THE BURL INDUSTRY IN THE NORTHWEST

By

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INTRODUCTION.

Little has been written concerning burls. Usually, when mention is made of them it is incidental to something else. Occasionally, brief articles are noted in the newspapers, or in some forestry publication. Such articles are usually attendant upon some current movement in the production of burls. A description and a definition are ordinarily given because many people aren't acquainted with this forest product, and many of those who are have only a hazy notion of a burl as a commercial product. This author has been unable to find anything approaching a complete discussion of the subject. The increased use made of burls in the past few years and the present size of the industry makes a thorough discussion worthy of interest. This thesis will attempt to cover the subject in all its phases as completely as possible. The burls discussed will be chiefly of those species native to the Pacific Northwest.

Material from various publications has been incorporated and used whenever it was found pertinent. Information has been secured from various producers, the Forest Service, and others informed on the subject. The author has drawn largely on his own experience in producing burls for much of the material concerning production.

HISTORY OF THE USE OF BURLS.

The history of the use of burl wood can only be sketchy due to lack of information to be found on the subject. However, the proof (2), that veneering and the art of veneering had their origin more than thirty-five centuries ago, are
the existing specimens of Egyptian furniture which have survived the long period of oblivion. Egyptian tombs have been opened and the examples found stand as mute testimony to the taste, skill, and artistry of these early craftsmen who made furniture for the Pharaohs. There was little wood to be had in Egypt; so rare woods were imported from India. Besides the ebony, rosewood, and teak logs and wood, there was a much smaller amount of burl such as amboyna, thuya, and probably others.

Evidences have been found of the use of figured woods in the early Babylonian, Assyrian, Greek, Roman, and Oriental civilizations. As a people became prosperous they sought luxuries and things ornamental, one phase of which was invariably the use of figured wood for highly decorative purposes.

Decorative furniture was quite in evidence in Europe in the seventeenth century. A table is described as "A highly finished table made of maple wood has a plain frame veneered with knotted portions of the maple." An escritoire of the period is described as "red deal overlaid with thin veneers of walnut and fine, knotted pollard oak."

In this country in the early days the settler's tastes for furniture were affected by the ideas that they brought from Europe. When they became well enough established to turn their thoughts to decorative furniture they went to the vast hardwood regions of the eastern and central states. Probably, more bird's-eye maple was used than all species of burl put together. Of course, the reason for this was that burl was more rare, harder to get, and more difficult to work, but
by this same token it became more highly prized. Maple burl was used early. Also, black walnut, cherry, and ash were in demand.

One of the most unusual of the exhibits(11) at the Buffalo Hobby Show, in 1937, was a display of antique burl bowls collected by Mr. H.M. Wiltsie of Kenmore, New York. It is said that the Indians in this country made wooden dishes and traded them with the white settlers particularly in New England. These bowls are quite often found in the hard timber belt of New England and New York. One cannot tell whether the Indians were the first to make the burl bowls or whether they copied them from the white settlers.

With a steady demand and a high price the supply of burls was rapidly cut out in the east. It is a relatively new industry on the Pacific coast. Production has only reached a size worthy of note in the last fifteen years. In that short time nearly everything, that has been readily available, has been cut. The burls that are left are largely those that have been overlooked or else they have been too inaccessible to be produced with a profit. It is quite likely that the industry will come to an end when the virgin supply has been entirely cut out. Of course, as the supply decreases the same country will be covered again and some of the burl, that was rejected in the first cut, will be taken.

DEFINITIONS AND POSSIBLE CAUSES.

A burl (9) is an abnormal excrescence or irregular growth forming at the base of a tree or upon the trunk. The growth may be of a wide variety of forms, sizes, or shapes. The wood
comprising the burl is a gnarly, interwoven mass of dense tissues, due to the presence of dormant buds or new buds that do not have a chance to develop. The surface of a burl, inside the bark, is covered with conical projections or spines, each terminated by a bud having a small central cylinder of pith. When these are cut across, by making a tangential cut, the wood encircled pith resembles the eye of a bird or small animal. The bark on trees having a burl figure presents a twisted appearance contrary to the ordinary pattern, making it easy for the experienced eye to recognize the existing figure even though there may be no bulging of the wood present. On the other hand, there may be a swelling on the tree in which there is no figure and this also may be recognized from the outer appearance of the bark.

