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(54) Real-time control plant for controlling the processing cycle of cold-extraction of olive oil

(57) A plant for the real-time control of the production cycle concerning the cold-extraction of olive oil, characterized in that it comprises:
i - at least three functional blocks (1a, 1b, 1c) for carrying out a detection and control, each of which is associated respectively to one of the operative units of the olive-processing plant, that is, the assembly olive crusher-scutching/homogenisation basins, the decanter, the separators;
ii - a central management or handling unit interconnected by means of bus communication lines to panels or boards (1a, 1b, 1c) located on the respective single unit for its local control, wherein said central unit effects the reception, acquisition and processing of the data concerning the various steps of the production cycle for each customer's order and in each section of the plant;
iii - a recording unit at the input and at the output, for recording a plurality of orders which provide to the olive processing plant variable quantities of olives to be subjected to the processing for the extraction of the oil.

It is possible to modify, each time this is required/desirable, the properties, the features, and the processing steps, by simply intervening on the software without any action being taken with respect to the hardware components.

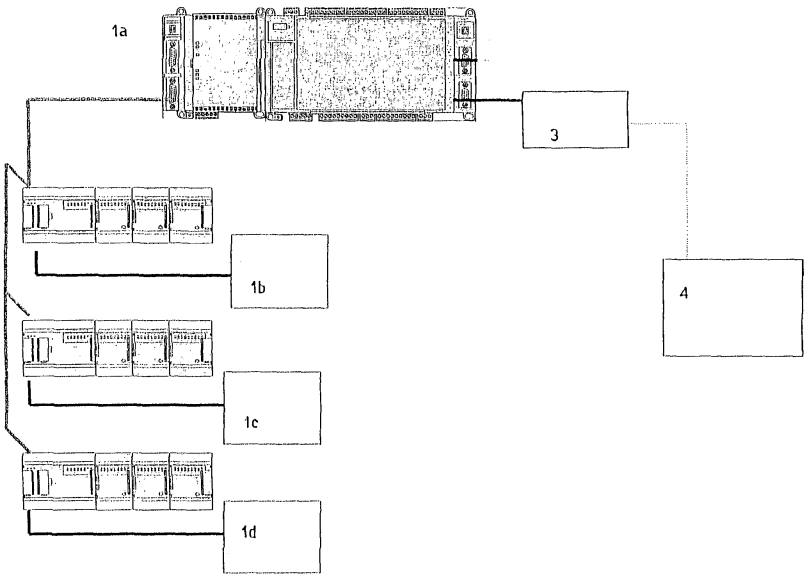

FIG. 2

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Description

Technical Field

[0001] The present invention generally relates to the technical field of machines used in olive oil extraction and processing, more particularly it regards an automatic parameter detection and control system for the parameters involved in this production process.

Background Art

[0002] A processing cycle allowing to obtain olive oil includes a standard series of separate, specific steps:

a) the breaking (milling) step, this operation having the purpose of breaking the cells of the pulp, causing the oil parts to come out;
b) the "scutching" and homogenisation, consisting in a continuous, slow mixing of the slurry obtained after the olive breaking step;
c) the extraction effected by centrifugation; the slurry, in its state after the scutching- homogenisation step is sent to the centrifugation, the latter occurring inside centrifugal separators known as "decanters", by adding water at room temperature;
d) the centrifugal separation; oil extracted by the decanter is processed in order to separate impurities and vegetation water.

[0003] It is well-known that the quality of the oil obtained as illustrated above depends on several factors which affect various steps of the production process. For instance, the "flavour profile" of oil is strongly influenced by the breaking (milling) procedure and by the duration and temperature of the scutching-homogenisation step, besides from the decanter type.

[0004] To further illustrate this concept by way of examples, usually in the scutching-homogenisation step warm water is circulated to perform heating of the oily slurry, thereby facilitating the subsequent extraction. But the scutching-homogenisation machine should perform its function at a controlled temperature in order to obtain an oil defined as "cold-extraction oil" for which the temperature of the oily slurry should be maintained below 27°C.

[0005] Various other properties could be mentioned among the organoleptic properties of olive oil that depend on how the product is treated in the various steps of the production cycle, but for shortness we shall not dwell on these considerations.

[0006] In any case, in the design of a machine for performing real-time control of an olive oil cold-extraction cycle, it is of fundamental importance to provide adequate, automatic regulation systems for the various quantities involved in the cycle and for the various parameters affecting the production process.

[0007] There have been proposed different solutions based on the detection of the flow amounts of respectively warm and cold water input into the centrifuges and which further detect the input temperature of the product in relation to other characteristic parameters of the product, like the turbidity, the acidity, etc.

[0008] Notwithstanding the variety of proposed means and the possibility of intervention that have been studied with the aim of optimising the individual steps of the processing cycle, until now nobody has proposed a solution for the control over the whole production process.

[0009] In fact, these methods have focused on the regulation of a single parameter, taken in isolation from the context of the whole production process, and for this reason they have failed in achieving a correlation (interdependence) between the various steps within a single supervision and control system.

