanuele II, 3
10125 Torino (IT)

(54) **TANNING UNIT FOR LIFE CYCLE ASSESSMENT COMPRISING A DRUM**

(57) A tanning unit comprises a drum (1), a separation device (20) between the tanning bath and the solid waste generated in use in the drum (1), an electronic control unit (2) and a plurality of sensors connected in data exchange with the control unit, in which the control unit (2) is connected in data exchange with the plurality of sensors including at least a flow sensor for the water entering the drum; a flow sensor for the water discharged

from the drum; a meter of electrical power absorbed by the drum (1) and a solid waste weight sensor connected to a collection device (24) for the solid waste intercepted by the separation device (20); and is programmed to process the data received via the sensors and any other data received via a user interface or through data acquisition and to provide life cycle assessment (LCA) and / or life cycle cost (LCC) data.



Description

TECHNICAL FIELD

[0001] The present invention relates to a tanning unit comprising a drum, a plurality of sensors and an electronic unit to allow monitoring of parameters relevant to the evaluation of the environmental impact and, in particular, of the evaluation of the life cycle and the relative processing.

[0002] The present invention also relates to a method for updating an already installed drum providing a kit in order to allow the monitoring of parameters relevant for the assessment of the environmental impact.

STATE OF THE ART

[0003] The need is felt to monitor the resources used in the production processes of leather tanning to identify any inefficient use of resources such as water, energy, chemicals, etc. and to reduce the polluting products in the waste fluids.

SCOPES AND BRIEF DESCRIPTION OF THE INVENTION

[0004] The object of the present invention is to improve the monitoring of the tanning process so as to allow a more efficient use of the resources, in particular of resources with environmental impact.

[0005] The object of the present invention is achieved by means of a tanning unit comprising a drum, a plurality of sensors including one or more of, in any combination, an input water flow meter, a meter for electric energy absorbed by the drum, a weight sensor for the batch of raw loading material, a sensor for the process temperature in the drum, a sensor for the weight of waste solids, a flow meter for water discharged from the drum, an estimation of the air discharged on the basis of the volume occupied in the drum by the skin and by the process bath and an electronic control unit programmed to process a life cycle assessment (LCA) and / or life cycle cost (LCC) based on the signals received from the sensors and, preferably, the estimation of discharged air. In particular, there is provided a device for separating from the tanning bath the solid waste generated during the use of the drum and a device for collecting such solid waste, to which the waste weight sensor is connected.

[0006] Preferably, the evaluation of the life cycle and of the life cycle cost with reference to the leather sector is carried out by the electronic unit to obtain data processing that are compliant with the requirements of international standards according to a non-limiting example ISO 14040, ISO 14044 and ISO 14025, the third of the which refers in particular to the 'product category rules' (PCR), necessary for data processing for specific categories of manufactured goods or intermediate. An example of product category specific rules for leather is represented

by the standard EN 16887, version 2.0 - 2011: 13, and by the PCR of the EPD System "PRODUCT CATEGORY RULES ACCORDING TO ISO 14025 - PRODUCT GROUP: A CPC 2912 FINISHED BOVINE LEATHER" version 2.0.

[0007] Preferably, the drum comprises a hollow rotary element in which the chemical-physical processes of the tanning take place, a fixed manifold, fluidly connected with the inside of the rotating element and configured to take samples of fluid, and sensors to detect traces of chemical agents to generate data on the fluid flowing in the manifold. In particular, through a closed fluidic circuit, the fixed manifold recirculates the process fluid coming from the rotating element and that, after flowing in the fixed tank, returns to the rotating element due to gravity or a special pump (version not shown).

[0008] Preferably, the electronic control unit is programmed to process the sensor signals so as to process data relating to each treatment batch processed by the drum.

[0009] According to the present invention, it is also possible to update a drum already installed in a tanning plant, by means of a method comprising the steps of connecting a sensor for measuring the quantity of solid waste to a solid waste collection device;

connecting to the sensor a unit programmed to process a life cycle assessment (LCA) and / or life cycle cost (LCC) based on the signals received from an input water flow meter, a meter for electric energy absorbed by the drum, a weight sensor for the batch of raw loading material, a sensor of the process temperature in the drum, a weight sensor for solid waste, a flow meter for water discharged from the drum and, preferably, based on the estimate of air used in the drum.

