

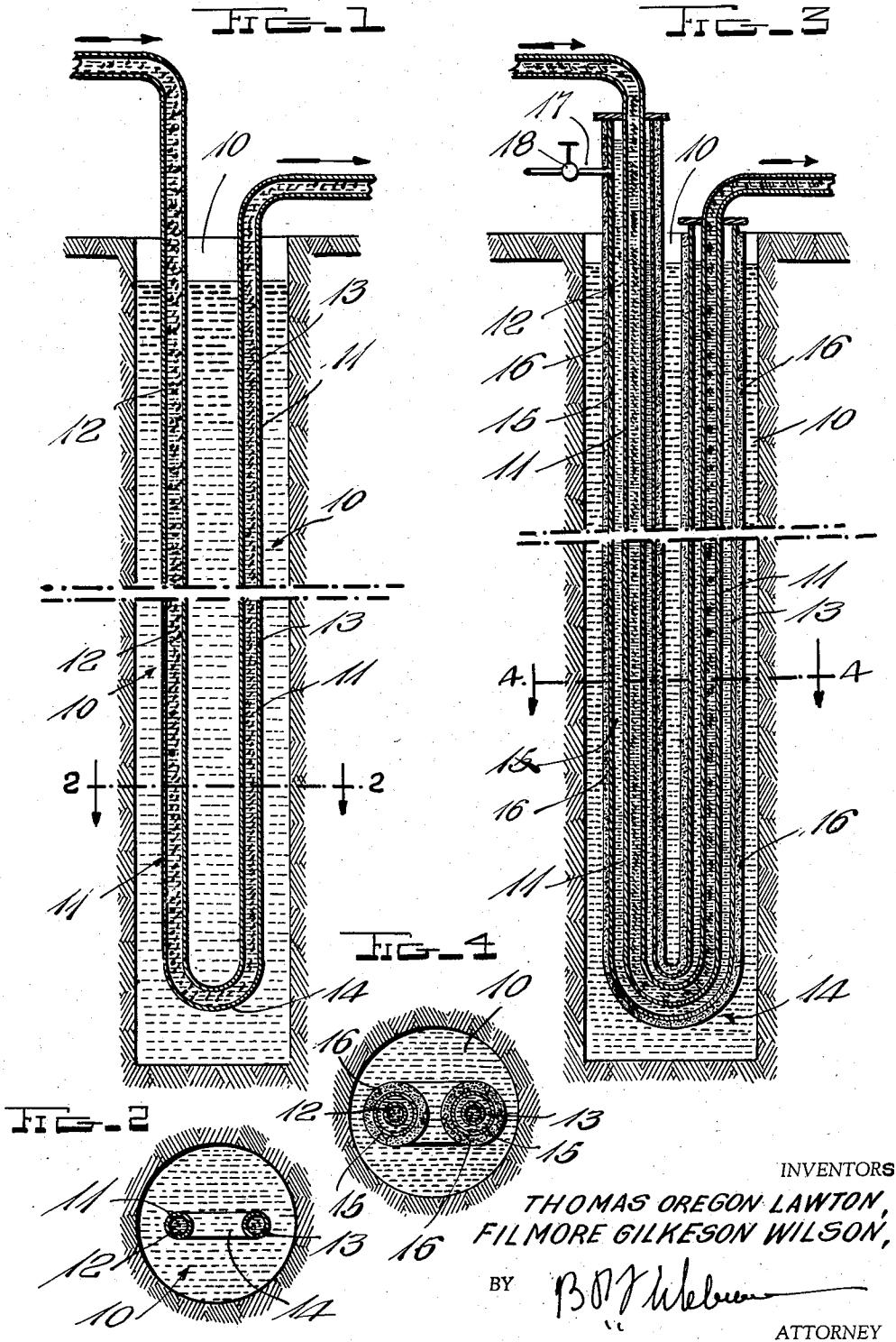
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METHOD FOR CHEMICALLY TREATING WOOD PARTICLES

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METHOD FOR CHEMICALLY TREATING WOOD PARTICLES

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Our invention relates to a method of and apparatus for the continuous chemical treatment of wood particles for the production of wood pulp.

A primary object of the invention is to provide an economical and simplified apparatus and method of the above-mentioned character, wherein an absolute minimum number of apparatus components are employed in a novel manner for carrying out the continuous chemical processing of the wood particles under high fluid pressure, without the necessity for sealing devices, valves, pumps, plugs and the like.

Another object is to provide an apparatus and method of the above-mentioned character which operates while open to atmospheric pressure, but which is capable of producing in the apparatus a tremendous fluid pressure necessary to the carrying out of the chemical treatment, the apparatus being so constructed and arranged that the internal fluid pressure within parts thereof is counter-balanced or offset by external fluid pressure in a hole or well surrounding the apparatus, thereby rendering it unnecessary to utilize heavy or strong material in the portions of the apparatus subject to great internal pressure.

Another object of the invention is to provide means for effecting the continuous flow or passage of the chemical liquor and wood particles through the processing conduit without the use of pumps or the like.

