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(54) **PLANT MOLDING PROCESS AND EQUIPMENT**

(57) The present invention relates to a plant molding process and device which the process includes: forming a pulp enveloping layer of molding products by dewatering paper serous fluid; forming a plant pulp layer of molding products by dewatering plant serous fluid; laminating the pulp enveloping layer and the plant pulp layer and processing non-fibrous material of the plant pulp layer to make it migrate toward the pulp envelope layer thereby combining them together. The plant molding device in-

cludes a vessel for containing slurry, a mold unit connected to the vessel by a transmission line and realized product transmission by a guiding device. This process can use different components of plants to help shape and improve strength, and to achieve 99% plant material utilization rate, energy conservation and environmental protection. The device is of intelligent operation, low manual intervention, low cost, high production efficiency and product yield.

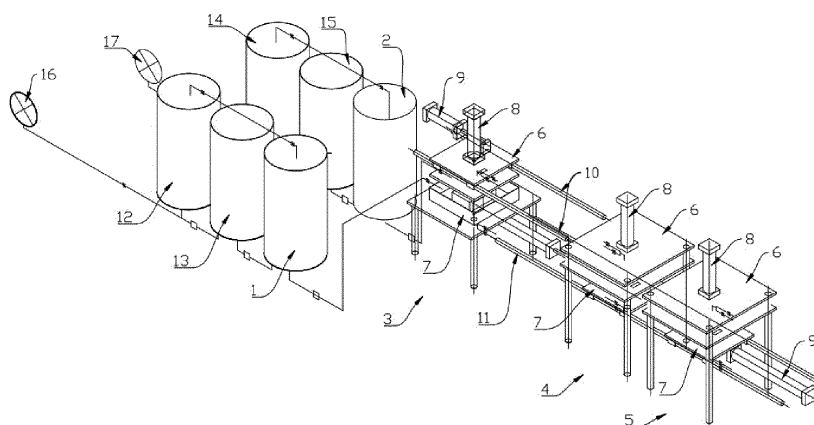


FIG. 1

Description

BACKGROUND

1. Technical Field

[0001] The present disclosure generally relates to a plant molding process and device for a plant molding product.

2. Description of Related Art

[0002] The conventional paper-making and paper pulp molding technology is using cellulose and hemi-cellulose diluted slurry as raw materials, but not directly using plant raw material for molding. It is necessary to chemically treat the raw material in order to obtain high purity fiber during the process, thereby the raw material utilization rate is low. In addition, it is also necessary to add chemical additives to serous fluid in order to form a paper molding product with a certain strength, configuration and function. In order to obtain the serous fluid with only cellulose and hemi-cellulose, it is necessary to add acid or alkali to plant mixture serous fluid of crushed plants to remove other substances in the plant raw material. For some packaging paper products, the cost of the aforementioned production process is too high, the waste of resources is serious, and the environmental pollution by the manufacturing process is large. Therefore, it is needed to improve the conventional technology of pulp molding products.

SUMMARY

[0003] The technical problems to be solved: in view of the shortcomings of the related art, the present disclosure relates to a plant molding process and device using same which can achieve high utilization of raw materials, waste reduction, energy saving and environmental protection.

[0004] The technical solution adopted for solving the technical problems of the present disclosure is: a molding process for a plant molding product includes the following contents:

forming a pulp enveloping layer of a molding product by dewatering paper serous fluid; forming a plant pulp layer of the molding product by dewatering plant serous fluid; laminating the pulp enveloping layer and the plant pulp layer and processing non-fibrous material of the plant pulp layer to make it migrate toward the pulp envelope layer for combining them together.

[0005] Wherein the process further includes the following steps: obtaining a high consistency paper pulp via adding water crushing pulp raw material; obtaining the paper serous fluid via the high consistency paper pulp diluted with water; obtaining a high consistency plant slurry via adding water crushing and wall-breaking plant raw material and obtaining the plant serous fluid via the high consistency plant slurry diluted with water.

[0006] Wherein the process further includes the following step of making non-fibrous material of the plant pulp layer take phase transition and then migrate toward the pulp envelope layer by changing the temperature and the pressure of the molding product.

[0007] Wherein a range of the temperature is between 30 degree below zero and 280 degree, and a range of the pressure is between 1 MPa and 11 MPa.

[0008] Wherein concentration of the paper serous fluid is between 0.5% and 1.5%, and concentration of the plant serous fluid is between 0.8% and 1.5%.

[0009] Wherein the plant raw material includes herbs, crop stalks and roots, stems, leaves, and shells of shrubs, and the pulp raw material includes pulp boards and recycled papers.