[0010] Further advantages of the present invention are presented in the description and in the dependent claims.

BRIEF DESCRIPTION OF THE FIGURES

[0011] The invention is described below on the basis of non-limiting examples illustrated purely for the purpose of explanation in the annexed drawings, which refer respectively to:

- Fig. 1 a functional diagram of the tanning unit according to the present invention;
- Fig. 2 an image showing the sensor data and the quantities processed by the electronic control unit;
- Fig. 3 a section along a vertical plane of a drum according to a first embodiment; and
- Fig. 4 a section along a vertical plane of a drum according to a further embodiment.

DETAILED DESCRIPTION OF THE INVENTION

[0012] Figure 1 schematically illustrates a unit for tanning comprising a drum 1, an electronic control unit 2 and a user interface 3.

[0013] Electronic control unit 2 can be on board drum 1 or remote, possibly integrated in an electronic control unit (not shown) for monitoring process activities, e.g. work cycles dependent on the type of hyde to be processed, i.e. bovine, sheep, etc., malfunctions and the like, of drum 1 and / or of a more complex process line of which drum 1 is part. The data transmission between drum 1 and electronic control unit 2 can be operated both via cables and wireless. Analogously with the data transmission between electronic control unit 2 and user interface 3, which can be on board drum 1 and / or in a remote and fixed position (not shown) and / or a mobile device, for example a personal mobile device, remotely and wirelessly connected to electronic control unit 2.

[0014] In particular, drum 1 comprises a main support frame 4, a rotating element 5 to receive a predefined quantity of raw material to be processed by chemical-physical processes, a plurality of sensors for controlling chemical-physical processes (Figure 2) and one or more actuators for driving rotating element 5 and performing any further automation.

[0015] Some process quantities or parameters, for example the temperature of the water bath and tanning chemicals, such as sulfides, lime, chrome or light metal salts, aniline dyes, lubricants, PH correctors etc. the weight of a production batch of raw leather, the amount of input water and the weight of the chemicals in the process bath, are detected, according to the present invention, by sensors connected in data exchange to electronic control unit 2. These sensors can be on board drum 1 or can be arranged remotely with respect to drum 1 but in any case connected in data exchange to electronic control unit 2. This is shown for example in the left part of figure 2.

[0016] In addition, electronic control unit 2 receives data from additional sensors to monitor quantities and factors used in the life cycle assessment (LCA) and life cycle cost (LCC). In particular (the right side of figure 2) the quantity of waste water and solid waste is also measured.

[0017] According to a further improved embodiment, electronic control unit 2 processes, for the purposes of the life cycle assessment (LCA) and the life cycle cost (LCC), the quantity and quality of chemical substances in the waste water, for example of substances resulting after chemical tanning reactions, such as residual chromium etc.

[0018] These quantities can be detected both outside the process line to be received by electronic control unit 2 or by manual input or by wireless data acquisition, for example on the basis of laboratory analyses performed on samples of the bath from rotating element 5 taken in one or more phases of the process performed by drum 1, for example at the end of this process. Alternatively, one or more sensors are mounted on board drum 1 and are connected in data exchange to electronic control unit 2.

[0019] Preferably, electronic control unit 2 is also programmed to estimate the air used in the drum on the

basis of a mathematical model, for example based on the subtraction from the internal working volume of rotating element 5, of the volume occupied by the load of hydres, water, process chemicals etc. or it is connected to a volumetric sensor that measures the air coming out of the drum, if it is adducted into a clean-up system.

[0020] Electronic control unit 2 collects the signals of the sensors and of the further parameters possibly inputted through the user interface and processes the relative data, in particular combining them with stored digital libraries, possibly proprietary and updatable, relating for example to the average price of the electricity, water etc.; to the equivalent production of carbon dioxide per Kg of processed raw material, to the price of the chemical products used, etc. in order to calculate the indices, parameters and factors necessary for the assessment of the life cycle (LCA) and the life cycle cost (LCC), for example according to the standards cited in the previous paragraphs.