[0010] Due to the lack of such a comprehensive vision, the possibility of realising an automatic management system, starting from the initial steps of breaking and scutching-homogenising, up to the control of the customer's order, including data management like the client's identification, the annexed fiscal document, the quality of the olives at the input and of the oil at the output for an individual lot (stock), has not been considered by anyone till now.

[0011] In case of a crusher which performs tens of operations of loading and discharge, for various customers, it becomes very burdensome — both under the viewpoint of the manual work and of the administrative/book-keeping workload — to effect a real-time control of the various steps related to each lot (stock) or order. An error may occur with a high probability and this may at the same time have very critical consequences. In any case, these operations, if not effected automatically, give rise to longer processing times and to a significant "waste" of human resources.

[0012] An object of the present invention is to provide a real-time control apparatus for the cold-extraction process of olive oil, allowing direct sampling of characteristic parameters starting from individual operative steps, and which, starting from this, permits to monitor the whole processing and to generate reports for validating (confirming) the optimum execution of the process for each order.

[0013] Another object of the present invention is to provide an integrated method of real-time control of the processing cycle for the cold-extraction of olive oil, this method being capable of managing in an effective way, for each individual lot (stock/batch), the loading and unloading activities — at the input and output stages — for the products involved in the processing of olives.

[0014] The real-time control method of the processing cycle of cold-extraction of olive oil also has the object to provide information related to the plant state (condition) — both for its operation and control, and for the maintenance to be effected by skilled technicians — to remote stations by means of the most common telephonic connections (modem, internet connections, etc.).

[0015] At last, an object of the present invention is to provide a real-time control apparatus of the processing cycle of cold-extraction of olive oil, which employs components, transmission protocols, and technologies, that are standardised in the field of industrial process control, in order to have a system of convenient cost and of easy maintenance.

[0016] These and further objects that will result from the following description are achieved by a real-time control apparatus of the processing cycle of cold-extraction of olive oil, whose characterising features are included in the appended claims.

[0017] The peculiarity of the innovative system consists in that the control of the three constituent blocks of the crusher (the assembly formed by the breaker-scutching/homogenisation vessels 1a, the decanter 1c, the separators 1b) has been split (divided up) so as to obtain three independent units, each of which can perfectly operate and be handled independently of the other.

[0018] Each unit has been implemented to meet the requirements of reliability and flexibility.

[0019] The reliability is a consequence of the "robustness" of the electronic apparatuses that are used. In fact, these devices are constructed so as to permit, above all, their use in an industrial environment, where they are subject to the most severe conditions under continuous operation conditions.

[0020] The flexibility is obtained by employing a programmable logic which allows, in contrast to a purely electromechanical solution, the modification of the properties, of the characteristics, of the working processes, by simply acting on the software each time this is considered necessary, without being forced to change the hardware.

[0021] As a consequence of employing a dedicated programmable logic for each unit, the entire system acquires a high expansion capability and modularity. Actually, it becomes easy to match the configuration of the oil production machine according to the specific needs of a customer, for instance by providing a greater number of decanters and/or separators with respect to the standard configuration.

[0022] Since the individual components of the crusher are interconnected by Bus communication lines of the kind ModBus, the operation of adding a decanter or a further separator only implies the necessity of expanding the data network.

[0023] The use of a centralised control of the system would not have permitted a diversification of the plants without modification of both the hardware and software parts.

[0024] The novelty resides also in the automatic monitoring, for each lot (stock/batch), of the temperature and of the other parameters involved in the entire production cycle. While in conventional plants a control was performed manually, or static measurements were performed for the characteristic parameters always at the same, specific points of the plant, in the system according to the present invention it becomes possible to obtain a log (trace) of the parameters inherent to each specific lot, in all steps of the processing cycle.

[0025] Assuming that in a conventional plant a local valve is not functioning properly, and that the temperature reaches 80°C, then it would be impossible to prevent the following lots from being negatively affected by this rise in temperature beyond the allowed limits. Therefore, it is very important that the monitoring is performed for each lot (batch) separately, to obtain a report with a significant "sampling frequency" (of the order of at least 30 sec.), this detection modality being in fact that implemented by the present invention.

Description of a preferred embodiment

[0026] Only for illustrative purposes and without thereby limiting the generality and possible application fields, in what follows a preferred embodiment of the invention will be described with reference to the annexed figures, in which:

FIGURE 1 is a general, schematic representation of the overall operation of the control system according to the present invention;

FIGURE 2 is a more detailed representation of the schematic illustration shown in Fig. 1;

FIGURE 3 is a schematic representation of a synoptic frame appearing on a operator's display panel included in the control network according to the present invention.

[0027] In the embodiment to be described, a local control of each unit is made possible by the use of a PLC programmable logic and by an interface panel for the operator, which are provided both in the general board 1a, located in the machine section associated with the breaking and scutching/homogenisation operations, and in the board located in the separators group 1b. For what concerns the decanter, the presence of an operator's interface panel is an optional feature depending on whether the same is provided separately or not.

