METHOD AND APPARATUS FOR LONGITUDINALLY IMPREGNATING WOOD
Monie S. Hudson, Box 2451, Spartanburg, S.C.
Filed May 6, 1966, Ser. No. 548,187
Int. Cl. B27k 3/08

This invention relates to a new and improved method for longitudinally impregnating lengths of wood, including logs, poles and the like, with fluid treating media and further relates to new and improved apparatus for impregnating such lengths of wood.

Today's use of wood requires that it be chemically treated to meet the specific need to which it is being applied. These treatments are designed to overcome the inherent weaknesses or disadvantages of wood, and impart new qualities which extend the usefulness and increase the commercial value of wood. Through treatment, such properties as resistance to decay and insects, resistance to fire, stability against shrinking and swelling, etc. are imparted to the wood.

The basic process for longitudinally impregnating lengths of wood was invented by Boucherie and disclosed in the year 1838 in French Patent No. 11,061. In practicing the Boucherie method, a disc of about 2 to 5 centimeters thickness is cut and removed from one end of a log. Removal of this disc is for the purpose of forming a liquid tight chamber and providing a fresh uncontaminated wood cross section that is not blocked by exudates and is also well wetted by the contained sap. The end of the log, after removal of the disc, is positioned in a chamber which is connected to a source of hydrostatic pressure, for example, a tank 10 to 30 feet above the log end. A treating liquid, such as a preservative solution, is then forced through the log end by this hydrostatic pressure. An inherent defect in the Boucherie process is the very long time, 10 to 21 days, required for complete impregnation of relatively long poles, such as the 30 to 40 foot long poles used in telephone and electric power lines. This defect has provided an incentive for improvement upon the Boucherie process and the prior art is replete with patents which allegedly improve upon this basic technique. In general, the efforts of workers subsequent to Boucherie have been directed toward obtaining a better seal between the end of the length of wood and the pressure chamber. The seal sought by these workers is one that can quickly and easily be applied to individual lengths of wood and which will withstand pressures higher than the 10 to 20 pounds per square inch used by Boucherie.

These modifications of the Boucherie process and apparatus have either been inoperative or so elaborate as to be impractical and have not been well received in the trade. As late as 1953, the basic Boucherie process was the only commercially used technique for longitudinally impregnating lengths of wood.

In addition to the inordinately long length of time required for thorough impregnation by the Boucherie process, a further serious limitation resides in the requirement that it can only be successfully applied to recently felled wood. Thus, if any appreciable length of time elapses between felling the tree and commencement of treatment, satisfactory impregnation cannot be obtained by the Boucherie method. Usually, this method must be applied to timber within 14 days after felling. Since wood-felling operations and delivery of felled timber to an impregnation plant are subject at times to long delays, often occasioned by bad weather, this limitation has been a deterrent to more widespread use of impregnation processes of the Boucherie type.

Accordingly, it is an object of this invention to provide a process and apparatus for longitudinally impregnating lengths of wood with liquid treating media and which obviate the many disadvantages present in the known processes and apparatus.

An important object of this invention is to provide an improved process for rapidly impregnating lengths of wood.

Still another object of this invention is to provide an improved end cap which has a liquid tight seal capable of withstanding high pressures and which is easy to apply and remove from a length of wood.

A further object of this invention is to provide an improved apparatus which facilitates practice of the improved process of this invention.

In attaining the objects of this invention, one feature resides in positioning one end of a length of wood in a treatment zone and introducing a first liquid into the treatment zone at a pressure sufficiently high to cause the liquid to enter the end of the length of wood. After treatment with this first liquid for a period of time, the treated end of the length of wood is cut to remove a relatively thin, solid, wooden disc therefrom. Following this, the freshly cut end of the length of wood is replaced in the treatment zone and is contacted with a treating liquid at a pressure sufficient to cause the treating liquid to enter the freshly cut end of the length of wood and impregnate the length of wood. By proceeding in this manner, the treating liquid flows through the length of wood at a substantial rate and allows thorough impregnation of the wood in a relatively short period of time.