[0021] Figure 3 shows a preferred embodiment of drum 1, in which support frame 3 comprises a first and a second upright 10, 11 and defines a rotation axis A of rotating element 5. The latter comprises inner peripheral ducts 12 having inlet and outlet ports 13 for the tanning bath spaced radially from the axis A so that, during rotation, by gravity the bath enters ducts 12 when the relative ports are in a lower zone I and exit towards the skin to be treated when the relative ports are in an upper zone S. Ducts 12 also converge towards a fixed manifold 15 in which a quantity of bath continuously flows from the inside of the drum during the operation of rotating element 5 because it is adducted through the rotation of the drum itself. In particular, a sliding seal is provided between rotating element 5 and manifold 15 to prevent leakage of fluid from the bath towards the external environment. This seal surrounds a plurality of ports 16 of ducts 12 arranged at a vertical height between the maximum vertical height of a port 13 and the minimum vertical height of port 13, so that a flow rate of the bath reaches manifold 15 by gravity while the relative duct 12 reaches the upper zone S and, again by gravity since manifold 15 is located at a higher level than the inferior zone I, a bath flow reaches again, through a port 13, the raw skin to continue the process.

[0022] Preferably, at least the temperature sensor is arranged in manifold 15. Furthermore, a load cell interposed between frame 3 and rotating element 5 allows to measure a lot of raw material when it is loaded into the drum before adding water. and chemical agents. The input water is advantageously measured by a flow meter connected to an inlet duct 17 of rotating element 5 concentric to axis A and connected to a hot water mixer by means of a sliding fluid seal. Furthermore, the absorbed electrical energy can be detected by monitoring the inverter that controls the electric motor connected to rotating element 5.

[0023] It is possible to weigh the quantities of each chemical agent to be added to the raw material in the

drum and to manually enter the data via user interface 3 or to connect a not shown weight scale in data exchange with electronic control unit 2.

[0024] It is also possible to take samples of the bath from manifold 15 to perform the chemical analyses of the residues present or install in manifold 15 special sensors capable of detecting the type and quantity of chemicals present in the bath. Likewise, it is possible to perform off-line chemical analyses or through sensors of the aeriform aspirated through a hood before the opening of rotating element 5 and to input the relative data through user interface 3 or through automatic data acquisition so that unit of control 2 can take this into account.

[0025] Figure 4 illustrates an embodiment in which manifold 15 comprises a continuous solid-liquid separation device 20 for extracting the solid waste that comes off the hides due to the mechanical action of the drum, e.g. flesh, filaments, shaving etc. from the flow of bath flowing in the collector. Preferably, a load cell connected in data exchange with electronic control unit 2 can be arranged in the solid waste collection area of the separation device 20 to weigh such waste.

[0026] According to a preferred embodiment of the invention, separation device 20 comprises a perforated half-cylinder housing a AISI 316 stainless steel helix inclined as an Archimedes' spiral, to intercept the flow of the bath from rotating element 5. This device causes the almost total separation of solid waste from the fluid. In particular, the solid waste is collected by a cochlea 22, made to gradually rise upwards through the inclined semi-cylinder, partially dehydrated and discharged from above to fall towards a collection container 24, which is reached by gravity from solid waste.

[0027] According to an alternative not illustrated embodiment, it is possible that drum 1 is emptied in a washing tank having a grid to evacuate the tanning bath and to retain the processed skin and solid waste. After the skins have been washed and removed, the grid retains solid waste that can be weighed. In this case, the grid performs both the function of separating the tanning bath from solid waste and the function of collecting this waste to allow weighing through the respective sensor.

[0028] It is also possible to update a drum already in use at a leather processing plant to allow the LCA and the LCC calculation. Since there are numerous configurations of drums, ranging from a purely mechanical version without any sensor, to the more complete versions, which include a plurality of sensors for process monitoring, it is mainly necessary to connect an electronic control unit appropriately programmed according to the indications in the previous paragraphs to an input water flow meter, a meter for electric energy absorbed by the drum, a weight sensor of the batch of input raw material, a process temperature sensor in the drum, a solid waste weight sensor and a flow meter for water discharged from the drum; and supplying both the separation device and the device for collecting the solid waste. Furthermore, based on the actual instrumentation already present on board

the drum to be updated, the missing sensors must be supplied. Preferably, it is necessary to provide the weight sensor to be connected to the solid waste collection device and / or the flow meter to measure the amount of fluid discharged from the drum after the process.

