BRIEF DESCRIPTION OF THE
MANUFACTURE OF BEER
AND WHISKEY BARRELS

Information Reviewed and Reaffirmed
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Numerous requests are received at the Forest Products Laboratory from persons desirous of obtaining information on the tight cooperage industry, especially the types and quality of material used for staves and heading and the various steps in the manufacture of beer and whiskey barrels from the standing tree to the finished product. The following general description of the methods used has been prepared to meet this demand. It should be pointed out, however, that the increased demand for beer and whiskey barrels that has existed for the last year or so cannot be expected to continue indefinitely, and that the manufacture of oak staves, heading, or barrels, should not be undertaken, therefore, without a thorough investigation of the probable future demand as well as the present needs for tight cooperage. For specific information on wood requirements, dimensions of various classes of stock, details of inspection, etc., the reader is referred to the "Grade Rules and Specifications Covering Tight Barrel Staves and Headings" issued by the Associated Cooperage Industries of America, St. Louis, Missouri.

The manufacture of beer, whiskey, and wine staves and heading is highly specialized. The only wood currently used for staves and heading for alcoholic liquor containers is white oak. The quality of oak required is the very finest. The only white oak generally recognized as suitable for beer staves and heading is the so-called genuine or "forked-leaf" white oak (Quercus alba). Upland oak is preferred to that growing at lower elevations; most of the stave and heading mills are located, therefore, in the higher, rougher parts of Arkansas, Missouri, Kentucky, Tennessee, and adjacent states.

Staves and Heading for Beer Barrels

The making of beer staves is a painstaking operation. Only the best white oak trees are selected for stave making -- trees with clear trunks 20 inches and over in diameter. The timber is felled and cut into sections of the
proper rough lengths. For convenience in handling the sections are split radially into roughly triangular bolts. Since beer staves must be practically free of sapwood and also free of defects, the outer layers of the bolts and the wood near the center containing heart defects are discarded leaving the clear middle portion available for staves. Rough stave blanks are made by hand by splitting bolts along the prominent pith rays which extend radially from the center toward the outside of the tree. These blanks are, in the larger sizes, approximately 2-1/2 inches by 5 or 6 inches in cross-section and up to 32 inches in rough length. While yet green the stave blanks are run through the "bucker" which puts the proper curvature on the inside and outside of the stave, or through the "dresser" which not only gives the stave its curvature but also dresses out the inside to required form. Most of the sapwood and the rough edges are removed from these blanks by a preliminary shaping on the "lister" at the stave mill. The rough staves are normally stacked crib fashion to air season for about 90 days before further refinement or shipment to cooperage factories. It has been standard practice for many years to thoroughly air dry staves and heading, but during recent years, as a result of the accelerated demand for stock, considerable kiln drying has been done. There is no question but that it is entirely possible and practicable to kiln dry staves green from the log so as to produce barrels as good, or even better, than those made of previously air-dried staves. A high grade kiln operator and good equipment are necessary, however, for really good results. A study of the moisture content of beer barrels in service indicates that the staves and heading should be either air dried to a moisture content of 18 percent as an average between the inside and outside of the stave or kiln dried to an average of 16 percent.

Heading and staves for beer barrels are generally made at separate plants, although it is not uncommon for one company to produce both staves and heading. The requirements of heading stock are as exacting as for staves. The material must be quarter-sawed white oak of the highest quality. Heading is made from short bolts, usually split radially into four or more pieces to facilitate sawing.

Beer Barrels

Beer barrels are commonly made at, or near, the point of use. Staves and heading in various stages of manufacture are shipped to cooperage plants where they are finished and made into the barrels. Staves are usually delivered ready for jointing. This operation puts the bevel on the edges and the taper from the center to the ends of the staves. They are then steamed for a time, after which they are bent to form by end pressure and each secured by a "span dog" which preserves the form of the stave until the proper number are assembled to form the barrel. Temporary hoops are applied to keep the staves in place. The span dogs are then released and the staves evened by dropping the barrel to the floor. The rough barrel is next placed in a machine which makes it ready for the heads. It is crozed (furrowed out for the head), chamfered (beveled at end), and howeled (surfaced on the inside)
all of which can be accomplished in one operation. Pressure on the barrel is then released to a point where the heads can be inserted.