The theory ordinarily advanced for the cause of burl growth is that of injury or disease. However, the wood shows no pathological defect upon examination, and differs from other wood only in that it has dormant buds present and the high degree to which it is figured. Suppression has been mentioned as a possible cause. The burl habits of madrone tend to disprove this suggestion. Burls on madrone are found most frequently on trees growing on the ridgetops, where the madrones are the dominant species present. Frequently, in such situations, they grow in a mixture with Oregon white oak, California black oak and second growth Douglas fir, overtopping the other species present. The madrone growing on the hillsides and in canyons, and which are much more suppressed by overtopping species such as Douglas fir, do not burl nearly
so often. There is a possibility that the shallow soil characteristic of ridgetops might have some formative effect. Good burls are often found in deep soil, however. Maple is a species that grows extensively in the bottom lands, and is probably more prone to burl than any other species. Quite often it is found that a large percentage of the individuals of a species in a certain locality tend to burl, while in other localities under seemingly similar conditions there may be a very low percentage. In view of this observation it would seem logical that the tendency to burl might be an inherent characteristic. At the present, there is certainly as much proof attendant to this theory as there is to any other.

In connection with the theory of heredity as a cause of burls, it is interesting to note some experiments (7) started by the Forest Products Laboratory. They have made grafts from highly figured bird's-eye maple in an attempt at rapid reproduction to supply the demand for this wood. If these experiments prove successful it would lend credence to the idea that burl figure might also be hereditary.

In describing burl it might be well to differentiate between burl and bird's-eye growth. Where the figure in burl is a result of a conical projection the bird's-eye figure is the result of a conical indentation of the grain toward the pith of the tree. The indentation is not due to a dormant bud or there would necessarily be a projection as in the case of burl. When such grain is cut across, as in rotary cut veneer, the distorted grain roughly gives the appearance of
a bird's eye. When a log of wood containing such grain is
split on a plane tangent to the annual rings, projections
are found upon the face of the piece that has been split from
the log. When the "bird's eyes" are large in size and num-
erous, the wood often becomes additionally figured by curly
grain, which adds to its attractiveness.

The bark adjacent to the wood containing the "bird's
eyes" follows the same contours that the wood does. A cross
section through the middle of the "bird's eyes", so as to ex-
pose an end view of both bark and wood, shows a projection
of bark inward into the indentation that constitutes the
"bird's eye". This indentation is apparent in the bark in
the form of rounded depressions, and is a characteristic by
which bird's-eye figure is recognized in the tree.

Another thing, about which people are sometimes confused,
is the difference between burl figure and stump figure. It
is common in the case of black walnut (S) to apply the mis-
nomer of "burl" to stumpwood. The figure in stumpwood is due
to the twisted grain caused by the roots branching off from
the stump. The distorted grain gives a highly decorative
effect when properly cut. A similar figure is obtained from
crotches. They are produced by cutting off the branches im-
mediately above the fork and taking a four to six-foot length
below the fork.

There are two general types of burl, stump and cluster
burl, recognized commercially. Stump burl is usually of a
better form for manufacture and has a better figure; there-
fore it commands a higher price on the market. It is formed
at the base of the tree and at times may be partly covered with dirt and debris. As a rule, however, the extent of the burl is in plain sight above the ground, discounting the idea sometimes held that the main part of a stump burl is hidden beneath the ground surface. The burl may extend up the trunk from a foot and one half to four feet or more in those large enough to be marketed. The stump burl is ordinarily a solid mass of figured wood. Cluster burl is formed in growths on the trunk of the tree. It has the same figure as stump burl but it may not extend into the trunk to any great distance. There, also, may be patches of burl interspersed with patches of straight wood. Sometimes there may be wood having a different type of figure between the patches of burl, making it possible to obtain a more valuable flitch.

**IMPORTANT SPECIES OF BURL WOOD.**

Burl isn't peculiar to any particular species or small number of species. Upon occasion it is found upon nearly every species, conifer and hardwood alike. However, there is a tendency for it to be much more common to some species than to others. Also, in some cases, burl is better developed as to shape, size, figure, and freedom from defect. For instance, Douglas fir occasionally produces a burl which would be satisfactory except for the fact that such burls are almost invar-
I ably infiltrated with pitch, which makes them worthless. On other trees burl may be produced which does not attain a size large enough to be of any value. So, for one reason or another, the number of species in the Northwest producing burls of commercial importance narrows down to a very few.

**Maple**

Of these, the most important, in the light of the amount produced, is bigleaf maple (*Acer macrophyllum*). Maple (12) is quite common west of the Cascades throughout Oregon and Washington. It grows along the borders of the foothills, along low mountain streams and reaches its largest size in the alluvial river bottoms. The Willamette Valley and its foothills have been the greatest source of the production of maple burl. Smaller amounts have been produced from other localities throughout the range of this tree.

Burl is quite common on maple, being found more frequently than on any other species in the Northwest. It isn't at all uncommon in some localities to find burl wood on half the trees present. There may be a tendency for burl to form more frequently on trees growing on the drier sites. Whether this be a fact or not, it is certainly true that those growing on dry sites produce a better burl for a commercial product. The burls on trees growing on dry sites are of a better shape and figure, and are more free from defect and decay.