Another feature resides in an apparatus comprising an end cap, the interior walls of which define a treating zone for a length of wood maintained therein with one end thereof adjacent the rear wall of the end cap. The end cap is provided with a fixed or movable retaining ring concentric therewith and adapted to encircle the length of wood and contact a rear retaining ring positioned about the circumference of the length of wood. A front retaining ring is also positioned about the length of wood and a resilient sealing member is provided between the front and rear retaining rings. Means are provided for restraining movement of the length of wood in the end cap. Means are also provided for introducing a fluid into the end cap under pressure for contact with the end of the length of wood.

Still another feature of this invention resides in an end cap as defined above which is composed of front and rear sections which sections can be separated to allow access to the length of wood and thereby facilitate removal of a thin disc from the length of wood after it has been impregnated with the first liquid.

Other objects, features and advantages of the invention will become more apparent from the following description when taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a side view of the apparatus of this invention for longitudinally impregnating a length of wood;

FIG. 2 is a side cross-sectional view of the apparatus of this invention and illustrates the improved sealing means of the apparatus;

FIG. 3 is an exploded perspective view of the apparatus of this invention and illustrates the individual sealing members of the end cap;

FIG. 4 is a side view of another embodiment of the apparatus of this invention.

The improved apparatus of this invention is comprised of an end cap that can be easily and quickly applied to and removed from the end of a length of wood and which can be efficiently used at high pressures, on the order of 50 p.s.i. and above. By using pressures of this magnitude, rapid longitudinal impregnation of the wood is possible.

As shown in FIG. 1, an end cap 10, in accordance with
this invention, has a front section 12 and a rear section 13. Rear section 13 is provided with conduit 14 connected to its end members 15 through which it is introduced into the end cap. Sections 12 and 13 are releasably connected to each other by bolts 16 inserted through brackets 18 and secured in place by nuts 17. Typically, the end cap is provided with four sets of brackets, nuts and bolts, although more or less may be present. As shown in sections 12 and 13 be explained below, guide pins 19 and brackets 20 are provided and aid in positioning sections 12 and 13 of the end cap in place. Rods 21 located in apertures 22 are employed to maintain the novel sealing means of the apparatus in place. Front section 12 is further provided with means to maintain the end cap positioned about log 11. In the embodiment illustrated in FIG. 1, this is accomplished by spikes 23 located in apertures 24 and driven into log 11 to a depth of about 1 inch or more. Equivalents of spikes 23, such as screws, can also be used.

As illustrated, section 13 can optionally be provided with a pressure release means comprising orifice 25 having conduit 28 inserted therein. A manually operated valve 29 is provided to effect release of air while filling the chamber with treating liquid. If air under pressure is forced into the pole end it will greatly hinder the impregnation. Gauges 30 and 31 are used to indicate when the pressure in end cap 10 is at the desired level.

An important feature of the present invention is the arrangement of sealing means in end cap 10. This novel sealing means is comprised of a plurality of individual sealing members. As shown in FIGS. 2 and 3, this sealing means consists of a front retaining ring 40, a strip of flexible material 41, a flexible lap seal 42, a relatively thin sealing member 43 and a rear retaining ring 44. An important part of the sealing means is fixed or movable retaining ring 46 attached to section 13 by means of rods 26, which can be threaded to permit frontward and rearward movement of ring 46. Retaining ring 46 acts to compress resilient sealing member 43 providing a pressure tight seal, as will be described below.

Having now described the end cap of this invention, the manner in which it is affixed to a length of wood, such as a log, a pole, and the like will be set forth. For purposes of illustration, the affixation of the end cap to a wooden pole having a circular cross-section will be described. It will be understood, however, that the end cap can be affixed to lengths of wood having square, rectangular, triangular, etc. cross-sections in which case the apertures for members 40 through 46 will be suitably altered to be square, rectangular, triangular, etc.

