Mar. 5, 1929. E. C. LOETSCHER 1,703,890

METHOD OF REMOVING KNOTS AND OTHER DEFECTS FROM LUMBER

Filed Feb. 10, 1927

Fig. 1

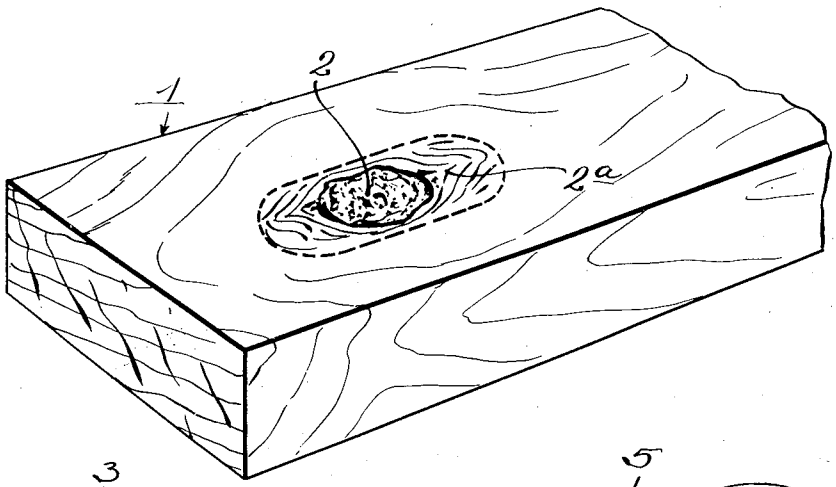



Fig. 2

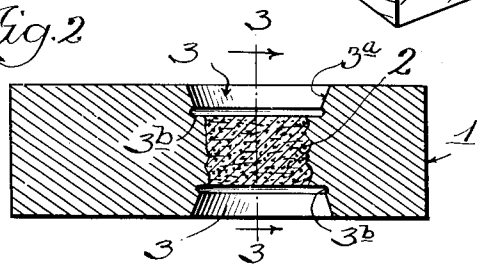



Fig. 4

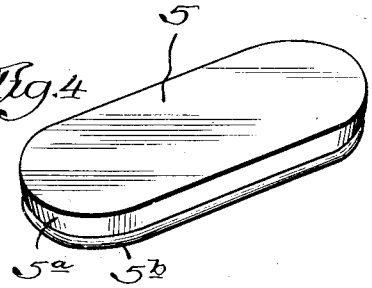



Fig. 3

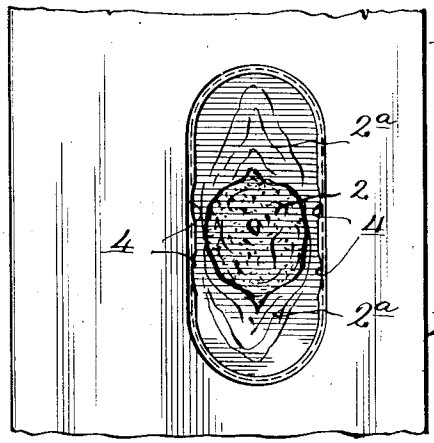



Fig. 5

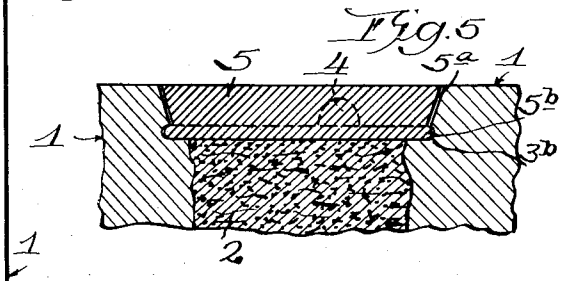
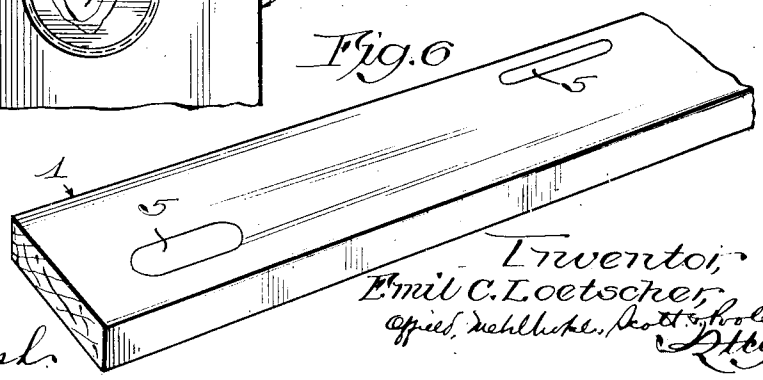



Fig. 6




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# UNITED STATES PATENT OFFICE.