[0010] In another aspect, a plant molding device according to an exemplary embodiment of the present disclosure includes a first storage tank configured for containing paper serous fluid; a second storage tank configured for containing plant serous fluid; a slurry pool including an outlet formed thereof and an inlet portion connected to the first and second storage tanks; a mold unit connected to the outlet. According to the process sequence, the mold unit sequentially includes a water mold, a forming mold and a drying mold with a heating device thereof. The water mold, the forming mold and the drying mold each include a first mold core and a second mold core matched with the first mold core. Each first mold core is mounted with an elevating driver for driving the first mold core to be opened and closed with the corresponding second mold core, and each of the first mold core and the second mold core is respectively connected with a vacuum gas circuit for adsorbing a plant molding product. A strainer is formed at a junction between each of the first mold core and the second mold core and its corresponding vacuum gas circuit for water permeation. A guiding device is positioned between every two adjacent the water mold, the forming mold and the drying mold; and wherein the first mold core or the second mold core of each mold of the water mold, the forming mold and the drying mold can move along the guiding device so that at least one set of the first and second mold cores respectively belonging to every two adjacent the water mold, the forming mold and the drying mold can achieve mold opening and mold closing.

[0011] Wherein the guiding device includes an upper guide rail extending along a direction towards the forming mold from the water mold and a lower guide rail, the first mold core of the water mold movably installed in the upper guide rail, the second mold core of both the forming mold and the drying mold movably installed in the lower guide rail. One end of the lower guide rail is corresponding to the upper guide rail and the other end of the lower guide rail is extended out through the forming mold and the drying mold.

[0012] Wherein each bottom surface of the first and second mold cores is connected with a compression gas circuit for releasing pressure of the plant molding product,

the first mold core of the water mold and each second mold core of the forming mold and the drying mold can be driven to respectively move along the guiding device by a corresponding horizontal cylinder.

[0013] Wherein the first storage tank is connected with a first water cleaning tank and a high consistency paper pulp tank; the second storage tank is connected with a second water cleaning tank and a high consistency plant pulp tank. The high consistency paper pulp tank is connected to a first hydraulic pulper and the high consistency plant pulp tank is connected to a second hydraulic pulping and kneading device. A corresponding pump valve member is provided between the first and second storage tanks and the slurry pool, between the first water cleaning tank, the high consistency paper pulp tank and the first storage tank, and between the second water cleaning tank, the high consistency plant pulp tank and the second storage tank.

[0014] The present disclosure provides the advantages as below.

[0015] The present disclosure can use different components of the plant to help shape and improve strength, and to achieve high utilization of raw materials, waste reduction, energy saving and environmental protection.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016]

FIG. 1 is a schematic view of the plant molding device in accordance with an exemplary embodiment.

FIG. 2 is a front schematic view of the plant molding device of FIG. 1.

[0017] In the figures, the element labels according to the embodiment of the present disclosure shown as below:

first storage tank 1, second storage tank 2, water mold 3, forming mold 4, drying mold 5, first mold core 6, second mold core 7, elevating driver 8, horizontal cylinder 9, upper guide rail 10, lower guide rail 11, high consistency paper pulp tank 12, first water cleaning tank 13, high consistency plant pulp tank 14, second water cleaning tank 15, first hydraulic pulper 16, second hydraulic pulping and kneading device 17, slurry pool 18, vacuum gas circuit 19, compression gas circuit 20, pump valve member 21.

DETAILED DESCRIPTION

[0018] The disclosure is illustrated by way of example and not by way of limitation in the figures of the accompanying drawings, in which like reference numerals indicate similar elements.

[0019] A plant molding process for a plant molding product includes the following contents: obtaining a high consistency paper pulp via adding water crushing pulp raw material (usually pulp boards or recycled papers)

and obtaining paper serous fluid via the high consistency paper pulp diluted with water; obtaining a high consistency plant slurry via adding water crushing and then wall-breaking (kneaders can be used) plant raw material and obtaining plant serous fluid via the high consistency plant slurry diluted with water. Concentration of the paper serous fluid is preferably between 0.5% and 1.5%, and concentration of the plant serous fluid is preferably between 0.8% and 1.5%. The purpose of diluting the high consistency slurry is to facilitate the delivery of the serous fluid in a pipeline to avoid clogging. At the same time, the diluted serous fluid has a certain flow rate after casting into a mold, which can be evenly filled with a mold core. The plant molding process further includes the following contents: forming a pulp enveloping layer of a molding product by dewatering the paper serous fluid; forming a plant pulp layer of the molding product by dewatering the plant serous fluid; laminating the pulp enveloping layer and the plant pulp layer and processing non-fibrous material of the plant pulp layer to make it migrate towards the pulp envelope layer for combining them together.

[0020] The plant raw material includes: surplus materials after harvesting of agricultural crops such as rice straws, wheat stalks, cotton stalks and corn stalks, forestry side materials such as shrubs and wild grasses and surplus materials after wood processing, such as saw-milling edge materials. The above raw materials are physically shredded and the shredding shape is not specifically required. But at least one dimension should be smaller than the thickness of the final product to meet the usage conditions. That is to say, the more a wall along the shredding plant original tissue interface is opened, the physical crushing of the plant materials is better. The plant material is added water to form the plant slurry.

