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# (54) METHOD OF CONTROLLING THE DRYING PROCESS OF HIDES IN THE TANNING INDUSTRY AND RELATED DRYING PLANT

VERFAHREN ZUR STEUERUNG DES TROCKNUNGSPROZESSES VON HÄUTEN IN DER GERBEREIINDUSTRIE UND ZUGEHÖRIGE TROCKNUNGSANLAGE

PROCÉDÉ DE COMMANDE DU PROCESSUS DE SÉCHAGE DE PEAUX DANS L'INDUSTRIE DU TANNAGE ET INSTALLATION DE SÉCHAGE ASSOCIÉE

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## Description

### TECHNICAL SECTOR

**[0001]** The present invention relates to a method for controlling the process of drying hides, or similar products, in the tanning industry. More specifically, the invention relates to a method for controlling the final stage of the drying process, wherein the hides have already been treated, usually by pressing and/or vacuuming, to remove the excess moisture so that a percentage of known residual moisture remains thereon and wherein from such a known percentage the hide must be gradually brought to a desired lower moisture value.

**[0002]** The invention also relates to a plant for controlling the hide drying process adapted for implementing the method of the invention.

### BACKGROUND ART

**[0003]** As is well known, tanning is a hide working process consisting of a succession of chemical and mechanical stages. All chemical operations, up to post-treatment and dyeing, are carried out by means of a "wet treatment process" in drums or other chemical reactors. The tanned hide resulting from these treatments has an extremely high level of moisture, in excess of 100%, and must therefore be subjected to controlled drying processes before it can undergo finishing treatments.

**[0004]** The drying process typically takes place in several successive stages through the use of specific drums and other specialised machinery and equipment.

**[0005]** A first phase is sammying in which the hide is mechanically processed through pairs of grooved rollers that compress it. At the outlet of this phase, the content of water absorbed by the tanned hide is significantly reduced to about 40%.

**[0006]** Following the sammying operation, a vacuum phase may take place in which the hide is adhered to a steel plate under which steam or hot water circulates and onto which a lid is lowered. A depression is then created inside the lid, and this facilitates the evaporation of the water. This phase is discontinuous and involves opening the machine, removing and inserting the hide, and then closing the machine again. Generally, the amount of residual moisture in the hide at the outlet of the vacuuming process is around 20%.

**[0007]** At the end of the aforementioned drying phases, the hide has in any case a known or measurable residual humidity and must undergo the final drying process to bring the hide in a controlled and gradual way to a final humidity value of between 8% and 12%, depending on the use purposes.

**[0008]** Various types of systems are known to perform the final hide drying phase. A first distinction between them is based on the position of the hide. In fact, plants exist in which the hides are kept in a fixed position during drying, as occurs, for example, in static conditioning cells or in laboratory vertical air-flow driers, and other plants in which the hides are moved through the drying environment by means of chain or belt conveyors, as in the case of rotary or tunnel dryers. A further distinction is made according to the manner in which the hides are supported. In fact, they can be kept in an extended configuration, as in hide supporting frames, or can simply be hung, as in the case of stick dryer systems.

**[0009]** Whatever the technology used, the purpose of the final drying process is to achieve an extremely controlled reduction in the moisture content of the hide that makes it possible, first and foremost, to maximise the yield (i.e. to obtain the smallest possible surface reduction) and also to optimise the final features of the hide from the point of view of workability, softness and so forth.

**[0010]** Regardless of the drying technology used, the main factors that characterise a drying process are: the temperature and relative humidity of the air in the drying environment, the air velocity on the surface of the product to be dried, and the overall drying time. The maximum duration of the drying cycle is often determined by the needs of the production process and is therefore usually considered a fixed parameter. With regard to the other three characteristic parameters of the process, current technologies are all designed to enable them to be regulated. Having thus established the time available for the drying cycle in the current drying plants for hides, the remaining three characteristic parameters are checked in order to optimise the process.

**[0011]** To date, no reliable apparatus or methods are known that can monitor the moisture content of the hides during the final drying cycle. Hence, the above three parameters that influence the decrease of the moisture content of the hides are adjusted based on the experience of the operators and on characteristic drying curves built up over time on the basis of experience.

**[0012]** In addition, and as already specified, optimal drying occurs when it is possible to minimise the removal of the hide's surface. However, even as regards this parameter, no reliable methods and technologies exist to make it possible to keep its evolution under control during the drying cycle.

**[0013]** Document CH 680 224 A5 discloses a method for controlling the drying process of moist hides, wherein said moist hides undergo a drying action until they reach a desired moisture content.

**[0014]** CH 680 224 A5 also discloses a drying plant for hides comprising a drying environment provided with means for creating a flow of hot air and with a plurality of support means each suitable for receiving one or more hides.

**[0015]** CH 680 224 A5 further discloses several sensors for detecting the temperature and the moisture content of said hot air and a control unit configured to adjust in real time the operating parameters of the drying environment based on the values detected by said sensors.

## SUMMARY OF THE INVENTION

**[0016]** The purpose of the present invention is to propose a method for controlling the drying process of hides in the tanning industry that makes it possible to overcome the above-mentioned limits.

**[0017]** A further purpose is to propose an apparatus for the drying of hides within the tanning industry that makes it possible to develop and realise a drying process that is highly efficient, reliable and that provides stability in terms of results.

**[0018]** Another purpose of the invention is to propose a method and associated plant, that makes it possible to optimise and standardise the hide drying process in the tanning industry.

**[0019]** Yet another purpose of the invention is to propose a method for controlling the drying process of the hides that makes it possible to vary at least one of the main parameters that influence the process during the process itself based on information relating to the moisture levels of the hides detected continuously during the process.

**[0020]** A further purpose of the present invention is to propose a drying plant for hides that makes it possible to know substantially continuously the moisture content of the hides contained therein during the drying process.

**[0021]** Another purpose of the present invention is to propose a drying plant for hides wherein at least one of the main parameters that influence the process is automatically modified during the process itself as a function of the moisture variation of the hides during the process itself.

