Oct. 7, 1969 A. J. A. ASPLUND 3,471,365

APPARATUS FOR IMPREGNATING FIBROUS MATERIAL

Original Filed May 16, 1966 4 Sheets-Sheet 1

Fig. 1.

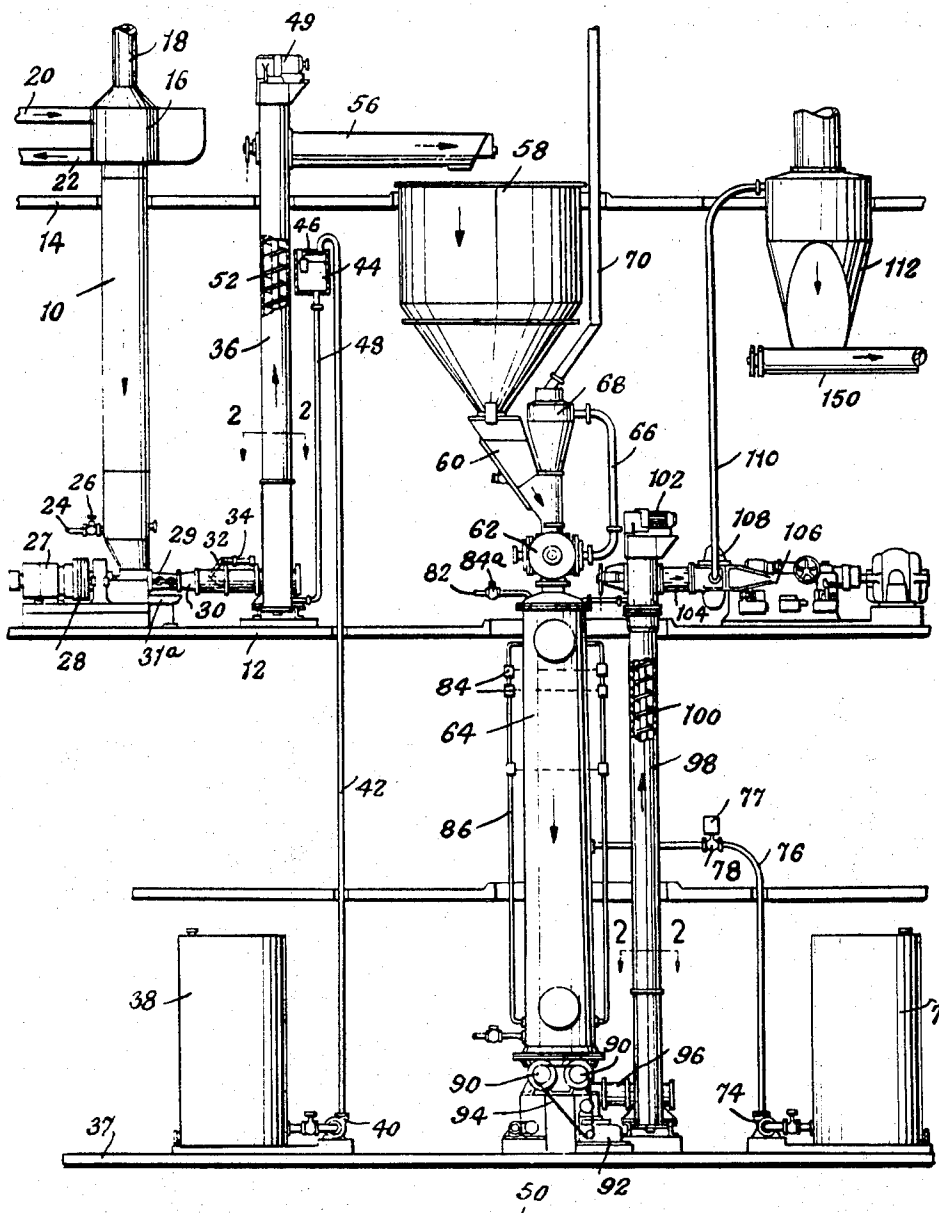


Fig. 2.