The percentage of decay and defect in maple burl is very high. It would probably be conservative to say that ninety percent of the maple burl found is of no commercial value due to some defect or other. In the first place, maple as a species
is highly susceptible to decay and this characteristic seems to be accentuated when burl is present. Aside from this, maple burl growing in moist situations often has ingrown bark or an irregular form that makes it worthless. Due to the faster growth rate of swamp burl, the figure is coarser and is considered inferior to the finer figure of dry land burl. If careful inspection is not made, a burl may have to be left after it is cut. Experience is necessary in order to know what indications of defect to look for and to ascertain its extent. In maple burl it can be depended upon that the extent of any decay present is greater than the outward appearance indicates. Ordinarily, if there is a hole or rot in sight, it will be found to follow the contour of the burl leaving only a shell, too thin to be of any value.

The wood of the burl is ordinarily darker than that of the trunk wood. It is light brown and may be classed with the so-called "blonde" furniture woods. The figure is quite consistent.

Myrtle

At present, Oregon myrtle or California laurel (Umbellularia californica) is second to maple in the amount produced. The range of myrtle(12) is in southwestern Oregon and the
coast of California. It grows along the borders of foothill streams, spring-watered gulches, and lower mountain slopes and canyons. Myrtle attains its best growth and largest size in southwestern Oregon and adjacent northern California. Most of the myrtle burl produced comes from this area.

Burl is fairly common on myrtle, but not so common as it is on maple. Cluster burl has a greater value in the case of myrtle because the straight-grained wood between the clusters may be utilized. Myrtle wood takes a beautiful finish and is easy to work, making it a popular wood for novelties made from straight-grained wood as well as figured wood. Decay isn't so prevalent in myrtle, but other defects are present. Many burls are found that are so rough and have such an irregular shape that they are without value. Ingrown bark is very common. Myrtle burl found in rocky soil quite often grows around a good-sized rock, completely enclosing it within the wood. Axes and saws may be injured by cutting into these rocks and an expensive Fig. 3. Myrtle cluster burl. veneer knife completely ruined during the process of manufacture.

Myrtle burl wood may vary somewhat in color. It often
has streaks of darker and lighter woods intermixed. When it is finished it is usually a beautiful, golden-brown color and may be classed with the lighter woods. The figure is more modified than it is in maple.

Madrone

Madrone (Arbutus menziesii) ranks with myrtle in the amount produced. First one, then the other may lead in production depending on changing public fancy. The range (12) of this tree extends through the coast mountains in Washington, west of the Cascades in Oregon and in the Sierras of California. It grows in the foothills and low mountain slopes in moist to very dry or poor gravelly soils. Madrone makes its best growth in Douglas County, in Oregon, where most of this species of burl has been produced.

Burl doesn't occur as frequently on this species as it does on maple and myrtle. Most frequently, burl producing trees are found growing on the ridgetops where the tree assume a large, branching form. The tall, pole-like trees growing in coniferous timber seldom produce burl. Usually, stump burl is found, while cluster burl of any value is rare.

The percentage of defect in this species is relatively low. The most common defect is the greater tendency to be ill-shaped. Ingrown bark is rare. Decay isn't nearly so pre-
valent as it is in maple. Oftentimes, when decay is present, it will form only a small cavity or a small hole through the center of the burl, rather than following the contour as it does in maple. This characteristic makes it possible to cut the burl so as to discard the rot and obtain valuable flitches. Madrone may be cut without a great risk of finding hidden defects that would call it.

Madrone burl may be a brownish-red color or it may be a bright red when finished. The figure varies considerably, but as a rule it is much milder than in maple, not being so sharply outlined. In this respect it more nearly resembles myrtle.

**Redwood**

Redwood (Sequoia sempervirens) is produced periodically, varying considerably with market demands. The range(12) of this tree is along the coast of central and northern California, and in the southwestern corner of Oregon. This tree grows entirely in the fog belt. Much of the burl production of this species has been in the vicinity of Crescent City in northern California.

Burls on redwood are rather common. Both butt and tree burls are marketed regularly. The burls are of a large size; so large in fact that usually they must be cut into sections to enable producers to handle them. A burl produced in 1927 and shipped to a veneer factory in Kansas City weighed, approximately twenty-seven tons. Burls of this size are common. A manufacturer (7) of redwood novelties reports that the largest burl produced to his knowledge was one taken near
Orick, California that weighed approximately eighty tons. As a rule redwood burls can only be taken just prior to logging, or as logging is carried forward, because the cost of stumpage for burl production as a separate operation would be prohibitive.

Ingrown bark is found to some extent. Some decay and pitch pockets are quite often present, but on the whole it is relatively easy to obtain large pieces free from defect.