**[0022]** Yet another purpose of the invention is to propose a drying plant for hides in which at least one of the main parameters that influence the process is automatically modified during the process itself as a function of both the variation in moisture and the surface of the hide during the process itself.

**[0023]** According to one aspect of the present invention, the aforementioned purposes are achieved by means of a method for controlling the drying process of hides, or similar products, in the tanning industry, wherein in a drying environment a plurality of support means are provided each adapted to receive one or more hides which, following previous processes for the removal of excess moisture, have a known moisture content. The method of the invention is characterised in that, by means of weight sensors associated with one or more of said hide support means, the weight of said hides is detected substantially continuously and the detected weight values are transmitted substantially continuously to a drying plant for hides control unit which, based on said weight values and on the value of the aforementioned known moisture content of the hides, substantially continuously calculates the instantaneous moisture value of said hides during the drying process and based thereon automatically controls at least one of the following working parameters: the temperature of the air in the drying environment, the relative humidity of the air in the drying environment, the drying time, and the speed of an air flow on the surface of the hide in said drying environment.

**[0024]** The method of the invention introduces a weight control on the hides during the drying process that enables continuous monitoring of the weight changes from which it derives the relative moisture variations which are then used, during the process itself, to modify variations of one or more of the working parameters, thus ensuring that the evolution of the drying process takes place in an optimal manner.

**[0025]** Further advantageous and characteristic aspects of the method of the invention are set forth in the dependent method claims.

**[0026]** According to another aspect of the invention, the above purposes are achieved by means of a drying plant for hides in the tanning industry comprising, in a drying environment, a plurality of support means each suitable for receiving one or more hides to be dried and a control unit adapted to control the working parameters of said drying plant for hides. The drying plant for hides of the invention is characterised in that it includes:

- weight sensors associated with one or more of said support means and suitable for detecting the weight of the hide associated therewith,
- wireless communication means associated with each of said weight sensors and adapted to transmit the weight values measured by said weight sensors to said control unit,

and in that said control unit is configured to calculate the instantaneous moisture value of said hides during the drying process based on the information relating to the weight values substantially continuously received from said communication means.

**[0027]** Advantageously, the control unit is also configured to adjust automatically adjust the working parameters of said drying plant for hides according to the instantaneous moisture value of said hides.

**[0028]** Further advantageous and characteristic aspects of the drying plant for hides of the invention are set forth in the dependent claims of the apparatus.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0029]** These and other aspects and advantages of the invention will become more comprehensible from the following description of an embodiment of the same, provided by way of example only, with the aid of the accompanying drawings, wherein:

- FIG. 1 provides an overall schematic view of a drying plant for hides according to the invention;
- FIG. 2 shows a detailed view of a component of the drying plant for hides of fig. 1;
- FIG. 3 represents a flowchart relating to the method

of controlling the drying process of the invention;

- FIGs. 4 and 5 show possible Cartesian diagrams of development of the drying process according to a method or a drying plant for hides of the invention.

## DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

**[0030]** With reference to FIG. 1, a drying plant for hides according to the present invention suitable for carrying out a final drying cycle of hides in the tanning industry is hereinafter referred to as 5. In the example embodiment shown, the drying plant for hides 5 is of the tunnel type in which a drying environment 10, through which the hides P being processed pass, is defined. The drying plant for hides 5 comprises means for generating an air flow 50 temperature control means 30, as well as relative air humidity control means 40 to condition it in the drying environment 10. The drying plant for hides 5 further comprises a control unit 15 adapted to intervene on the aforementioned means 30, 40 and 50 to adjust corresponding working parameters of the drying plant for hides, namely: the temperature of the air in the drying environment, the relative humidity of the air in the drying environment, and the velocity of the air flow on the surface of the hide.

**[0031]** In this example embodiment, the hides P are constrained, in an extended configuration, to frames 26 integral with support means 21, which keep them associated with an overhead chain conveyor 20, which is driven by way of special handling means 25 and crosses the drying environment 10 mentioned above, in such a way that the hides P can enter from the inlet side 11 and exit from the opposite or outlet side 12, of the drying environment 10. The control unit 15 also controls the handling means 25 thus adjusting a further working parameter of the drying plant for hides consisting of the drying time, which in this embodiment of a drying plant for hides according to the invention corresponds to the time required for crossing the drying environment 10.

**[0032]** With reference also to FIG. 2, in the embodiment represented each of the support means 21 is equipped with weight sensors 22 positioned so as to detect the weight of the group consisting of the frame 26 with the supported hide P. In other embodiments, the weight sensors may be associated with only some of the support means 21. The weight sensors are advantageously made up of load cells placed at the lower end of the support means 21 and on these is hung the frame 26 the weight of which is known, so that the weight of the hide P is obtained indirectly.

**[0033]** Communication means 24, suitable for transmitting the weight information detected to the control unit 15, which is configured and programmed to determine the working parameters of the drying plant for hides on the basis of said information, are associated with each of said sensors 22 and therefore with relative support means 21.

**[0034]** In this embodiment, the support means 21 are also equipped with surface measurement sensors 23 suitable for measuring the surface size of the hide P associated with the respective support means 21. Preferably, the aforesaid surface measurement sensors 23 consist of cameras, photocells, laser sensors or other optical instruments arranged in such a way as to detect, with a high level of reliability and precision, the size of the surface of the hide P. The measurement information detected by the surface measurement sensors 23 is also transmitted to the control unit 15 via the communication means 24 mentioned above, and the control unit is programmed to set the working parameters of the drying plant for hides also on the basis of the information relating to the surface variations of the hides P.

**[0035]** It should be noted that the information relating to the weight of each hide P present in the drying plant for hides and, where appropriate, to the relative surface size, is detected substantially continuously by the sensors 22 and 23 and is also substantially continuously transmitted (in both cases, obviously, with a certain sampling rate dictated by the technologies used) to the control unit 15 which is then programmed to vary the working parameters of the drying plant for hides 5 in real time during the drying process based on the aforementioned information concerning the weight and/or surface size of the hide P.