Initially, one end of pole 11 is de-barked about 15 to 20 inches from the end 60 to provide a relatively smooth sealing surface. Front retaining ring 40, preferably made of steel and having an inside diameter approximately that of the pole, is placed about end 60 of pole 11 about 10 inches from the end thereof. Strip of flexible material 41, such as a short skien of cheesecloth, is next placed about pole 11 adjacent front retaining ring 40. This acts to correct for any major irregularities in the pole surface. Flexible lap seal 42 having an internal diameter slightly less than the outside diameter of pole 1 is then slipped over the end of the pole and forced against front retaining ring 40 thereby maintaining flexible material 41 in place. Next, relatively thick resilient sealing member 43 is placed about the end of pole 11 and positioned in contact with lap seal 42. Sealing member 43 can be comprised of any resilient material. Foam rubber and inelastic rubber rings are suitable for this purpose, although equivalent materials can be used. While members 41, 42 and 43 are illustrated as being single units, a plurality of each of these sealing members can be employed. Rear retaining ring 44, preferably made of steel and having an internal diameter larger than that of pole 11, is next placed about pole 11 in contact with sealing member 43.

Front section 12 of end cap 10 is then slipped over pole 11 and its encircling sealing members 40, 41, 42, 43 and 44 and rods 21 are inserted through apertures 22 in front of retaining ring 40. Spikes 23 are then inserted through apertures 24 and driven into pole 11 to a depth of 0.5 to 1.0 inch or more. This prevents movement of pole 11 during compression of the sealing means and in operation. Section 13 is then positioned over the free end of the pole by inserting guide pin 19 in brackets 20 to properly align section 13. Rods 21, thus bringing ring 46 into contact with rear retaining ring 44. Bolts 16 are next inserted through brackets 18 and locked in place by means of nuts 17. By tightening nuts 17, sections 12 and 13 are brought in contact and sealed by means of rubber O ring 45. Threaded rods 26 are then run in forcing ring 46 against retaining ring 44 thus compressing sealing members 42, 43 and 44 against the pole and against the wall of section 12 to form a pressure tight seal.

As best shown in FIG. 2, the space defined by the interior walls of sections 12 and 13, pole 11 and its rear end 60, and the previously described sealing members, forms a liquid tight treatment zone for the longitudinal impregnation of pole 11. In operation, a treating fluid is introduced into the treatment zone through conduit 14 connected to hose 15. As the liquid tight seal of this end cap can withstand pressures of 50 p.s.i. up to 200 p.s.i. and above, it provides means for rapid impregnation of the length of wood. With the end cap, poles 20 to 40 feet in length can be thoroughly impregnated in 1 to 4 hours at pressures of 50 to 200 p.s.i. Accordingly, the improved end cap of this invention constitutes a significant technical advance over those previously known.

In addition to providing a liquid tight seal which can withstand high pressures, the embodiment illustrated in FIGS. 1-3 offers the advantage of providing ready access to the end of the length of wood. Thus, by simply turning the nuts 17 and removing bolts 16, rear section 13 of end cap 10 can be removed without disturbing the position of section 12. End 60 of pole 11 can then be inspected or acted upon in accordance with the process of this invention. When the operator wishes to resume treatment, section 13 can be easily mounted to section 12 as previously described.

While it is preferred that end cap 10 be comprised of two sections 12 and 13, thereby permitting ready access to the length of wood, this is not necessary. As shown in FIG. 4, the end cap 50 can be in the form of a single continuous unit. In the illustrated embodiment of single unit end cap 50, rods 21 and apertures 22 have been eliminated. Movement of the sealing means is prevented by screws 23 which are driven into pole 11 just in front of front retaining ring 40. Of course, end cap 10 can be modified in a similar manner or end cap 50 can be provided with rods 21 and apertures 22. Screws 23 can be substituted by any equivalent means, such as spikes. The other features of end cap 50 are the same as in end cap 10, that is, the same sealing means are employed. Naturally, the guide pins 19 and section securing means 16, 17 and 18 are eliminated.

As with end cap 10, end cap 50 provides a liquid type seal which will withstand extremely high pressures and can be used to rapidly impregnate lengths of wood.

As a result of the low pressures which must be used with currently available equipment, the liquid type process is limited by the extremely long period of time required to thoroughly impregnate relatively long lengths of wood and the sole applicability of the process to newly felled timber. It has now been found that a surprisingly simple modification of the Bouchier process greatly increases the rate of flow of treating liquid through the wood, thereby allowing increase being on the order of ten to thirty-fold, and permits rapid and thorough impregnation of lengths of wood that have been stored even several months after being cut.