Redwood is the only softwood which produces burls of commercial importance on the Pacific coast. The figure is very marked and the color usually a rich, dark red. The figure, perhaps, is more regular than any of the other western burl woods.

**Other Species**

Other species sometimes produce commercially useful burls. Being somewhat rare, however, these burls ordinarily aren't among the standing orders of the exporters, and a market has to be created when one is found.

Of these species, black walnut (Juglans nigra) is important. Walnut burl has been produced elsewhere in the United States so that its worth is well known and a market is readily created for it. Walnut has been widely planted throughout Oregon and Washington. It grows best in deep, rich, well-drained soils. Burl is rather rare. Probably, a large part of what people have considered as burl has been confused with stumpwood. When a walnut log is cut the stump is left attached to the log. The roots are trimmed flush with the stump. The stump yields a variety of interesting
figured wood. Walnut is quite highly resistant to rots. When walnut burl is found it usually has excellent figure. The color is a rich, dark brown and the wood takes a beautiful finish.

Oregon ash (Fraxinus oregona) grows in damp sites in western Oregon and Washington. Occasionally small shipments of ash burl are noted. Burl is uncommon but when it is present it has an excellent figure. The wood is very light-colored, being nearly white. Bursts large enough to cut show a high percentage of rot.

Oregon oak (Quercus garryana) grows between the Cascades and the Coast Range in Oregon and Washington. Occasionally, an oak burl is located. The wood is light-colored, hard and finishes well. As in ash, there is a high percentage of rot prevalent.

**PRODUCTION.**

**Economic Importance**

In comparison with other timber industries, production of burls is relatively unimportant due to the limited quantity of raw material. The industry does not promise to reach large proportions. However, it is a most interesting phase of the timber industries to those who are intrigued by beautiful figured wood. Burl wood may be classed with specialty goods in contrast to the mass production of more common woods.

The sale of burls provides a welcome income to farmers on whose lands the burls are found. Ordinarily, a farmer doesn't know that a burl has any commercial value, and is surprised that anyone would offer to pay him for it. He
may be glad to have the producer remove the burl, because it means more ground cleared for farming or grazing purposes. A burl is just a stump to him, and he may try to sell the producer all the stumps on his place, not seeing any difference between them and the burl that is taken. On the other hand, the owner may know something of the value of burls. In that case, he is quite likely to have exaggerated ideas of their worth, and demand a stumpage price that would make it impossible to take them out with a profit. Stumpage is usually purchased by the ton. The price paid the owner varies from three to ten dollars per ton. Sometimes the producer will offer the owner a flat price for the burl, basing the offer on the estimated amount that can be salvaged from the tree. The latter procedure may be more satisfactory to the owner in some cases due to the difficulty in having the burls weighed to his satisfaction. Also, the owner is insured against loss should defect be discovered after the burl is cut.

A few burls are cut and sold by the owners of the land. The bulk of the production, however, is by men regularly engaged in the business. These men usually produce burls for a company that ships to manufacturers. They may work on some sort of a salary basis, or more often, they fill orders, receiving so much a pound for the burls. They may receive a price of from one to four cents per pound delivered at the docks in Portland. The price, of course, varies with the species and the market conditions. The producer is usually an expert in selecting and cutting burls. He gives employment to a small crew of men, ordinarily not over a half a dozen
in one vicinity. He may operate in several localities and have several such crews employed, dividing his attention between them. The men working for him usually have a good deal of experience and follow his operations around over the country. The yarding and trucking may be done by local men, depending on the size of the producer's operations.

The exporters, most of whom in this region are in Portland, are the middlemen between the raw resources and the manufacturers. They locate markets and promote new ones, both foreign and domestic. They keep the production of burls active so that they won't lose the services of men who have become expert and upon whom they can depend.

The burl industry has formed a steadily increasing source of income in the past few years. Incidentally, the burl business often isn't engaged in exclusively by a producer. He may at the same time be on the lookout for other types of figure in trees and other sorts of novel and rare woods.

Quantities

Burl exports for 1935 topped all previous records with a total of 726 tons shipped from Portland and two from Longview, Washington (6). Later statistics indicate that this record may have been exceeded again in the past two years. In face of a fifty percent decrease in exports from the Northwest of logs in 1937 as compared to 1936 wood burl held approximate parity. These are water exports, of course, and it must be borne in mind that they represent only approximately half of the burl that is produced. In recent years about half of the production has been shipped by rail for trans-
shipment from east coast ports.

Burls, according to the report of the Pacific Northwest Experiment Station in Portland, did not appear as items of export until 1928 when thirteen tons were shipped to France, Holland, and the United Kingdom. From 1928 to 1932 annual shipments ranged from seven to twenty-five tons, mostly of bigleaf maple. In 1934, 615 tons were exported. Increased tonnage in the past few years has been accompanied by an increase in the kinds of wood shipped. Maple, in 1935, comprised thirty-seven percent of the total, myrtle fifteen percent and madrone fifteen percent. The remaining twenty-three percent was made up of redwood, ash, and unnamed species which were supposedly a combination of maple, myrtle and madrone.