Claims

1. Tanning unit comprising a drum (1), a separation device (20) for separation of the tanning bath and solid waste generated in use in the drum (1), an electronic control unit (2) and a plurality of sensors connected in data exchange with the control unit, wherein the control unit (2):

a. is connected in data exchange with the plurality of sensors among which at least a flow sensor of the input water in the drum; a flow sensor for the output fluid discharged by the drum after the process; a meter for electric power absorbed by the drum (1) and a solid waste weight sensor connected to a collecting device (24) for the solid waste intercepted by the separation device (20); and

b. is programmed to process data received via the sensors and possible other data received via a user interface or by means of a data acquisition process; and to provide life cycle assessment data (LCA) and/or life cycle cost data (LCC).

2. Tanning unit according to claims 1, wherein the separation device (20) and the collecting device (24) are different devices and are configured so that the collecting device (24) is reached by gravity by solid waste collected through the separation device (20).

3. Tanning unit according to any of the preceding claims, wherein the drum (1) comprises a static manifold (15) fluidically connected to the rotating element (5) to receive a process fluid flow while the drum (1) is in use and at least a chemical analysis sensor mounted in the static manifold (15).

4. Retrofit method of a tanning drum comprising the steps of:

connecting a weight sensor for solid waste generated during the use of the drum to a solid waste collecting device (24);

connecting to said sensor a control unit programmed so as to process a life cycle assessment (LCA) and/or a life cycle cost (LCC) on the basis of signals from a flow sensor of the input water; a counter for electric power absorbed by the drum (1), a weight sensor for a batch of input raw material, a process temperature sensor, the

solid waste weight sensor and a flow sensor for the output fluid discharged by the drum.

5. Retrofit method comprising the steps of:

5

Connecting to an exhaust port a flow sensor for the output fluid discharged by the drum; connecting to said sensor a control unit programmed so as to process a life cycle assessment (LCA) and/or a life cycle cost (LCC) on the basis of signals from an input water counter, a counter for electric power absorbed by the drum, a weight sensor for a batch of input raw material, a process temperature sensor, the solid waste weight sensor and a flow sensor for the output fluid discharged by the drum

10

15

6. Method for processing life cycle assessment (LCA) and/or the life cycle cost (LCC) for a unit according to claims 1, comprising the step of collecting solid waste from one or more batch and weighing the weight thereof.

20

7. Method for processing life cycle assessment (LCA) and/or the life cycle cost (LCC) for a unit according to claim 1, comprising the step of measuring the fluid flow discharged after the process.

