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## FOREST PRODUCTS LABORATORY

In cooperation with the University of Wisconsin

MADISON, WISCONSIN

### USE OF WOOD BY THE FRUIT AND VEGETABLE INDUSTRIES OF FLORIDA

By J. B. CUNO  
Associate Wood Technologist



July 1, 1936

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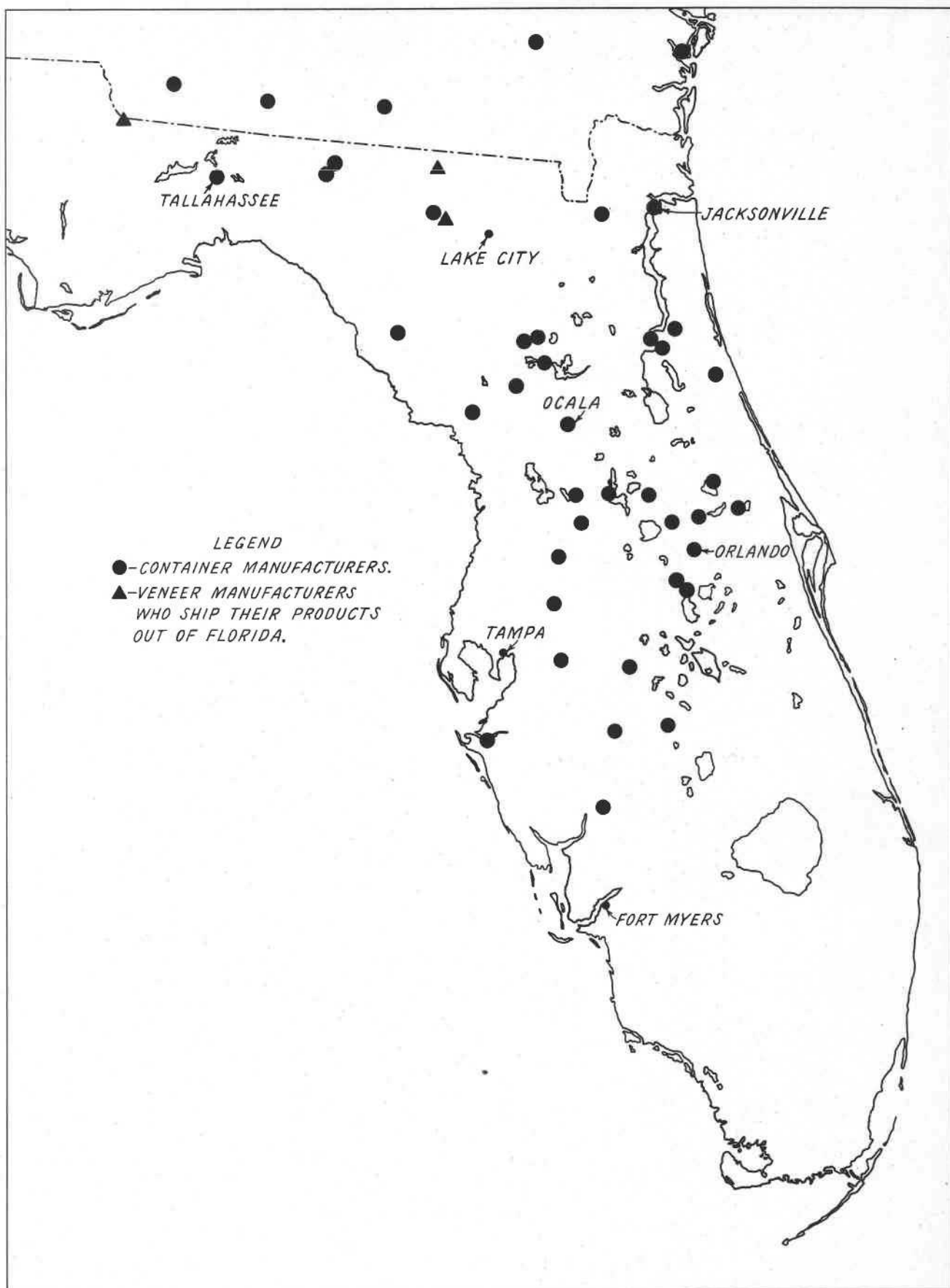
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Introduction

The fruit and vegetable businesses in Florida have been expanding steadily for a number of years. The bulk of their product has been and continues to be shipped in wooden containers, boxes, crates, lugs, hampers, and baskets made of yellow pine, black, tupelo, and red gum, evergreen magnolia, sweet bay, and several other species. Container manufacturers in some parts of Florida are faced with a definite shortage of nearby choice veneer timber, particularly pine. To overcome this, many are either bringing in bolts from distant parts of the state which means costly freight bills, or they are using smaller bolts from nearby and veneering the latter to smaller core diameters. In the past when cut out, mills moved closer to nearby raw material. They may move now but they will have to move farther for raw material which means longer shipments of finished containers.