It seems apparent that production for the domestic markets was established somewhat earlier. In the years prior to the depression from 1925 to 1930, maple burls were being produced from the Willamette Valley and madrone burls from Douglas County in carload lots. Also, quantities of redwood and myrtle were being shipped.

Methods

The first thing a producer must do is to locate some burls, which may not be as simple as it sounds. It involves a great amount of hiking and the painstaking combing of the country to find trees with burl. When a man becomes accustomed to the habits of the burl species he is looking for, his task becomes considerably lightened. He can immediately discard unlikely territory and confine his search to more
prospective areas. Sometimes, he is aided by an owner who has located some burls that he wants to sell. The benefit of such help is rather dubious because nine out of every ten burls located by an inexperienced man are of no value.

Next is the problem of obtaining the stumpage. It is often quite difficult to find out to whom it belongs. There may be only one or two burls on a man's place and so he may not consider it worth his while to go out and determine whether or not they are on his land. Then again, he may not know his land lines well enough to claim ownership without a survey. It may be that the burls when located are found to be on governmet, state, or county land, or belonging to other absentee owner whom it would be difficult to contact. Some producers, if they are operating in the vicinity, will take out such burls without attempting to locate the owner. Ordinarily, such lands are isolated and the operation is so brief that there is little chance of discovery. Most owners are glad to get a chance to pick up a few extra dollars by the sale of burls. Of those who won't sell, some have a mistaken idea as to their value. Others fear that damage will be done to their crops or fences in taking the burls out. In some localities unscrupulous producers have operated and never paid for the stumpage, making it difficult for an honest operator to do business.

After the stumpage is obtained the producer may commence operations. The preparation of burls for the market requires considerable skill and knowledge of the woods produced, an understanding of the requirements of the veneer manufactur-
er and the mechanics of producing veneer, and last, but not least, perseverance in the face of difficulties.

There are a number of things an expert notes in determining whether a burl is suitable for market. The first two that he notices immediately are shape and size. The burl should be smooth and free from ridges and deep gullies. One exporter suggests that the ideal shape would be that of an ordinary onion. The size of burl depends somewhat on its shape and the species of wood. Usually, any flitch that is cut should be not less than eight inches thick at the very minimum and large enough to cut sheets of veneer 24" x 24". Also, the type and amount of figure is noted. An expert will determine the burl's suitability on these counts at a glance. Defects to look for are straight grained wood, ingrown bark, decay, and discolored wood. Any non-figured wood will be discovered when examining for figure. Ingrown bark is located by chopping into suspicious places in such a manner as to not damage the burl. Decay may be in plain sight or it may be indicated by a hole leading into the burl. The extent may be determined by comparing the outward indications with the known habits of the species in that respect. Dead branches and roots are reliable indicators of rot. An axe may be used to advantage in discovering the extent of decay. An augur can also be used to advantage in this respect.

Requirements for veneer manufacture vary with the manufacturer. Following are veneer mill specifications (1) as outlined by Harry Hartke of the Acme Veneer Co. of Cincinnati:

"We believe the following rules should be followed in
in getting out burls for market:
1. No defects should be incorporated. Defects would be deep seams, bark, knots, checks, or discolorations.
2. Character of figure most desired is intense deep burl figure. Where plain spots intervene, the burl should be considered second class.
3. Size of burl depends to some extent on its shape and the kind of wood. The solid wood should not be less than eight inches thick.
4. Burls should be trimmed so that the burl figure shows on the two ends. If a root burl, all spurs should be cut off. In fact, burls would have their greatest value if all plain wood were trimmed off, as is done in the case of imported burls.
5. We doubt if it is any protection to burls to paint or paraffin them. They will check or discolor in warm weather and should not be gotten out in the summer months.
6. The best protection to shipper is to demand inspection at the point of shipment. This is the only real protection."

The above specifications can be seen to be very general and not very informative to a person who isn't familiar with the type of burl wood desired. The producer, with this general knowledge in mind, adds a wealth of specific information to determine the type of burl he ships.