Another object is to provide apparatus of the above-mentioned character which need not embody any large overhead structure, building to house the apparatus or expensive foundation, or the like, and which is capable of developing almost unlimited fluid pressures very economically, the degree of pressure being limited only by the depth to which it is practical and economical to dig or drill a suitable hole in the earth.

A still further object is to provide an apparatus of the mentioned character in which the sections of subterranean tubing may be removed and replaced by flotation, with a minimum of cost and labor.

A further object is to provide a method and apparatus of the above-mentioned character, wherein the fluid pressure in the tube or vessel increases uniformly from atmospheric pressure to a constant and very great maximum, and then decreases uniformly back to atmospheric pressure at the outlet of the vessel, without the use of any control devices whatsoever.

Still another object of the invention is to provide a method and apparatus which may utilize for the treatment tube or vessel thereof relatively thin-walled and inexpensive corrosion resistant tubing, or the like, without fear of the tubing bursting or collapsing in operation, due to the perfect pressure balance upon the tube.

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Other objects and advantages of the invention will appear during the course of the following description.

In the accompanying drawings, wherein like reference numerals are employed to designate like parts throughout the same,

Figure 1 is a central vertical longitudinal section through apparatus embodying a preferred form of the invention and which is utilized in the practice of our method,

Figure 2 is a horizontal transverse section taken on line 2—2 of Fig. 1,

Figure 3 is a central vertical longitudinal section through a modified form of the apparatus used in the practice of the method, part broken away, and,

Figure 4 is a horizontal transverse section taken on line 4—4 of Figure 3.

In the drawings, where for the purpose of illustration are shown preferred embodiments of our invention, attention is directed first to Figures 1 and 2, wherein the numeral 10 designates a deep vertical hole or well in the earth formed by digging or boring or by other suitable means. The well 10 may be of substantially any desired depth, depending upon the degree of fluid pressure which it is desired to create in the apparatus. For example, the well 10 may be approximately 100 feet deep, if desired, and the only limiting factor on the depth of the well 10 is the economic feasibility of digging or boring the well beyond certain practical limits.

The numeral 11 designates generally a U-shaped tube or vessel preferably formed of relatively thin-walled corrosion resistant steel or the like. The U-shaped tube 11 is arranged within the well 10, as shown, and may extend close to the bottom of the well. The tube 11 may be formed of other suitable materials if preferred. The U-shaped tube 11 includes spaced vertical sections or sides 12 and 13, joined at their lower ends by a curved bent portion 14 near the bottom of the well. The tube sections 11 and 12 extend slightly above the open top of the well, as shown, and are open at their upper ends to the atmosphere. The well 10 is likewise open at its top to the atmosphere. The tube section 12 preferably extends a slight distance above the top of the tube section 13 for the purpose of inducing a continuous flow of the chemical liquor and wood particles through the U-shaped tube as the same are introduced into the tube at the top of the tube section 12. The arrangement results in the formation of a slightly unbalanced fluid pressure within the tube sections 12 and 13, due to the fact that the tube section 12 is longer vertically and creates a somewhat greater fluid pressure or head than the tube section 13. Accordingly, when the fluid mass enters and fills the U-shaped tube 11, the same will flow continuously out of the top of the shorter tube section 13, as long as it is continuously introduced into the top of the tube section 12.

In the use of the apparatus shown in Figures 1 and 2 for the practice of the method, a chemical liquor bearing wood chips or particles is continuously introduced into the top of the tube section 12 and fills the U-shaped tube and continuously flows out through the top of the tube section 13, both of the tube sections being open to the atmosphere. The well 10 or space surrounding the U-shaped tube 11 is filled with water or other fluid having approximately the same specific gravity as the chemical liquor within the tube 11. This arrangement main-

tains a perfect fluid pressure balance upon the inside and outside of the tube 11, so that the same will not burst or collapse due to the extremely great pressure at and near the lower end portion 14.

The chemical processing or treatment of the wood chips or particles in the chemical liquor takes place near and at the lower end of the U-shaped tube 11 where the pressure within the tube is at a maximum, and the chemical treatment is dependent upon this very great pressure. The pressure within the U-shaped tube increases uniformly from atmospheric pressure at the top of the tube to a constant maximum pressure at the lower bight portion 14, and then decreases uniformly back to atmospheric pressure at the upper outlet end of the U-shaped tube. The chemical treatment of the wood particles for converting them to pulp will thus take place gradually from some point within the U-shaped tube 11 where the pressure is sufficiently great to induce the desired chemical action, and this treatment or chemical action will be accelerated to a maximum intensity at the bottom of the U-shaped tube and then will gradually decrease and be completed at some point in the outlet side 13 of the tube where the fluid pressure is decreased sufficiently to no longer induce the chemical action. When the chemical liquor flows out of the top of the tube section 13, the wood will have undergone the desired complete chemical treatment for the production of wood pulp.