In this study, facts were obtained on the species, sizes, and quantities of wood used by the fruit and vegetable industries principally for shipping containers and the prices paid for raw material. The methods of veneering and sawing the raw material for containers were observed to determine, if possible, whether a larger percentage of the worked-out turpentine timber, abundant from Fort Myers to the Georgia state line, can not be employed in place of the clear, high-grade veneer bolts now used. Consideration was given to the possible use of the choice veneer for plywood rather than for shipping containers which make one trip and are then discarded.





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The methods of seasoning wood used in containers were observed, and consideration given to the high loss in time and material from breakage of hoops and bands when bent, for hampers, baskets, strawberry cups and tubs. Consideration was also given to the use of the Doyle rule and cubic foot rule for scaling veneer bolts.

### Wood Used

Approximately 145 million board feet of wood is used in Florida for fruit and vegetable shipping containers in a normal year, which with probable expansion of fruit and vegetable industries may be expected to increase. The term normal is defined with difficulty because freezing weather may any year reduce the crops in large volume. The depression years, too, can be considered subnormal. They have been used, nevertheless, in some of the computations which follow because better figures were not available and also because they are probably conservative.

Of the total, 107,406,185 board feet, or 74 percent, is used for citrus containers, orange, grapefruit, and tangerine. These figures were derived by using the average for five seasons, 1930-31 to 1934-35, of the "commercial or shipped crop" which went by rail, boat, truck, and express (22,684,535 orange and grapefruit boxes, 1,789,419 tangerine boxes - Florida Citrus Exchange). Of this, 71,366,286 board feet, or 66.4 percent, is veneer and the balance sawn material.

The standard orange and grapefruit box contains 2.993 board feet of veneer and 1.500 board feet of sawn material, and the tangerine box contains 1.940 board feet of veneer and 1.125 board feet of sawn material. These footages were used in computing consumption.

The total fruit production for the state is considerably greater than the "commercial or shipped crop" shown. It includes fruit consumed locally, 8 percent of the total, and fruit canned, 10 percent.

For vegetables, 37,745,514 board feet, or 26 percent of the total was used. Of this, 24,731,605 board feet, 65.5 percent, was veneer, and the balance sawn material. In this case the average acreage and yield per acre figures of each vegetable reported for a long period of years by the State Department of Agriculture and the footage of veneer and sawn material in each standard hamper, basket, and crate



Fig. 1.--Typical worked-out turpentine timber for  
headsticks and hamper bottoms.

recognized by the Standard Container Manufacturers' Association were used in the computations.

The total consumption of 145,151,699 board feet is made up approximately of the following species:

	<u>Percent</u>
Loblolly, longleaf, and slash pine.....	70
Black and tupelo gum.....	18
Red gum.....	8
Evergreen magnolia and sweet bay.....	3
Maple, basswood, red bay, elm, and miscellaneous.....	<u>1</u>
	100

These percentages were derived by using figures obtained from census reports submitted by part of the manufacturers and by personal visit to every mill in the state making containers.

The approximately 102 million board feet of pine reaches the mills in the following form:

	<u>Percent</u>
Choice, large veneer bolts.....	71.1
Small bolts or logs for headsticks and hamper bottoms.....	22.3
Seasoned lumber in long lengths for headsticks (purchased in the open market).....	<u>6.6</u>
Total....	100.0

The percentages of wood used in veneer and sawn form are shown purposely to direct attention to the drain being made on Florida's diminishing supply of choice, clear round timber, particularly pine. No figures are available as to what percent of the 43 million feet of hardwoods used is choice veneer bolts, but it is probably considerably more than the 71.1 percent reported for pine inasmuch as very little hardwood is used for hamper bottoms or headsticks (the thick pieces on ends and in partitions of crates). Some hardwood cores are so used and some hardwood lumber is purchased, but most of the hardwood consumed is veneer from large clear bolts.

From Fort Myers to the Georgia state line is an abundance of worked-out turpentine timbers more of which may well be used in containers. At present the sides, tops, bottoms, and panels in the ends and partitions of most containers are rotary cut veneer, both pine and hardwood. Wide,



