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(54) COMPLETE SELF-CONTAINED MULTIPURPOSE DAIRY PROCESSOR UNIT FOR MILK DERIVATIVES PRODUCTION
KOMPLETT UNABHÄNGIGE VIELZWECKMILCHVERARBEITUNGSEINHEIT ZUR ERZEUGUNG VON MILCHDERIVATEN
UNITE DE TRANSFORMATION DE PRODUITS LAITIERS POLYVALENTE ENTIEREMENT AUTONOME POUR LA PRODUCTION DE DERIVES DU LAIT

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This invention relates to a complete self-contained multipurpose dairy processor unit for milk derivatives production for bovine, buffalo, sheep and goat holdings and for public-access farms.

Various types of plants for milk conversion in small quantity are known, constructed according to the classical scheme of the dairy farm and based on a coagulation vessel, the walls of which have an interspace through which hot or cold water is circulated to achieve heat transfer with the milk or whey contained in it. These vessels are sometimes provided with mechanical means for stirring and cutting the curd.

The use of this interspaced coagulation vessel usually requires two specific hot or cold water feed systems which very often require a considerable time for accumulating the energy required for the process. They are always in the form of plants composed of piping, valving, connection fittings, hydraulic pumps and reservoirs requiring particular plant design and installation, with considerable cost and processing time, as the milk to be processed, contained in the coagulation vessel, keeps the entire plant engaged until the end of the entire coagulation process. These plants are hence designed for specific milk quantities and are able to process only such specific milk quantities at a time.

US-A-207800 discloses an apparatus for thermal treatment of liquids, particularly milk, comprising a heat exchanger device in the form of a coil which can be immersed in the liquid to be treated. The coil is selectively feedable with hot water, steam, or cold water, depending on whether heat is to be transferred to the liquid or removed from it. The coil has a vertical axis around which it can rotate in order to improve the heat transmission. However, this apparatus is unsuitable for producing cheeses. In fact such a coil is unable for generating an effective flow in the liquid. Therefore, if the liquid to be treated is a curd (in which lumps of casein are dispersed in a liquid phase) from which a cheese has to be obtained, the lumps of casein adhere to the coil and degrades ("burn") thus compromising the wanted result. Furthermore, within a short time the quantity of casein on the coil also hinders the mechanical function of the coil which in practice is no longer able to generate any flow.

An object of the present invention is to provide the user with a complete self-contained multipurpose dairy processor unit for the production of milk derivatives, which allows the sequential processing of several milk quantities in several simple containers not forming part of the processor unit, with considerable utilization versatility and in any environment, while satisfying health regulations.

Further objects of the invention are:

- from the technical viewpoint, to advantageously replace the many plants and machines of the traditional cheese dairy, so achieving independence from the milk quantities to be processed;
- from the technological viewpoint, to enable all the processes of any cheese dairy to be effected, to obtain all types of cheese both from unpasteurized and from pasteurized milk, buttermilk curd, butter, yoghurt, etc.;
- from the time viewpoint, to have available a processor unit which is of immediate use, which enables the coagulation time to be drastically reduced, and allows processing to be effected in sequence on several milk containers, which may be of different capacities.

A further object of the invention is to provide a dairy processor unit which is easy to clean, so offering maximum guarantee of hygiene and avoiding contamination of the liquid (milk or whey) to be treated, and is simple and economical to operate, without the use of specialized labour or complicated technologies.

The invention hence consists of having concentrated in a single processor unit all the heat transfer, physical-chemical, microbiological and mechanical functions currently performed in the various sectors and plants of a traditional cheese dairy, while satisfying health regulations and without modifying the technology of traditional cheeses.

These and further objects which will be apparent hereinafter are attained by a dairy processor unit comprising:

- a hot-water or steam generator device (14);
- a heat exchanger device (18) immersible in the liquid to be treated and selectively feedable with hot water or steam produced by the hot-water or steam generator device (14), or with cold water, depending on whether heat is to be transferred to the liquid to be treated or removed from it;
- means to generate, within the liquid to be treated, a forced flow which grazes the heat exchanger (18); characterized in that
- the hot-water or steam generator device (14) is of the instantaneous type; and
- the means to generate within the liquid a forced flow is a variable-speed turbine which draws the liquid from below and expels it through the exchanger (18).

According to one embodiment of the present invention, mechanical means for stirring and cutting the curd can be connected to the flow generating means.