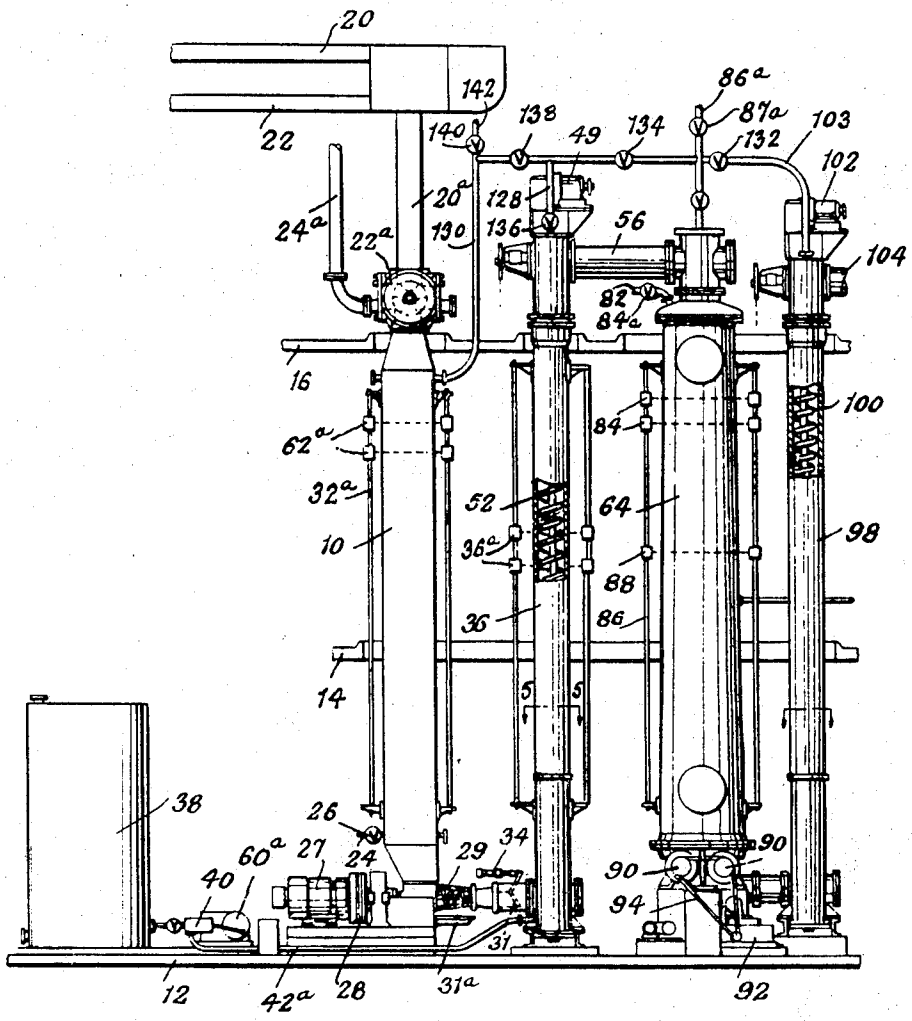
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APPARATUS FOR IMPREGNATING FIBROUS MATERIAL

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Fig. 3.



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APPARATUS FOR IMPREGNATING FIBROUS MATERIAL

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Fig. 4.

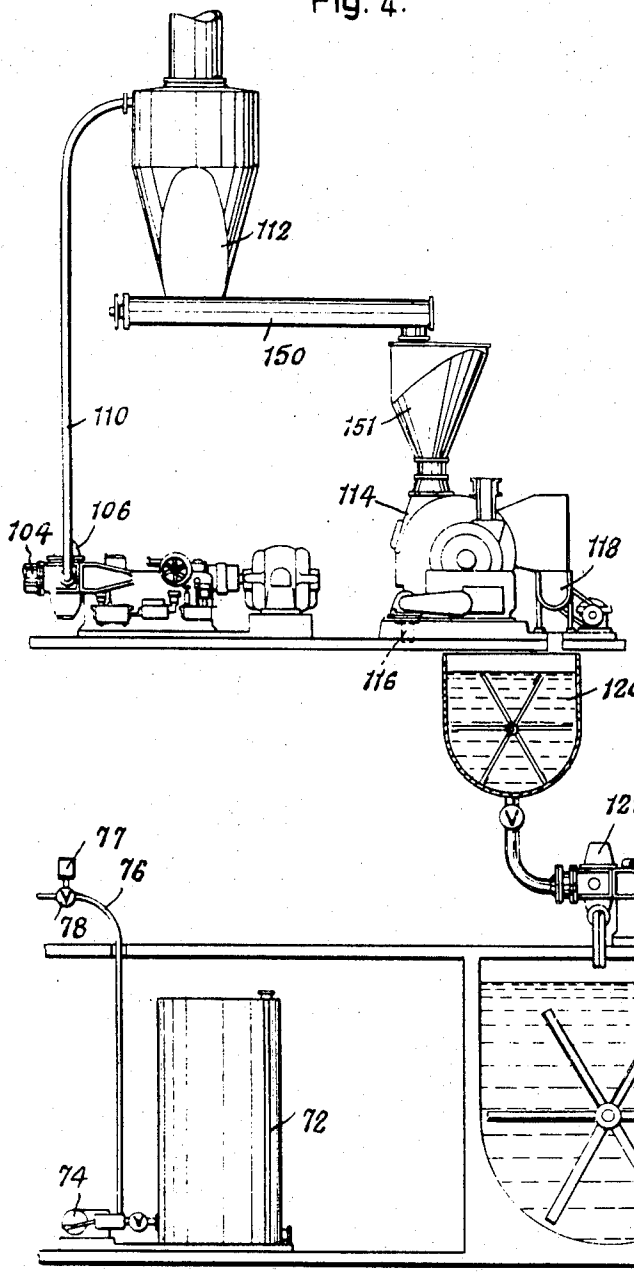
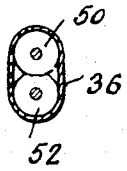