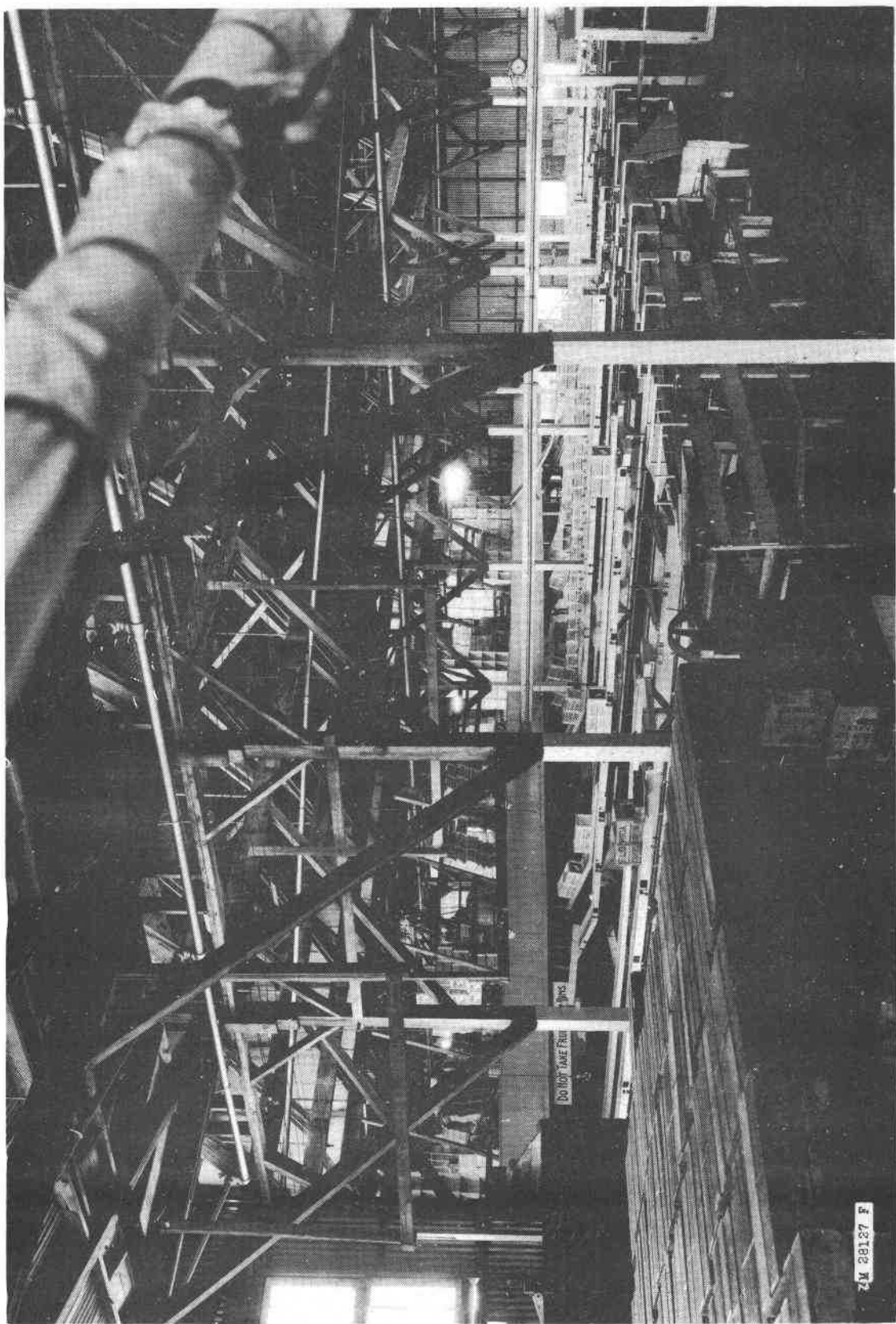


Fig. 2.--Interior of fruit packing house. Notice the large quantity of wood used in the building in addition to the wood used for containers.

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clear veneer sheets are used, and the container with this high quality veneer in it, used but once, is, when empty, discarded by the grocer or consumer.

The naval stores industry, a dominant one in the state, to be more successful and permanent should have a larger outlet for worked-out trees so that they can be removed from the land to make room for a second crop of small pines. Paper and pulp mills are, of course, potential users of worked-out timber, but the container industry is already on the ground, and can by changing methods of manufacture use larger quantities. Long time planning for closer integration with the naval stores industry is necessary if Florida is to use its forest resources to better advantage.

No piece in any Florida shipping container is so large that it can not be sliced or sawn from worked-out timber of medium size. It is recognized, of course, that the traditional use of rotary cut veneer is based primarily on cheapness in manufacture, but if in the years ahead prices for choice bolts continue to rise, and if methods of slicing, sawing, and resawing of smaller pine can be developed, so great a dependence need not be placed upon rotary cut veneer. As a matter of fact the manufacture of plywood in conjunction with container manufacture merits consideration. The choicest bolts, both pine and hardwood, could be used for plywood veneer, and the smaller, less choice material for containers. Experimental work in this direction could well go hand in hand with the work now being done by several manufacturers in rotary cutting to smaller cores.

#### Containers for White Potatoes

Special attention is given to containers for shipping white potatoes because they are preponderantly made from worked-out pine. The staves are sawn on barrel saws, and the heads on swing saws, pendulum type. Some white potatoes are shipped in burlap sacks, and crates made of hardwood slats or hardwood veneer bound with metal are being used more and more. A hardwood veneer barrel fastened to elm hoops is also now being used.

In the 1934-35 season 3,932 carloads of white potatoes were produced. Of these approximately 225 cars were

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\*"The Supply and Status of Naval Stores Timber in Unit No. 1 Florida," Forest Survey Release No. 8, January 12, 1935, Southern Forest Experiment Station, Lake City, Florida.

trucked out of Florida, presumably in sacks, and 850 cars were consumed in Florida of which it is assumed 250 in sacks were trucked. In other words, probably 3,457 cars were loaded with potatoes in wooden containers, barrels, or crates. Assuming that 90 percent of the wooden shipping containers were sawn pine the result is 3111 cars or 575,535 barrels (185 barrels to the car). As the average sawn pine barrel contains approximately 7.5 board feet of lumber, 4,316,512 board feet of worked-out pine timber was used for white potato barrels. The 1934-35 potato production being lower than usual it may be said that approximately 5 million board feet of lumber is used in a normal year.