When the burl survives the rather close examination given it the work of taking it out may begin. The procedure on a stump burl is to dig a trench around the tree so that the roots are exposed. The roots are chopped off when the dirt is cleared away from them. The roots are cut once flush with the burl and once two or three feet from the burl so that a section may be removed and allow the digging of the trench to a size sufficient to carry on the work without being cramped for room. Time and hard work can be saved by doing a little more digging in order to make a trench large enough to work in comfortably. In the same manner as the undercutting of a tree, the initial work is done on the side of the tree in the direction of which it is desired for it
to fall. The dirt is dug out from under the burl on that side and all of the roots are cut in order to eliminate danger of working under that side when the tree is ready to fall. From here the work proceeds to the back of the tree. Ordinarily the tree falls before all of the roots are cut. If it is stubborn, sometimes a large root on the side opposite the "undercut" may be sawed in two and wedges used to aid in pushing it over. A small tree standing nearby that can be felled into it will sometimes do the trick. Sometimes a team or a caterpillar with a drum follows the digging operation. In that case a few of the main roots may be cut and the tree pulled over by a line hung in its top. This procedure is very rare. The operation is nearly always small and man power is cheaper than the other. Dynamite cannot be used. In cases where it has been tried, it was found that the "eyes" were shaken and would have a tendency to fall out when veneer cut from such burls was dried. Under average conditions two men can dig a 3000-pound madrone burl in a day. Depending on its shape, a madrone burl of this weight would be about six feet in its greatest diameter, which would probably be at the ground line or just below.

The tree, having been left attached to the burl, helps in breaking loose the roots and turns the burl up in a position so that it may be trimmed. A large amount of dirt and rocks will remain attached between the roots and in the crevices on the bottom of the burl. This dirt must all be cleaned out so that the roots can be trimmed. The roots are cut off flush with the bottom of the burl so that no unfigured
wood will remain. This job requires much axe work under rather difficult chopping conditions. There are times when a saw can be used but the danger of running into hidden rocks and dirt makes the use of a saw unpractical in most cases. Rocks are often grown over and entirely enclosed in the wood. The burl is cut from the trunk of the tree at the point where the burl figure meets the straight wood of the trunk. The appearance and saleability of the burl is improved by trimming any rough projections such as that made by burl figure tending to follow the roots. All cutting should be done with the picture in mind of what an ideal burl should look like. When the burl has been trimmed in this fashion no more is necessary unless it requires flitching. Usually the presence of rot requires the burl to be flitched in order to determine its full extent. All decayed wood must be trimmed back to sound green wood. The presence of straight wood may require that one side be cut off. Sometimes the removal of a V-shaped piece will get rid of the defect. Often a burl that has deep gullies may be cut into two or more pieces that have a better sale value than the original rough piece. Sometimes a large burl is cut to make it a size that is more easily handled. If a stump burl doesn't require flitching, two men can trim it in about the same length of time that it takes.
them to dig it.

Tree burl is easier to obtain than stump burl. If the burl circumscribes the tree all that is necessary is to saw it once below and once above the burl. If straight wood is present it may be necessary to cut off one side of the piece. A certain amount of straight wood is permissible. Decayed wood is treated in the same way as it is in stump burl. Redwood burls both stump and tree are often produced by sawing them off the tree in large chunks.

Burls should be produced in the winter to avoid danger of their checking. If they are produced at other times they should be painted with a heavy coat of "Check Seal", a prepared liquid resembling paint that will reduce danger of checking to the minimum. It is applied to the freshly cut surfaces of the burl. The bark serves as a protection on the parts that it covers. Even with this protection it isn't safe to leave burls exposed for long periods during the hot season. Exporters use this preparation on burls that are shipped long distances requiring a good deal of time before the burls reach their destination.

Yarding of burls may be done with teams or with caterpillar tractors. A producer, who has his own equipment for yarding, will usually have a tractor with a small drum on it.
Those who depend on local men to do the yarding will usually have it done with horses. In this case the producer will have the necessary blocks and lines and will enlist the services of a man with his team. Horses have the advantage of being more easily moved about in the woods to get to the scattered situations where burls are located. The horses may be taken one at a time if narrow trails or dense timber warrants it. Often short cuts through the woods can be taken advantage of where tractors couldn't go. On the other hand, cats have more power if the footing is sufficient. Also, a cat may be worked steadily, whereas a team will have to rest often when pulling heavy loads. Most operations being small, widely scattered, and periodic, producers find it to their advantage to employ local teamsters, rather than make a large investment in a yarding unit of their own. This makes yarding costs high because it is rare when yarding can be done with more than fifty percent efficiency by inexperienced men.

Burls are much more difficult to yard than logs of equal weight. They have a large surface bearing on the ground. They are quite rough on the bearing surface, having projections that dig into the ground and impede their progress. Due to their shape it is quite often difficult to make a choker stay on a burl in a manner to make it easy to pull. The pull is easiest if the pulling agent is as close as possible to the burl and hooked on in such a manner that the front side of the burl is lifted slightly while it is being pulled. On fairly level ground some sort of a sled or "lizard" (the fork of a tree used for runners) may be used to decrease the
bearing surface. Such a contrivance is used but little because where the country is at all rough or steep more time is lost trying to keep the burl on a pair of runners than is gained by the extra ease of pulling. Burls may be yarded for distances of as much as three or four miles. Trying conditions are the rule rather than the exception. Burls can be yarded for long distances on level or down hill shows, but if much up grade is encountered it soon becomes a losing proposition. It is much more feasible to take a burl down hill a much longer distance over rough country than to try even a short distance up hill.