**[0036]** As will be immediately apparent, the drying plant for hides 5 described above represents only one example of the application of the drying process control technology according to the present invention which can be implemented in many drying plants for hides of the types known. For example, in a stick drying plant the support means 21 comprise the sticks themselves and the respective means of connection to the chain conveyor 20, and suitable weight sensors 22 with corresponding communication means 24 capable of detecting the weight of the hung hides and of substantially continuously transmitting the detected value to the control unit 15, can then be inserted in these. According to another embodiment, a drying plant for hides according to the present invention can also be of the static type in which the hides remain within the drying environment 10 in a substantially fixed position for the duration of the drying process. In this case, the chain conveyor 20 with the handling means 25 will not be present. However, the control unit 15 can be configured to set the working parameter for the duration of the drying cycle based on the weight of the hides P detected by suitable weight sensors 22, for example by shutting down the drying plant for hides or activating a signal that goes off once the desired drying level has been reached. Obviously, in a drying plant for hides according to the present invention not all the previously mentioned working parameters may be controllable, only some of them, or other working parameters not among those mentioned may be controllable by the control unit 15 based on the weight and/or surface measurement of the hides P detected.

**[0037]** A drying plant for hides according to the invention as described above enables the implementation of a method for controlling the drying process of hides in the tanning industry according to the invention.

**[0038]** With reference to the flowchart of FIG. 3, and to the Cartesian diagrams of FIGs. 4 and 5, a method for controlling the hide drying process in the tanning industry comprises a drying environment 10 in which a plurality of support means 21 are provided, each suitable for receiving one or more hides P having a known moisture content. The moisture content of the hide P at the beginning of the drying process can be known in various ways: it can be measured by a hygrometer or other suitable instrument, it can be predetermined by the previous operations of removal of excess moisture such as the aforementioned sammying or vacuum phases, or it can be calculated by knowing the weight of the hide at the beginning of the drying phase and the dry shaved weight of the hide itself. The drying process commences with working parameters set according to a desired moisture reduction trend.

**[0039]** In FIGs. 4 and 5 Cartesian diagrams in which the process time is shown on the abscissae, the moisture content of the leather on the ordinates and the desired moisture reduction trend with a solid line. FIG. 4 shows the diagram of a cycle for which a linearly decreasing trend of the desired moisture reduction is programmed over a total duration of the drying cycle of six hours, while FIG. 5 shows a drying cycle lasting a total of fifteen hours in which a desired moisture reduction rate is programmed that initially has a low reduction rate in the moisture content of the hides, and in the middle phase of the process has a higher reduction rate which gradually decreases once again towards the end of the process. The desired trends, and the setting of the appropriate working parameters to achieve them, are defined on the basis of experience in order to obtain, depending on the type of hide and its intended use purpose, an optimum drying process, such as to ensure the best surface yield of the hide. The work programme, meaning the setting and temporal evolution of the working parameters in the drying environment 10, is then set on the basis of experience as the most suitable for achieving the desired moisture reduction trend.

**[0040]** According to the method of the invention, by means of weight sensors 22 associated with one or more of said support means 21 of the hides P, the weight of said hides P is detected substantially continuously and the measured weight values are transmitted substantially continuously to a control unit 15 which, depending thereon and on the basis of the initial moisture value of the hides, calculates substantially continuously the instantaneous moisture value of said hides P during the drying process. The calculated instantaneous moisture value is compared with the moisture value that the hide ought to have according to the desired moisture reduction trend and, in the presence of deviations exceeding a certain maximum permissible deviation, automatically controls at least one of the following parameters: the temperature of the air in the drying environment, the relative humidity of the air in the drying environment, the drying time, the speed of an air flow over the surface of the hide in said drying environment 10, so that the actual moisture reduction trend (indicated with a dotted line in FIGs. 4 and 5) follows the desired one as closely as possible.

**[0041]** According to the invention, therefore, the work programme can still be initially set on the basis of experience, but is automatically corrected during the process based on actual data regarding the instantaneous moisture content of the hides. Furthermore, application of the method of the invention makes it possible to improve greatly the implementation of the initial work programmes which can be based on real data obtained in previous drying processes according to the invention, suitably stored and post-processed.

**[0042]** According to a preferred embodiment, the duration of the process is set as a fixed working parameter, and from time to time the control unit 15 receives the information relating to the weight of the hide during the process so as to calculate the moisture content of the hide itself and accordingly to adjust from time to time the temperature and relative humidity of the air as well as the air speed over the surface of the hide to optimise the actual moisture reduction trend.

**[0043]** In an advantageous embodiment of a method according to the present invention, by means of surface measurement sensors 23, the surface size of said hides P is detected substantially continuously and the detected size values are transmitted substantially continuously to the control unit which also automatically controls at least one of the following parameters: the temperature of the air in the drying environment, the humidity of the air in the drying environment, the length of time spent by the hides in the drying environment and the rate at which an air flow is introduced into said drying environment. In the drying process, the hide's surface must as a rule be reduced to a minimum in order to obtain the optimum hide yield. The information regarding the instantaneous size of the hide's surface during the drying process makes it possible build up an analysis of the trend in the reduction of the hide's surface during the drying process that can be useful for studying optimised work programmes.

**[0044]** Where air flow generating means 50 are present in the drying environment, according to the method of the invention the control unit 15 automatically adjusts the means for generating said air flow 50.

**[0045]** Where the drying environment contains handling means 25 of said support means 21 suitable for transporting said support means from an inlet 11 of said drying environment 10 to an outlet 12 from said drying environment 10 via a predetermined path, according to the method of the invention the control unit 15 automatically regulates the speed at which said handling means 25 transport the support means 21.

**[0046]** According to an advantageous embodiment, the method of the invention provides for the automatic

determination of the completion of the drying process of the hides P upon reaching a certain weight value detected by the weight sensors 22 associated with the support means 21, said value being calculated as a function of a desired residual moisture content of said hides P at the end of the drying process, which can be set in advance.