[0021] The enveloping layer of the molding product is formed by the paper serous fluid, and the pulp raw material can be pulp boards or recycled papers. The pulp enveloping process can adjust a color and a smoothness of the pulp, make the molding product better and meet different requirements of the manufacturers. The enveloping layer should control its density and thickness, and its density and thickness can be changed by the paper serous fluid concentration (between 0.15 and 1.5 %), the vacuum (between minus 0.05 MPa and minus 0.07 MPa) and the forming time (between 1 ms and 1 min).

[0022] According to the requirement, the cooperation of the plant serous fluid layer and a fabric layer can be controlled. An example of the molding product with a three-layer configuration is taken: firstly, the paper serous fluid is casted in a mold to form an inner layer of the plant molding product, and then the plant serous fluid is casted onto the inner layer to form an interlayer of the plant molding product. Finally, the plant serous fluid is casted onto the interlayer to form an outer layer of the plant molding product. In this way, the plant molding product with a three-layer configuration is obtained. During casting the structure of each layer, the moisture of the serous fluid should be removed in order to gradually form

the layer. In this process, the moisture removed from each layer can be returned to the corresponding high consistency slurry for recycling again. At last, the plant molding product is heated and dried to obtain a final plant molding product. Generally, the molding product with pressure dehydration is transferred to a corresponding mold. So, a final product can be finalized, according to the product requirements, the selection of materials, the temperature range in 30 degree below zero and 280 degree, the real-time temperature environment, a continuous pressure range between 1 MPa and 11 MPa and a time range from 30 s to 30 min.

[0023] The conventional paper-making pulping technology requires the separation of cellulose from other substances as much as possible to retain cellulose and hemi-cellulose. The fluid with a certain concentration is formed to suit the process requirements of a paper sheet, with the material utilization at about 30%. The present disclosure uses crop straws and other plant materials as the plant raw materials, and the purpose is to crush the plant rather than separate fibers. And then all the fiber materials within the plant itself, such as pectin, fat, resin, are used to take phase transition and migration so that the fiber lap is realized. The strength of the plant molding product is increased by using material such as lignin and ash in the plant, and partial material surface migration is realized in the heating mold to meet the strength demand of the plant molding product. The present disclosure can utilize different components in the plant to achieve the plant molding product and enhancing the strength, and obtain 99.9% utilization rate of the raw material. The phase transition refers to the material from one phase changed to another phase, such as from solid-phase to the liquid-phase.

[0024] The conventional pulp molding process usually takes a pulp sucking, one time or more times molding methods in order to make the plant molding product look more neat and beautiful. The present disclosure process is provided for pulp sucking more than once and molding more than once. The plant molding product can be divided into three layers with an inner layer, a middle layer and an outer layer so that it is to impart various kinds of sensory perception to the product. In this way, this kind of plant molding process can not only ensure the strength of the plant molding product and meet various different demands, but also can guarantee the plant molding product configuration via molding for many times namely to numerous reshaping and functionality. At the same time, in order to realize the need of multiple molding, the requirement of the temperature, the vacuum degree and the parameters are higher than that of the conventional pulp molding process. A range of the vacuum degree is controlled within 0.05 MPa to 0.07 MPa, a temperature range in the mold is between 30 degree below zero and 280 degree, and an internal pressure of the mold is controlled by the hydraulics stepless regulation way.

[0025] In the present embodiment of the disclosure, the multi-layer structure can change biochemical char-

acteristics and adjust the life cycle of the plant molding product by controlling thickness and density of each of the inner layer, the interlayer and the outer layer, as well as the interlayer between each two adjacent the inner layer and the outer layer. The principle is that the temperature and the pressure is applied between the pulp enveloping layer and the plant pulp layer, thereby the non-fibrous material of the plant pulp layer (such as pectin, resin, starch and other organic matter and inorganic metal molecules) can migrate from the plant pulp layer to an adjacent interface between the two parts. An organic matter is tightly wrapped in the structure by a fine structure of the pulp enveloping layer to be solidified and molded so that the organic matter is non-contacted with oxygen, thereby the oxidation reduction speed of the organic matter is reduced. In addition, a fine degree of the plant molding product can be adjusted by controlling the molding pressure of the mold. That is to say, the more the pressure is, the more dense the plant molding product is, thereby the path which gas molecules passing in a denser product is more narrow and tortuous. Thus, the transmittance of oxygen is also decreased. Therefore, it is possible to control the rate of oxidation and adjust the life cycle of the product by changing the fine density of the product to change the transmittance of oxygen. In the present disclosure, the reason for retaining the organic matter is that the organic matter can accelerate the degradation rate of the product during the degradation process. The whole product is a kind of pure plant raw material, with its waste product being composted, so it can directly carry on natural degradation and enter the natural circulation law.

[0026] Referring to FIG.1 and FIG. 2, a corresponding plant molding device is provided in order to achieve the above mentioned plant molding process.

[0027] The plant molding device includes a first storage tank 1, a second storage tank 2, a slurry pool 8 and a mold unit. The first storage tank 1 is configured for containing the paper serous fluid, and the second storage tank 2 is configured for containing the plant serous fluid. The slurry pool 8 includes an inlet portion connected to the first and second storage tanks 1, 2 and an outlet connected to the mold unit.