The wooden barrel with elm hoops has served its purpose very well. From the standpoint of available supply close to potato sections of small worked-out pine needing a market, it would be unfortunate if the sawn pine barrel were driven off the market by some other form that requires choice veneer bolts. The advantage of the hardwood crate or barrel, however, is that heartwood of a species, such as red gum, is not undesirable, and the weight of the container per unit is less. The hardwood crate also has certain advantages in loading and in displaying at retail stores.

Containers most generally used for fruits and vegetables are as follows:

Avocados	crate, long
Beans, snap	hamper
Beans, lima	hamper, 6-basket
	one 32-quart crate
Beets	hamper, crate
Cabbage	half-barrel crate
Carrots	crate, hamper
Celery	crate
Corn	half-bushel crate,
	pepper crate
Cucumbers	hamper, crate
Egg plant	crate
Figs	crate
Grapes	basket
Guavas	crate
Lettuce	hamper, crate
Mangoes	crate
Okra	hamper, 6-basket crate
Oranges	crate
Peaches	box
Pears	basket
Peas	hamper
Peppers	1-1/2 bushel crate, hamper

Pineapples	crate
Potatoes, sweet	100-pound sack, crate, hamper
Potatoes, white	barrel, crate, sack
Squash	hamper, crate, pepper crate
Strawberries	box (crate)
Tomatoes	crate, long

The wood used in shipping such fruits as avocados, figs, grapes, guavas, mangoes, peaches, and pears is not inconsiderable.

Practically all the containers made in Florida are used in the state with the exception of a small percent used by southern Georgia and Alabama fruit and truck growers for their products shipped in early spring after the Florida winter shipping season is over. In the northern part of the state several manufacturers using Florida timber ship their sheet veneer to Savannah, Georgia, and other points north. On the other hand, sheet veneer for the manufacture of containers is brought in to some extent from Alabama and Georgia, and some finished containers come from nearby mills in southern Georgia. A limited number of yellow poplar containers from Georgia are used for shipping tomatoes by truck, and a good many strawberry cups are brought in from other states. Although the quantities of sheet veneer and knocked-down containers leaving and entering the state are not known, they represent only a small portion of the total used.

Like all business there have been changes in the container industry. In years past the number of types and size of containers was limited, and the manufacturer could make large quantities and store them in his warehouses until shipping orders were received. At present, each packing house or citrus association demands a container which will distinguish its brand, perhaps an all-pine crate, perhaps an "all-white" crate, by which is meant all black or tupelo gum, perhaps a crate with pine sides and bottom and red gum ends, perhaps an "all-white" crate with purple, red, green, blue, or a mixture of these colors for cleats. Perhaps one packing house has its name printed on one side in green and its address on the other in purple. For tomatoes there seems to be a constant change in types of lugs and crates, and for tangerines considerable change in crates.

A good deal of this diversity in wood, in color of cleats or crates, or of hoops on hampers is done to please the customer. The customer as in all things likes distinction in color and change in style, and much of it is natural and desirable but there is need for simplification. Moreover, the demand for wood absolutely free of defects which do not weaken the container is wasteful.

The use of thin hardwood veneer, particularly red gum, bound with metal wires or straps for containers is on the increase. These metal bound containers often contain less wood, and weigh less per unit of contents than nailed containers. The sizes of slats, staves, ends, tops, or bottoms in them are, however, never larger than could be sawn or sliced from small to medium size worked-out turpentine timber.

In attempting to determine what will be the future types of containers used in the state, thought may be directed to the cardboard carton. It is already used almost entirely for the 10 percent of the total fruit crop by the two dozen or more canners of grapefruit and grapefruit juice shipping canned goods. The cartons are of tough fiber reinforced at corners, and reach the canning factories in knocked-down condition. Small quantities of resawn cypress, western yellow pine, or other species are used for exporting canned goods, but even for export trade the carton has proved suitable.

For vegetables, unless cardboard can be cheaply made resistant to moisture changes so that it will not wrinkle and warp it will not soon replace wood. Wooden containers can be carried to the fields, be rained on, or moistened with dews and water from the vegetables themselves without being seriously harmed. Although orange, grapefruit, and tangerine crates are not exposed to the weather, the fruit is washed and may not be entirely dry when packed. It exudes some moisture in transit and this exudation, increased by sudden changes in temperature, would have a disintegrating effect upon most varieties of fibre board. There is no evidence as yet of fibre cartons being used for either fruit or vegetables. Moreover, before it is considered it will have to compete in price, in stiffness, and other strength properties, and be as attractive in appearance. There is something about a bright-colored wooden box filled with fruit that appeals to the consumer which the dark-looking carton does not possess.

