No. 626,819.

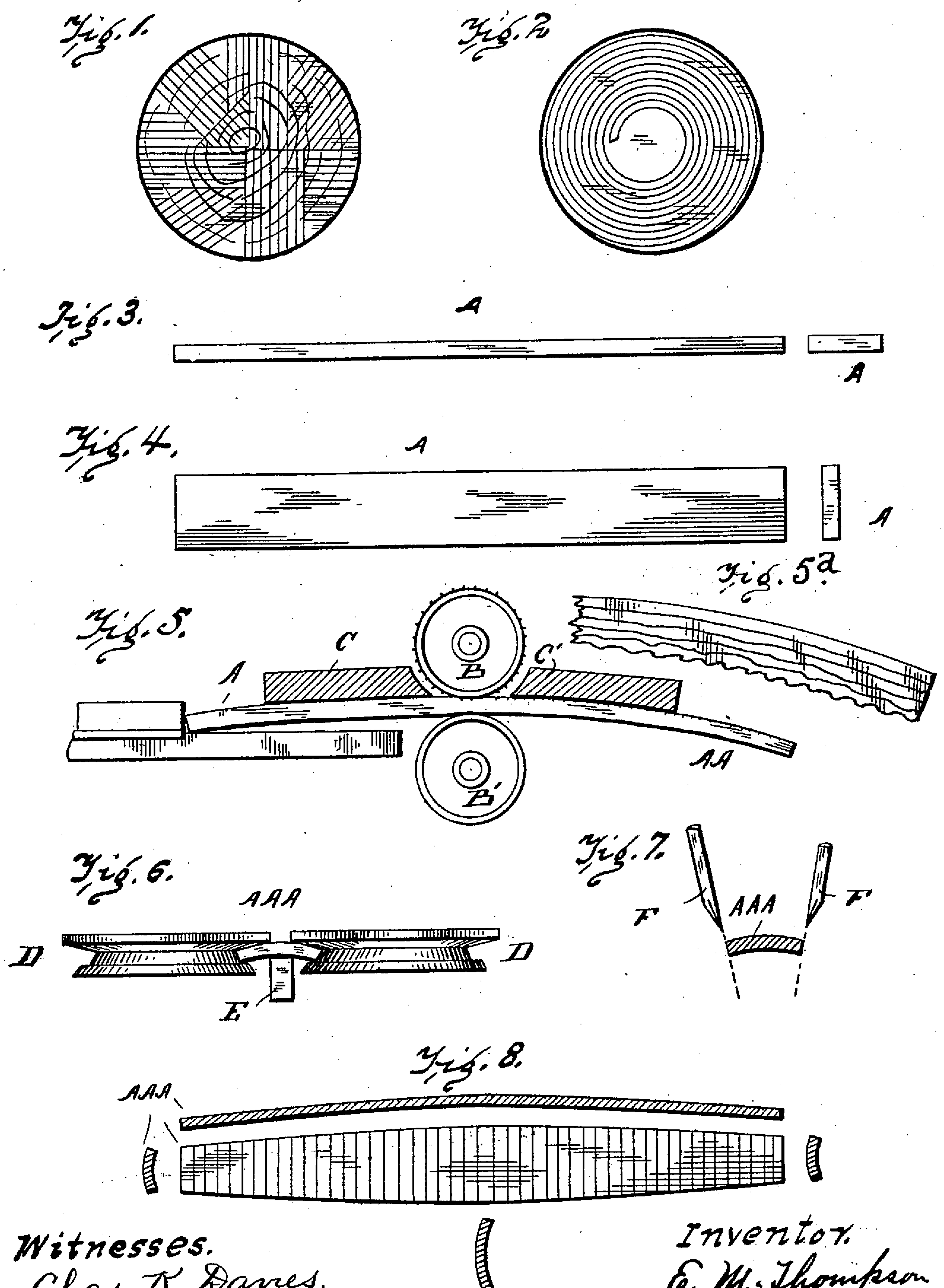
Patented June 13, 1899.

E. M. THOMPSON.

STAVE FOR BARRELS.

(Application filed Nov. 29, 1898.)

(No Model.)