[0028] Preferably, the first storage tank 1 is connected with a first water cleaning tank 13 and a high consistency paper pulp tank 12, and the second storage tank 2 is connected with a second water cleaning tank 15 and a high consistency plant pulp tank 14. The high consistency paper pulp tank 12 is connected to a first hydraulic pulper 16 and the high consistency plant pulp tank 14 is connected to a second hydraulic pulping and kneading device 17. A corresponding pump valve member 21 is provided between the first and second storage tanks 1, 2 and the slurry pool 18, between the first water cleaning tank 13, the high consistency paper pulp tank 12 and the first storage tank 1, and between the second water cleaning tank 15, the high consistency plant pulp tank 14 and the second storage tank 2. The delivery of the serous

fluid is achieved by the pump valve member 21.

[0029] According to the process sequence, the mold unit sequentially includes a water mold 3, a forming mold 4 and a drying mold 5 with a heating device thereof. The water mold 3, the forming mold 4 and the drying mold 5 each include a first mold core 6 and a second mold core 7 matched to the first mold core 6. Generally, the first mold core 6 is positioned on top of a mold, while the second mold core 7 is positioned on bottom of the mold. Each first mold core 6 is mounted with an elevating driver 8 (the elevating driver 8 can be driven to lifting up and down by a cylinder) for driving the first mold core 6 to be opened and closed with the corresponding second mold core 7. Each of the first second mold cores 6, 7 is respectively connected with a vacuum gas circuit 19 for adsorbing the plant molding product. A strainer is formed at the junction between each of the first and second mold cores 6, 7 and its corresponding vacuum gas circuit 19 for water permeation. The strainer may be a plurality of apertures evenly distributed across each of the first and second mold cores 6, 7 only for the gas and the water passing through the plurality of apertures. When the vacuum gas circuit 19 can not only absorb the plant molding product through the plurality of apertures, but also be as a function of water removal. In this way, the serous fluid is gradually solid so that the plant molding product is formed in the first and second mold cores 6, 7. The vacuum degree of the vacuum gas circuit 19 is controlled between 0.05MPa and 0.08MPa.

[0030] A guiding device is positioned between every two adjacent the water mold 3, the forming mold 4 and the drying mold 5. The first mold core 6 or the second mold core 7 of each of the water mold 3, the forming mold 4 and the drying mold 5 can move along the guiding device so that at least one set of first and second mold cores 6, 7 respectively belonging to every two adjacent the water mold 3, the forming mold 4 and the drying mold 5 can achieve mold opening and mold closing. The plant molding product can be transmitted between the water mold 3, the forming mold 4 and the drying mold 5 via the movement of each of the first mold core 6 and the second mold core 7 and the opening and closing between the water mold 3, the forming mold 4 and the drying mold 5 to complete the corresponding process in each mold without requiring excessive manual intervention.

[0031] Furthermore, the water mold 3 is corresponding to the position of the outlet of the slurry pool 8 and the serous fluid in the slurry pool 18 is pumped through its vacuum gas circuit 19. The mold is in correspondence with the outlet of the slurry pool 18 to implement the use of the liquid in the slurry pool 18, which has been achieved in several ways in the conventional plant molding process. The typical method is that the mold is directly connected to the outlet of the slurry pool 18 or the mold is moved into the outlet of the slurry pool 18 and then draws the liquid from the slurry pool 18 to a corresponding mold core. In the present disclosure, the second mold core 7 of the water mold 3 is corresponding to the location of

the outlet of the slurry pool 18, thereby the second mold core 7 of the water mold 3 and the slurry pool 18 can be connected through the pipeline, and the second mode core 7 can be moved until the inlet of a casting liquid is connected with the outlet of the slurry pool 18, and then the serous fluid can be sucked from the slurry pool 18 into the corresponding mold core by the vacuum gas circuit 19.

[0032] The guiding device includes an upper guide rail 10 extending along a direction towards the forming mold 4 from the water mold 3 and a lower guide rail 11. The first mold core 6 of the water mold 3 is movably installed in the upper guide rail 10, and the second mold core 7 of both the forming mold 4 and the drying mold 5 is movably installed in the lower guide rail 11. One end of the lower guide rail 11 is corresponding to the upper guide rail 10 and the other end of the lower guide rail 11 extends out through the forming mold 4 and the drying mold 5. Each the first mold core 6 or the second mold core 7 of the water mold 3, the forming mold 4 and the drying mold 5 is driven by a horizontal cylinder 9 to move along their corresponding guide rail.

[0033] Preferably, each bottom surface of the first and second mold cores 6, 7 is connected with a compression gas circuit 20 for releasing the pressure of the plant molding product in order to facilitate transmission of the plant molding product.