Three men make an efficient yarding unit. One man drives the team or tractor. One changes the rigging when necessary, chops brush and logs, and takes care of anything that turns up to impede progress. The third man goes ahead picking a route and swamping it out. If it is necessary to use blocks one man takes care of the rigging at the burl, one changes tail holds and the driver goes ahead as before.

The burls are yarded out to a point where they can be reached with a truck. It is advantageous to place them on a bank at about the same level as the truck bed. Skids are laid from the truck bed to the ground and the burls are pulled on by winches on the truck or more often by use of a team with a line laid across the truck. Shipment may be made, as it quite often is, by truck to Portland for reshipment or the burls may be loaded on a freight car. Burls may be shipped from Douglas County to Portland for from six to eight dollars per ton.
MARKETING.

Some burl is marketed in the northwest, where it is produced, for manufacture into novelties and a small amount of veneer. The amount thus marketed represents a very minor portion, indeed. About half (6) of the total produced goes by rail to the eastern United States. Some of the burl is distributed to veneer factories in that part of the country. The rest is trans-shipped to foreign countries.

There is an amount of burl approximately equal to that shipped by rail that goes directly from local ports to their point of destination in foreign countries. Most of these water shipments are from Portland. Those from any other port are inconsequential. From Portland the burls go the United Kingdom, Germany, France, Italy, The Netherlands, Belgium, Japan, Australia and New Zealand. The countries taking the

Fig. 7. Burls on the Portland docks.
greatest amounts are usually France, Germany, Italy, and the United Kingdom in the order named.

It is difficult to get information concerning the exact destination of foreign burl shipments. The location of the ultimate factory that makes the burls into veneer is somewhat of a mystery. The major shipments go to such "free ports" as Genoa and Havre where they can be processed for transshipment with little or no duty.

Burls are sold by the pound. Their irregular form makes any other means of measurement highly inaccurate. The value per pound varies with the species, the type of burl, and the extent to which it meets specifications. The price ranges from two to ten cents per pound delivered at the factory. Stump burl commands about double the price usually paid for cluster burl. Myrtle and madrone are perhaps the most valuable species, although the price range between species isn't so great as that between stump and cluster types.

**MANUFACTURE.**

From burls are manufactured two general types of products. The greater percentage of the total goes into the manufacture of fancy veneer. The remainder is used for making wood novelties. As a rule these two different types of product are made in independent factories.

**Veneer**

Usually, the first operation (3) on the receipt of the burl at the factory is the flitching of it into suitable sizes and shapes for the slicing of veneer. This may have been done before the burl reaches the factory, either in the
woods or sometime before it is shipped. The producer can often take advantage of this necessity for flitching to make smaller pieces that may be handled with greater ease. On the other hand, if he cuts it, he may lose a good deal of weight in trimming that will mean a loss to him when he is producing by the pound.

After flitching, sometimes before, the burl is placed in steaming or boiling vats. The process varies. In some cases the burls may be subjected to a steaming process and in other setups they are placed in hot or boiling water. Here they may stay for several days until they are thoroughly heated and softened. Veneer slicing of the harder woods is impossible without some softening process. Too much heat may produce a roughness in the cutting that is undesirable.

When the flitch has been sufficiently softened it is ready for a slicing or a stay log machine. On a slicing machine the flitch is bolted to a table that operates up and down on slides bringing the face of the flitch against a veneer knife. A slice of veneer is taken off, then the knife and veneer block are moved together by the amount of the thickness of the veneer being cut and another slice taken off. The usual thickness of fancy veneer is one twenty-eighth of an inch.

The stay log machine is a semi-circular, wide-sweep, off-center, cutting device, attached to an ordinary veneer lathe. The stay-log, as an attachment, is usually adjustable for the sweeps or diameter of cuts desired to be made. Practically speaking, the veneers cut on a stay log machine are
the same as those would be if the flitches were bolted to the outside of a large cylinder; in fact, a stay log attachment is a segment of such a cylinder. The diameter of the cut can be increased within the capacity of the stay log.

A high degree of skill is required to mount the flitch on the veneer machine so that the figure will be cut to the best advantage. It may be necessary to change the piece a number of times as cutting proceeds. The sheets of veneer are kept in sequence as they come from the machine. The object of this is to keep adjacent pieces together so that similar figure may be had for purposes of matching when the veneer is mounted on the ultimate, finished product.