It is thus seen that the apparatus and method for chemically treating the wood particles for the production of wood pulp requires no outside apparatus in the nature of pumps, valves, pressure boosters, or the like. The system is entirely open to the atmosphere, and the material need only be introduced continuously by any suitable means into the top of the tube section 12 and collected by any suitable means as it flows continuously out of the top of the tube section 13. The portions of the U-shaped tube 11 which project above the top of the well may be supported by or connected with suitable structure, not shown in the drawings merely for the purpose of rendering the U-shaped tube stationary in use. There is no necessity for any elaborate overhead structure or building to house the apparatus, as the tube 11 is substantially entirely enclosed by and protected by the subterranean well. As previously stated, due to the fact that the fluid pressure on the inside and outside of the tube 11 is balanced, extremely thin-walled tube which is quite inexpensive may be satisfactorily employed.

Removal and/or replacement of the tube 11 is rendered quite easy and inexpensive by merely expelling the fluid mixture from the tube gradually with compressed air or the like and allowing the tubing to float out of the well, cutting off sections of the tube as it emerges from the well in lengths suitable for handling. The reverse procedure is followed for installing new tubing within the well.

In Figures 3 and 4 there is shown a modification of the invention, wherein all of the elements described in Figures 1 and 2 may be identical in construction and mode of operation. In Figures 3 and 4, however, an outer U-shaped tube or wall 15 surrounds and encloses the U-shaped tube 11 and is concentrically spaced therefrom, as shown. The outer tube or jacket 15 may be of the same thin-walled tubing as the inner tube 11, and if preferred, the outer tube 15 may be entirely covered with a jacket 16 of suitable heat insulating material. The jackets 15 and 16 enclose substantially the entire U-shaped tube 11 in Figures 3 and 4 and may project somewhat above the open top of the well 10.

As previously described, the chemical liquor having the wood particles therein flows continuously through the U-shaped tube 11 while the well 10 is filled with pressure balancing liquid, such as water. Additionally, hot water or steam or the like is introduced at any point into the outer tube or jacket 15 through a suitable pipe

17 having a valve 18 connected therein. By this means, the chemical treatment or process near the lower end of the U-shaped tube may be carried on in the presence of heat, which in some instances is desirable. The hot liquid filling the space between the tubes 11 and 15 will effect the same pressure balance with the liquids inside of the well and the tube 11 as before described in connection with the first form of the invention, and neither of the tubes 11 or 15 will tend to burst or collapse.

Direct introduction of hot water or steam or the like into the wood-chemical mixture at any point through smaller tubes or pipes connected to the inner wall can be utilized to obtain processing temperatures up to a maximum temperature equivalent to saturated steam at the pressure of the liquid at the point of introduction into the tube.

All other parts and their functions are identical with those shown and described in connection with the first form of the invention.

It is to be understood that the forms of the invention herewith shown and described are to be taken as preferred examples of the same, and that various changes in the shape, size and arrangement of parts and in the sequence of method steps may be resorted to, without departing from the spirit of the invention or scope of the subjoined claims.

Having thus described our invention, we claim:

1. A method of chemically treating wood particles for the production of wood pulp comprising introducing a chemical liquor having the wood particles therein into the top of one side of a long U-shaped vessel while such vessel is substantially submerged within a liquid of substantially the same specific gravity as the chemical liquor, and allowing the liquor to flow out of the top of the other side of the U-shaped vessel while the chemical treatment takes place continuously under high pressure near the bottom of the vessel.

2. A method of chemically treating wood particles or the like comprising introducing a chemical liquor having the wood particles contained therein into the top of a long U-shaped tube which is open to the atmosphere and while the tube is submerged in a pressure balancing liquid, and allowing the chemical liquor to flow continuously out of the top of the U-shaped tube at an elevation somewhat below that at which the liquor is introduced into the tube.

3. A method of chemically treating wood particles or the like comprising introducing a chemical liquor bearing the wood particles into the top of a long U-shaped tube which is open to the atmosphere and while the tube is submerged in a pressure balancing liquid, supplying heat to the tube for heating the chemical liquor therein, and allowing the chemical liquor to flow continuously from the top of the U-shaped tube at an elevation below that at which the liquor enters the tube.

4. A method of chemically treating wood particles for the production of wood pulp comprising introducing a chemical liquor having the wood particles therein into the top of a vertically elongated vessel having a continuous passage for the liquor and a discharge opening near its top spaced somewhat below the inlet opening to the vessel, applying fluid pressure to the outside of the vertically elongated vessel throughout substantially its entire length for substantially counterbalancing the internal pressure in the vessel caused by the chemical liquor, and causing the chemical liquor to flow substantially continuously through said passage of the vessel and out of the discharge opening while the chemical treatment takes place under high pressure near the bottom of the vessel.

5. A method of chemically treating wood particles or the like comprising continuously flowing the chemical liquor into the top of a vertically elongated tubular vessel and out of the vessel at a point near and below the point at which the liquor is introduced into the vessel and while the vessel is open to the atmosphere, and applying

fluid pressure to the outside of the vertically elongated tubular vessel throughout substantially its entire height substantially equal to the internal fluid pressure on the vessel caused by the chemical liquor.

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