25

30

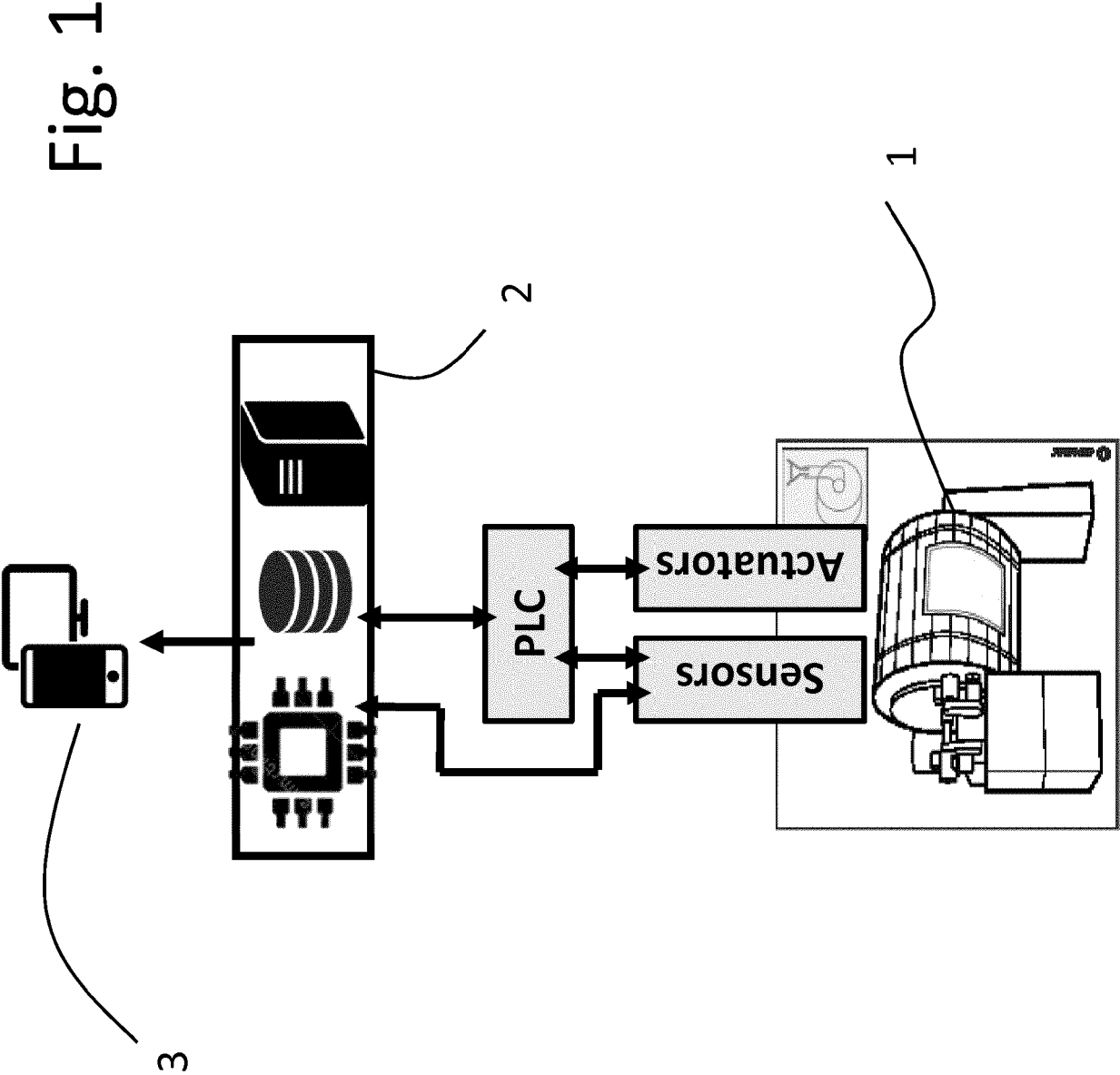
35

40

45

50