In this manner a complete self-contained multipurpose dairy processor unit is obtained. It should be noted that the term "cold water" means water the temperature of which is not substantially higher than ambient. Water having a temperature satisfying this requirement is for example mains water, well water or spring water.
[0012] The hot water or steam generator is conveniently of the type using liquid or gaseous fuel, and provided with operating and control means powered by the electric mains or by an electrical generator unit.

[0013] The lifting means can be operated either manually (in which case it is conveniently of the counterweighted type to limit operator fatigue), or by a pneumatic or hydraulic actuator, or by a geared motor unit powered by the electric mains or by the said electrical generator unit. The turbine for generating flow within the liquid to be treated can also be operated by a geared motor powered in the same manner.

[0014] The various components of the processor unit according to the present invention can be mounted on the same and the same support structure or base.

[0015] To allow the processor unit to be easily moved, the said structure can be provided with wheels to allow it to be moved by pushing.

[0016] If the amount of movement required of the processor unit is considerable, it can be motorized for this purpose and provided with a driver's position, to finally assume the form of an actual motor vehicle with an internal combustion engine.

[0017] According to a modified embodiment of the present invention, the heat exchanger device can consist of several heat exchangers; each provided with a turbine. Such a modified embodiment can be useful if the mass of liquid to be treated is considerable.

[0018] According to a further modified embodiment of the present invention, the lifting means can also consist of a monorail, possibly directionable, with a hoist from which the heat exchanger and relative turbine are suspended.

[0019] The processor unit can also be provided with a conventional control device, for example of microprocessor type, to totally or partially automate its operation.

[0020] Further characteristics and advantages of the invention will be more apparent from the description of one embodiment thereof given hereinafter with reference to the accompanying drawing, on which the single figure shows a very schematic side elevation view of the complete self-contained dairy processor unit according to the present invention.

[0021] As can be seen from the figure, the processor unit 10 comprises a base 12 carrying an instantaneous steam generator 14. The base also carries a lifting means 16, from the rotatable arm 24 of which there is suspended a heat exchanger 18, within the tube bundle of which there is coaxially positioned a variable speed turbine (not shown on the figure) which generates a flow within the liquid by drawing liquid from below to then expel it laterally and radially through the vertically extending tube bundle. A heat exchanger of this type is for example described in Italian patent application No. M093A 000005 in the name of the present applicant and entitled a "Radial Dynamic Heat Exchanger of Immersion Type".

[0022] Said turbine is supported by the heat exchanger 18 and is operated by a geared motor 22 positioned above the heat exchanger 18.

[0023] As can be seen from the figure, the lifting means 16 basically consists of an upright 17, to the upper end of which there is hinged an arm 24 operated by a cylinder-piston mechanism 19 via a suitable control unit (not shown) carried by the base 12. It should however be noted that the lifting means can also be operated in a different manner, for example hydraulically or by a geared motor, or even manually if provided with a counterweight to limit operator fatigue. As already stated it can also be in the form of a monorail, possibly directionable, with a relative lifting hoist.

[0024] As shown in the figure, the arm 24, and consequently the heat exchanger 18, can assume two significant positions, namely a working or lowered position in which the heat exchanger 18 is immersed in the liquid to be treated contained in the vessel 20 (this position shown in the figure by full lines), and a raised position in which the heat exchanger 18 is out of the vessel (shown by dashed lines in the figure).

[0025] As can be seen from the figure, the shaft of the turbine (not visible) projects beyond the lower edge of the heat exchanger 18 and carries fixed thereto a connection element 28 enabling the shaft to be connected to a stirrer means or a curd cutting means (not shown).

[0026] For simplicity, the figure does not show the hydraulic connections or the electrical installation, or the valve enabling hot water or steam to pass into the heat exchanger rather than cold water.

[0027] These are however obvious to an expert of the art.

[0028] As can be seen from the figure, the base 12 is provided with adjustable feet 26. As stated, these can be replaced or supplemented at their sides with wheels (not shown) to facilitate the movement of the processor unit 10.

[0029] It should be noted that the vessel 20 normally does not form part of the processor unit 10, as it can be any vessel provided it is suitable for the purpose and satisfies the health regulations applicable to the particular case. In particular, it does not need to be a traditional copper vessel of interlaced type, with all the advantages which this brings.