**[0047]** In a system or method according to the invention, the control unit 15 is configured to adjust the working parameters automatically based on predefined algorithms or on decision-making systems based on neural networks. In fact, according to the invention the calculation unit 15 could even control a single working parameter, for example the air temperature, based on information relating to the trend of the instantaneous moisture of a single hide P during the drying process; or it could regulate each of the working parameters listed above, or others on the basis of numerous factors and according to complex decision-making models. By way of example, instantaneous values of both moisture content and surface size of each of the hides present in the drying environment can be used in the drying environment 10 as well as numerous other factors relevant to the quality of the drying process and the operating costs of the drying plant for hides.

**[0048]** A system and a method according to the invention make it possible to optimise the drying process by adjusting the working parameters of the system based on the actual residual moisture data of the hide measured in real time during the process itself. The drying plant for hides of the invention is inexpensive since it provides for the addition of several sensors and communication means to existing drying plants for hides and enables optimisation of the process both from the point of view of the quality of the hides obtained and of the overall efficiency of the drying plant for hides.

## Claims

1. Method for controlling the drying process of hides, or similar products, in the tanning industry, wherein in a drying environment (10) a plurality of support means (21) each suitable for receiving one or more hides (P), having a known moisture content, are provided, said method being **characterized in that,** through weight sensors (22) associated with one or more of said support means (21), the weight of said hides (P) is substantially continuously detected, the detected weight values being substantially continuously transmitted to a control unit (15) which, depending thereon and on the value of said known moisture content of said hides (P), substantially continuously calculates the instantaneous moisture value of said hides (P) during the drying process and based thereon automatically controls at least one of the following working parameters: the temperature of the air in the drying environment, the relative humidity of the air in the drying environment, the drying time, the speed of an air flow over the surface of said hides (P) in said drying environment.

2. Method for controlling the drying process of hides, or similar products, according to claim 1 **characterised in that** through sensors for measuring the surface (23), the size of the surface of said hides (P) is substantially continuously detected, the size values detected being substantially continuously transmitted to said control unit (15) which also depending thereon automatically controls at least one of the following parameters: the temperature of the air in said drying environment (10), the humidity of the air in said drying environment (10), the residence time of said hides (P) in said drying environment (10), the speed of introduction of an air flow into said drying environment (10).

3. Method according to claim 1 or 2, wherein said drying environment comprises temperature control means (30) and air humidity control means (40) in said drying environment (10), said method being **characterised in that** said control unit (15) automatically regulates said temperature control means (30) and said air humidity control means (40).

4. Method for controlling the drying process of hides or similar products according to claim 1, **characterised in that** it provides for the automatic determination of the completion of said drying process of said hides (P) upon reaching a certain weight value detected by said weight sensors (22) associated with said support means (21), said value being calculated as a function of a desired residual moisture content of said hides (P), settable beforehand, at the end of the drying process.

5. Method for controlling the drying process of hides according to claim 1, wherein in said drying environment (10) means for generating an air flow (50) towards said hides (P) are envisaged, said method being **characterized in that** said control unit (15) automatically regulates said means for generating an air flow (50).

6. Method for controlling the drying process of hides according to claim 1, wherein said drying environment (10) comprises handling means (25) of said support means (21) suitable for transporting said support means from an inlet (11) of said drying environment (10) to an outlet (12) of said drying environment (10) via a predetermined path, said method being **characterized in that** said control unit (15) automatically regulates the speed of transport of said support means (21) by said handling means (25).

7. A drying plant for hides in the tanning industry com-

prising: a drying environment (10) in which a plurality of support means (21) are provided each suitable for receiving one or more hides (P) to be dried; and a control unit (15) for controlling the working parameters of said drying plant, said plant being **characterised in that** it comprises:

- weight sensors (22) associated with one or more of said support means (21) and suitable for detecting the weight of said hides (P) associated therewith,
- communication means (24) of wireless type associated with each of said weight sensors (22) and suitable for transmitting the weight values measured by said weight sensors (22) to said control unit (15),

wherein said control unit (15) is configured to automatically adjust operating parameters of said drying system based on weight value information received substantially continuously from said communication means (24).

**8.** A drying plant for hides according to claim 7 or 8, **characterised in that** said weight sensors (22) associated with said support means (21) comprise load cells.

**9.** A drying plant for hides according to claim 7 or following, **characterised in that** it comprises sensors for measuring the surface (23) of said hides (P), said communication means (24) being suitable for transmitting the surface values measured by said sensors for measuring the surface (23) to said control unit (15), said at least one control unit (15) being configured to automatically regulate the operating parameters of said drying plant as a function also of the measurement of the surface area of said hides (P) detected substantially continuously during said drying process by said sensors for measuring the surface (23).

**10.** A drying plant for hides according to the preceding claim **characterised in that** said sensors for measuring the surface (23) are associated with said support means (21) and comprise optical type detection systems.

**11.** A drying plant for hides according to claim 7 or following, **characterised in that** said working parameters comprise at least one among:

- the temperature of the air in said drying environment (10), conditioned by means of temperature control means (30);
- the relative humidity of the air in said drying environment (10), conditioned by means of air humidity control means (40);
- the speed of the air over the surface of said hide (P), regulated by said means for generating an air flow (50);
- the drying time, regulated by handling means (25) of said support means (21) suitable for transporting said support means (21) from an inlet (11) of said drying environment (10) to an outlet (12) of said drying environment (10) through a predetermined path.

**Patentansprüche**

**1.** Verfahren zur Steuerung des Trocknungsprozesses von Häuten oder ähnlichen Produkten in der Gerbereiindustrie, wobei in einer Trocknungsumgebung (10) eine Vielzahl von Trägermitteln (21) vorgesehen sind, die jeweils zur Aufnahme einer oder mehrerer Häute (P) mit einem bekannten Feuchtigkeitsgehalt geeignet sind, wobei das Verfahren **dadurch gekennzeichnet ist, dass** durch Gewichtssensoren (22), die mit einem oder mehreren der Trägermittel (21) verbunden sind, das Gewicht der Häute (P) im Wesentlichen kontinuierlich erfasst wird, die erfassten Gewichtswerte im Wesentlichen kontinuierlich an eine Steuereinheit (15) übertragen werden, die in Abhängigkeit davon und von dem Wert des bekannten Feuchtigkeitsgehalts der Häute (P) im Wesentlichen kontinuierlich den momentanen Feuchtigkeitswert der Häute (P) während des Trocknungsprozesses berechnet und auf dieser Grundlage automatisch mindestens einen der folgenden Arbeitsparameter steuert: die Temperatur der Luft in der Trocknungsumgebung, die relative Feuchtigkeit der Luft in der Trocknungsumgebung, die Trocknungszeit, die Geschwindigkeit eines Luftstroms über die Oberfläche der Häute (P) in der Trocknungsumgebung.