Fig. 5.



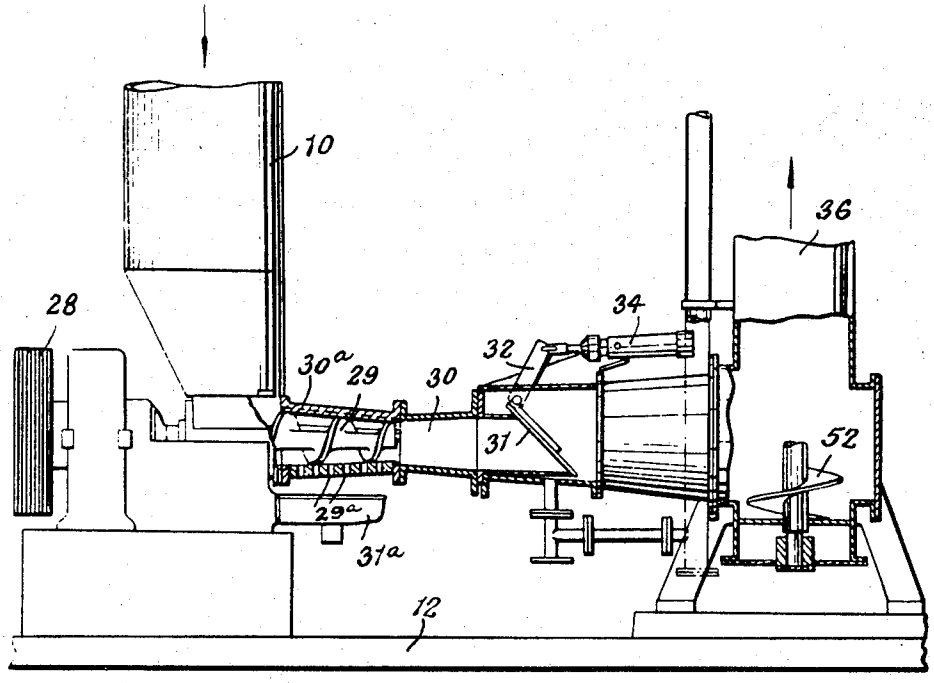
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APPARATUS FOR IMPREGNATING FIBROUS MATERIAL

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Fig. 6.



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3,471,365

APPARATUS FOR IMPREGNATING FIBROUS MATERIAL

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Continuation of application Ser. No. 550,560, May 16, 1966. This application Aug. 7, 1967, Ser. No. 658,953
Int. Cl. D21c 7/00
U.S. Cl. 162—237 10 Claims

ABSTRACT OF THE DISCLOSURE

Apparatus for treating lignocellulose-containing material for the production of paper pulp in which the lignocellulose-containing material is introduced into a steam treating chamber from which is conveyed into an impregnating chamber where it is subjected to steam and chemicals under elevated pressure, the steam treating chamber and the impregnating chamber being interconnected by a conduit in which the material is compressed incrementally into a series of plugs and sequentially discharged into the pressurized impregnating chamber where they expand to enhance the absorption of the impregnating chemicals.

This application is a continuation of Ser. No. 550,560 filed May 16, 1966, which is a division of application Ser. No. 237,911, filed Nov. 15, 1962, both now abandoned.

The raw material to be treated in accordance with the present invention is in the first instance constituted by wood disintegrated into chips; but also several varieties of grass, straw, bagasse and the like may be used with satisfactory results. The pulp is intended for use in the paper industry and also for the manufacture of fibre board and building elements or other products consisting of or containing such pulp.

According to the present invention, the raw material is subjected to an impregnation stage, at least one cooking step and a subsequent mechanical disintegration step. The impregnation step includes a mechanical compression of the material for partial elastic deformation and subsequent expansion thereof below the surface of chemicals containing liquid. Prior to the mechanical compression the material is heated to a temperature of 60 to 100° C. or even more, preferably by steam. By the compression, air and liquid present between the pieces of material, such as chips, and particularly within the pores of said material, is removed and when the mechanical compression ceases and the material is regaining its original volume, liquid is sucked into the pores. If the material in its raw state contains moisture exceeding 0.8 parts per one part of material calculated as completely dry, part of said moisture is pressed out which facilitates the subsequent impregnation with the chemicals-containing liquid.