Bags made of plant fibre, such as jute, hemp, and paper twine, have had their effect on the use of wooden containers, just how much can not be said. State law now makes it necessary that fruit formerly shipped in bulk be individually marked for identification unless shipped in packages. During the winter of 1935-1936 bags holding 4/5 of a bushel, half as much as a standard crate, cost 8 cents apiece, or 16 cents for two, which was more than the price of a wooden box. From the standpoint of price alone, therefore, it was not to the packer's advantage to use bags. For certain grades of fruit, however, a bag has advantages, such as taking little room. Unless moisture resistant, however, the paper twine bag will soften and burst at the point where an orange may crush



or soften enough to wet it. Citrus fruit shipped by rail in bags must be placed on racks or enclosed in crates to prevent crushing and creasing. In truck shipments bags are laid on a layer of excelsior on the floor and then loosely piled on top of one another.

No mention has been made of the cypress used for field boxes, the container for hauling fruit and vegetables from the field to the packing house. Figures of the quantity of wood used each year are not available, but thousands of boxes are owned by the many packing houses.

In addition to the wood used for shipping containers a large quantity of wood is used in the construction of packing houses, offices, sheds, platforms, barns, homes, tool houses, car bracing, fuel in orchards to prevent freezing, excelsior, ladders, stakes, and other things connected with fruit and vegetable production. No figures on the wood used for these latter purposes are available, but it is considerable when one considers the large number of packers and growers in the state.

#### Size and Quality of Bolts

Veneer.--To determine the size of the pine timber used for veneer a few bolts were measured at a number of mills throughout the state. Butt bolts only were selected, and the diameters read inside the bark at the large end where the tree joined the stump. Figure 3 shows that of the 184 veneer bolts measured 78 percent were between 14 and 24 inches. Almost 75 percent of the bolts measured were loblolly, usually called "black" pine, which averaged 19.7 inches at 60 years. Veneer bolts were free of surface knots which means that in the woods only a limited number of bolts in the lower part of the tree are taken. Knotty material in the tree above the veneer bolts is either used for sawlogs or fuel or left in the woods, depending upon nearness to a market.

Where certain manufacturers have attempted to reduce veneer cores to diameters as small as 3-3/4 inches there has been a tendency of the men selling bolts to bring in smaller material of lower than usual grade. Choice veneer bolts as mentioned, particularly pine, are growing scarce in many sections of Florida. To increase the growth of bolts of veneer quality, owners of timber may well consider the pruning of lower branches on small trees. A little pruning by the many owners of timber scattered throughout the state would help to build up Florida's future supply of clear veneer bolts.