In accordance with the process of this invention, liquid is forced into the end of a length of wood followed by a cessation of the liquid flow and removal of a relatively thin, solid, wooden disc from the impregnated end of the
length of wood. When the liquid flow is resumed, the flow rate of liquid through the length of wood is greatly increased, on the order of ten to thirty-fold.

In the context of the Boucherie process, the improvement of this invention constitutes a pre-treatment of the length of wood. Standard operation of the Boucherie process includes removal of a relatively thin disc from the length of wood, affixation of a suitable end cap, and impregnation of the wood with treating fluid. It has now been found that if the wood is longitudinally impregnated with a liquid for a short period of time and then a relatively thin solid wooden disc cut and removed from the treated end, the flow rate of liquid through the wood is greatly increased when the end cap is subsequently affixed and treating liquid forced longitudinally through the wood.

In practicing this invention, it is preferred to first remove a thin wooden disc from the length of wood, prior to any treatment. This provides a fresh, uncontaminated wood surface that is not blocked by exudates and is well-wetted with sap. However, if freshly felled non-renewable woods, removal of this initial disc is unnecessary. Removal of this first disc is conventional in the Boucherie process.

Any liquid compatible with the treating liquid can be used in the pre-treatment step. Frequently, it will be most convenient to employ the same liquid which is used to thoroughly impregnate the wood in the second stage, that is, in the conventional Boucherie treatment which follows. However, comparable results can be obtained using other liquids, such as water.

Using any suitable apparatus, the liquid is forced longitudinally through the wood. The length of time during which the wood is treated with liquid prior to removal of the thin, solid, wooden disc is dependent upon the liquid pressure employed. With high pressures, pre-treatment for very short periods of time is satisfactory. For example, a liquid pressure of 200 p.s.i. applied for only 2½ minutes is very effective. Conversely, with long treatment times, low pressures can be used. By way of example, a pressure of only a few inches of liquid applied for a period of four hours has been found sufficient to produce the high rate of flow after removal of the disc and resumption of the liquid flow through the log. Because of the wide range of comparable pressures and times, it is not possible to quantitatively limit the pressure and time which can be employed during this pre-treatment.

As pre-treatment at relatively high pressures, on the order of 50 p.s.i. and above, gives good results when applied for only short periods of time, it is preferred that this pre-treatment be accomplished in an end cap which can withstand high pressures. The end cap illustrated in FIGS. 1, 2 and 3 is particularly useful for this purpose. After the initial impregnation of the length of wood, it is only necessary to remove nuts 17 and separate sections 12 and 13 to expose the end of the wood. This facilitates removal of the thin wooden disc from the end of the log and application of liquid pressures in the conventional manner. With somewhat more difficulty, an end cap such as that illustrated in FIG. 4 can be used to practice the process of this invention. These end caps offer the added advantage of permitting higher pressures, on the order of 50 p.s.i. and above, to be used in the second impregnation step. This process can be practiced with other available end caps and the particular apparatus employed does not constitute a limitation on the process. When only slight liquid pressure is applied during the pre-treatment, the pre-treatment steps can be accomplished by merely slipping one end of a rubber tube, such as a section of automobile inner tube, over the end of the length of wood, hanging the other end over a suitable support, and filling the tube to a depth of several inches with the liquid. By leaving the length of wood in contact with liquid for several hours in this manner, the wood will be conditioned sufficiently that upon removal of the wood.

en disc from the end of the length of wood, subsequent liquid flow under pressure through the wood will be substantially increased.

Important in the practice of this process is that after the initial application of liquid pressure, a relatively thin wooden disc is cut and removed from the treated end of the length of wood. Generally, this disc will be between ½ and 1 inch in thickness. There is no advantage in deviating from this range. In a commercial operation, it has been found suitable to remove a disc having a thickness of between about 0.25 and about 1 inch after the initial liquid impregnation.

In this specification and the appended claims, the word "disc" is used to define the cross-section of wood removed from the end of the length of wood. It is intended that "disc" be interpreted as meaning only circular cross-sections, for when the length of wood has an oval, square, rectangular, triangular, etc., cross-section, the cross-section removed will have an oval, square, rectangular, triangular, etc., configuration.