**2.** Verfahren zur Steuerung des Trocknungsprozesses von Häuten oder ähnlichen Produkten, gemäß Anspruch 1 **dadurch gekennzeichnet, dass** durch Sensoren zur Messung der Oberfläche (23) die Größe der Oberfläche der Häute (P) im Wesentlichen kontinuierlich erfasst wird, wobei die erfassten Größenwerte im Wesentlichen kontinuierlich an die Steuereinheit (15) übertragen werden, die auch in Abhängigkeit davon automatisch mindestens einen der folgenden Parameter steuert: die Temperatur der Luft in der Trocknungsumgebung (10), die Feuchtigkeit der Luft in der Trocknungsumgebung (10), die Verweilzeit der Häute (P) in der Trocknungsumgebung (10), die Geschwindigkeit der Einführung eines Luftstroms in die Trocknungsumgebung (10).

**3.** Verfahren nach Anspruch 1 oder 2, wobei die Trocknungsumgebung eine Temperatursteuereinrichtung (30) und eine Luftfeuchtigkeitssteuereinrichtung

(40) in der Trocknungsumgebung (10) umfasst, wobei das Verfahren **dadurch gekennzeichnet ist, dass** die Steuereinheit (15) die Temperatursteuereinrichtung (30) und die Luftfeuchtigkeitsregelungsmittel (40) automatisch reguliert.

**4.** Verfahren zur Steuerung des Trocknungsprozesses von Häuten oder ähnlichen Produkten nach Anspruch 1, **dadurch gekennzeichnet, dass** es die automatische Bestimmung des Abschlusses des Trocknungsprozesses der Häute (P) bei Erreichen eines bestimmten Gewichtswertes vorsieht, der von den Gewichtssensoren (22) erfasst wird, die mit den Trägermitteln (21) verbunden sind, wobei dieser Wert in Abhängigkeit von einem gewünschten Restfeuchtigkeitsgehalt der Häute (P) berechnet wird, der vorher eingestellt werden kann, und zwar am Ende des Trocknungsprozesses.

**5.** Verfahren zur Steuerung des Trocknungsprozesses von Häuten nach Anspruch 1, wobei in der Trocknungsumgebung (10) Mittel zur Erzeugung eines Luftstroms (50) in Richtung der Häute (P) vorgesehen sind, wobei das Verfahren **dadurch gekennzeichnet ist, dass** die Steuereinheit (15) die Mittel zur Erzeugung eines Luftstroms (50) automatisch regelt.

**6.** Verfahren zur Steuerung des Trocknungsprozesses von Häuten nach Anspruch 1, wobei die Trocknungsumgebung (10) Handhabungsmittel (25) der Trägermitteln (21) umfasst, die geeignet sind, die Trägermittel von einem Einlass (11) der Trocknungsumgebung (10) zu einem Auslass (12) der Trocknungsumgebung (10) über einen vorbestimmten Weg zu transportieren, wobei das Verfahren ist **dadurch gekennzeichnet, dass** die Steuereinheit (15) automatisch die Geschwindigkeit des Transports der Trägermittel (21) durch die Handhabungsmittel (25) regelt.

**7.** Trocknungsanlage für Häute in der Gerbereiindustrie, umfassend eine Trocknungsumgebung (10), die eine Vielzahl von Trägermitteln (21) bereitstellt, von denen jedes geeignet ist, eine oder mehrere zu trocknende Häute (P) aufzunehmen, und eine Steuereinheit (15) zum Steuern der Arbeitsparameter der Trocknungsanlage, wobei die Anlage **dadurch gekennzeichnet ist, dass** sie umfasst:

- Gewichtssensoren (22), die mit einem oder mehreren der Trägermittel (21) verbunden und geeignet sind, das Gewicht der damit verbundenen Häute (P) zu erfassen,
- Kommunikationsmittel (24) vom drahtlosen Typ, die mit jedem der Gewichtssensoren (22) verbunden und geeignet sind, die von den Gewichtssensoren (22) gemessenen Gewichtswerte an die Steuereinheit (15) zu übermitteln,

wobei die Steuereinheit (15) so konfiguriert ist, dass sie die Betriebsparameter des Trocknungssystems auf der Grundlage der im Wesentlichen kontinuierlich von den Kommunikationsmitteln (24) empfangenen Gewichtswertinformationen automatisch einstellt.

**8.** Trocknungsanlage für Häute nach Anspruch 7 oder 8, **dadurch gekennzeichnet, dass** die Gewichtssensoren (22), die mit den Trägermitteln (21) verbunden sind, Wägezellen umfassen.

**9.** Trocknungsanlage für Häute nach Anspruch 7 oder folgenden, **dadurch gekennzeichnet, dass** die Anlage Sensoren zur Messung der Oberfläche (23) der Häute (P) umfasst, wobei die Kommunikationsmittel (24) geeignet sind, die von den Sensoren zur Messung der Oberfläche (23) gemessenen Oberflächenwerte an die Steuereinheit (15) zu übermitteln, wobei die mindestens eine Steuereinheit (15) so konfiguriert ist, dass sie die Betriebsparameter der Trocknungsanlage auch in Abhängigkeit von der Messung der Oberfläche der Häute (P), die im Wesentlichen kontinuierlich während des Trocknungsprozesses von den Sensoren zur Messung der Oberfläche (23) erfasst wird, automatisch regelt.

**10.** Trocknungsanlage für Häute nach dem vorhergehenden Anspruch, **dadurch gekennzeichnet, dass** die Sensoren zur Messung der Oberfläche (23) mit den Trägermitteln (21) verbunden sind und optische Erfassungssysteme umfassen.