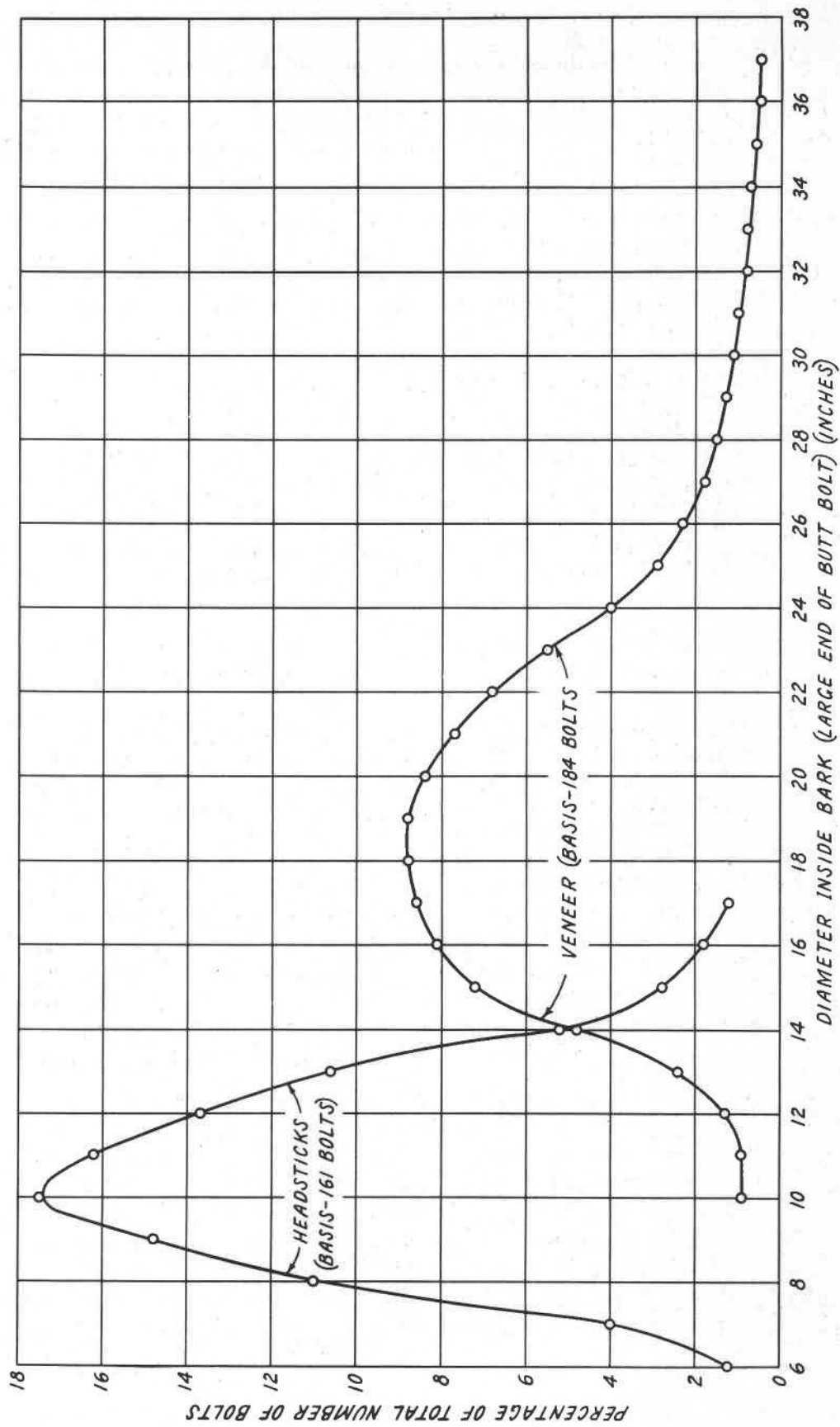


FIG. 3  
PERCENTAGE OF BOLTS OF EACH DIAMETER (INSIDE BARK AT LARGE END OF BUTT BOLT)  
FOR VENEER AND FOR HEADSTICK MATERIAL



Headsticks.—This is the term applied to the thick-sawn pieces used on the ends of crates and in partitions. Bolts and logs used for headsticks were a mixture of worked-out or round slash, longleaf, and loblolly pines. Figure 3 shows the range in size of 161 of these bolts or logs measured across the large end of butt cuts as with the veneer bolts. Approximately 84 percent of the bolts were between 8 and 13 inches. This class of material if in short lengths was usually purchased by the cord instead of by the thousand board feet, Doyle rule.

### Timber Ownership

Most container manufacturers purchase their bolts or logs. Only a few own timber which they cut themselves or have cut under contract. These few are more or less selectively cutting their timber, or at least not wrecking the stands so that another cut can not be profitably made for generations. They cut only the larger trees and leave the smaller ones to grow to more profitable sizes, and apparently the growth each year pays for the taxes and other overhead in taking care of it.

The general expansion of the fruit and vegetable industries in the state and the consequent increased demand for containers should, it would seem encourage rather than discourage timber growing. If Florida's fruit and vegetable industries were expected within a few years to decline, there naturally would be no incentive to grow timber for containers, but such is not the case. The tax situation, as everyone knows, is particularly bad on some forest land in the state, but the expectation is that it should improve rather than grow worse.

Timber trespass in the state is rather common. Much of it takes place on land held by absentee owners or on land where taxes have not been paid and the owner has lost title. Timber trespassed can generally be sold at a lower price than timber on which the taxes have been paid. The result is a demoralized stumpage value.

### Scaling Veneer Bolts

By state law, "whoever buys or sells any logs or square timber by any other measure or scale than Doyle's rule and log book - - - shall be punished by fine not exceeding \$200 or by imprisonment not exceeding 6 months. When it is mutually agreed between the buyer and seller, another than Doyle's rule book may be adopted. - -"



Fig. 4.--Potato barrel, fish barrel, hamper bottoms, and cleats made from small pine.