[0030] The operation of the processor unit 10 will now be briefly described, although this should be apparent from the foregoing. It will be assumed that the heat exchanger 18 is already immersed in the liquid (milk or whey) contained in the vessel 20 and that the turbine enclosed within it (not visible) is in operation. As soon as the instantaneous hot water or steam generator 14 feeds hot water or steam into the heat exchanger 18 via the relative hydraulic circuit, the heat exchanger 18 begins to transfer heat to the liquid in which it is immersed. This means that at the outlet of the heat exchanger 18 there is condensate which is returned to the instantaneous hot water or steam generator 14 to be retransformed into hot water or steam, to hence repeat
the cycle.

[0031] If instead the heat exchanger 18 is not immersed in the liquid and the steam generator 14 is operated, the heat exchanger temperature tends to rise to a value close to the temperature of the steam passing through it, with the significant result of sterilizing and disinfecting it.

[0032] As already stated, the heat exchanger 18 can also operate in the reverse direction. In this respect it can be used to cool the liquid in which it is immersed merely by closing the steam feed and feeding it with cold water, for example mains water (which normally has a temperature not exceeding 15°C) or spring, well or similar water. Consequently the heat exchanger 18 then removes heat from the liquid in which it is immersed, to cool it to the required temperature (which for the applications of interest is substantially higher than mains water temperature). The heat exchanger and the turbine enclosed within it, ie those parts of the processor unit 10 which come into contact with the liquid to be treated, are conveniently of stainless steel, this material being preferred from the hygiene viewpoint. This eliminates one of the problems of the traditional dairy industry, in which the vessel itself, necessarily of copper, has to be heated to transfer sufficient heat per unit of time to the liquid to enable the required result to be achieved. The result is that copper particles are transferred to the final dairy product (Japan has recently refused grain consignments because of excessive copper content under Japanese law). In our case, as the heat exchanger used results in a very high heat transfer rate, it is no longer necessary to use copper for those parts transferring heat to the treated liquid, so that the heat exchanger tubes can be constructed of a material of lower thermal conductivity than copper, such as stainless steel, hence overcoming the problem of copper particle release.

[0033] As will be apparent to the expert of the art, the described processor unit is of considerable versatility and achieves a very high heat transfer rate because of the presence of a radial dynamic heat exchanger of immersion type. This significantly reduces the time and cost of the production cycle without however changing the typicality of the traditional manufacturing process. In addition the processor unit according to the invention enables any production requirement to be satisfied (from the individual shepherd level to the large industrial cheese dairy), with a truly significant energy saving over a traditional plant.

[0034] This also results in a lesser environmental impact due to the significant reduction in burnt gas emission, complete elimination of water consumption for the coagulation, a considerable reduction in detergent effluent, and a significant reduction in the area required for production. Furthermore the processor unit of the invention enables the traditional fixed-volume copper vessel of interspaced type to be completely dispensed with, the vessel now being a simple vessel of any material suitable for food use (such as stainless steel or food-suitable plastics).

Claims

1. A complete self-containing multipurpose dairy processor unit (10) comprising:

   - a hot-water or steam generator device (14);
   - a heat exchanger device (18) immersible in the liquid to be treated and selectively feedable with hot water or steam produced by the hot-water or steam generator device (14), or with cold water, depending on whether heat is to be transferred to the liquid to be treated or removed from it;
   - means to generate, within the liquid to be treated, a forced flow which grazes the heat exchanger (18); characterized in that
     - the hot-water or steam generator device (14) is of the instantaneous type; and
     - the means to generate a forced flow within the liquid is a variable-speed turbine which draws the liquid from below and expels it through the exchanger (18).

2. A processor unit (10) as claimed in claim 1, wherein the steam generator (14) is of the liquid or gaseous fuel type.

3. A processor unit as claimed in claim 1 or 2, wherein the lifting means is of the manually operable type.

4. A processor unit as claimed in claim 3, wherein the manual lifting means is of the counterweighted type.

5. A processor unit (10) as claimed in claim 1 or 2, wherein the lifting means is operated by a pneumatic or hydraulic actuator (19).

6. A processor unit as claimed in claim 1 or 2, wherein the lifting means is operated by a geared motor powered by the electric means or by an electrical generator unit.

7. A processor unit (10) as claimed in any one of the preceding claims, wherein the turbine is operated by a geared motor (22) also suspended to the lifting means (16) and powered by the electric means or by an electrical generator unit.

8. A processor unit (10) as claimed in any one of the
9. A processor unit (10) as claimed in claim 8, wherein the support structure is provided with wheels which enable it to be moved.