[0034] The preferred implementation process of the present disclosure is shown as follows:

The pulp board or the waste paper is broken in hydraulic pulper to obtain the high consistency paper pulp, and then the high consistency paper pulp is transferred to the high consistency paper pulp tank 12. The plant raw material is first shredded in the hydraulic pulper and then kneaded by a kneading device until the fiber of the plant is exposed outside to obtain the high consistency plant slurry, and the high consistency plant slurry is transferred to the high consistency plant pulp tank 14. In this way, the high consistency paper pulp and water is pumped to the first storage tank 1 by the pump valve member 21, thereby the paper serous fluid is obtained. At the same time, the high consistency plant slurry and water is also pumped to the second storage tank 2 by the pump valve member 21 to obtain the plant serous fluid.

[0035] Furthermore, the pump valve member is first started to transfer the paper serous fluid through the pipeline to the slurry pool 18, and then the vacuum gas circuit 19 of the second mold core 7 of the water mold 3 is opened to draw the paper serous fluid from the slurry pool 18 to the second mold core 7 of the water mold 3. At the same time, the moisture therein is discharged from the vacuum gas circuit 19 via the strainer so that the inner layer of the plant molding product is formed. The slurry pool 18 is cleaned and the plant serous fluid is transferred to the slurry pool 18, and then the vacuum gas circuit 19 connected with the second mold core 7 of the water mold 3 is opened to draw the plant serous fluid from the slurry pool 18 to the second mold core 7 of the water mold 3,

moisture therein is thirdly discharged from the vacuum gas circuit 19 via the strainer so that the interlayer of the plant molding product is formed. Finally, the slurry pool 18 is cleaned again and the plant serous fluid is sucked by the vacuum gas circuit 19 to cast onto the interlayer and remove the moisture via the strainer so that the outer layer of the plant molding product is formed. In this way, the plant molding product with a three-layer structure is obtained.

[0036] The first mold core 6 of the water mold 3 is driven downward to match with its second mold core 7 for forming the plant molding product. After reaching a certain compression time, the vacuum gas circuit 19 of the second mold core 7 is closed and its compressed gas circuit 20 is then opened, and the vacuum gas circuit 19 of the first mold core 6 is opened to absorb the plant molding product. At this time, the elevating driver 8 is lifted again so that the plant molding product adsorbed on the first mold core 6 of the water mold 3 is following to lift.

[0037] The first mold core 6 of the water mold 3 is moving along the upper guide rail 10 towards the forming mold 4 under action of the horizontal cylinder 9, and the second mold core 7 of the forming mold 4 is also moving along the lower guide rail 11 towards the water mold 3 until the two parts corresponds up and down. The first mold core 6 of the water mold 3 is moved downward under action of the horizontal cylinder 9 to match with the second mold core 7 of the forming mold 4, the vacuum gas circuit 19 belonging to the first mold core 6 of the water mold 3 is closed and its compression gas circuit 20 is opened to release the plant molding product, while the vacuum gas circuit 19 belonging to the second mold core 7 of forming mold 4 is opened to absorb the plant molding product. In this condition, the first mold core 6 of the water mold 3 and the second mold core 7 of the forming mold 4 are opened to reset along their corresponding guide rails.

[0038] The first mold core 6 of the forming mold 4 is moving downward to match with its second mold core 7 and further compress and remove moisture from the plant molding product until the first mold cores 6 and the second mold core 7 of the forming mold 4 are opened after a certain time. At the same time, the plant molding product is adsorbed on the first mold core 6 of the forming mold 4 by means of the corresponding operation of both the vacuum gas circuit 19 and the compression gas circuit 20 to follow moving upward.

[0039] After the mold opening, the second mold core 7 of the forming mold 4 is moving towards the water mold 3 to receive a next plant molding product, the second mold core 7 of the drying mold 5 is moved along the lower guide rail 11 to below the forming mold 4. At this time, the first mold core 6 of the forming mold 4 is moved downward to match with the second mold core 7 of the drying mold 5, and the next plant molding product is transferred to the second mold core 7 of the drying mold 5 by means of the corresponding operation of both the vacuum gas circuit 19 and the compression gas circuit 20.

[0040] The second mold core 7 of the drying mold 5 moves back to its reset position along the lower guide rail 11 and its first mold core 6 moves downward to close with the corresponding second mold core 7, the heating device is then opened to dry the plant molding product, thereby a final plant molding product is obtained.

[0041] In the present disclosure, the necessary mold used in the plant molding process of the product is designed to be an active installation and engaged with a corresponding guide rail to realize the delivery and docking of the final product by the molds. In this way, the structure can reduce manual intervention and improve high production efficiency and product yield.

[0042] Although the features and elements of the present disclosure are described as embodiments in particular combinations, each feature or element can be used alone or in other various combinations within the principles of the present disclosure to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.