The following examples will point out, by way of illustration only, certain embodiments of this invention.

EXAMPLE I

In this example, the length of wood to be treated was a Southern Pine pole felled 15 days prior to treatment. One end of the pole was debarked to a distance of 20 inches. A wooden disc one inch thick was then cut and removed from the debarked end of the pole, thereby providing a clean working surface. The end cap illustrated in FIGS. 1, 2, and 3 was then affixed to the debarked end of the pole in the previously described manner. Chromated copper arsenate preservative solution (25% by weight) was then pumped into the end cap under a pressure of 200 pounds per square inch. Treatment with this solution was continued for 15 minutes during which time no appreciable leakage from the end cap was observed. The rate of flow through the pole during this initial treatment was 2.2 gallons per hour per square foot cross-section.

Following this initial treatment, the rear section of the end cap was removed and a disc 0.25 inch thick was cut and removed from the end of the log. The end cap was then replaced and the chromated copper arsenate preservative again pumped into the end cap under a pressure of 200 pounds per square inch. Treatment in this manner was continued for 75 minutes. During this subsequent treatment, which thoroughly impregnated the log with the preservative solution, the flow rate of liquid through the log was measured and was 79.2 gallons per hour per square foot cross-section.

As shown by this example, removal of the wooden disc prior to the initial impregnation with liquid does not result in substantial flow through the wood, as the flow rate was only 2.2 gal./sq. ft./hr. However, when the wooden disc is removed subsequent to impregnation for a short period of time, the flow rate is greatly increased, in this case by a factor of over 30.

While a principal advantage of the present process is its applicability to wood which has not recently been felled, it can also be used to obtain greatly increased flow rates through freshly cut poles, as will be illustrated by the following example.

EXAMPLE II

In this manner, a Southern Pine pole, 4 days after being felled, was debarked as in Example I and a one-inch thick wooden disc cut and removed from the debarked end. The end cap of FIG. 1 was then affixed to the debarked end of the pole and a 2% solution of chromated copper arsenate pumped into the end cap at a pressure of 200 p.s.i. for one hour. At this stage of the treatment, the liquid flowed through the pole at a rate of 6.4 gallons per hour per square foot cross-section. On the following day, the solution was pumped into the end cap again at a pressure of 200 p.s.i., this time for three hours. The flow rate
was 6.1 gallons per hour per square foot cross-section. On the seventh day following felling, the solution was again pumped into the end cap at a pressure of 200 p.s.i. for 1 hour with the flow rate being 4.5 gallons per hour per square foot cross-section. Thus, the flow rate was gradually decreasing with each subsequent impregnation. At this point, the rear section of the end cap was removed and a 1 inch thick wooden disc cut from the debarked end of the pole. The end cap was replaced and the solution pumped into the treatment zone at a pressure of 200 p.s.i. for 1 hour. During this impregnation, the flow rate was 97.5 gallons per hour per square foot cross-section, an increase of about twenty-fold. Example III illustrates pre-treatment at very low liquid pressure.

EXAMPLE III

A Southern Pine pole, 16 days after being felled, was debarked and a thin disc removed in the conventional manner. A section of inner tube was then placed over the debarked end of the pole and filled with 8 gallons of 2% chromated copper arsenate solution. The inner tube was the one which was placed above the pole to give a pressure on the end of the pole of about 8 inches of liquid. After impregnation in this manner for 4½ hours, the inner tube was removed from the end of the pole and a disc ¼" thick was cut off the end of the pole. The pre-treated pole was then placed in the end cap of Fig. 4 and the end cap affixed. Chromated copper arsenate solution was pumped into the end cap under a pressure of 200 p.s.i. and the flow rate immediately measured. Liquid flow rate through the pole was at a rate of 75.3 gallons per hour per square foot cross-section. After one hour, the pole was thoroughly impregnated with preservative. Thus, the practice of this invention is not limited to initial liquid treatment at high pressures or high pressure treatment for lengthy periods of time. Extremely high liquid flow rates are obtained even though the pre-treatment pressure is very low.