**11.** Trocknungsanlage für Häute nach Anspruch 7 oder folgenden, **dadurch gekennzeichnet, dass** die Arbeitsparameter mindestens eines der folgenden umfassen:

- die Temperatur der Luft in der Trocknungsumgebung (10), die mittels einer Temperatursteuerungseinrichtung (30) konditioniert wird;
- der relativen Luftfeuchtigkeit in der Trocknungsumgebung (10), die mit Hilfe von Luftfeuchtigkeitsregelungsmitteln (40) eingestellt wird;
- die Geschwindigkeit der Luft über der Oberfläche der Haut (P), die durch die Mittel zur Erzeugung eines Luftstroms (50) geregelt wird;
- die Trocknungszeit, die durch Handhabungsmittel (25) der Trägermittel (21) geregelt wird, die geeignet sind, die Trägermittel (21) von einem Einlass (11) der Trocknungsumgebung (10) zu einem Auslass (12) der Trocknungsumgebung (10) über einen vorbestimmten Weg zu transportieren.

## Revendications

1. Méthode de contrôle du processus de séchage des peaux ou de produits similaires dans l'industrie du tannage, dans laquelle un environnement de séchage (10) comporte plusieurs supports (21) aptes à recevoir chacun une ou plusieurs peaux (P) ayant un taux d'humidité connu, cette méthode étant **caractérisée en ce que** grâce à des capteurs de poids (22) associés à un ou plusieurs desdits moyens de support (21), le poids desdites peaux (P) est détecté de manière pratiquement continue, les valeurs de poids détectées étant transmises de manière pratiquement continue à une unité de commande (15) qui, en fonction de celle-ci et de la valeur de la teneur de l'humidité connue des peaux (P), calcule de manière pratiquement continue la valeur instantanée de l'humidité des peaux (P) au cours du processus de séchage et, sur cette base, contrôle automatiquement au moins l'un des paramètres de travail suivants: la température de l'air dans l'environnement de séchage, l'humidité relative de l'air dans l'environnement de séchage, le temps de séchage, la vitesse d'un flux d'air sur la surface desdites peaux (P) dans ledit environnement de séchage.

2. Méthode de contrôle du processus de séchage des peaux ou de produits similaires, selon la revendication 1 **caractérisée en ce que** par l'intermédiaire de capteurs de mesure de la surface (23), la taille de la surface desdites peaux (P) est détectée de manière sensiblement continue, les valeurs de taille détectées étant transmises de manière sensiblement continue à ladite unité de commande (15) qui, en fonction de celle-ci, contrôle également automatiquement au moins l'un des paramètres suivants: la température de l'air dans ledit environnement de séchage (10), l'humidité de l'air dans ledit environnement de séchage (10), le temps de séjour desdites peaux (P) dans ledit environnement de séchage (10), la vitesse d'introduction d'un flux d'air dans ledit environnement de séchage (10).

3. Méthode selon la revendication 1 ou 2, dans laquelle ledit environnement de séchage comprend des moyens de contrôle de la température (30) et des moyens de contrôle de l'humidité de l'air (40) dans ledit environnement de séchage (10), ladite méthode étant **caractérisé en ce que** ladite unité de contrôle (15) régule automatiquement lesdits moyens de contrôle de la température (30) et lesdits moyens de contrôle de l'humidité de l'air (40).

4. Méthode de contrôle du processus de séchage des peaux ou de produits similaires, selon la revendication 1, **caractérisée en ce que** elle prévoit la détermination automatique de l'achèvement dudit processus de séchage desdites peaux (P) à l'atteinte d'une certaine valeur de poids détectée par lesdits capteurs de poids (22) associés auxdits moyens de support (21), cette valeur étant calculée en fonction d'un taux d'humidité résiduelle souhaité des peaux (P), réglable au préalable, à la fin du processus de séchage.

5. Méthode de contrôle du processus de séchage des peaux, selon la revendication 1, dans ledit environnement de séchage (10) sont prévus des moyens pour générer un flux d'air (50) vers lesdites peaux (P), ladite méthode étant **caractérisée en ce que** ladite unité de commande (15) régule automatiquement lesdits moyens pour générer un flux d'air (50).

6. Méthode de contrôle du processus de séchage des peaux, selon la revendication 1, dans lequel ledit environnement de séchage (10) comprend des moyens de manutention (25) dudit moyen de support (21) aptes à transporter ledit moyen de support d'une entrée (11) dudit environnement de séchage (10) à une sortie (12) dudit environnement de séchage (10) par un chemin prédéterminé, ladite méthode étant **caractérisée en ce que** ladite unité de commande (15) régule automatiquement la vitesse de transport dudit moyen de support (21) par ledit moyen de manutention (25).

7. Installation de séchage des peaux dans l'industrie du tannage comprenant un environnement de séchage (10) doté d'une pluralité de moyens de support (21) aptes à recevoir chacun une ou plusieurs peaux (P) à sécher et une unité de commande (15) pour contrôler les paramètres de fonctionnement de ladite installation de séchage, ladite installation étant **caractérisée en ce qu'**elle comprend:

   - des capteurs de poids (22) associés à un ou plusieurs desdits moyens de support (21) et aptes à détecter le poids des peaux (P) qui leur sont associées,
   - des moyens de communication (24) de type sans fil associés à chacun desdits capteurs de poids (22) et aptes à transmettre les valeurs de poids mesurées par lesdits capteurs de poids (22) à ladite unité de commande (15),

   dans lequelle ladite unité de contrôle (15) est configurée pour ajuster automatiquement les paramètres de fonctionnement dudit système de séchage sur la base des informations relatives aux valeurs de poids reçues de manière pratiquement continue par lesdits moyens de communication (24).

8. Installation de séchage des peaux selon la revendication 7 ou 8, **caractérisée en ce que** lesdits capteurs de poids (22) associés auxdits moyens de support (21) comprennent des cellules de charge.