According to one feature of my invention the expansion of the material within the liquid is effected while this liquid is subjected to an external superatmospheric pressure. The pressure to which the material is subjected during the expansion within the liquid may in this manner be increased to a many times larger pressure than the static pressure exerted by the liquid column itself onto the material. As a consequence, the remainder of air within the material is compressed and occupies a correspondingly minor volume for which reason the material will be capable of absorbing more liquid. If the container or conveyor within which the impregnation is made has so great height that the liquid column within the same is 8 metres, for example, the maximum of pressure exterted by the liquid column adjacent to the base of the container will be about 0.8 kilograms per square centimetre. According to the teaching of the present invention, the pressure acting on the liquid may, without difficulty be increased to ten times said value, for example, so as to cause the air remaining in the pores of the ligno-cellulose-containing material to be compressed to a corresponding small volume, which allows additional impregnation liquid to reach the interior of the material. The reduction of pressure in the pores of the materials caused by the upwardly directed movement of the material out of the liquid will become so inconsiderable, calculated in per cent, as to become negligible.

A feature of the invention resides in a plug-forming means by which the material being fed from one container to another is compressed against a pressure-regulatable wall, which can assume the form of a pivoted flap under hydraulic pressure to oppose the movement of the material to a predetermined extent until the material has built up into a plug of the desired density.

According to the present invention, the several cooking steps involved therein may employ the solutions of chemicals having mutually different composition. For example, in the production of pulp by cooking wood chips in solutions of sodium sulphite which is quite neutral, the wood substance is affected by the organic acids usually present in said substances, such as formic acid and acetic acid. In order to avoid the hydrolysis thus caused, sodium carbonate or sodium hydroxide or possibly both or some other neutralizing substance are added.

With the above described objects and others to be hereinafter set forth in view, I have devised the arrangement of parts and method steps to be described and more particularly pointed out in the claims appended hereto.

In the accompanying drawings, wherein illustrative embodiments of the invention are disclosed,

FIG. 1 shows in elevation, and partly in section, a plant or carrying out the method according to my invention;

FIG. 2 is a sectional view, taken substantially on the line 2—2 of FIG. 1, looking in the direction of the arrows;

FIG. 3 shows in elevation and partly in section, a slightly different embodiment of the invention;

FIG. 4 shows in section, the remainder of the plant partly shown in FIG. 3;

FIG. 5 is a sectional view, taken on the line 5—5 of FIG. 4, and

FIG. 6 is an enlarged view, partly in section, of the mechanical compressing or plug-forming mechanism and associated parts.

Referring to the embodiment of the invention shown in FIGS. 1 and 2, there is therein shown a container **10** erected on a flooring **12** and extending vertically upwardly through a flooring **14** located at a higher level. The container **10** has an upper closure member **16**, the upper end of which is formed with a steam outlet **18**. Chips are supplied to the member **16** from a storage bin (not shown) through a duct **20** from which the chips fall down into the container **10**. If the supply of chips is too great, the excess returns through a duct **22** to the storage bin. Passing through the ducts **20** and **22** is a scraping conveyor (not shown). Steam is supplied to the container **10** through a pipe **24** connected to the lower part of the container and provided with a valve **26** and thus flows upwards in the opposite direction to the chips, descending within the container **10** for the purpose of producing a softening of said chips. The container **10** thus serves as a kind of zone for softening by means of steam within which zone the chips are gradually heated to a temperature exceeding 70° C. and suitably maintained between 80° C. and 90° C. and in some cases reaching the boiling point of water at atmospheric pressure. Any excess of steam may escape through the outlet **18**, but the supply of steam through the pipe **24** is controlled so as to avoid such excess as far as possible.

The chips softened in the base zone are conveyed by a screw conveyor **29** located in the lower part of the container **10** and driven by an electric motor **27** through a reduction gear **28**, into a plug-forming tube **30**. Inside this tube is disposed a pivoted flap **31** (FIG. 5) which, through the intermediary of an arm **32** is loaded by a hydraulic servo-motor **34** and thus assists in subjecting the mass of chips to high pressure. In this part of the apparatus the chips are compressed mechanically so as to expel air and water present in the pores of said chips. The air and water thus expelled from the chips passes out through apertures **29***a* provided in the lower portion of the frustoconical housing **30***a* for the screw conveyor **29**. The water thus drained from the housing **30***a* descends into the receptacle **31***a* and is drained therefrom in any suitable way.