[0028] Preferably the additional panel is not located on the decanter but on the separator, since it is to the latter that several dedicated commands need to be sent. Actually, it must be possible, with the separator, to actuate or to stop the operation of the pump used to draw the liquid (oil) from the decanter for supplying it to the separator, moreover, it must be possible to initiate the process manually or automatically, etc. (all these constitute operations or functions that are in any case included in the control board (control panel, or console)). Therefore, it has been chosen to effect the control of the decanter on the main control board, so as to operate a remote control (because after its starting it does not require further controls).

[0029] Fig. 2 shows the various control groups, that is, the general board 1a, the board 1b of the separator, the board 1c of the decanter, and a possible supplemental panel or board 1d of an additional decanter or separator.

[0030] A modem 3 connects the general board 1a to a supervisory processing unit 4.

[0031] In the specific embodiment which is based on a PLC technology, in accordance with the preceding description, each section is provided with a master CPU for its own plant, such as to insure the operation of the latter also in case of a malfunction or failure.

[0032] The protocol Modbus RTU, used by this system to interconnect the various machines, insures a data exchange rate of the order of 38400 baud (bit/sec), and moreover it is a standard, universally known protocol, well-known by all manufacturers of industrial automation systems.

[0033] In order to insure a complete connection between all local modules and the Master/Slave central units, a signal regeneration system (LH-4V) on two copper cables (RS485), or alternatively, in order to reduce noise on the bus, an optical fibre system (LH-4VLWL) capable of reaching distances of 20km for each network segment have been used. Moreover, the system is designed in such a way as to insure continuity of the signal also in the eventuality of a malfunction of the repeater.

[0034] In normal operative conditions the master CPU of the general board 1a performs a polling of all the slave CPUs 1b, 1c, 1d; each of this letter performs a continuous check on the correct polling interrogation effected by the master CPU, and therefore it checks the efficiency of the communication network. Should the slave CPU verify that a polling interrogation by the master CPU has not occurred, it will automatically act as Master Modbus to interrogate all or part of the CPUs associated with the machines, in accordance with the kind of BUS malfunction that has occurred.

[0035] In normal conditions of the system, it is provided that only one CPU, the one in the main board 1a, be the Master Modbus of the line, while the CPU located in the decanter board 1c and the CPU located in the separator's board 1b, are slave CPUs. In the general board 1a and on the separator's board 1b there will be provided a touch panel keyboard (tactile keyboard) for "data collection", which is connected to the data transmission network of the backbone and collects all the data to be transmitted to the local, supervisory PC 4.

[0036] This system, which is connected to the network, allows the control over the whole plant from every host workstation moreover it permits to monitor and record the whole processing on the apposite PC. It is possible to make updates of the software through a normal telephone line and to remotely perform the visualisation by using the Internet, and in this way it is possible to control the production, to control the orders management, the electric energy consumption, and using the software it becomes possible to obtain an approximate evaluation of the profits for each order.

DESCRIPTION OF SOFTWARE PROCEDURES

[0037] The system, besides the three software applications for the control of the single machine parts, provides for the use of two supervision software applications allowing the operator to manage the operation of the machine, to monitor and sample the product temperature which is processed (treated) in the various processing steps, and consequently, to generate a log (reports) certifying the actual cold-breaking/milling of the olives for each order.

[0038] The management and control procedures perform a series of detections of the parameters involved in the production, starting with the temperature monitoring — with a possible feedback for the regulation of the local input valve — and ending with the detection of the rpm of the centrifuges.

[0039] The supervision software, incorporated in the main panel or board, has the feature of visualising, in a summarising screen (screenful), the state of operation of the whole plant, and the temperatures detected in the most important steps of the processing.

[0040] In Fig. 3 there is shown a synoptic frame of the kind available to the operator on the general panel or board, which relates to an apparatus including four basins or vessels 11 for scutching/homogenising, the latter cooperating with a decanter 12 located downstream, which in turn is followed by a final separator 13. In this frame, there are shown the measured quantities which vary continuously (that is, in real-time). In practice, the operator, and more generally the

users, may follow one by one the steps which characterise the processing cycle, having available the direct sampling of the physical parameters with which the apparatus is working.

[0041] Besides this direct visualisation and control it is necessary to take account of the fact that normally an olive-press or crusher works according to orders — or lots (stocks/batch) — that is, according to a certain, specific amount of product, which is loaded at the input for carrying out the processing. Therefore, at the beginning of the production line this amount is "traced or logged" through the crushing and scutching/homogenisation, thereafter, the parameters involved in the processing inside the decanter are evaluated, and at last, the production parameters of the product inside the final separator are detected. Summing up, the individual lot is monitored, step by step, while it passes through the various sections making up the plant, which in turn correspond to specific steps of the production process.

[0042] All this is performed automatically in the solution according to the present invention. It is not necessary, in this context, to dwell on the basic components allowing to manage the flow amount regulations, since these are well known to the skilled persons.

[0043] Instead, it is important to emphasize that the result of the detection substantially amounts to a complete and detailed trace or log, since the lot or batch is followed, that is, traced, from the instant of time when the olives are loaded into the hopper, up to the time when the oil is discharged from the final separator.