10. A processor unit (10) as claimed in claim 8, wherein the support structure is provided with an internal combustion engine and is configured to form an actual motor vehicle.

11. A processor unit (10) as claimed in claim 1, wherein the heat exchanger device comprises two or more heat exchangers, each provided with a turbine.

12. A processor unit (10) as claimed in any one of claims 1 to 3, wherein the lifting means comprises a monorail.

13. A processor unit (10) as claimed in claim 12, wherein the monorail is of directionable type.

14. A processor unit (10) as claimed in any one of the preceding claims, wherein a control device is provided to totally or partially automate the operation of the processor unit.

15. A processor unit (10) as claimed in claim 13, wherein the control device is of microprocessor type.

16. A processor unit (10) as claimed in claim 7, wherein the shaft of the turbine projects beyond the lower edge of the heat exchanger (18) and carries fixed thereto a connection element (28) enabling the shaft to be connected to a stirrer means or a curd cutting means.

Patentansprüche

1. Völlig unabhängige Mehrzweckmilchverarbeitungseinheit (10), mit:
   - einer Heißwasser- oder Dampferzeugungseinrichtung (14);
   - einer Wärmetauschereinrichtung (18), die in die zu behandelnde Flüssigkeit eingetaucht werden kann und wahlweise mit Heißwasser oder Dampf, der durch die Heißwasser- oder Dampferzeugungseinrichtung (14) erzeugt wird, oder mit Kaltwasser gespeist werden kann, und zwar abhängig davon, ob der zu behandelnden Flüssigkeit Wärme zugeführt oder abgeführt werden soll;
   - einer Einrichtung, um in der zu behandelnden Flüssigkeit eine erzwungene Strömung zu erzeugen, die an dem Wärmetauscher (18) vorbeiströmt; dadurch gekennzeichnet, daß
     - die Heißwasser- oder Dampferzeugungseinrichtung (14) verzögerungsfrei arbeitet; und
     - die Einrichtung zum Erzeugen einer erzwungenen Strömung in der Flüssigkeit eine Turbine mit veränderbarer Geschwindigkeit ist, die die Flüssigkeit von unten ansaugt und sie durch den Tauscher (18) ausstoßt.

2. Verarbeitungseinheit (10) nach Anspruch 1, bei der der Dampferzeuger (14) mit flüssigem oder gasförmigem Brennstoff arbeitet.

3. Verarbeitungseinheit nach Anspruch 1 oder 2, bei der die Hebeeinrichtung manuell betätigbar ist.

4. Verarbeitungseinheit nach Anspruch 3, bei der die manuelle Hebeeinrichtung mittels Gegengewicht arbeitet.

5. Verarbeitungseinheit (10) nach Anspruch 1 oder 2, bei der die Hebeeinrichtung durch ein pneumatisches oder hydraulisches Betätigungsmittel (19) betrieben wird.

6. Verarbeitungseinheit nach Anspruch 1 oder 2, bei der die Hebeeinrichtung durch einen Getriebemotor betrieben wird, der durch eine Elektroeeinrichtung oder durch eine elektrische Generatoreinheit angetrieben wird.

7. Verarbeitungseinheit (10) nach einem der vorhergehenden Ansprüche, bei der die Turbine durch einen Getriebemotor (22) angetrieben wird, der ebenfalls an der Hebeeinrichtung (16) angehängt ist und durch die Elektroeeinrichtung oder durch eine elektrische Generatoreinheit angetrieben wird.

8. Verarbeitungseinheit (10) nach einem der vorhergehenden Ansprüche, bei der die Haltestruktur (22) montiert sind.

9. Verarbeitungseinheit (10) nach Anspruch 8, bei der die Haltestruktur mit Rädern versehen ist, wodurch es möglich ist, sie zu bewegen.

10. Verarbeitungseinheit (10) nach Anspruch 8, bei der die Haltestruktur mit einem Verbrennungsmotor versehen und dazu ausgestaltet ist, um ein wirkliches motorgetriebenes Fahrzeug zu bilden.

11. Verarbeitungseinheit (10) nach Anspruch 1, bei der die Wärmetauschereinrichtung zwei oder mehrere Wärmetauscher enthält, die jeweils mit einer Turbine versehen sind.
12. Verarbeitungseinheit (10) nach einem der Ansprüche 1 bis 3, bei der die Hebeeinrichtung eine Einschienen-Einrichtung aufweist.