Mounted on the flooring **12** is another container **36** which also extends upwardly through the flooring **14**. In the container **36** impregation of the chips is effected while the mass of chips is simultaneously conveyed up to the higher floor. On a still lower flooring **37** stands a vessel **38** within which a solution of chemicals is prepared and is conveyed to a pump **40** and through a pipe **42** up to a container **44** provided with a level control **46** which insures that the solution of chemicals is maintained at a predetermined constant level within this container. A tube **48** inter-connects the base parts of the containers **44** and **36** and thus in the container **36** a liquid column is formed reaching to substantially the same level as that in the container **44**.

When the mass of chips is compressed strongly, for example, subjected to a high pressure of 30 to 50 or even to 100 atmospheres in the tube **30** enters the container **36** at its base, it will immediately enter a bath of the chemical solution. The chips expand towards their original volume and the solution is sucked into the pores of the chips. The preheating in the base section **10** is intended to facilitate the compression in the plug-forming tube **30** and expansion takes place in the liquid-containing part of the container **36** which insures an extremely good impregnation of the chips with the chemical solution.

The chips are conveyed upwardly within the container **36** preferably by means of two screw conveyors **50, 52** (FIG. 2) driven by an electric motor **49**, the conveyors having a pitch preferably of the same magnitude as the diameter of the container and being rotated at a low number of rotations such as 5 to 15 revolutions per minute. The spacing between the axes of the two screw conveyors should not be substantially larger than the sum of the radii of the screws and may possibly be less in order to produce an effect preventing rotational movement of the chips. To the same end, partitions **54** may be provided which are individually secured by welding and shaped to the periphery of the screws and designed to fill the areas adjacent the zones where the screws meet or engage one another.

The chips are conveyed upwardly by the screws **50, 52** initially below the level of the liquid in the container **36**, and leave the liquid at the top part of the container **36** and are discharged from the container by means of a conveyor **56** extending in a transverse direction and located in the upper end portion of the container **36**. The liquid column in the container **36** is dimensioned so as to produce a relatively high hydrostatic pressure adjacent the base of the container where the compressed chips are allowed to expand. This pressure may be of the order of 3 to 5 meters and may possibly reach 10 meters water column and assists in forcing the solution of chemicals into the pores of the chips.

This preliminary impregnation of the chips by the solution of chemicals is followed by a cooking or boiling of the chips. The conveyor **56** delivers the impregnated chips into a hopper-shaped vessel **58**. From there the chips fall into a vibrating feeder **60** to a so-called rotating cell feeder **62** having individual pockets separated from one another, the chips content of which is delivered to a container **64** extending downwardly to the lowest flooring of the plant. The cell feeder is also so constructed as to prevent direct communication between the closed container **64** and the vibrating feeder **60**. The pockets of the cell feeder when moving upwards during rotation, contain steam at high pressure, which steam escapes through a duct **66** provided with a centri-cleaner **68** to separate any entrained chips, and thence through a duct **70**.

The lowermost flooring carries a container **72** of the same type as the container **38** and also intended for preparation of a solution of chemicals. This solution is fed by a pump **74** through a pipe **76** provided with a valve **78** controlled by a servo-motor **77** to the closed cooking container **64**. The pipe **76** preferably opens near the middle portion of the container **64** to which steam is also supplied at the base through a pipe **80** provided with a control valve **82**.

The cell feeder **62** is controlled by two systems of level regulators **84** which may be adjustably mounted on guides **86** and between which the level of the column of chips may fluctuate. The level of the solution of chemicals is also controlled by one or more systems of level regulators **88**, which may be mounted on the same guides **86** and which actuate the servo-motor **77**. In the cooking container **64** steam is maintained at a pressure of the order of 8 to 10 kg./cm.^{2} and at corresponding temperature. During their downward passage within the container **64** the chips initially meet a steam atmosphere and are subjected to cooking in said atmosphere while also being affected by the chemicals with which they were earlier impregnated. The chips subsequently descend into the chemical solution in the form of a column of liquid in the container **64** which may be greater in extent than the vapor space provided in said container. The cooking is continued in the liquid bath, the chips being progressively exposed to fresh solution of chemicals supplied from the container **72**.

Adjacent to the base of the container **74** conveyors **90** driven through suitable transmission **94** by an electric motor **92** feed the chips to a further conveyor **96** opening into a container **98** standing adjacent to the container **64**. Container **58** houses screw conveyors **100** driven by an electric motor **102**. The container **98** and the conveyors **100** may be of the same construction as the container **36** and its screw conveyors. Within the container **98** the liquid will be at a level approximately the same or slightly higher than that within the container **64** and the cooking in the liquid phase is thus continued during the upwardly directed movement of the chips within the container **98**. The container **98** which, in the same manner as the container **64**, is closed and heat-insulated with respect to the surrounding atmosphere, has an upper vapor chamber within which a second cooking in the vapor phase may be effected.