[0044] This functionality of the control system is already evident from the schematic drawing of Fig. 3, wherein, as stated above, there is shown the arrangement of the temperature sensors used for the detection at the input and output of the four scutching/homogenisation apparatuses 11 A, B, C, D associated with the respective "monopumps". Also, on this scutching/homogenisation assembly 11 there is provided a direct measurement means 18 of the monopump operation velocity. On an upper frame there are displayed the scutching/homogenisation times (in minutes) of each unit.

[0045] From the scutching/homogenisation system the product is transferred to the decanter 12, and from there, to the separator 13, on which temperature detections and visualisation of results are in any case performed, besides the detection of the rpm of the individual pumps ("monopumps").

[0046] At the lower side of the screen there is provided a choice menu whose selectable items include the selection of a specific customer's order, for visualising the related data. Moreover, there are provided selections related to alarms, a general menu for commands, selections for the individual processing units, etc.

[0047] In fact, this first screenful allows in any case to accede to the "work pages" dedicated to the individual units (assembly of olive crusher-scutching/homogenisation apparatuses, decanter, separators) constituting the plant, in order to observe and control their operation.

[0048] The work page associated with the assembly of the crusher-scutching and homogenisation machines, allows to manage all the loading operations, the crushing operation, the operation of scutching and homogenisation and of discharge of treated raw material. A novel feature - not of minor importance - consists in the possibility of setting the temperature value of the water present inside the scutching/homogenisation basins A, B, C and D, and in the possibility of varying the discharge velocity through the regulation of the rotation frequency (velocity) of the monopumps.

[0049] Alternatively, the system will (by selecting the automatic option) prevent an increase in temperature over 27°C of the slurry contained in the basin, by continuously adjusting the temperature of the water.

[0050] A further feature of the present new system is to be able to select, during maintenance works, the velocity value of the monopumps and their direction of rotation (direct rotation and reverse rotation). The importance of this technical feature becomes immediately clear in case the metal detector detects the presence of a foreign body inside the connection duct connecting the monopump to the decanter. The interface associated with the decanter allows to actuate and stop the olive cake conveyor and the decanter itself; the round per minutes (rpm) reached by the decanter angular velocity is displayed, and it is also possible to establish a minimum rpm value below which the whole system must automatically come to rest.

[0051] A threshold is set, normally corresponding to 100 rpm below the nominal value, so that if the round per minutes decrease below this limit value the pump is automatically stopped. In addition to this kind of direct control there is also provided a feedback control, according to which, when the detected rpm of the motor progressively decreases, the inverter is automatically adjusted to diminish the flow rate of the slurry being supplied to the decanter. This is done for the purpose of making the rpm of the decanter increase again.

[0052] For what concerns the separator, there are two interface screens, respectively used for the automatic management and the manual management. In both visualisations, indications will be displayed such as "stop supply of oily liquid" and "cycle restarting" , and indications of the state of the active process (outflow, closure, etc.) and the time left. Moreover, control keys for manual control and time settings will also be provided.

[0053] The same information is provided both on the main control board and on the board located on the separator. This allows an operator to manage the operation of the separator indifferently by a local control or by a remote control. The remote control operations are displayed also on the local panel or board, and vice versa.

[0054] As already mentioned, the new system is capable of monitoring and sampling temperature values in all processing steps used to process the raw material. This operation is carried out in a fully automatic way since the system can establish the exact location of the product — corresponding to an individual lot — according to the commands given by

the operator.

[0055] In the following table a plant is considered which manages four orders. Each order is dealt with one of the four scutching/homogenisation vessels or basins making part of the machine. When the user accedes to the loading input port of the vessel or basin "B" and sends the command for the start of the automatic processing, the order B (= Commessa "B") is selected, and a dialogue window will be opened through which it will be possible to input the customer data (customer name, note number, number of the lot, product amount) and to confirm the start of the processing.

[0056] The state of the sampling for each order is displayable by means of two visualisations as shown in the table.

DD-Sept -YY							hh:mm:ss
Order A		*Order B*		*Order C*		*Order D*	
ABCDEFGHIJKLMNO		ABCDEFGHIJKLMNO		ABCDEFGHIJKLMNO		ABCDEFGHIJKLMNO	
Note No. ABCDEFGH		Note No. ABCDEFGH		Note No. ABCDEFGH		Note No. ABCDEFGH	
Amount (Kg.)	1234	Amount (Kg.)	1234	Amount (Kg.)	1234	Amount (Kg.)	1234
Lot No.	1234	Lot No.	1234	Lot No.	1234	Lot No.	1234
Hopper	12,3	Hopper	12,3	Hopper	12,3	Hopper	12,3
Crusher	12,3	Crusher	12,3	Crusher	12,3	Crusher	12,3
Basin A	12,3	Basin A	12,3	Basin A	12,3	Basin A	12,3
Decanter	12,3	Decanter	12,3	Decanter	12,3	Decanter	12,3
Separator	12,3	Separator	12,3	Separator	12,3	Separator	12,3

[0057] A page (Commesse = orders) summarises information about all the above four orders, and it is subdivided into four main areas illustrating the four orders.