Witnesses.
Chas. K. Davies.
M. E. Brown

Inventor.
E. M. Thompson
By. W. A. Bartlett
Attorney.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

EVERT M. THOMPSON, OF INDIANAPOLIS, INDIANA, ASSIGNOR TO WILLIAM H. HUBBARD, TRUSTEE, OF SAME PLACE.

STAVE FOR BARRELS.

SPECIFICATION forming part of Letters Patent No. 626,819, dated June 13, 1899.

Application filed November 29, 1898. Serial No. 697,756. (No model.)

To all whom it may concern:

Be it known that I, EVERT M. THOMPSON, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented certain new and useful Improvements in Staves for Barrels, &c., of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to staves for barrels, casks, pails, and the like, such as are used for merchandise other than liquids.

The object of my invention is to cheapen the cost of manufacture of such packages of the better grades by using staves properly prepared from made lumber cut as nearly as may be with the laminæ of the wood as it grew, and particularly to produce from such staves slack barrels that show a more uniform rotundity and tighter joints between the staves than are shown ordinarily in slack barrels made from the ordinary kind of staves.

The invention is largely based on changes produced in the cellular structure of wooden staves.

By breaking down and resetting the cellular structure mainly on the inner surface while the slat is bent longitudinally I practically eliminate the tendency to warp, permanently shorten the fibers of the shorter face of the bent stave, so that it will remain bent, and reduce the porosity of the wood, so that it will have less affinity for moisture. By straining the cellular structure of the slat previous to its conversion into a stave in widthwise direction, but not to the extent of breaking down the cellular structure or destroying the elasticity, I provide staves which will compress or compact under the hoop-pressure, but have elasticity to close the joints tightly and expand sufficiently to compensate for shrinkage due to climatic changes, &c. By compressing the fibers of the inner layers or laminæ of the slat to greater extent than the outer in widthwise direction the tendency of the staves to form a true arch in the hoops is increased. These treatments of staves are especially applicable to such as are produced from lumber cut by a constantly-advancing knife from a rotating log or what is known as "veneer-cut" lumber. The objectionable slickness and stiffness of such staves are mitigated or overcome by external corrugation, lateral or longitudinal, or both.

Referring now to the drawings, which are merely illustrative of certain conditions, mechanisms, and modes of treatment which might not otherwise be understood, Figure 1 is an end view indicating a log and showing approximate lines of direction of cut of so-called "radially-cut" staves. Fig. 2 is an end view indicating a log and the lines of circumferential cut by which circumferential lumber is produced, as in veneer-cutting machines. Fig. 3 is an edge and end view, and Fig. 4 a face and end view, of a rectangular slat supposed to be cut from circumferential lumber. Fig. 5 is a diagrammatic representation of compressing-rolls and guides and a slat between the same undergoing simultaneous bending and pressure. Fig. 5ª is an enlarged representation indicating the approximate position of bent-wood fibers before compression. Fig. 6 is an end view of slat between pressing and curving rolls. Fig. 7 is a section of slat, showing inclined knives by which the edges of the staves are cut. Fig. 8 shows plan, edge, and cross-sections of a completed stave with transverse corrugations or ridges indicated on the convex face thereof.

To correctly describe the present invention, it will be necessary to revert to the art of making barrels, firkins, pails, and similar packages.

Barrels or casks for containing liquids are called "tight" barrels and are made by special machines. Barrels for flour, sugar, salt, vegetables, and the like are known as "slack" barrels. The staves of a barrel arch in two directions and the strength of the barrel depends largely upon this double-arched form. The staves of a pail or tub generally arch in one direction only. My invention is applicable to staves either for barrels or tubs and either may be produced. For pails or tubs the staves need not be arched lengthwise, but the hoops will determine this.

While numerous attempts have been made to produce barrels from lumber cut circumferentially of the log, Fig. 2, these attempts have not been largely successful, for the reason that staves made from this circumferentially-cut lumber are very liable to warp and shrink and swell and are stiff and slippery and in other ways objectionable, and many more slack barrels are at present made from staves cut "radially," so called, than from staves cut circumferentially of the grain of the wood.