**9.** Installation de séchage des peaux selon la revendication 7 ou **caractérisée en ce que** elle comprend des capteurs de mesure de la surface (23) desdites peaux (P), lesdits moyens de communication (24) étant aptes à transmettre les valeurs de surface mesurées par lesdits capteurs de mesure de la surface (23) à ladite unité de commande (15), ladite au moins une unité de commande (15) étant configurée pour régler automatiquement les paramètres de fonctionnement de ladite installation de séchage en fonction également de la mesure de la surface desdites peaux (P) détectée de manière sensiblement continue au cours dudit processus de séchage par lesdits capteurs de mesure de la surface (23).

**10.** Installation de séchage de peaux selon la revendication précédente **caractérisée en ce que** lesdits capteurs de mesure de la surface (23) sont associés auxdits moyens de support (21) et comprennent des systèmes de détection de type optique.

**11.** Installation de séchage des peaux selon la revendication 7 ou suivantes, **caractérisée en ce que** lesdits paramètres de travail comprennent au moins l'un parmi:

- la température de l'air dans ledit environnement de séchage (10), conditionnée par des moyens de contrôle de la température (30);
- l'humidité relative de l'air dans ledit environnement de séchage (10), conditionnée par des moyens de contrôle de l'humidité de l'air (40);
- la vitesse de l'air sur la surface de ladite peau (P), régulée par lesdits moyens de génération d'un flux d'air (50);
- le temps de séchage, régulé par des moyens de manutention (25) dudit moyen de support (21) aptes à transporter ledit moyen de support (21) d'une entrée (11) dudit environnement de séchage (10) à une sortie (12) dudit environnement de séchage (10) à travers un parcours prédéterminé.