[0058] Each of them includes two parts; the upper part relates to the client's (customer's) data and allows access to these data to possibly modify them; the lower part is designed for the display of temperatures that have been detected at various points of the plant.

[0059] From this page it is possible to accede to the visualisation (screenful) relating to the reports, if one wants to display the data regarding a single order; it suffices to slightly press on an area where temperatures are displayed in order to open a "work page" containing the following data:

- name of customer, note number, lot number, amount;
- date and hour of start and end of the process;
- - time consumed for scutching/homogenisation (in minutes);
- temperatures related to the five steps: elevator, olive-crusher, scutching/homogenisation vessel, decanter (horizontal centrifuge), separator.

DD/MM/YY		**hh:mm:ss**
PRINTED REPORT		
Customer name ABCDEFGHIJKLMNO		Lot number 1234
Note number ABCDEFGH		Amount (Kg) 1234
Date and hour (start of processing) DD-Sept - YY hh:mm:ss		Date and hour (end of processing) DD-Sept -YY hh:mm:ss
Time Interval of homogenisation	1234 min	Oil amount (Kg)
Temperature of hopper	12,3 °C	Temperature of separator 12,3 °C
Temperature of crusher	12,3 °C	
Temperature of basin B	12,3 °C	
Temperature of horizontal centrifuge (decanter)	12,3 °C	

Industrial applicability and advantages of the invention

[0060] The system is based on hardware components of industrial type, that is, characterised by high reliability and easy to be found.

[0061] The use of programmable logics and of other technologically advanced apparatuses allows the optimisation of the production steps and therefore an optimum use of the individual hardware components of the control system according to the present invention; as a result, the average durability of operation of the apparatuses will increase and a noticeable energy saving is achieved.

[0062] A peculiarity of this system is to simplify as much as possible the operations necessary for putting the same into service. This goal is achieved completely since the final user needs simply to provide adequate electric power supply outlets required for the operation of the individual units of the machine. The network interconnections of these units will be obtained by employing a common pair. The advantages of the interconnection via a network BUS are obvious:

- reduction of the time required for putting the system into service;
- extreme ease in the logistic distribution of the apparatuses;
- saving of costs, due to the elimination of numerous electric connections between the control board or panel and the controlled apparatus;
- possibility of using both a remote control and a local control of the apparatuses. The fact of having described specifically one embodiment of the present invention using the PLC technology should not be interpreted in a limitative way. The above considerations on the process control generally apply to other types of architectures — for instance to one based on a PC (using the Ethernet) or mixed PC/PLC -, and for each of them the performances of the related control are likely to be the same.

[0063] A further advantageous feature is that the control is effected independently on each line and on each apparatus making up the machine, so that a condition is created whereby the product is not "stopped" on the whole production apparatus in case of a malfunction/failure on a single production line.

Claims

1. A plant for the real-time control of the production cycle concerning the cold-extraction of olive oil, **characterized in that** it comprises:

   i — at least three functional blocks (1a, 1b, 1c) for carrying out a detection and control, each of which is associated respectively to one of the operative units of the olive-processing plant, that is, the assembly olive crusher-scutching/homogenisation basins, the decanter, the separators, so that these units be operable like three independent apparatuses or units, each of which is perfectly functional and manageable independently of the others;
   ii - a central management or handling unit interconnected by means of bus network communication lines to panels or boards (1a, 1b, 1c) located on the respective single unit for its local control, wherein said central unit effects the reception, acquisition and processing of the data concerning the various steps of the production cycle for each customer's order and in each section of the plant;
   iii - a recording unit at the input and at the output, for recording a plurality of orders which bring to the olive processing plant variable quantities of olives to be subjected to the processing for the extraction of the oil.

2. A plant for real-time control of the production cycle concerning the cold-extraction of olive oil, according to claim 1, **characterised in that** it comprises an operator interface panel or board, both in the general panel or board (1a), located in the machine section associated with the operations of crushing and scutching/homogenisation, and in the panel or board located in the separator assembly (1b).

3. A plant for real-time control of the production cycle concerning the cold-extraction of olive oil, according to each of the preceding claims, **characterised in that** it includes an apposite dedicated operative interface for the assembly formed by the olive crusher-scutching/homogenisation basins, allowing the management of all the loading, crushing, scutching/homogenisation operations and the discharge operations of the treated raw material.

4. A plant for the real-time control of the production cycle concerning the cold-extraction of olive oil, according to each of the preceding claims, **characterised in that** it includes a function of regulation of the water temperature present inside the scutching/homogenisation basins (11A, B, C and D) and of regulation of the velocity of discharge, by

controlling the rotation frequency of monopumps.

5. A plant for the real-time control of the production cycle concerning the cold-extraction of olive oil, according to each of the preceding claims, **characterised in that** it performs the regulation of the monopumps' velocity and of its rotation direction.

6. A plant for the real-time control of the production cycle concerning the cold-extraction of olive oil, according to each of the preceding claims, **characterised in that** in the regulation of the process parameters of the decanter, there is defined a minimum value of rounds per minute, below which the whole system will be automatically stopped.