Claims

1. A plant molding process comprising the following steps:
 - forming a pulp enveloping layer of a molding product by dewatering paper serous fluid;
 - forming a plant pulp layer of the molding product by dewatering plant serous fluid;
 - laminating the pulp enveloping layer and the plant pulp layer and processing non-fibrous material of the plant pulp layer to make it migrate toward the pulp envelope layer for combining them together.
2. The plant molding process as claimed in claim 1, wherein the process further comprises the following steps: obtaining a high consistency paper pulp via adding water crushing pulp raw material; obtaining the paper serous fluid via the high consistency paper pulp diluted with water; obtaining a high consistency plant slurry via adding water crushing and wall-breaking plant raw material and obtaining the plant serous fluid via the high consistency plant slurry diluted with water.
3. The plant molding process as claimed in claim 2, wherein the process further comprises the following step of making the non-fibrous material of the plant pulp layer take phase transition and then migrate toward the pulp envelope layer by changing the temperature and the pressure of the molding product.
4. The plant molding process as claimed in claim 3, wherein a range of the temperature is between 30 degree below zero and 280 degree, and a range of

the pressure is between 1 MPa and 11 MPa.

5. The plant molding process as claimed in claim 4, wherein concentration of the paper serous fluid is between 0.5% and 1.5%, and concentration of the plant serous fluid is between 0.8% and 1.5%. 5
6. The plant molding process as claimed in claim 5, wherein the plant raw material includes herbs, crop stalks and roots, stems, leaves, and shells of shrubs, and a pulp raw material includes pulp boards and recycled papers. 10
7. A plant molding device comprising: 15
 - a first storage tank configured for containing paper serous fluid;
 - a second storage tank configured for containing plant serous fluid;
 - a slurry pool comprising an outlet formed thereof and an inlet portion connected to the first and second storage tanks; 20
 - a mold unit connected to the outlet, according to the process sequence, the mold unit sequentially comprising a water mold, a forming mold and a drying mold with a heating device thereof; the water mold, the forming mold and the drying mold each comprising a first mold core and a second mold core matched with the first mold core, each first mold core mounted with an elevating driver for driving the first mold core to be opened and closed with the corresponding second mold core, each of the first mold cores and the second mold cores respectively connected with a vacuum gas circuit for adsorbing a plant molding product; 25
 - a strainer formed at the junction between each of the first mold core and the second mold core and its corresponding vacuum gas circuit for water permeation; 30
 - a guiding device positioned between every two adjacent the water mold, the forming mold and the drying mold; and wherein the first mold core or the second mold core of each of the water mold, the forming mold and the drying mold can move along the guiding device so that at least one set of the first and second mold cores respectively belonging to every two adjacent the water mold, the forming mold and the drying mold can achieve mold opening and mold closing. 35
8. The plant molding device as claimed in claim 7, wherein the guiding device comprises an upper guide rail extending along a direction towards the forming mold from the water mold and a lower guide rail, the first mold core of the water mold movably installed in the upper guide rail, the second mold 40

core of both the forming mold and the drying mold movably installed in the lower guide rail, and one end of the lower guide rail corresponding to the upper guide rail and the other end of the lower guide rail extending out through the forming mold and the drying mold.

9. The plant molding device as claimed in claim 8, wherein each bottom surface of the first and second mold cores is connected with a compression gas circuit for releasing pressure of the plant molding product, the first mold core of the water mold and each second mold core of the forming mold and the drying mold can be driven to respectively move along the guiding device by a corresponding horizontal cylinder. 45
10. The plant molding device as claimed in claim 9, wherein the first storage tank is connected with a first water cleaning tank and a high consistency paper pulp tank; the second storage tank is connected with a second water cleaning tank and a high consistency plant pulp tank; the high consistency paper pulp tank connected to a first hydraulic pulper and the high consistency plant pulp tank connected to a second hydraulic pulping and kneading device; a corresponding pump valve member provided between the first and second storage tanks and the slurry pool, between the first water cleaning tank, the high consistency paper pulp tank and the first storage tank, and between the second water cleaning tank, the high consistency plant pulp tank and the second storage tank. 50

Amended claims under Art. 19.1 PCT

1. A plant molding process comprising the following steps:
 - forming a pulp enveloping layer of a molding product by dewatering paper serous fluid;
 - forming a plant pulp layer of the molding product by dewatering plant serous fluid;
 - laminating the pulp enveloping layer and the plant pulp layer and processing non-fibrous material of the plant pulp layer to make it migrate toward the pulp envelope layer for combining them together.
2. The plant molding process as claimed in claim 1, wherein the process further comprises the following steps: obtaining a high consistency paper pulp via adding water crushing pulp raw material; obtaining the paper serous fluid via the high consistency paper pulp diluted with water; obtaining a high consistency plant slurry via adding water crushing and wall-breaking plant raw material and obtaining the plant 55

serous fluid via the high consistency plant slurry diluted with water.