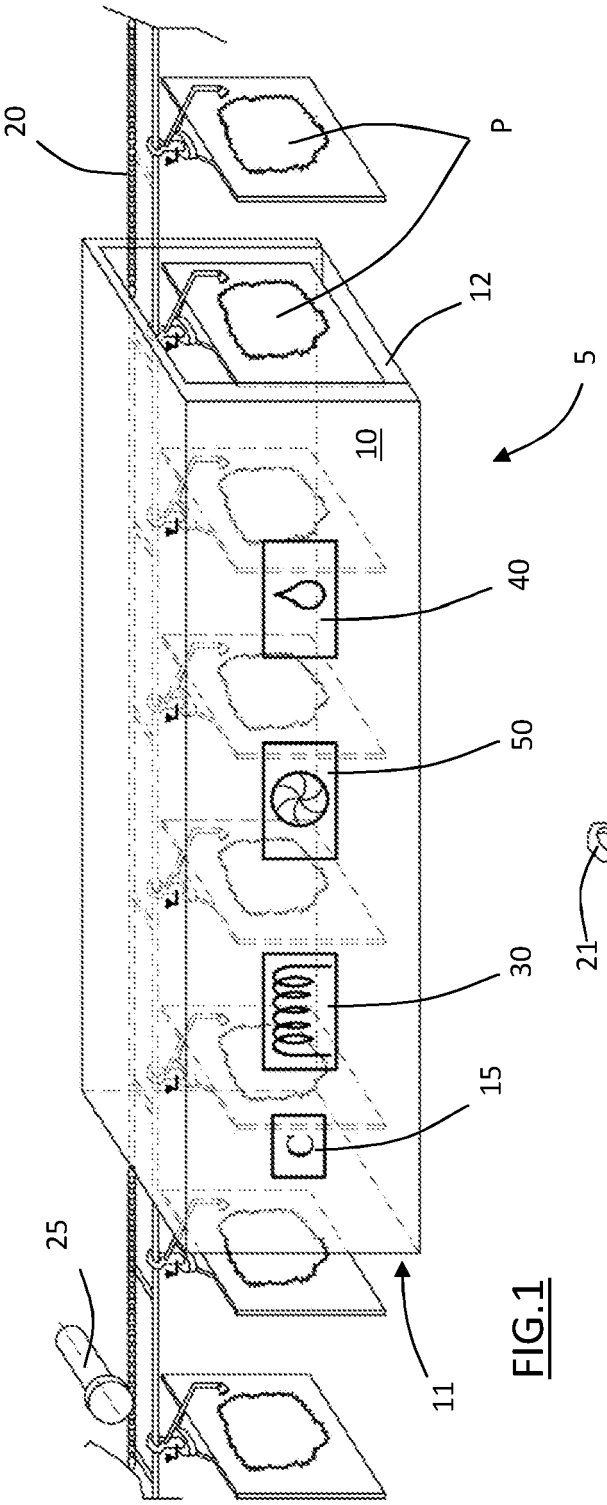


FIG.1

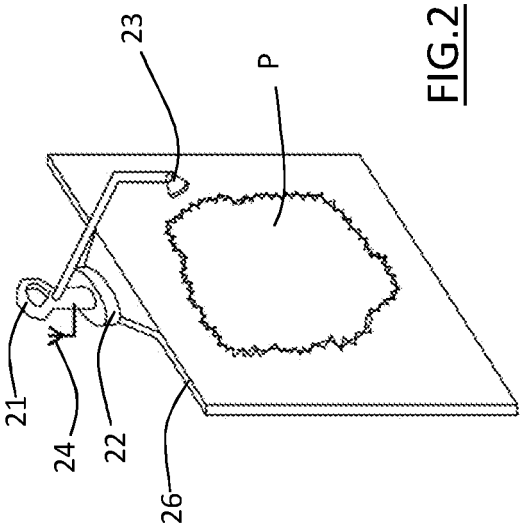


FIG.2

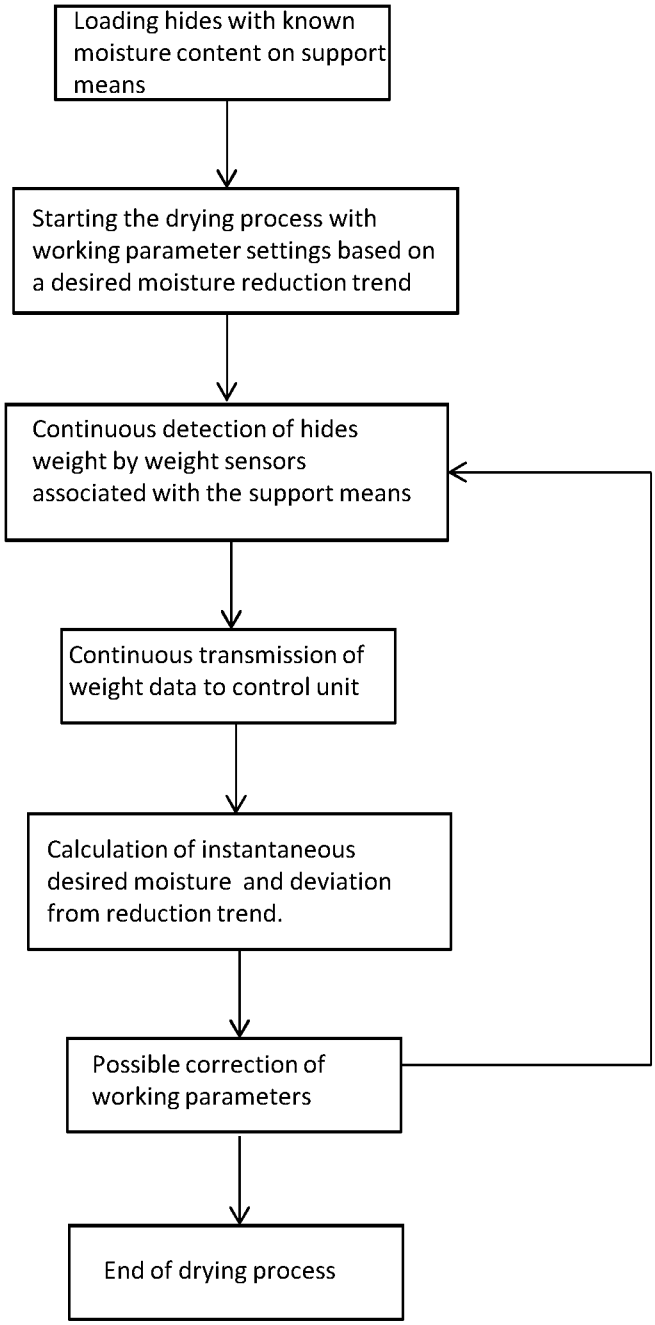
Loading hides with known moisture content on support means
Starting the drying process with working parameter settings based on a desired moisture reduction trend
Continuous detection of hides weight by weight sensors associated with the support means
Continuous transmission of weight data to control unit
Calculation of instantaneous desired moisture and deviation from reduction trend.
Possible correction of working parameters
End of drying process

FIG. 3

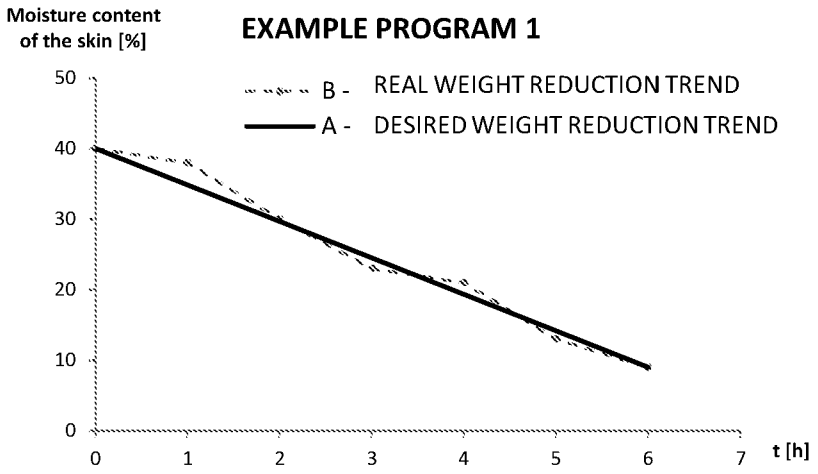
Moisture content of the skin [%]
EXAMPLE PROGRAM 1
B - REAL WEIGHT REDUCTION TREND
A - DESIRED WEIGHT REDUCTION TREND
50
40
30
20
10
0
0 1 2 3 4 5 6 7
t [h]

FIG. 4

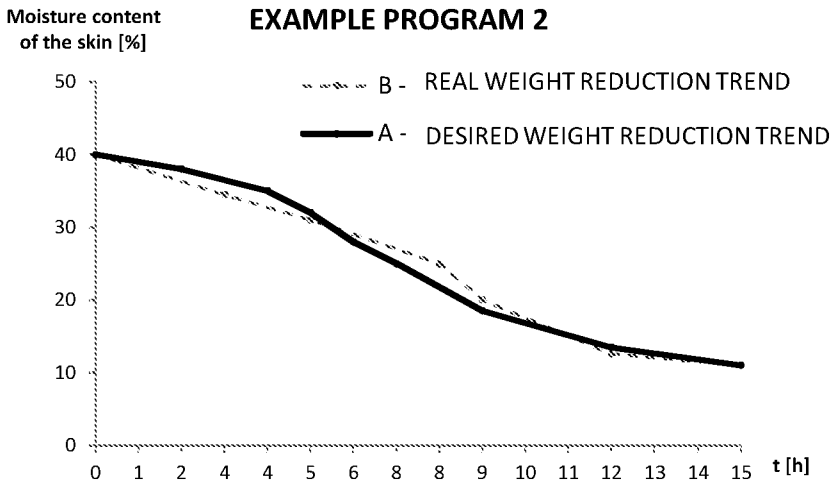
Moisture content of the skin [%]
EXAMPLE PROGRAM 2
B - REAL WEIGHT REDUCTION TREND
A - DESIRED WEIGHT REDUCTION TREND
50
40
30
20
10
0
0 1 2 4 4 5 6 8 8 9 10 11 12 13 14 15
t [h]

FIG. 5

## REFERENCES CITED IN THE DESCRIPTION

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### Patent documents cited in the description


- CH 680224 A5 **[0013] [0014] [0015]**