13. Verarbeitungseinheit (10) nach Anspruch 12, bei der die Einschienen-Einrichtung vom direktionalen Typ ist.

14. Verarbeitungseinheit (10) nach einem der vorhergehenden Ansprüche, bei der eine Steuerungseinrichtung vorgesehen ist, um den Betrieb der Verarbeitungseinrichtung vollständig oder teilweise zu automatisieren.

15. Verarbeitungseinheit (10) nach Anspruch 13, bei der die Steuerungseinrichtung vom Mikroprozessor-Typ ist.

16. Verarbeitungseinheit (10) nach Anspruch 7, bei der die Welle der Turbine bis unter die untere Kante des Wärmetauschers (18) vorstehend und ein daran befestigtes Verbindungselement (28) trägt, wodurch es möglich ist, die Welle mit einem Rührwerk oder einem Milchgerinnselzerschneidemittel zu verbinden.

Revendications

1. Unité de transformation de produits laitiers polyvalente entièrement autonome (10) comprenant :
   - un dispositif générateur de vapeur ou d'eau chaude (14);
   - un dispositif échangeur de chaleur (18) apte à être immergé dans le liquide à traiter et à être alimenté de manière sélective en vapeur ou en eau chaude produite par le dispositif générateur de vapeur ou d'eau chaude (14), ou en eau froide, selon qu'il faille élever ou abaisser la température du liquide à traiter;
   - un moyen pour générer, dans le liquide à traiter, un mouvement de circulation forcé effleurant l'échangeur thermique (18);
   - le dispositif générateur de vapeur ou d'eau chaude (14) est du type instantané ; et
   - le moyen destiné à générer une circulation forcée du liquide est une turbine à vitesse variable qui aspire le liquide par dessous et le refoule à travers l'échangeur thermique (18).

2. Unité de transformation (10) selon la revendication 1, caractérisée en ce que le générateur de vapeur (14) est du type fonctionnant avec un combustible gazeux ou liquide.

3. Unité de transformation selon la revendication 1 ou 2, caractérisée en ce que le moyen de levage peut être commandé manuellement.

4. Unité de transformation selon la revendication 3, caractérisée en ce que le moyen de levage est du type à contrepoids.

5. Unité de transformation (10) selon la revendication 1 ou 2, caractérisée en ce que le moyen de levage est commandé par un actionneur pneumatique ou hydraulique (19).

6. Unité de transformation selon la revendication 1 ou 2, caractérisée en ce que le moyen de levage est actionné par un moto-réducteur alimenté par le réseau électrique ou par un groupe électrogène.

7. Unité de transformation (10) selon l'une quelconque des revendications précédentes, caractérisée en ce que la turbine est entraînée par un moteur-réducteur (22) également suspendu au moyen de levage (16) et alimenté par le réseau électrique ou par un groupe électrogène.

8. Unité de transformation (10) selon l'une quelconque des revendications précédentes, caractérisée en ce que tous ses composants sont montés sur la même structure de support (12).

9. Unité de transformation (10) selon la revendication 8, caractérisée en ce que la structure de support est dotée de roues lui permettant d'être déplacée.

10. Unité de transformation (10) selon la revendication 8, caractérisée en ce que la structure de support comprend un moteur à combustion interne et est configurée de manière à former un véritable véhicule automobile.

11. Unité de transformation (10) selon la revendication 1, caractérisée en ce que le dispositif échangeur de chaleur comprend au moins deux échangeurs thermiques, dotés chacun d'une turbine.

12. Unité de transformation (10) selon l'une quelconque des revendications 1 à 3, caractérisée en ce que le moyen de levage comprend un monorail.

13. Unité de transformation (10) selon la revendication 12, caractérisée en ce que le monorail est du type orientable.

14. Unité de transformation (10) selon l'une quelconque des revendications précédentes, caractérisée en ce qu'un dispositif de commande est prévu afin d'automatiser totalement ou partiellement le fonctionnement de l'unité de transformation.

15. Unité de transformation (10) selon la revendication...
13. caractérisée en ce que le dispositif de commande est du type à microprocesseur.

16. Unité de transformation (10) selon la revendication 7, caractérisée en ce que l'arbre de la turbine dépasse du bord inférieur de l'échangeur thermique (18) et supporte de manière fixe un élément de raccordement (28) permettant à l'arbre d'être raccordé à un moyen d'agitation ou à un moyen de séparation des grumeaux.