After the veneer, has been cut it goes through some sort of a drying process (4). In loft drying, sheets of veneer are placed in finger racks to separate the sheets and still hold them relatively straight and flat. Such lofts or drying rooms should have ample ventilation and be maintained at temperatures around ninety to one hundred degrees Farenheit and a humidity of sixty to seventy percent. This is as hot as can be endured by workers, and lower humidities often cause crinkly stock, due to rapid and uneven drying. Other means of drying may be some type of a kiln or systems of hot rollers. These faster methods of drying wreak a good deal of havoc with delicate, fancy veneer stock.

The procedure for sizing and matching (5) demands that chief emphasis be placed on figure, and that saving of waste
be secondary. Only skilled workmen can be used on this job. It requires an experienced and trained perception and imagination to visualize the most effective way to select each sheet and then to produce artistic results. Veneer sheets are cut by means of a clipping machine that makes no appreciable tearing of the grain. Fragile veneer must not be too dry at this stage, in fact, some manufacturers moisten it a trifle to toughen the texture. Cuts must be made to form perfect right angles. In matching, two pieces of veneer are placed together so that they match perfectly, although the ends may require further trimming. Matching may be in a number of ways such as: a two-piece side-matched, a two-piece end-matched, a four-piece side- and end-matched, diamond matched, diamond matched with center oval, border veneering, etc.

Veneer is kept in storage rooms, all the sheets from one flitch being kept together. Stocks are piled solid so that the sheets are kept flat and true, without wrinkling or check-
ing. Sometimes the sheets may be crated and stored all ready for shipment. Each pile or crate is tagged with a serial number and the square footage.

Veneer is usually sold to furniture makers who are independent of the veneer manufacturing process. The unit of measure is the square foot. The price ranges from two to thirty-five cents a square foot for fine face veneers with an average of about ten cents.

**Turnery and Novelties**

For purposes of turnery and novelties much smaller pieces of burl may be used. If turnery articles were manufactured in conjunction with veneer, much of the waste from the veneer process might be utilized.

The greatest cost to the novelty manufacturer after the original cost of the burl is the curing expense. It takes from one to three years before the burl can be made into finished novelties.

After the burl is received at the factory in large pieces, it is sawed on a band saw into small pieces in varying sizes to be later made into bowls, trays, etc. From the band saw these pieces are taken to a lathe and turned into shapes which it is intended that they should be used. Then they are placed on shelves to cure from one to three years, according to the size of the piece. Most redwood burl will decrease in weight from forty to fifty percent (10) during the curing time. This insures that the piece when finished will not check. After the piece has been seasoned it is ready to be placed on the lathe again and smoothed down into a finished article.
After the article has been turned and smoothed, five to seven applications of finish are applied, allowing twenty-four to forty-eight hours between each application for drying. After the finish has been applied, the article is again put on the lathe for rubbing down the finish. From there the article is transferred to a stock room and then to retail stores or wholesale customers. It is a fact that each piece is handled sixteen times before it gets into the public's hands.

Myrtle and redwood are the species most frequently used for novelty manufacture. The trade caters to local people and tourists. Representative of the products manufactured are: lamps, bowls, trays, salt and pepper shakers, match holders, ash trays, candle holders, bookends, picture frames, buttons, brooches, compacts, vases, tables, and many others.

**CONCLUSION.**

Burl production is a small but profitable industry. Evidences point towards an early end to the industry due to the exhaustion of the virgin supply. With the exception of redwood the burl species of importance in the Northwest are hardwoods. It is silviculturally desirable to have a mixture of species in the stand of hardwoods with the conifers. In connection with the virgin supply of burl it is recommended that there be closer utilization standards of that which is left. It would be possible to use for novelty manufacture much of the trimmings from veneer flitches that are now left in the woods. Then, a novelty factory in connection with the veneer plant would take care of much of the waste from
the veneer manufacturing process. In the future, when and if intensive forest management is practiced in this region, it would be desirable to show special favor to the hardwoods in the stand that showed a tendency to burl. A stump burl of high value could be produced from that part of the tree that is ordinarily wasted and at the same time logs would be produced in the bole of the tree.
BIBLIOGRAPHY

(1) "Burls: How They Are Cut and Marketed", Timberman, Vol. 30 (8), pp. 49-50, (June, 1929).


(4) Ibid, pp. 208-211.


(10) Redwood Empire Novelty Co., Crescent City, California.


APPENDIX
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* Burd exports in pounds from northwest in recent years.

(1933 - Oregon)

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Statistics taken from those compiled by J. Elton Lodewick, Pacific Northwest Forest Experiment Station. (Source -- From summaries of U.S. Customs records by the Seattle and Portland Merchant's Exchanges and Independent Stevedore Co., Marshfield, Oregon). These figures represent water-borne exports. It should be kept in mind that they represent approximately half of the production in the Pacific Northwest.