The chips thus treated are fed from the top portion of the container **98** by a horizontal conveyor **104** to a mechanical disintegrator **106** provided with two grinding discs mutually rotatable and disposed within a zone **108** of the plant. The ground material or pulp then passes through a conduit **110** to a centri-cleaner **112** after which it may be subjected to further treatment such as a further mechanical grinding step. The defibrator **106** may suitably be of a known kind. The mechanical disintegration in the embodiment shown is effected subsequent to the last cooking step and under the same conditions regarding temperature and pressure. The disintegration may, however, also be effected under atmospheric conditions.

The embodiment of the invention disclosed in FIG. 3 is similar in most respects to that shown in FIG. 1, a primary difference being that the several containers **10, 36, 64** and **98** are arranged on the same flooring or level. These elements may have such longitudinal dimension as to project from the flooring **12** upwardly through

higher floorings **14** and **16** respectively. In this embodiment, the chips enter through duct **20** to the container **10** through the vertical discharge tube **20***a*. The latter communicates with the container **10** through a rotating cell feeder **22***a* having individual pockets separated from one another, the chips content of each of which is separately delivered to the container **10** through the top thereof. The cell feeder is in connection with a duct **24***a* through which steam or air present in the pockets escapes into the surrounding atmosphere during the movement of the pockets upwardly from the container **10**. It is readily understood that the cell feeder **22** blocks free communication between the top portion of the vertical container **10** and the surrounding atmosphere. Steam flows upwardly in the container in a direction opposite to that of the chips descending within the container, the steam being introduced into the base portion of the container through the pipe **26** controlled by the valve **28**.

In the container **10** the raw material is preheated by means of steam to a temperature usually kept below 100° C. and reaching higher temperature in some cases to 120 to 130° C., or even more. Simultaneously with the heating of the chips by the steam, part of the air present in the individual in the pores thereof, or between the chips, is expelled. The cell feeder **22***a* provides for the feed of the air thus expelled from the container **10**, to the conduit **24***a*. Within the container **10** atmospheric pressure, or a slighter pressure, may be maintained. The upper level of the column of chips in the container **10** may fluctuate and be controlled within limits defined by level regulators **62***a* in the known manner. These regulators are adjustably mounted on guides **32***a* and actuate the driving motor of the cell feeder.

The plug-forming mechanism located at the base of the container **10** is substantially similar to that shown in FIG. 6, except for the reversal of position of the hydraulic servo-motor **34**. By means of this mechanism, the flap **31** forms a wall against which the material is compressed to form a plug of the desired density, the flap having a regulatable pressure opposing the material until the required build-up is attained and then allowing the material to move forwardly into the container **36**. The materials proceed into the container **36** in the manner described in the previous embodiment of FIG. 1.

In the present embodiment, a solution of chemicals prepared in the vessel **38** is fed into the base part of the conveyor **36** through a tube **42***a* and pump unit **40**. The tube **42***a* may be surrounded by a heating coil **60***a* to effect a heating of the solution flowing towards the container **36**. Within the container **36** the liquid is caused to rise to a level controlled by the level regulators **36***a*, which in the illustrated embodiment of the apparatus, as shown in FIG. 3, actuate the pump **49**. In this embodiment the horizontal conveyor **64** to the cooker **64** which has a vertical dimension of substantially the same magnitude as the container **10** and the container **36** respectively. The quantity of chips housed in the cooker **64** is controlled by level regulators **84** which in turn govern the feeding speed of the screw feeder **29**. Solution of chemicals is supplied to the cooker **64** from a storage vessel **72** through the tube **76** provided with the pump **74** and a valve **78** controlled by the servo-actuated motor **77**. The tube **76** may open into the cooker **64** substantially in the middle zone thereof. The level regulator **88** positioned below the regulator **84** is intended to actuate the servo-motor **77** to effect control of the liquid level within the cooker **64**. Said regulators are mounted adjustably in the vertical direction on guides **86**. Steam under pressure, as described in conjunction with FIG. 1, is supplied to the cooker **64** through a conduit **82** controlled by a valve **84***a*. Air collecting in the system may be intermittently removed through an escape tube **86***a* controlled by a valve **87***a*.