55



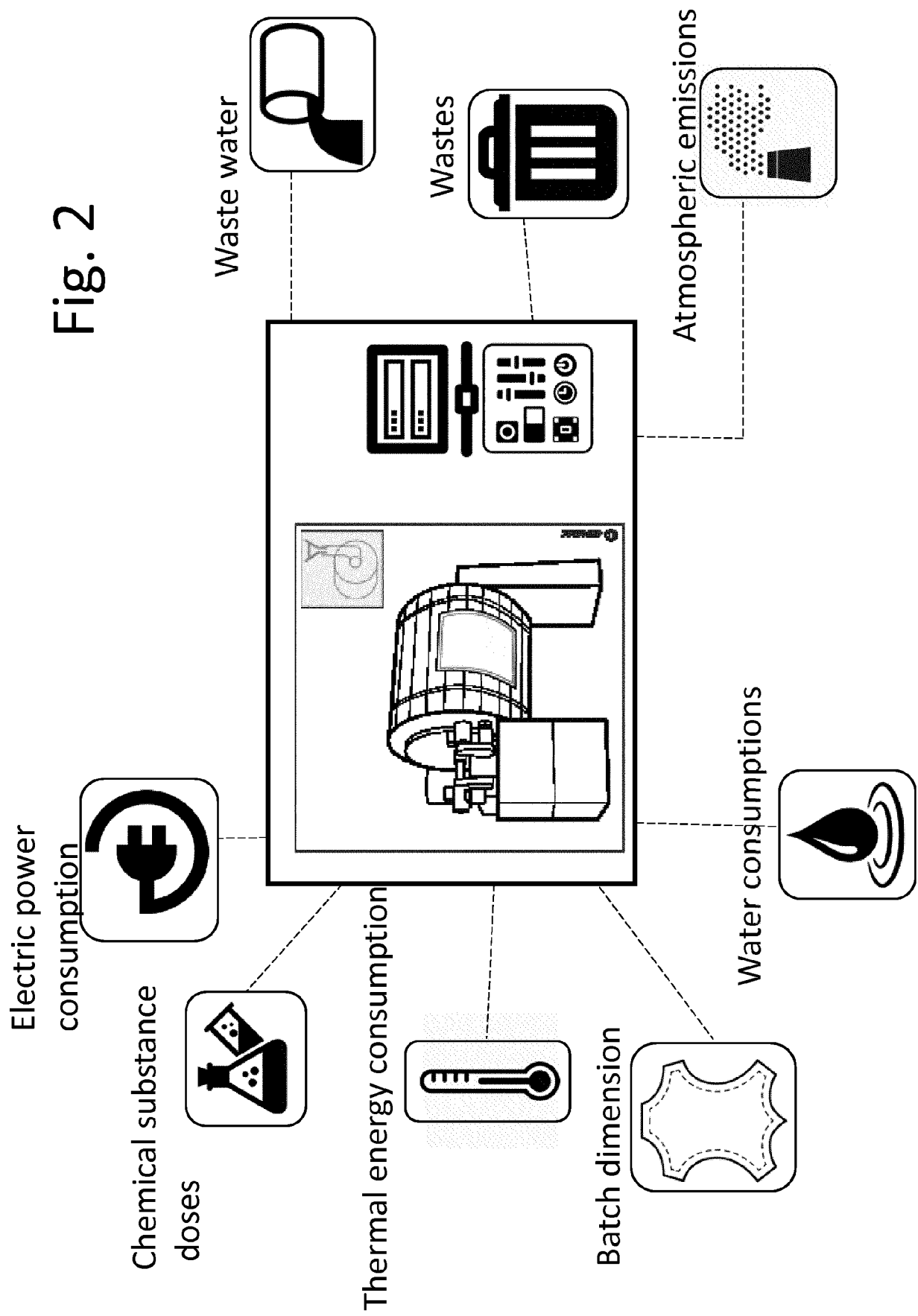