3. The plant molding process as claimed in claim 2, wherein the process further comprises the following step of making the non-fibrous material of the plant pulp layer take phase transition and then migrate toward the pulp envelope layer by changing the temperature and the pressure of the molding product.
4. The plant molding process as claimed in claim 3, wherein a range of the temperature is between 30 degree below zero and 280 degree, and a range of the pressure is between 1 MPa and 11 MPa.
5. The plant molding process as claimed in claim 4, wherein concentration of the paper serous fluid is between 0.5% and 1.5%, and concentration of the plant serous fluid is between 0.8% and 1.5%.
6. The plant molding process as claimed in claim 5, wherein the plant raw material includes herbs, crop stalks and roots, stems, leaves, and shells of shrubs, and a pulp raw material includes pulp boards and recycled papers.
7. A plant molding device comprising:

a first storage tank (1) configured for containing paper serous fluid;
 a second storage tank (2) configured for containing plant serous fluid;
 a slurry pool (8) comprising an outlet formed thereof and an inlet portion (101) connected to the first and second storage tanks (1, 2);
 a mold unit (100) connected to the outlet, according to the process sequence, the mold unit (101) sequentially comprising a water mold (3), a forming mold (4) and a drying mold (5) with a heating device thereof;
 the water mold (3), the forming mold (4) and the drying mold (5) each comprising a first mold core (6) and a second mold core (7) matched with the first mold core (6), each first mold core (6) mounted with an elevating driver (8) for driving the first mold core (6) to be opened and closed with the corresponding second mold core (7), each of the first mold cores (6) and the second mold cores (7) respectively connected with a vacuum gas circuit (19) for adsorbing a plant molding product;
 a strainer (103) formed at the junction between each of the first mold core (6) and the second mold core (7) and its corresponding vacuum gas circuit (19) for water permeation;
 a guiding device (102) positioned between every two adjacent the water mold (3), the forming mold (4) and the drying mold (5); and wherein

the first mold core (6) or the second mold core (7) of each of the water mold (3), the forming mold (4) and the drying mold (5) can move along the guiding device (102) so that at least one set of the first and second mold cores (6, 7) respectively belonging to every two adjacent the water mold (3), the forming mold (4) and the drying mold (5) can achieve mold opening and mold closing.

8. The plant molding device as claimed in claim 7, wherein the guiding device (102) comprises an upper guide rail (10) extending along a direction towards the forming mold (4) from the water mold (3) and a lower guide rail (11), the first mold core (6) of the water mold (3) movably installed in the upper guide rail (10), the second mold core (7) of both the forming mold (4) and the drying mold (5) movably installed in the lower guide rail (11), and one end of the lower guide rail (11) corresponding to the upper guide rail (10) and the other end of the lower guide rail (11) extending out through the forming mold (4) and the drying mold (5).
9. The plant molding device as claimed in claim 8, wherein each bottom surface of the first and second mold cores (6, 7) is connected with a compression gas circuit (20) for releasing pressure of the plant molding product, the first mold core (6) of the water mold (3) and each second mold core (7) of the forming mold (4) and the drying mold (5) can be driven to respectively move along the guiding device (102) by a corresponding horizontal cylinder (9).
10. The plant molding device as claimed in claim 9, wherein the first storage tank (1) is connected with a first water cleaning tank (13) and a high consistency paper pulp tank (12); the second storage tank (2) is connected with a second water cleaning tank (15) and a high consistency plant pulp tank (14); the high consistency paper pulp tank (12) connected to a first hydraulic pulper (16) and the high consistency plant pulp tank (14) connected to a second hydraulic pulping and kneading device (17); a corresponding pump valve member (21) provided between the first and second storage tanks (1, 2) and the slurry pool (18), between the first water cleaning tank (13), the high consistency paper pulp tank (12) and the first storage tank (1), and between the second water cleaning tank (15), the high consistency plant pulp tank (14) and the second storage tank (12).