The best staves as heretofore made are supposed to be cut radially of the log. Referring to Fig. 1, it will be seen that only a few staves can be made from a log on actual radial lines. The radial staves, which are cut quite transversely to the rings of growth, are few in number. Those nearest to the radial staves are more or less oblique to the radii of the log, and as they depart very considerably from radial relation to the grain are called "bastard" staves. They are subject to greater or less degree to the objections heretofore existing in circumferentially-cut staves.

The waste in cutting staves radially is enormous, as there are many triangular pieces of timber unsuitable for staves, and the desire to utilize as much as possible of the timber of the log causes the staves to be made of varying widths. This in turn produces irregularity in jointing, as the curve of the edges of a wide stave must be greater than the curve of a narrow stave, and the bevel also differs, and in slack barrels as made from radial staves the curve and bevel are in general but approximations to the theoretical best form.

The economy of production of lumber cut on a spiral approximately in the direction of the laminæ of the tree is very great, as lumber of great width may be produced by cutting with a constantly-advancing knife from a rotating log in manner well known. The lumber so produced as the basis of my staves should be somewhat in excess of the thickness of the desired stave. Such lumber is cut or formed into what I denominate "slats," of uniform length, width, and thickness, such length being preferably the length of the completed barrel-stave and the width and thickness in excess thereof. These slats are thoroughly dry when subjected to the treatment hereinafter described. A in the drawings indicates such a slat. The grain of the wood in such radially-cut lumber and in the slats A runs pretty nearly in the direction of the length of the slat. The laminæ of the wood produced by the tree growth are superposed nearly uniformly, the layers generally extending substantially the full width and length of the slat, the number of such layers depending on the grain of the wood and the thickness of the slat. As the circumferentially-cut lumber may not be of absolutely straight grain, such conditions of laminæ are approximate, not absolute, but the nearer the laminæ of the wood approximate uniformity throughout the slat the better is the stave likely to be. The width of the slat is generally in the direction of the annular rings of tree growth and the thickness of the slat in direction through the laminæ of the wood or nearly so. Such a slat is less liable to split than a radial slat of like proportions and is much stiffer. Great objections to staves made from lumber heretofore have been that they are too stiff and tend to "cup in," and so depart from the arched shape necessary to make a perfect barrel, that they are slippery, so that the hoops slip from the barrels, and, as has been stated, that they shrink and swell with changes of temperature and changed hygrometrical conditions.

Any departure from a true arched form in any of the staves of a barrel weakens the barrel materially. Barrels of salt, cement, and the like frequently collapse under the weight of superimposed barrels, and almost always by reason of a cup-in stave or staves. A barrel of perfect form hardly ever breaks under pressure, and the strength of such a barrel is enormous.

In carrying out my invention and by a machine to be described in a subsequent application the slats A of radially-cut lumber—that is, with the wood layers extending in the general direction of the length and breadth of the slat and superposed to form the thickness of the slat, said slats being in a dry or seasoned condition—are passed to power-driven rolls, as B B′. These rolls are of great strength and compress the slat very materially—say as much as one-fourth, more or less—in its thickness.

When a piece of wood is bent or bowed lengthwise, the outer fibers do not lengthen, but the inner fibers are compressed and loosened relatively to each other. The endeavor of the wood to resume normal conditions is the elastic energy of the wood. If the cellular structure of the inner fibers be permanently broken down while under the compression strain of bending, the longitudinal elasticity is permanently destroyed in large measure.

The slats A are fed to the rolls B B′ while subjected to the longitudinal bending strain of guide-pieces C C′. The smooth roll B′ acts on the compacted and bent inner surface of the slat and breaks down and compacts the bent and loosened fibers, reducing the thickness of the slat by perhaps one-sixth. The roll B, acting on the convex face of the arch, serves as a bearing against which the compression takes place. This roll preferably has fine longitudinal and sometimes circumferential corrugations, which are impressed into the outer surface of the bent slat.