EXAMPLE IV

A 1-inch thick disc was removed from the end of a Southern Pine pole 10 days after felling and an end cap affixed as previously described. A 2% chromated copper arsenate solution was pumped into the treatment zone at a pressure of 200 p.s.i. for 30 minutes. Flow through the pole was at a rate of 18 gallons per hour per square foot cross-section. The end cap was then removed, a one-inch thick solid wooden disc cut from the treated end of the pole, the end cap replaced, and the solution pumped into the pole. Liquid flow rate through the pole was 18.4 gallons per hour per square foot cross-section. In order to show that poles treated in this manner retain their high flow rate even after passage of long periods of time, the end cap was removed from this pole and the pole set aside. At the end of one month, the end cap was replaced, no disc being cut from the pole in this instance. The same treating solution was then pumped into the end cap under a pressure of 200 p.s.i. for one hour. The flow rate through the pole was 41.2 gallons per hour per square foot cross-section, more than twice the rate before carrying out the improved pre-treatment step of this invention.

In an attempt to ascertain the reason why removal of the thin disc after an initial period of liquid pressure greatly accelerates the flow rate, extensive experiments have been conducted. Microscopic examination of the outer surface of the first disc removed, that is, the disc removed in a conventional manner prior to treatment with any liquid, and of the end of the pole after the second disc has been removed, has not shown anything to explain this phenomenon. Removal of dirt and resinous exudates by means of detergents, alcohol, and even abrasion with wire brushes, subsequent to cutting off the first disc as conventionally done in the Boucherie process, is ineffective in obtaining the high flow rate provided by this invention. The only manner in which these high flow rates can be obtained is by removing the wooden disc after the initial application of the liquid.

The process and apparatus of this invention can be used to rapidly and efficiently impregnate lengths of wood with a wide variety of treatment liquids. Any of the liquids commonly employed for the purposes of treating wood to preserve it from decay; to make it fire retardant; to dimensionally stabilize the wood, i.e., to prevent its shrinkage and swelling with changes in moisture content; to render it resistant to chemicals such as acids and alkalies, etc., may be employed. Among the examples of wood preservatives which may be utilized are included aqueous solutions of preservative salts such as acid copper chromate, ammonical copper arsenite, chromated copper arsenate, copperized chromated zinc arsenate, chromated zinc chloride, fluor-chrome-arsenate-phenol preservatives, and the like. Oily-type preservatives, such as creosote, creosote-coal tar solutions, and petroleum solutions of oil-soluble preservatives such as pentachlorophenol and copper napthenate can also be used. Among examples of fire retardant chemicals in aqueous solutions that can be employed by the method of the invention are included the fire retardant formulations listed in the Manual of the American Wood Preservers Association and referenced as types A, B, C and D in the Manual.

While the invention has been described with reference to certain preferred embodiments thereof, it will be apparent to those skilled in the art that numerous changes and modifications in the apparatus described and illustrated and in the process can be made without departing from the spirit of the invention. Accordingly, it is intended that the invention be limited only as indicated by the following claims.

What is claimed is:

1. A process for the impregnation of the interior of a length of wood including a log, a pole and the like comprising positioning one end of said length of wood in a treatment zone, introducing a first liquid into said treatment zone to cause the liquid to enter and impregnate said length of wood, cutting said end of the length of wood to remove the first liquid from said end, and then introducing a treating liquid into the treatment zone at a pressure sufficient to cause the treating liquid to enter the end of said length of wood and impregnate said length, said treating liquid flowing through said length of wood at a substantially greater rate than did said first liquid.

2. The process of claim 1 wherein the pressure of said first liquid in said treatment zone is at least about 50 p.s.i.

3. The process of claim 1 wherein the pressure of said treating liquid in said treatment zone is at least about 50 p.s.i.

4. The process as defined in claim 1 wherein said first liquid is a solvent wood having a thickness of from about ½ inch to about one inch.

5. The process of claim 1 wherein said first liquid and said treating liquid are of the same composition.

6. The process of claim 5 wherein said treating liquid is a preservative for wood.

7. The process of claim 5 wherein said treating liquid is a composition for dimensionally stabilizing wood to prevent shrinkage and swelling.