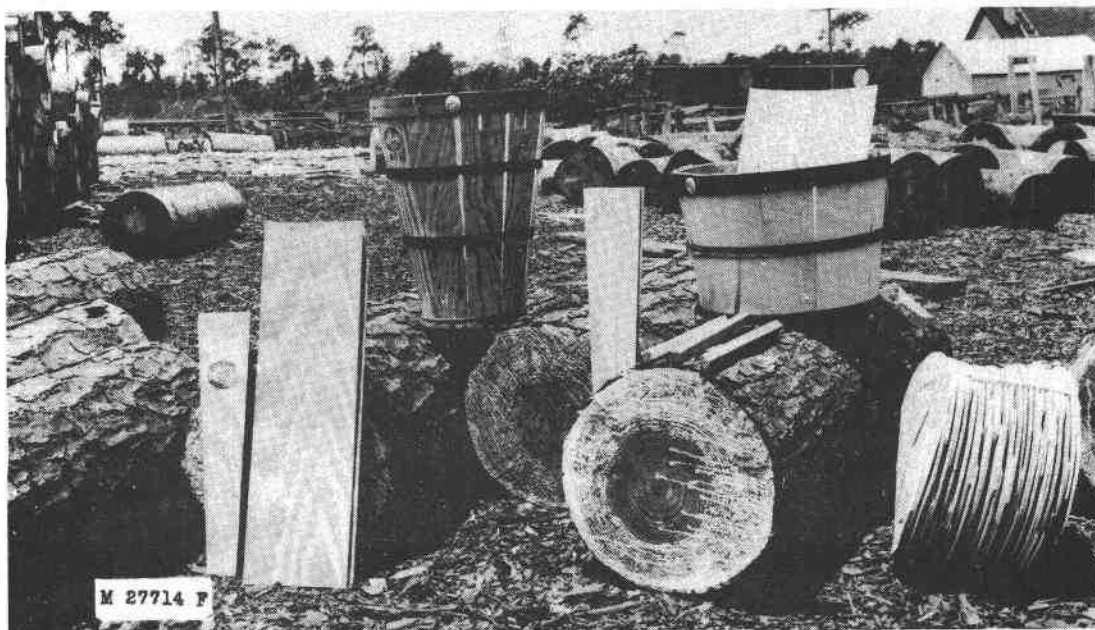


Fig. 5.--Choice pine veneer blocks for hampers and baskets.

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Table 1 Comparison of contents of 52 inch long veneer bolts by the Doyle rule with actual cubic contents.

Diameter inside bark small end	Contents		Difference	Contents after deducting 15 percent for manufacturing loss
	Doyle rule	Actual <sup>1</sup>		
<u>Inches</u>	<u>Board feet</u>	<u>Board feet</u>	<u>Percent</u>	<u>Board feet</u>
10	9.8	18.6	90.0	15.6
11	13.2	24.6	86.4	20.9
12	17.3	30.6	77.0	26.0
13	21.9	37.8	73.3	32.1
14	27.0	45.0	66.6	38.2
15	32.8	53.4	62.8	45.4
16	39.0	61.8	58.0	52.5
17	45.8	71.4	56.0	60.7
18	52.8	82.2	55.6	69.9
19	60.7	91.8	51.3	78.0
20	69.9	102.6	46.7	87.2
21	78.1	114.6	46.7	97.4
22	88.2	126.6	43.5	107.6
23	98.3	139.8	42.3	118.8
24	108.9	153.0	40.5	130.0
25	119.5	167.4	40.0	142.3
26	130.8	181.8	39.0	154.5
27	143.1	196.2	37.1	166.8
28	156.0	211.8	35.7	180.0
29	169.1	228.6	35.2	194.3
30	182.8	245.4	34.6	208.6

<sup>1</sup>This is derived by multiplying the cubic contents of the bolt (minus the 6 inch core) by 12.

It is wise, of course, for the state to desire uniformity in log scaling. The Doyle rule has served the container industry fairly well, but as everyone knows it was designed to allow for slabs, edgings, and sawdust which do not occur in rotary veneering and is, therefore, unsound for the purpose. There are, to be sure, manufacturing losses in veneering, which result from unsymmetrical and crooked bolts, clipping the sheet veneer, and trimming and ripping out defects, in addition to the core. Table 1 compares the Doyle rule with the cubic foot rule converted to board feet. Even after allowing a 15 percent manufacturing loss in addition to the core the bolts yield considerably more wood than the Doyle rule. The 12-inch bolt cuts out 50 percent, the 18-inch bolt 32 percent, and the 24-inch bolt 19 percent more wood than shown by the Doyle rule.

In adopting the cubic foot as a basis of measurement for buying and selling veneer bolts, if 15 percent is not the proper figure, a satisfactory percentage loss can be agreed upon by buyer and seller according to the average core each manufacturer cuts and his efficiency in manufacture. The price per thousand board feet would, as in the past, depend upon the size and grade of bolts. In Florida, 6 inches is a fair average core diameter to use, although the tendency to cut to smaller cores is spreading.

The argument might be raised that if the Doyle rule serves the purpose why not continue it? It serves the purpose, but everyone interested in the use of wood and the growing of timber in Florida should be interested in putting the most exact values possible upon timber and forest products and should want the simplest system to establish them. The cubic foot is not only scientific, but it is fairest to the buyer in the long run, fairest to the man selling the bolts, and fairest thus to the general welfare of the state.

Much progress has been made in standardizing the finished containers themselves, the work to accomplish which has taken years of painstaking effort. That effort has proved worth while to both the manufacturer and to the timber owner. In similar manner the standard for purchasing raw material could be changed. To initiate the change, the manufacturers, well organized as they are, stand in a splendid position. There is no danger in violating the state law, as that was intended for sawlogs, not veneer bolts. The commonly accepted definition of a log infers 8 feet or more in length, and pieces shorter than 8 feet are classed as bolts.



## Prices for Pine Bolts

Veneer.--An analysis of prices paid for pine veneer bolts delivered to Florida mills in the winter of 1935-1936 shows clearly that mills near abundant raw material paid less than those far from it. Across the northern border of the state from Jacksonville to Tallahassee an average of \$12 per thousand board feet, Doyle scale, was paid. The average price for the same class of bolts paid by mills just to the south in the Gainesville, Micanopy, Palatka, Ocala, and Gulf Hammock area showed no decided increase, but in the Leesburg, Sanford, Kissimmee, and Zephyr Hills area farther south the average price paid was \$14. In the extreme southern end of the container manufacturing section, Avon Park, Nocatee, Manatee, and Keyville the price averaged slightly over \$15. In other words, mills paid approximately \$3 more per thousand board feet for veneer bolts in south central Florida where large pine is relatively scarce than in the northern and northwestern section of the peninsula where it is more abundant.