The amount of compression or breaking down of cellular structure necessary to secure permanent curvature of the slat depends on the character of the material. With some wood it may be necessary to pass it through a series of rolls, increasing the compression; but by one or more passages of slats between rolls of this general character, applying great pressure to a small surface of wood, I am enabled to permanently destroy or largely reduce the longitudinal elasticity of the wood by this breaking down of the cellular structure, and the bend or longitudinal arch of the slats is made permanent, or the slats are so weakened as to stiffness that they can be readily bent and drawn to arch shape by the hoops of the barrel in the further progress of construction. While not so stiff, the slats after passing through the bending-rolls and guides are compacted, and probably stronger to stand external concussion than before the treatment. The corrugation of course tends to reduce the "slick" or slippery condition of the slats. Such a slat, bent or broken down in lengthwise direction, is marked AA in the drawings. The concave face is smooth and the laminæ compressed.

The line of compression is preferably a straight line transverse to the slat. As the slat is compelled at this line to assume the position of the roll-surfaces, any warp which the slat may have had is there eliminated: The slat which may have been warped and buckled is permanently trued by the compacting while under tension.

As the cellular structure of the dry slats is broken down by the pressure and the wood solidified and rendered less porous, the wood is thereafter less subject to climatic and hygrometric changes.

Permanent lengthwise bending of the staves lessens the labor of making a barrel, for it avoids the necessity of using a windlass and heater, as employed in the common process of making barrels.

The permanent compacting of the cellular structure of the slat places the material in excellent condition for the widthwise straining of the cellular structure, which I will now describe.

The bent slat AA is preferably subjected to widthwise compression or partial crushing between the powerful rollers D D, said rolls being formed at their edges in such manner as to impel the slat into an arched position transversely, a guide-piece E assisting in the pressure. A very great pressure may be applied by rolls in this manner, and the wood can be compacted widthwise to a considerable extent, and the transverse arch of the varying pieces is thus formed to a uniformity of curve, and a permanent tendency toward such a form is established in the material. The slat thus arched in two directions is indicated at AAA in the drawings.

The widthwise pressure on the slat must not be so great as to permanently reduce the width of the slat in any material degree and it is left so that the elasticity of the wood in this direction restores it to its old width, but the material having been once partially crushed can be a second time compressed (as by the barrel-hoops) much more easily.

Veneer-cut lumber is more elastic in the direction of its width than radial lumber. This is probably due to the laminated structure of the tree. After the cellular structure of a slat or stave is once strained by the treatment described it will be relatively easy to impel the stave to its arched form, yet the elasticity will remain in the material to close the joints of a barrel.

I find that a piece of wood strained progressively, as by passing between rollers, resumes its former dimensions more readily than if compressed simultaneously, as in a clamp. The order of the procedure of these steps in the treatment of such material in the production of staves might perhaps be reversed, and where more than one pressure is desirable the steps may alternate. The pieces may pass through several machines, but I have devised a single machine to produce completed staves from slats A, and such will form the subject-matter for an application to be filed hereinafter.

The double-arched piece AAA becomes a stave when jointed. I have devised a special machine in which all staves will be jointed with a uniform bevel and taper, but such a result may also be attained by other mechanism.

F F indicate blades by which the beveling or tapering cuts or joints of the stave may be made. These knives or other cutters F are arranged to cut the stave at angles approximating the radii of circles of which the transverse arches of the stave are segments.

In slack barrels the bevel of the edge of the stave is preferably such that the inner edges of the staves are first brought in contact when the barrel is first set up, and the pressure of the hoops closes the joints by compression of the material. In my compressed staves the fiber or cellular structure of the wood having been strained widthwise and the widthwise elasticity of the wood having been developed there is less resistance to the closing of the joints than in the staves as usually heretofore made. Thus the "quarter" of the staves ordinarily provided for is unnecessary with my staves, as the material of the stave once crushed will compress under the pressure of the truss-hoop and barrel-hoops to form tight joints with much less difficulty than would staves not so crushed or compressed.

It is desirable to have all the staves of a barrel of uniform size for strength, appearance, convenience in assembling, and convenience in manufacture. I have devised what I call "ratio" staves with extreme end width of 3.1416 inches and middle width according to the length and bilge of the barrel. With such staves each inch in diameter of the barrel-head adds one stave. A fifteen-inch head requires fifteen staves and an eighteen-inch head eighteen staves.