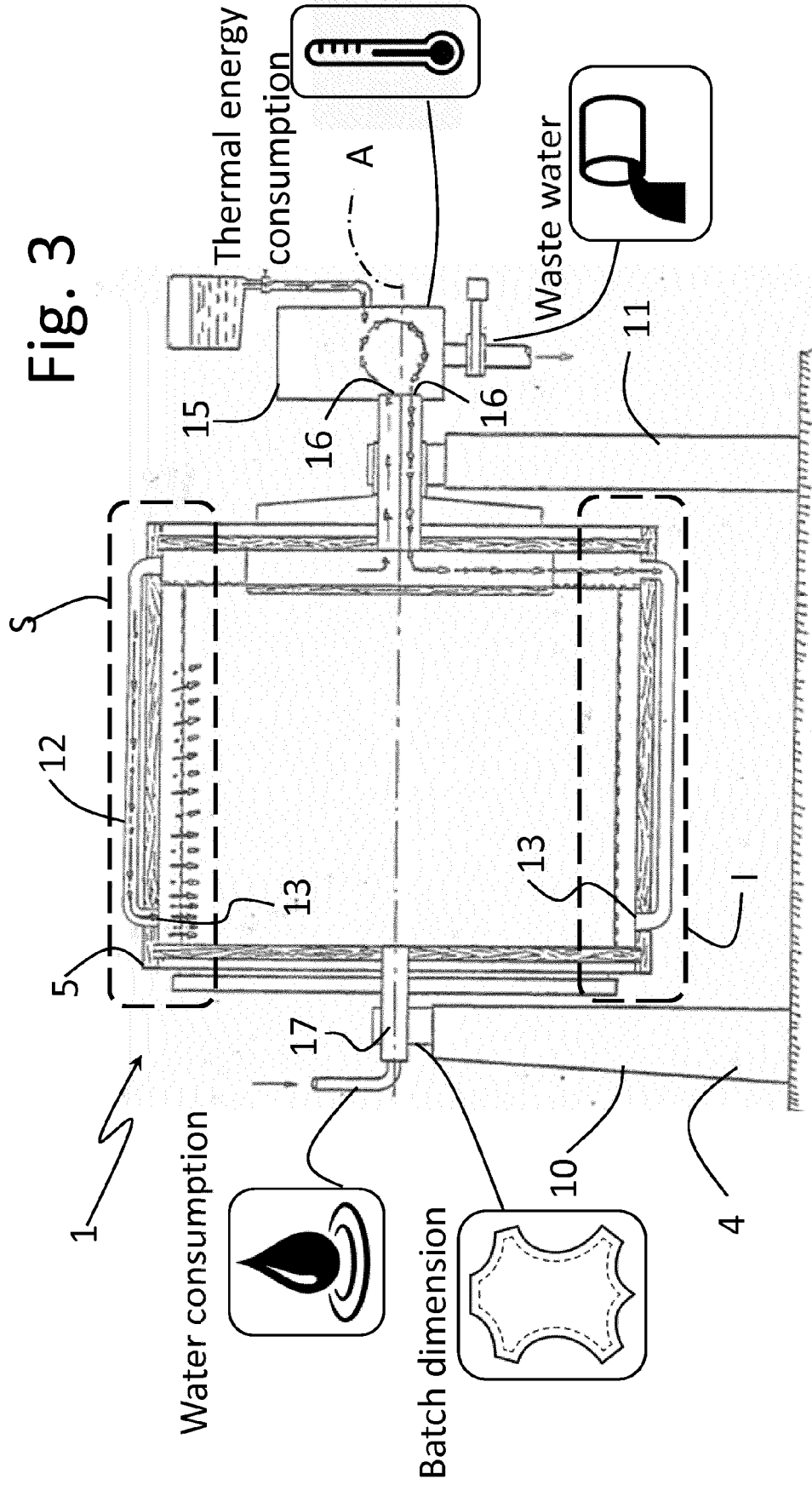
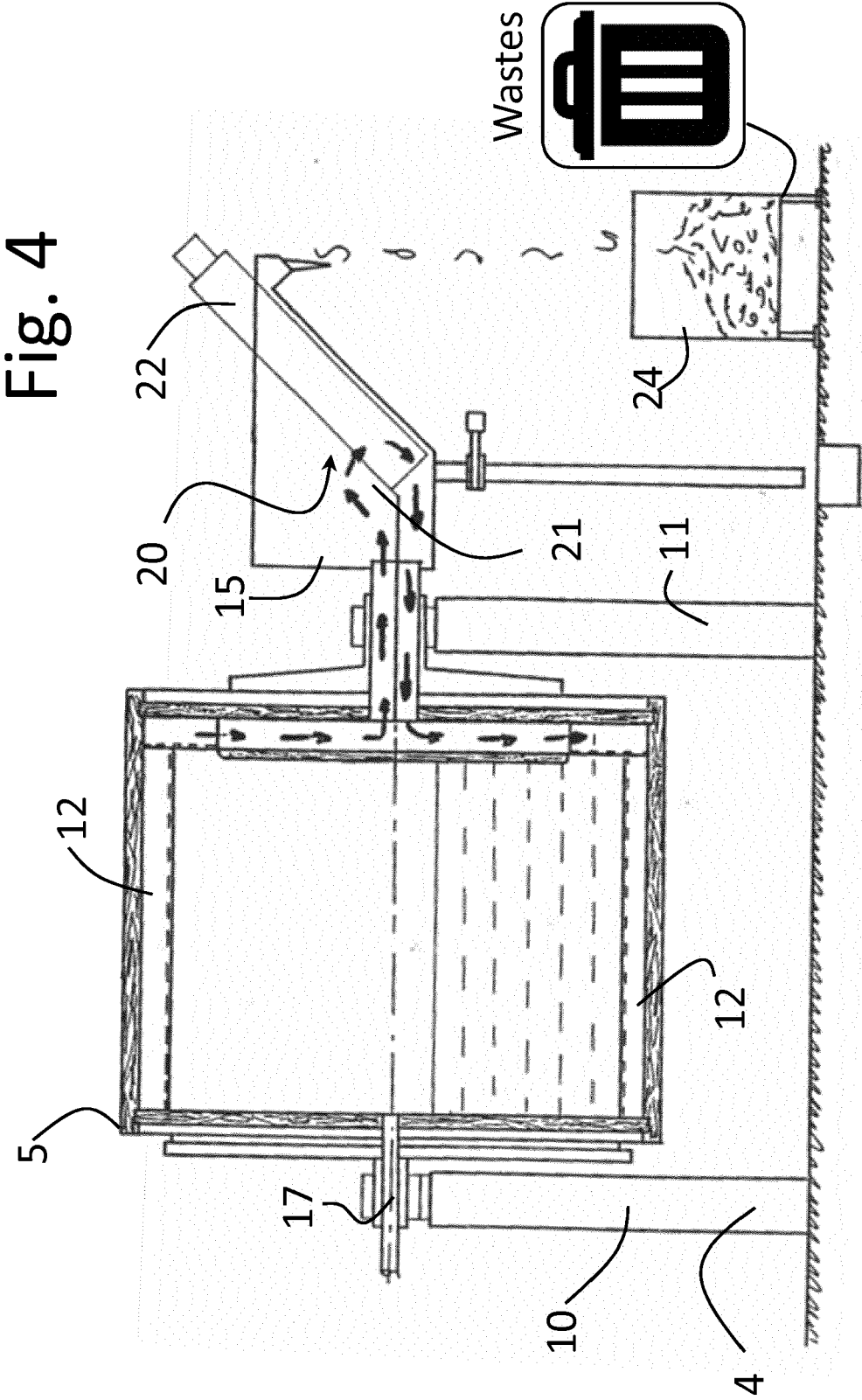