When the chip material strongly compressed within the plug-forming tube **38** expands again in the base part of the conveyor-container **36** chemicals containing solution is sucked up into the pores of the material. At the same time the chips are exposed to an elevated pressure which partly is determined by the liquid column formed in the container **36** and partly by the vapor pressure produced in the top part of said container. This latter pressure may be more than ten times larger than the pressure exerted by the liquid column. As a result, the air still present in the pores of the chips will be compressed to a corresponding degree and replaced by solution of chemicals so as to insure an almost perfect impregnation of the chips.

The chemicals containing liquid admitted to the container **36** has preferably a relatively low temperature such as 80 to 100° C. in order to avoid heating of the raw material to higher temperatures prior to its thorough impregnation with the chemicals containing liquid. If, however, the disadvantageous effects caused by high temperatures such as alteration of color of the pulp into brown, beginning hydrolysis or similar effects are negligible, the liquid when pumped into the container **36** may have a temperature of 150 to 180° C. and even a still higher temperature.

In the portion of the container **36** located above the regulators **36***a* and also in the portion of the cooker **64** above the regulator **88** an atmosphere of water vapor is formed. The impregnated chips are thus initially subjected to cooking in a vapor phase and are subsequently cooked in a liquid phase formed in the zone of the cooker **64** located below the regulator **88**.

From the base portion of the container or cooker **64** the chips are conveyed into the container or conveyor **98** as described in connection with FIG. 1.

In the illustrated apparatus, all reaction vessels or containers **10**, **36**, **64** and **98** may be interconnected to equalize the pressure prevailing therein. To this end the pressure-equalizing tube **103** has branch connection tubes **128**, **130** to the containers **36** and **10** respectively. For each of the tubes controlling valves denoted by **132**, **134**, **136**, and **138** respectively, are provided. A valve **140** controls a tube **142** through which water vapor may be supplied or which may also serve as a discharge conduit. In the various containers the same pressure may thus be maintained, or if desired, pressure differences may be produced if the containers by suitable adjustment of the valves.

The ligno-cellulose-containing material treated in this way may be directly blown out into the centri-cleaner **112** (FIG. 4) or any other suitable receiving apparatus. In the embodiment shown in FIG. 4, a mechanical disintegrating apparatus **106** constructed as a disc refiner, for example, is interposed ahead of said cleaner. The discharge side of the apparatus **106** is connected with the centri-cleaner **112** through conduit **110** and behind the centri-cleaner a conveyor **150** transports the materials to a hopper **151** forming part of a de-watering device **114**, from which the cooking liquid expelled by compression is drawn off through a tube **116** whereas the pulp product is discharged by means of a conveyor **118**. This product may be diluted with water in a vessel **120** and is refined in a second disc refiner **122** whereupon it is fed into a storage vessel **124** to be conveyed further to a paper-making machine by means of a pulp pump **126**, for example.

The chemicals used in the treatment of the lignocellulose-containing material may be of any known kind and have suitably mutually different composition in the liquids used in the impregnating steps. The impregnating liquid in the container **36** may substantially consist of sodium sulphite and sodium carbonate in the presence of which chemicals, the treatment in the vapor phase within the upper zones of the container **36** and the cooker **64** is effected. The cooking liquid prepared in the container **38** may contain sodium sulphite and sodium hydroxide or

sodium sulphide. The particular composition employed may be used in both embodiments of the invention.

If a higher pressure is maintained in the container **36** than in the container **10** a plug of material formed in the feeding device **29** to **34** is normally sufficient to act as a barrier preventing vapor and liquid from escaping through said device. If, however, this barrier for some reason or other should cease to be operative and as a consequence the pressure in the container **10** should rise, the cell feeders **22***a* will prevent raw material, liquid and vapor from escaping out of the system which means that open communication between the system operating under high pressure and the surrounding atmosphere will not be established under such conditions.

What is claimed is:

1. An apparatus for treating lignocellulose-containing fibrous material for the production of paper pulp, including:

(a) a steam treating chamber;

(b) conveying means opening into said steam treating chamber and feeding the lignocellulose-containing material in the form of particles into an upper portion of said chamber;

(c) a conduit means connected to said chamber and a steam source connected to said conduit for introducing steam into said chamber;

(d) an elongated, upwardly extending, impregnating chamber and a second conduit means connected thereto feeding impregnating chemicals into said chamber, said chamber having a substantial volume of impregnating chemical therein;

(e) means for feeding chemicals to said second conduit means;

(f) means exteriorly of said impregnating chamber and opening thereinto for creating an elevated pressure on the impregnating chemical in the lower portion of said chamber;

(g) a material conduit interconnecting the lower portions of said two chambers;

(h) means in said conduit for receiving fibrous material from said steam treatment chamber, for compressing said material incrementally into a series of plugs, and for sequentially discharging each plug into said pressurized impregnating chamber, whereby said fibrous material expands and absorbs impregnating chemicals;

(i) conveyor means for conveying the expanded and impregnated material upwardly in said impregnating chamber; and

(j) outlet means in the upper portion of said impregnating chamber for discharging the impregnated material.