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## METHOD OF REMOVING KNOTS AND OTHER DEFECTS FROM LUMBER.

Application filed February 10, 1927. Serial No. 167,095.

This invention relates to improvements in methods of removing knots and like defects from lumber, and particularly to a process of inlaying pieces of clear wood into the surface of the lumber where knots and like blemishes occur.

The object of the invention is to provide a practical and economical treatment for lumber used in the better class of mill work, such as doors, which require clear lumber free from knots and hence is carefully selected and therefore costly. By the use of my method of removing surface defects, it is possible to use lumber of inferior grades thus effecting a considerable saving in the cost of the stock without detracting from the appearance or quality of the finished product.

A preferred embodiment of my invention is described in the accompanying drawings, in which

Figure 1 is a perspective view of a piece of lumber prior to treatment.

Figure 2 is a view in cross section through the piece of lumber showing the recesses including the surface portions of the knot.

Figure 3 is a plan view of the same piece showing the surface after it has been recessed.

Figure 4 is a perspective view of the plug used in the treatment.

Figure 5 is a sectional view showing the plug inserted in the recess; and

Figure 6 is a perspective view of the piece of lumber showing the appearance after treatment.

It will be understood at the outset that the method here involved seeks only to remove and replace the surface portions of the knot, leaving the heart of the same intact.

Thus in Figure 1 is shown a piece 1 of relatively thick lumber, such as would be suitable for making the stiles or frame members of a door or the like. Passing through the piece is a knot 2 of the usual hard resinous character with its ends (usually of an irregular oval shape) exposed on opposite sides of the piece.

In the main, the treatment of the knot consists in cutting out the surface portions of the knot including the resinous portions which surround the knot and inserting or inlaying a plug of clear wood into the recess thus formed. While such a method may appear to be an obvious expedient, the merit of the present method of treatment resides in the novel method of forming the recess and plug whereby the inlay becomes an integral part of the whole without the use of an adhesive agent. As shown in the drawings, the recess 3 is of elongated oval shape with its major axis extending in the direction of the grain of the wood and having straight parallel sides and rounded ends. The length and width of the recess is governed by the size of the knot, including the surrounding resinous wood $2^a$, which invariably extends from the knot in opposite directions with the grain of the wood. Moreover, the particular shape of the recess is the result of the method of cutting and the style of cutter used. In depth, the recess is relatively shallow, since ordinarily it is not necessary to cut deeper than $\frac{3}{16}$ or $\frac{1}{4}$ of an inch. The sectional contour of the recess, which is uniform throughout, presents a tapered or beveled wall portion $3^a$ throughout the greater portion of its depth, which slopes inwardly from the top edge to a point short of the bottom of the recess, where it joins a rounded undercut kerf or groove $3^b$ extending around the bottom of the recess. The degree of taper or slope of the beveled wall portion $3^a$ is relatively gradual, although 10° to the perpendicular being about the limit, which will enable the plug to be inserted.

The recess is preferably formed or cut by using a rotary cutting tool, termed a routing cutter, which may be described generally as a bit having an extreme diameter equal to the width of the recess and having its cutting edges shaped to correspond to the contour of the recess to be cut. The cutter is driven to rotate axially at a relatively high speed, so that the surfaces will be comparatively smooth and clean cut. In operation, the cutter presents a circular cutting edge, so that in forming the recess it is first sunk axially into wood at a point between the ends of the recess to be cut, and when the proper depth is reached, is shifted transversely until the initial circular recess is elongated to the desired length. Owing to the fact that the cutter has an undercutting edge at its base extending laterally beyond the tapering cutting edges above, the sides of the initial sinking cut are straight, but when the recess is complete there remain notches 4, 4 in the opposite side walls of the recess where the cutter has cut through the beveled wall. Likewise in

withdrawing the cutter, a similar pair of notches would be formed, unless care is taken to withdraw the cutter at the same point where it entered in making the initial cut. While these notches can not very well be avoided, their presence is not a detriment but rather a desirable feature, since they afford a means of escape for the air which otherwise would be entrapped in the recess when the plug is inserted and thus prevent a perfect fit.

The plugs or inlays 5, as already suggested, are pieces of clear wood having as nearly as possible the same grade, color and graining as the wood being treated and cut to exactly the same size, shape and contour as the recess. Somewhat the same method of cutting the plugs is followed as in cutting the recesses, the preferred method being to use a routing cutter which is the reverse of the recess cutter, that is, its cutting edges have the same profile as the edge of the recess. Thus the plug would have beveled edge portions $5^a$ tapering inwardly and a rounded bead $5^b$ around its lower edge. However, in practice the plugs are cut with the beaded edge uppermost, so that the cutter can travel entirely around the circumference of the plug before it is severed from the strip or slab from which they are cut.