Fig. 3







EUROPEAN SEARCH REPORT

Application Number
EP 19 15 8295

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	CN 202 786 270 U (NINGXIA WEST CHINA FUR CO LTD) 13 March 2013 (2013-03-13) * abstract *	1-7	INV. C14B1/00 C14B3/00 C14C3/00
A	----- CN 203 878 156 U (WANG ZONGQIONG) 15 October 2014 (2014-10-15) * abstract; figures 1-3 *	1,4,5	
A	----- WO 01/32937 A1 (ITALPROGETTI ENGINEERING S R L [IT]; SERRINI MARIO [IT]) 10 May 2001 (2001-05-10) * pages 5-9; figures 1-7 *	1-7	
A	----- EP 0 960 948 A1 (ERRETRE S R L [IT]) 1 December 1999 (1999-12-01) * abstract; figure 1 *	1	
A	----- EP 0 990 707 A2 (ERRETRE S R L [IT]) 5 April 2000 (2000-04-05) * abstract; figure 1 *	1	
			TECHNICAL FIELDS SEARCHED (IPC)
			C14B C14C
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 9 May 2019	Examiner Iamandi, Daniela
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 19 15 8295

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

09-05-2019

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CN 202786270 U	13-03-2013	NONE	
CN 203878156 U	15-10-2014	NONE	
WO 0132937 A1	10-05-2001	AU 7922500 A BR 0007273 A EP 1141420 A1 IT PI990068 A1 WO 0132937 A1	14-05-2001 16-10-2001 10-10-2001 30-04-2001 10-05-2001
EP 0960948 A1	01-12-1999	AR 018857 A1 AT 246257 T BR 9901838 A DE 69909890 T2 EP 0960948 A1 ES 2204028 T3 IT VI980107 A1	12-12-2001 15-08-2003 07-12-1999 09-06-2004 01-12-1999 16-04-2004 29-11-1999
EP 0990707 A2	05-04-2000	AR 021831 A1 AT 259427 T BR 9907467 A DE 69914691 T2 EP 0990707 A2 ES 2216399 T3 IT VI980184 A1	07-08-2002 15-02-2004 26-09-2000 07-10-2004 05-04-2000 16-10-2004 28-03-2000

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82