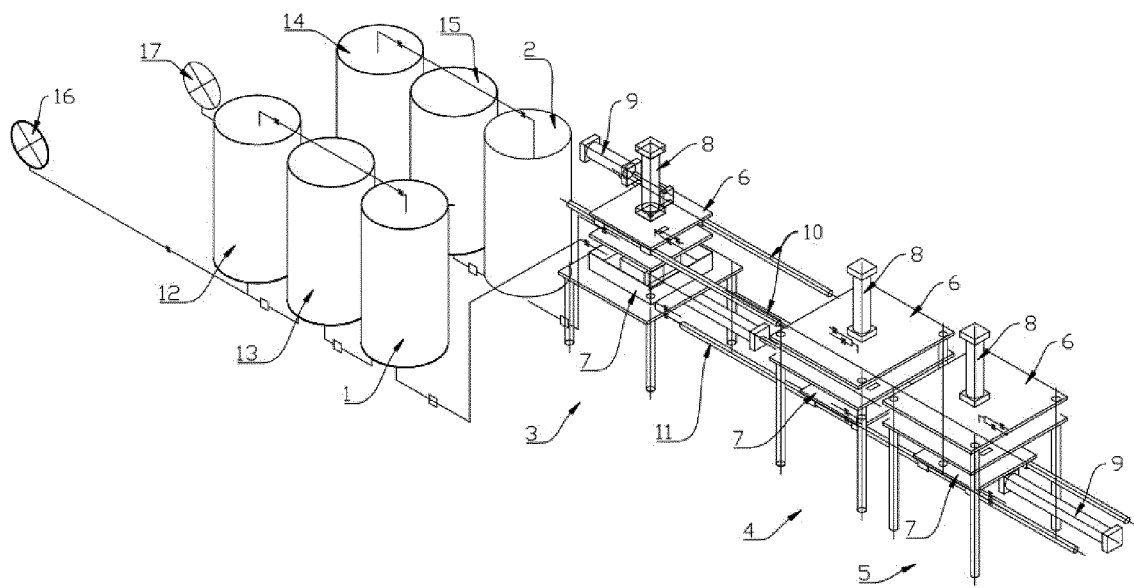


FIG. 1

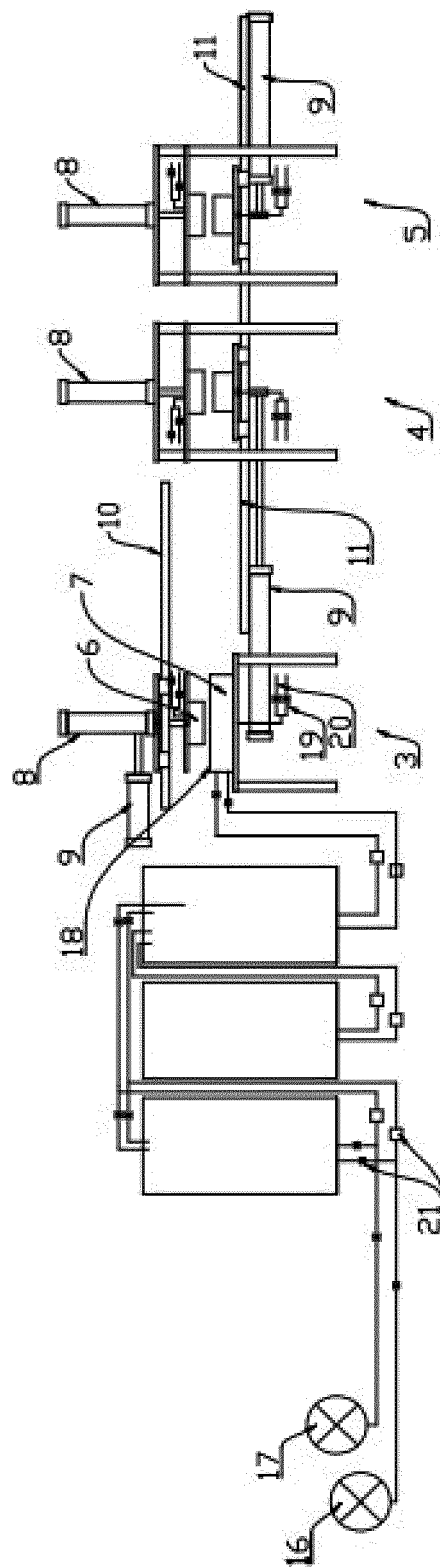


FIG. 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2017/112960

A. CLASSIFICATION OF SUBJECT MATTER

D21J 3/00 (2006.01) i; D21J 5/00 (2006.01) i
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

D21J

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNKI, CNABS, CNTXT: 纸浆, 植物浆, 脱水, 模塑, 成型, 贴合, 结合, 粘, 移, 层, 相变; VEN: pulp, stuff, plant, botany, dehydration, dewatering, mold, joint, combine, unite, together, stick, adhere, glue, paste, move, lay, phase transition, phase change

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 1307154 A (SHANGHAI RIJIAN PACKING EQUIPMENT CO., LTD.) 08 August 2001 (08.08.2001), description, specific embodiment, and figures 1 and 2	1-10
A	CN 103526649 A (ZHANG, Baohua) 22 January 2014 (22.01.2014), entire document	1-10
A	CN 2422338 Y (DONGHONG LIGHT INDUSTRY MACHINERY CO., LTD.) 07 March 2001 (07.03.2001), entire document	1-10
A	CN 102212986 A (TPV DISPLAY TECHNOLOGY (XIAMEN) CO., LTD.) 12 October 2011 (12.10.2011), entire document	1-10
A	CN 105908578 A (DONGGUAN DONNELLEY PRINTING CO., LTD.) 31 August 2016 (31.08.2016), entire document	1-10
A	CN 1279048 A (ZHENG, Bingyan) 10 January 2001 (10.01.2001), entire document	1-10

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

☒ See patent family annex.

* Special categories of cited documents:

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

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“O” document referring to an oral disclosure, use, exhibition or other means

“P” document published prior to the international filing date but later than the priority date claimed

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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

“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

12 February 2018

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2017/112960

5	C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
10	A	JP 4403001 B2 (ARAKAWA SEISAKUSHO K.K.) 20 January 2010 (20.01.2010), entire document	1-10
15			
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Form PCT/ISA/210 (continuation of second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2017/112960

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 1307154 A	08 August 2001	CN 1124381 C	15 October 2003
CN 103526649 A	22 January 2014	None	
CN 2422338 Y	07 March 2001	None	
CN 102212986 A	12 October 2011	None	
CN 105908578 A	31 August 2016	None	
CN 1279048 A	10 January 2001	None	
JP 4403001 B2	20 January 2010	JP 2005290597 A	20 October 2005