2. A structure as set forth in claim **1**, wherein said means in (f) for creating an elevated pressure in the lower portion of said impregnating chamber comprises:

(a) a pressure tight cooking chamber having a steam source connected thereto, and a material inlet; and

(b) a pressure sealed transfer conduit extending from said material inlet to said outlet means of said impregnating chamber.

3. An apparatus for treating lignocellulose-containing fibrous material for the production of paper pulp, including

(a) a steam treating chamber;

(b) conveying means opening into said steam treating chamber and feeding the lignocellulose-containing material in the form of particles into an upper portion of said chamber;

(c) a conduit means connected to said chamber and a steam source connected to said conduit for introducing steam into said chamber;

(d) an elongated, upwardly extending, impregnating chamber and a second conduit means connected thereto feeding impregnating chemicals into said chamber, said chamber having a column of impregnating chemical therein exerting an elevated hydrostatic pressure in the lower portion of said chamber;

(e) means for feeding chemicals to said second conduit means;

(f) a material conduit interconnecting the lower portions of said two chambers;

(g) means in said conduit for receiving fibrous material from said steam treatment chamber, for compressing said material incrementally into a series of plugs, and for sequentially discharging each plug into said pressurized impregnating chamber, whereby said fibrous material expands and absorbs impregnating chemicals;

(h) conveyor means for conveying the expanded and impregnated material upwardly in said impregnating chamber; and

(i) outlet means in the upper portion of said impregnating chamber for discharging the impregnated material.

4. Apparatus as set forth in claim **3**, wherein said means (g) further includes means to drain off liquid discharged from said fibrous plugs by said compression.

5. Apparatus as set forth in claim **3**, wherein said means (g) includes a continuous conveyor in said passage, a plate movable into and out of blocking position relative to said passage, and force means biasing said plate toward blocking position but releasing said plate when the compression of said fibrous plug reaches a desired maximum.

6. An apparatus for treating lignocellulose-containing fibrous material for the production of paper pulp, including

(a) a steam treating chamber;

(b) conveying means opening into said steam treating chamber and feeding the lignocellulose-containing material in the form of particles into an upper portion of said chamber;

(c) a conduit means connected to said chamber and a steam source connected to said conduit for introducing steam into said chamber;

(d) an elongated, upwardly extending, impregnating chamber and a second conduit means connected thereto feeding impregnating chemicals into said chamber, said chamber having a column of impregnating chemical therein exerting an elevated, hydrostatic pressure in the lower portion of said chamber;

(e) means for feeding chemicals to said second conduit means;

(f) a material conduit interconnecting the lower portions of said two chambers;

(g) conveyor means in said conduit receiving fibrous material from said steam treatment chamber and forcing said material into a compression chamber to thereby form a compressed plug, said compression chamber having a movable blocking means blocking the outlet thereof;

(h) a force means acting on said blocking means to bias it into blocking position but releasable when said compressed plug has reached a preset pressure to suddenly eject said plug into said impregnating chamber whereby said fibers are expanded and impregnated;

(i) conveying means for conveying the thus expanded and impregnated material upwardly in said impregnating chamber; and

(j) outlet means in the upper portion of said impregnating chamber for discharging the impregnated material.

7. An apparatus as set forth in claim **6**, wherein said compression chamber further includes means to drain off liquid discharge from said fibrous plugs by said compression.

8. A structure as set forth in claim 6 wherein said blocking means comprises a pivoted plate and said force means comprises a piston and cylinder acting on said plate, the force exerted by said cylinder being adjustable.

9. A structure as set forth in claim 3, further including

(a) a sealed cooking chamber having a steam source connected thereto providing an elevated pressure in said cooking chamber, and a material inlet; and

(b) a sealed, pressure tight, transfer conduit extending between and connected to said outlet means from said impregnating chamber and said material inlet of said cooking chamber,

whereby said elevated steam pressure will increase the pressure on the impregnating chemical in said impregnating chamber.

10. A structure as set forth in claim 6, further including

(a) a sealed cooking chamber having a steam source connected thereto providing an elevated pressure in said cooking chamber, and a material inlet; and

(b) a sealed, pressure tight, transfer conduit extending between and connected to said outlet means from said impregnating chamber and said material inlet of said cooking chamber,

whereby said elevated steam pressure will increase the pressure on the impregnating chemical in said impregnating chamber.

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HOWARD R. CAINE, Primary Examiner

U.S. Cl. X.R.

162—246