7. A plant for the real-time control of the production cycle concerning the cold-extraction of olive oil, according to each of the preceding claims, **characterised in that** during a detection of the process parameters of the decanter, an inverter is automatically controlled by diminishing the flow rate of slurry supplied to the decanter, when a progressive decrease of the rounds per minute of the motor is determined.

8. A plant for the real-time control of the production cycle concerning the cold-extraction of olive oil, according to each of the preceding claims, **characterised in that** the control of the activities of the separator includes such functionalities like a setting of time periods, the stopping of the supply of oil-containing liquid, and the restarting of the cycle, besides the management of active process during the outflow, the closing, etc.

9. A plant for the real-time control of the production cycle concerning the cold-extraction of olive oil, according to each of the preceding claims, **characterised in that** when a new lot to be processed is delivered at the input, a dialogue interface is available by means of which it is possible to input the customer data relating to the name, the note number, the lot number, the product amount, and by means of which it is possible to confirm the start of the processing.

10. A plant for the real-time control of the production cycle concerning the cold-extraction of olive oil, according to each of the preceding claims, **characterised in that** it is provided with two work areas on a single interface, including:

    i- in the first work area, the customer data, to which access is permitted at any time for their modification;
    ii- in the second work area, corresponding to a read-only area, the display of the temperatures detected at various points of the plant.

11. A plant for the real-time control of the production cycle concerning the cold-extraction of olive oil, according to each of the preceding claims, **characterised in that** it utilizes a programmable logic based on the use of a PLC.

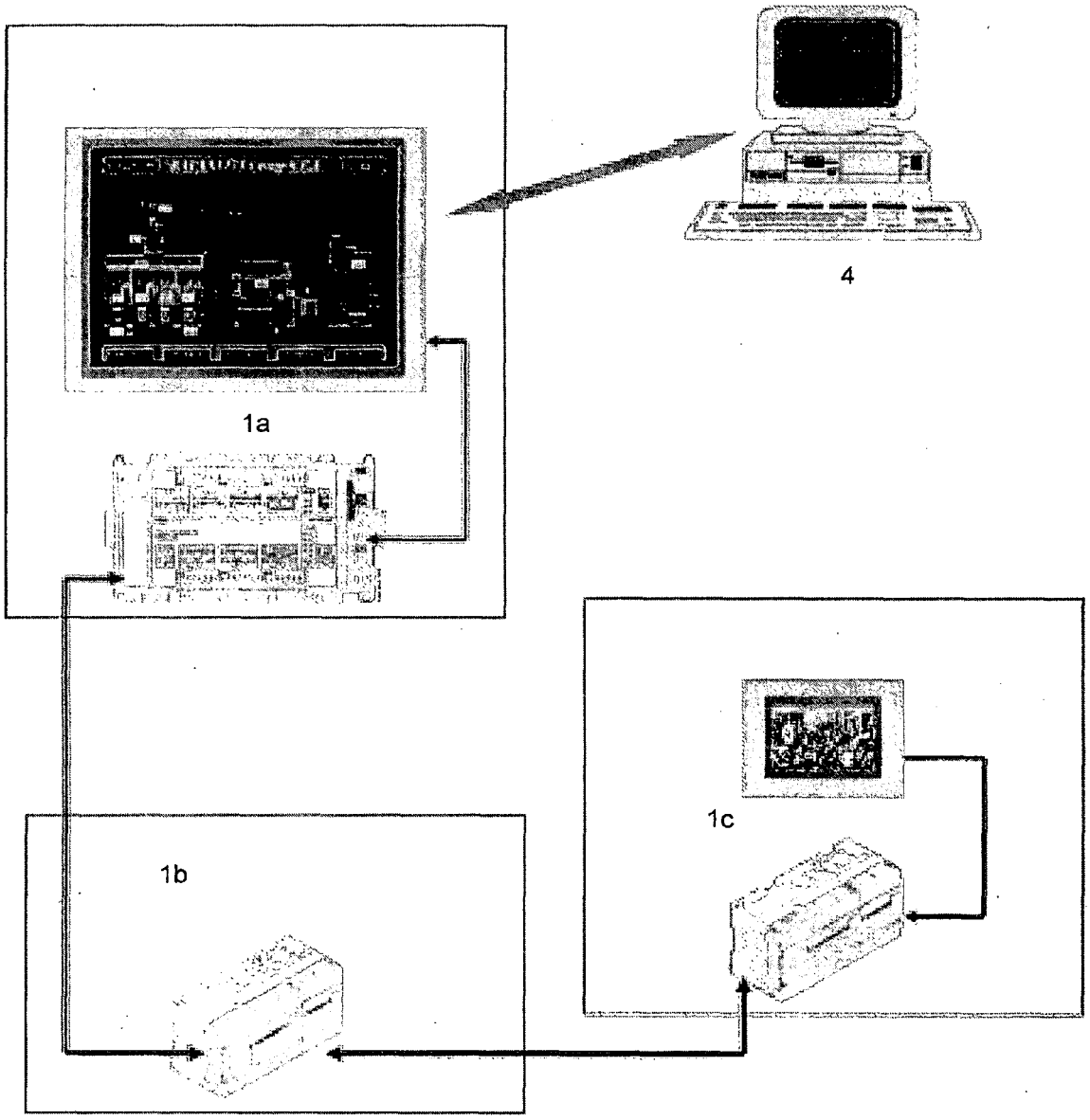
12. A plant for the real-time control of the production cycle concerning the cold-extraction of olive oil, according to each of the preceding claims, **characterised in that** each section includes a master CPU of its own apparatus, in order to insure the operation of same also in case of a malfunction/failure.