The staves described herein have been produced after many years of study and experiment and long experience in the manufacture of wooden articles. The nature of the cellular structure of the wood has been carefully studied and the conditions necessary for successful results ascertained. I have commercially demonstrated that barrels made from staves cut from circumferential lumber and compacted, as hereinbefore indicated, are not only absolutely cheaper, but stronger, tighter, more symmetrical and of better appearance than the best barrels made from like material with radially-cut staves. The corrugations on the outer side of the staves give to the barrel a velvety or corduroy appearance, which is quite apparent and may be with the grain or across it, or both. The hoops are tightly held on such a surface, but may be driven on or off with sufficient facility. The corrugations, however, are very slight in depth and do not sever the outer laminæ or layers of the wood.

Of course it will be understood that the arched staves of barrels resist most of the compression strains caused by piling barrels on each other, &c. The expanison strains tending to burst the barrel are resisted by the barrel-hoops.

Other mechanism than rolls might be used for compressing widthwise the wood of the staves—as, for instance, a hydraulic press; but as rolls will apply an enormous pressure quickly, thus "starting" the pithy laminæ of the wood, and as the pressure is quickly removed, permitting the material to resume its normal position as near as may be, I prefer rolls as means for developing compressibility and the consequent widthwise elasticity.

It will be understood from the foregoing that I start with a material (veneer-cut lumber) which is at the extreme as to the objectionable features of stiffness, slickness, tendency to warp, &c., but is about uniformly so. By subjecting this material to a violent quick compression while bent in the long arch and to a considerable compression while bent in the short arch I permanently change the character of the wood, so that the staves produced are of a remarkable uniformity and are tractible and in most, if not all, respects superior to the much more expensive radially-cut staves, which have never been uniform in any considerable number either as to merits or defects.

What I claim is—

1. A wooden stave composed of laminæ extending generally in the direction of the length and width of the stave, and having the cells of its inner layers broken down and compacted mainly on its inner surface so that such layers are shortened, whereby longitudinal curvature is produced, substantially as described.

2. A wooden stave composed of laminæ extending generally in the direction of the length and width of the stave, having the cells of its inner layers permanently compacted to a greater extent than the outer layers, to produce shortening of the inner laminæ and consequent curvature, and having the outer surface transversely corrugated, substantially as described.

3. A wooden stave having the wood laminæ extending in the general direction of the length and width of the stave, and having its layers compacted more than the natural wood structure due to tree growth, the inner layers being more compacted than the outer layers, substantially as described.

4. A wooden stave having the wood laminæ extending in the general direction of the length and width of the stave, and having the lateral elasticity developed by an edgewise compression of the stave, and this arching tendency developed by a greater compression on its inner surface than on its outer surface, substantially as described.

5. A wooden stave having the wood laminæ extending in the general direction of the length and width of the stave, the layers of the wood having been compressed as to thickness more on the inner side than on the outer, and more than the natural wood formation, said stave compacted widthwise not beyond the elastic limit of the wood, substantially as described.

6. A wooden stave having its wood laminæ extending generally in the direction of the length and width of the stave, having the inner layers broken down and shortened to a greater degree than the outer layers, and having the sidewise elasticity developed by sidewise pressure, and having the external or convex surface roughened by corrugations, substantially as described.

7. A wooden stave having its laminæ extending in the general direction of the length and width of the stave, and having its arch tendency in direction of width developed by pressure to the distortion of the original wood structure, the inner layers being strained to greater degree, in widthwise direction, than the outer layers, substantially as described.

8. A wooden stave having the wood laminæ extending generally in the direction of the length and width of the stave, permanently arched lengthwise by the compacting of the cellular structure of the inner layers whereby said laminæ are shortened, and having a tendency to arch widthwise developed by compression and straining of the laminæ in widthwise direction, substantially as described.

9. A barrel-stave, having the wood laminæ extending in the general direction of the length and width of the stave, and having its inner laminæ compacted to a greater degree than the outer laminæ, and to a greater degree than the natural structure of the wood, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

EVERT M. THOMPSON.

Witnesses:

JNO. W. KEALING,

LEWIS C. WALKER.