Heads of beer barrels are made by dowelling together several relatively narrow pieces to make a square of the proper size for circling. The bevel on the edge of the head is made to fit the croze on the barrel. Dry "flagging" (reed), usually made from cat-tail leaves, is inserted between the staves near the ends and between the pieces making up the heads to prevent leakage. When the heads have been inserted, permanent hoops are applied. The bung is bored, the bushing set, and the barrel is finished. It is then inspected thoroughly for defects that affect serviceability and stored for shipment.

Staves and Heading for Whiskey and Similar Barrels

Bourbon, whiskey, alcohol, spirit, and wine staves and heading may be of white oak or any species of white oak that may be suitable for those purposes. The very finest staves in the above classifications are hand rived to get perfectly straight-grained stock comparable with that used for beer barrels. The bulk of the staves, however, are sawed from the bolts by means of a cylinder saw. Sawing greatly increases production and reduces waste. The average quality of sawed staves, however, is somewhat below those made from hand-rived stock.

The woods operations in making Bourbon and similar staves are in many respects like those employed in producing beer staves. The trees, however, may be of smaller size. The trunks are cut into sections about 36 inches long. The portion between the sapwood and the heart center is cut radially into more or less rectangular bolts. These bolts are commonly about 6 or 7 inches thick by 8 inches or 10 inches wide in cross-section. As a rule a trunk section yields only one circular row of bolts. If the tree is large, trunk sections may yield two circular rows of bolts. The bolts are hauled to a stave mill usually located in the vicinity where they are stacked for sawing. The rough staves are made by using a barrel-shaped saw which gives them the proper curvature on both sides. The bolts are placed on the carriage for sawing in such manner that each stave cut presents a quarter-sawed appearance on the wide face. The rough staves are stacked in hollow square piles where they are left to air season for 60 to 90 days. Bourbon and similar staves are commonly 3/4 inch, 7/8 inch, or 1 inch in thickness when finished. They average about 4-1/2 inches wide at the bilge. To meet specifications the number of staves per barrel must not exceed 21. The rough staves, when air dry, are sometimes given a preliminary jointing to remove rough edges and sapwood.

Heading for Bourbon and similar barrels for alcoholic liquors is commonly made from bolts. Heading bolts are usually 20 inches or 24 inches long. The bolts are split radially into four or more pieces, each of which is sawn into quartered stock of the thickness desired. Heading is generally air seasoned at the point of manufacture.
Staves and heading are usually shipped to cooperage plants in an air seasoned condition. Because of the present demand for tight cooperage stock some staves and heading are now being kiln dried green from the saw. The moisture content of air-seasoned staves and heading for whiskey barrels is probably from 15 to 20 percent, or about that to which the barrels will naturally come in service. It is universal practice, however, even though the staves may be air seasoned first, to kiln dry the stock finally to a moisture content of from 8 to 12 percent in order that the staves may swell and thus tighten in service.

Whiskey and Similar Barrels

The first mechanical operation on the staves at the cooperage plant is jointing. The proper bevel and taper are put on in that operation; also jointing removes excess sapwood and other defects not permitted in staves. The properly jointed staves are assembled into barrels by placing them inside a 21-inch end truss hoop. A second 27 to 30-inch truss hoop is forced upward to hold the staves in a flaring position. While in this condition the barrel is steamed. This is done by passing the barrel on an endless chain through a steam box for one-half hour to 1 hour. The temperature of the box is maintained at about 200° F. When the barrel has reached the end of the line it is "windlassed," that is, a wire rope is thrown about the flaring staves and they are brought close together. A second truss hoop is forced on and the barrel assumes its characteristic shape. The barrel without heads, properly trussed and with staves evened by dropping to the floor, is placed over a gas or coke flame for drying and setting which requires several minutes for each end. It is then placed over a wood flame for charring. This operation requires 1 to 2 minutes, depending upon the depth of charring desired. The heads are charred separately. The croze (groove for head) and the chime (bevel at end of stave) are put on the barrels in one operation. The assembly of the barrels is continued by inserting the heads. They are then planed and sanded, and permanently hooped. The completed barrel, if it passes inspection, is now ready for use.