13. A plant for the real-time control of the production cycle concerning the cold-extraction of olive oil, according to each of the preceding claims, **characterised in that** during normal operational conditions the master CPU associated with the general control board (1a) polls, all the slave CPUs (1b, 1c, 1d), and a continuous check is made whether the poll, is correctly performed by the same master CPU, and if a slave CPU finds that a poll, by the master CPU has not occurred, it automatically acts as Master Modbus by polling all or part of the CPUs located in the apparatuses according to the type of malfunction/failure BUS that has occurred.

14. A plant for the real-time control of the production cycle concerning the cold-extraction of olive oil, according to each of the preceding claims, **characterised in that** it utilises a programmable logic based on the use of a personal computer.

15. A plant for the real-time control of the production cycle concerning the cold-extraction of olive oil, according to each of the preceding claims, **characterised in that** it uses a mixed programmable logic based on the use of a PLC and a personal computer.

16. A plant for the real-time control of the production cycle concerning the cold-extraction of olive oil, according to each of the preceding claims, **characterised in that** properties, features, and production process, are each modifiable each time it is desirable, simply by intervening on the software, without any action being taken with regard to the hardware components.


4
1a
1c
1b

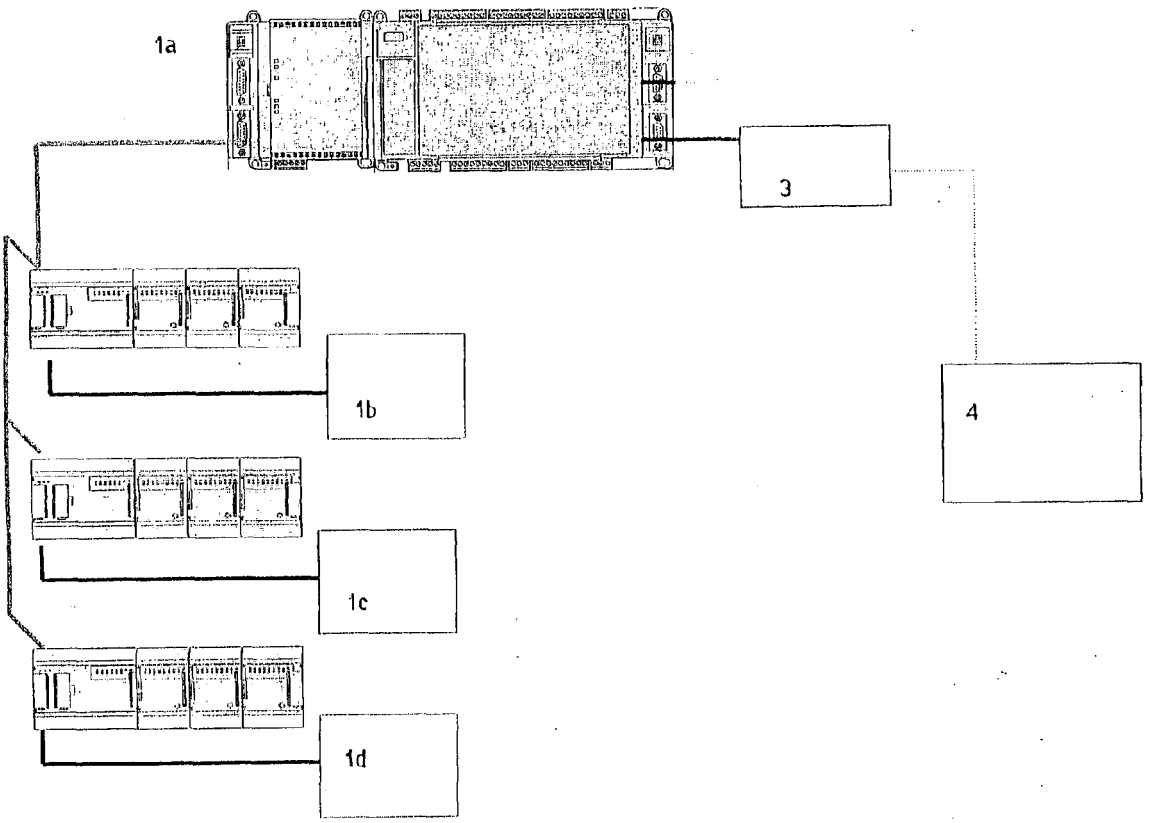


FIG. 2

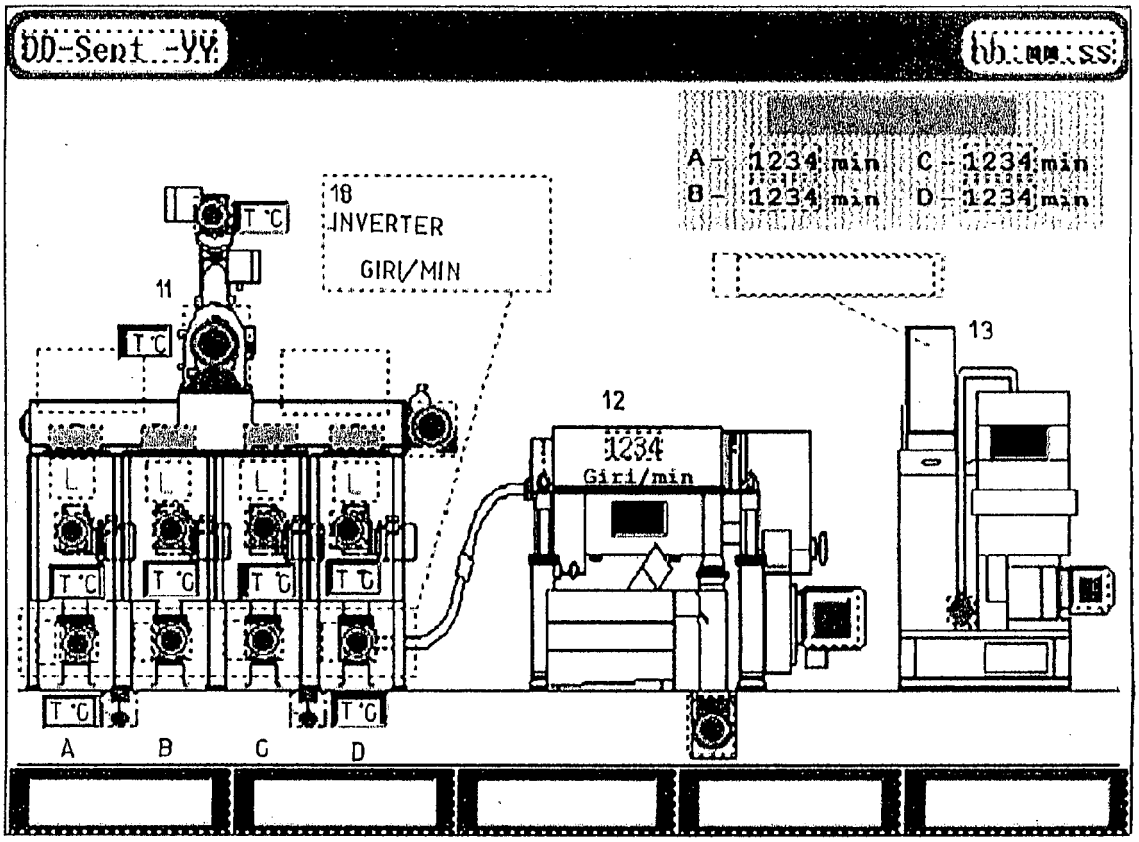

A – 1234 min C – 1234 min