After the plug or plugs have been made they are dried in a kiln which draws out the moisture and causes them to shrink to less than their normal size. It may even be desirable to first moisten the wood before cutting the plugs so that the amount of shrinkage will be even greater when the plugs are dried.

The dried plugs 5 are then pressed into the recesses 3, there being sufficient clearance due to the shrinkage to allow the bead $5^b$ to enter the undercut groove $3^b$ at the base of the recess without distorting the wood, as shown in Figure 5. Once a plug is in place, it will absorb moisture from the atmosphere, and as its normal moisture content is restored, will expand to its initial size and fit within the recess with such tightness as to become practically integral with the wood into which it is inlaid.

Owing to the shape of the plug and recess, it is not necessary to use glue or other adhesive to hold it in place, although it may be used if desired. In all other methods of which I have knowledge, circular plugs with straight sides are used, which depend entirely on adhesive to hold them in place, and hence are secure only as long as the adhesive does not deteriorate. In the present method, the permanence of the treatment is not dependent upon adhesive owing to the interlocking character of the joint between the plug and the body of the wood. After the plug has been inserted, the surface is dressed and the lumber is ready for use.

In practice, the material thus treated is used largely for work that is to be painted or enamelled. It, of course, can be used for a varnished finish although it is not quite so satisfactory since it is difficult to conceal the outline of the plug unless particular pains are taken to match the grain. For painted finishes, however, the plug is entirely concealed, and in this connection, the glueless joint avoids any possibility of the glue discoloring the paint or enamel finish.

The shape and size of the area treated will, of course, depend on the size and extent of the knot or other defect on the surface of the lumber. Thus in Figure 6 will be seen several shapes of plugs, although invaribly they will be elongated. However, the shape of the recess is not the important feature of the invention, but rather the method of cutting the recess and plugs, and in this connection, also, I do not wish to be limited to the exact sectional contour of the recess or plug disclosed, since an interlocking joint may be produced by a somewhat different cutting of the edges.

Having disclosed a preferred embodiment of my invention, I claim:

1. A method of removing knots and like defects from lumber, consisting of cutting a circular recess into the surface to a predetermined depth with a rotary cutting tool having a beveled cutting edge and an undercutting edge at its lower end, shifting the tool transversely to form an elongated recess having an undercut beveled edge, cutting a plug from clear lumber having complementary beveled edge and a bead to fit within said recess, shrinking said plug and pressing the same into said recess.

2. A method of treating lumber for the purpose described consisting of cutting a recess in the surface to a predetermined depth to include the area to be treated, said recess having beveled sides and undercut groove below its top edge, forming a wood plug of the same shape and contour as said recess, and pressing said plug into said recess.

3. A method of removing knots and other defects from the surface of lumber consisting of cutting a recess in the surface, having its sides tapering inwardly from the top, and an undercut groove about its bottom, forming a plug from clear lumber of the same size and sectional contour as said recess, and pressing said plug into said recess.

4. A method of removing knots and other defects from the surface of lumber consisting of cutting out the surface portions of the knot with a rotary cutting tool shaped to cut a relatively shallow recess, having side walls beveled to converge toward the bottom of said recess and an undercut groove below the beveled portion

of said side walls, cutting a plug from clear lumber of a size and shape to the same dimentions as said recess, and having complementary diverging beveled side walls and a bead about its lower edge, and pressing said plug into said recess.

5. A method for treating lumber for the purpose described, consisting of removing the area to be treated with a tool capable of cutting a recess having convergent sides and an undercut groove, cutting a plug of clear lumber of the same size and contour as the material removed, and forcing said plug into said recess.

6. A method of treating lumber for the purpose described, consisting of cutting an elongated bevel sided recess in the surface to a predetermined depth and including the area to be treated with a tool capable of forming an undercut groove around the bottom of said recess, cutting a plug from another piece of lumber of the same size as said recess, having a bead about its lower edge and pressing the plug into said recess with sufficient pressure to force said bead into said undercut groove.

7. A method of removing knots and like defects from lumber, consisting of cutting a circular recess into the surface to a predetermined depth with a rotary cutting tool having a beveled cutting edge and an undercutting edge at its lower end, shifting the tool transversely to form an elongated recess having an undercut beveled edge, cutting a plug from clear lumber having complementary beveled edge and a bead to fit within said recess, and pressing said plug into said recess.

Signed at Dubuque this 7th day of Feb., 1927.

EMIL C. LOETSCHER.