8. The process of claim 5 wherein said treating liquid is a composition for inhibiting attack by corrosive liquids.
9. The process as defined in claim 5 wherein said treating liquid is a fire retardant composition.
10. In a process for impregnating a length of wood including a log, a pole and the like wherein one end of said length of wood is positioned in a treatment zone and a treating liquid is forced longitudinally through said length of wood under pressure, the improvement for increasing the rate of flow through the wood comprising, prior to initiation of said process, introducing a first liquid longitudinally into said end of the length of wood and subsequently cutting said end of the length of wood to remove a relatively thin, solid disc of wood therefrom.

11. An apparatus for longitudinal fluid impregnation of a length of wood comprising an end cap having a rear wall and side walls defining a treatment zone, said rear wall having mounted thereon a retaining ring adapted to encircle said length of wood and engage a sealing means, said sealing means comprising a rear retaining ring and a front retaining ring each adapted to encircle said length of wood and having a resilient sealing member, adapted to encircle said length of wood, located therebetween, means for preventing frontward movement of said sealing means in said end cap, means for releasably affixing said end cap to said length of wood, and means for introducing a fluid into said treatment zone.

12. The apparatus as defined in claim 11 wherein said sealing means further includes a flexible lap seal adapted to encircle said length of wood and having an inside diameter less than the outside diameter of said length of wood, said flexible lap seal being positioned between said resilient sealing member and said front retaining ring.

13. The apparatus as defined in claim 11 wherein the retaining ring mounted on said rear wall is adapted for forward and rearward movement in said end cap to compress said sealing means and thereby provide a liquid tight seal capable of withstanding high pressures.

14. The apparatus as defined in claim 11 wherein said means for preventing frontward movement of said sealing means comprise rods inserted through apertures in the side walls of said end cap in front of said front retaining ring.

15. The apparatus as defined in claim 11 wherein said means for releasably affixing said end cap to said length of wood are elongated members inserted through apertures in the side walls of said end cap and adapted to pierce said length of wood.

16. The apparatus as defined in claim 11 further including means for removing gas from said treatment zone.

17. An apparatus for longitudinal fluid impregnation of a length of wood comprising an end cap having rear and front sections, means for releasably connecting said rear and front sections, said rear section having rear and side walls and said front section having side walls, said walls defining a treatment zone, said rear wall having mounted thereon a retaining ring adapted to encircle said length of wood and engage a sealing means, said sealing means comprising a rear retaining ring and a front retaining ring each adapted to encircle said length of wood and having a resilient sealing member, adapted to encircle said length of wood, located therebetween, means for preventing frontward movement of said sealing means in said end cap, means for releasably affixing said end cap to said length of wood and means for introducing a fluid into said treatment zone.

18. The apparatus as defined in claim 17 wherein said sealing means further includes a flexible lap seal adapted to encircle said length of wood and having an inside diameter less than the outside diameter of said length of wood, said flexible lap seal being positioned between said resilient sealing member and said front retaining ring.

19. The apparatus as defined in claim 17 wherein the retaining ring mounted on said rear wall is adapted for forward and rearward movement in said end cap to compress said sealing means and thereby provide a liquid tight seal capable of withstanding high pressures.

20. The apparatus as defined in claim 17 wherein said means for preventing frontward movement of said sealing means comprise rods inserted through apertures in the side walls of said end cap in front of said front retaining ring.

21. The apparatus as defined in claim 17 wherein said means for releasably affixing said end cap to said length of wood are elongated members inserted through apertures in the side walls of said end cap and adapted to pierce said length of wood.

22. The apparatus as defined in claim 17 further including means for removing gas from said treatment zone.

References Cited

UNITED STATES PATENTS
1,366,616 1/1921 Wheeler 21—68
2,473,480 6/1949 Svensson 21—63
2,884,302 4/1959 Sommer 21—62
2,919,971 1/1960 Loetel 21—7

OTHER REFERENCES

MORRIS O. WOLK, Primary Examiner.
SIDNEY MARANTZ, Assistant Examiner.
U.S. Cl. X.R.
21—62, 63, 68, 71; 117—59, 117, 147; 118—35, 50, 72, 404