B – 1234 min D – 1234 min
18
INVERTER
GIRI/MIN
11
12
1234
Giri/min
13
A
B
C
D

FIG 3

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EUROPEAN SEARCH REPORT

Application Number
EP 06 42 5388

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	NUNEZ-REYES A ET AL: "Comparison of different predictive controllers with multi-objective optimization application to an olive oil mill" PROCEEDINGS OF THE 2002 IEEE INTERNATIONAL CONFERENCE ON CONTROL APPLICATIONS. CCA 2002. GLASCOW, SCOTLAND, U.K. , SEPT. 18 - 20, 2002, IEEE INTERNATIONAL CONFERENCE ON CONTROL APPLICATIONS, NEW YORK, NY : IEEE, US, vol. 2, 18 September 2002 (2002-09-18), pages 1242-1247, XP010606154 ISBN: 0-7803-7386-3 * the whole document *	1-16	INV. C11B1/00 G05B19/05
X	SERRANO, A., MARTIN-SANCHEZ, J. M., AND MATA, J.: "Applicaciones de control adaptivo predictivo (SCAP) an la industria agroalimentaria - Applications of adaptive predictive control systems in the agrofood industry" ALIMENTACION EQUIPOS Y TECNOLOGIA, vol. 17, no. 6, June 1998 (1998-06), pages 103-107, XP008071183 ESALCION, MADRID * pages 103-106 *	1-16	TECHNICAL FIELDS SEARCHED (IPC) C11B G05B
A	BORDONS, C., AND CUELI, J. R.: "Predictive controller with estimation of measurable disturbances.Applications to an olive oil mill." JOURNAL OF PROCESS CONTROL, vol. 14, 2004, pages 305-315, XP002407169 GBOXFORD * the whole document *	1-16	

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1 The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	14 November 2006	Rooney, Kevin

CATEGORY OF CITED DOCUMENTS

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14-11-2006

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