## Headsticks and Hamper Bottoms

Small pine, worked-out longleaf and slash principally, 7 to 13 inches in diameter at the small end, for headsticks and hamper bottoms brought \$3.75 to \$5.50 per 4x8-foot cord, according to length delivered at the container mills. The usual length of bolt is 52, 57, or 63 inches, which, converted to 48-inch length, makes the price range \$3.46 to \$4.19, or a difference of 73 cents. The price per cord is not greater in the southern part of the state than in the northern. The small price difference is largely because of difference in quality.

## Manufacture of Headstick and Hamper Bottom Lumber

Inasmuch as the suggestion has already been made that container manufacturers give thought to a larger use of worked-out timber a brief discussion is given here of the methods now employed in sawing it as well as pine and hardwood veneer cores. The discussion may shed light on what may be the problems of expanded use of worked-out timber.

The equipment commonly used to manufacture headsticks and hamper bottom lumber is as follows:

Types of equipment :	Rawmaterial :	Mills using equipment in- dicated
<u>Name</u> :	<u>Type</u> :	<u>Number</u>
Sawmill (circular) :	Logs :	9
Vertical or sash gang saws :	Bolts :	3
Circular gang saws :	Bolts and veneer cores :	2
Barrel heading saw, pendulum type :	Bolts :	3
Shingle saw (horizontal) :	Veneer cores :	3
Bolter mill, short carriage :	Bolts :	3

The nine small circular mills operated by container mills in Florida were using logs 7 to 20 inches in diameter and 8 to 16 feet in length. Flitches were in most cases edged on the headsaw, a method of manufacture extremely wasteful particularly with small logs. Crook and taper, as is well known, in long logs of small diameter are the source of great loss. Cost of operation was not low at these mills. The average mill cutting 5,000 board feet per day requires 5 or 6 men to operate, so that at \$1.50 per man per day the labor cost alone for a 6-man crew would be \$1.80 per thousand. Assuming logs worth \$9.00 per thousand board feet the total cost would be \$10.80. In sawing headstick lumber the logs are usually turned on the carriage to get as high a yield of clear material as possible, which in itself is an advantage over the other methods discussed, although turning logs for quality sawing is time-consuming.

Vertical or sash gang saws are used where a large volume of headstick lumber is required. Initial cost of equipment is high, and a sizeable crew of men is necessary to operate one, but saw kerf loss is low compared to saw kerf loss in circular sawmills. The resultant lumber is uniform in thickness, rather rough on surfaces, and being flitch-sawn contains a relatively low percentage of upper grades.



Circular gang saws (Fig. 7) are also employed where a large volume of headstick lumber is required. The equipment for handling rough bolts 6 to 13 inches in diameter must be sturdily built. Cost of installation of a sturdily built plant is high, loss in saw kerf, particularly if inserted teeth are used, is high, but the number of men required to run the plant is not great. Wing type circular saws seem better adapted to circular gang sawing than plain saws. For sawing veneer cores of uniform size the installation need not be as rugged. A system of rolling cores down an incline to a conveyor in a trough where the cores feed automatically to a circular gang saw has proved economical. One man is able to supervise the operation, keep the machinery in running order, pick out slabs, and pile the headstick lumber on a cart for removal by a second man.

Barrel heading saws, pendulum type, are used chiefly by makers of hamper bottom stock. The operator places a short bolt upright in the pendulum, clamps the bolt and holds it down by hand, swings the pendulum toward the saw, and cuts the required thickness. The equipment is very simple, but the thickness of stock is not as uniform as in other methods of manufacture because that depends to a large extent upon the skill of the operator. Moreover, the surfaces of the lumber cut are very rough.

The shingle saw, horizontal type (Fig. 8), used principally for sawing short veneer cores into hamper bottom or headstick lumber, makes very uniform material with relatively smooth surfaces, and the saw kerf is not thick. For successful operation of the shingle saw, it is essential to mount it well above the ground or floor level so that sawn flitches can drop conveniently to a conveyor or to a cart for removal to the seasoning yard and so that sawdust does not pile up to interfere with sawing. Output of machines is, however, limited.

Bolter sawmills with adequate power and short horizontal cable feed carriage operating rapidly, for handling 5 or 6-foot bolts 7 to 13 inches in diameter and using solid tooth saws with considerable hook to the  $3/16$  inch teeth, appear to be very efficient for making headstick lumber. Because of shortness of bolts, the loss of material from crook and taper is very low. At one mill three men were able to produce 10,000 board feet of lumber per day from 63-inch bolts at a labor cost of only 47-1/2 cents per thousand. One man kept the bolts on the deck rolled close to the saw, and two men placed the bolt on the carriage and held it against the carriage blocks throughout the sawing process. They discarded slabs and piled the sawn flitches on a cart for removal to the

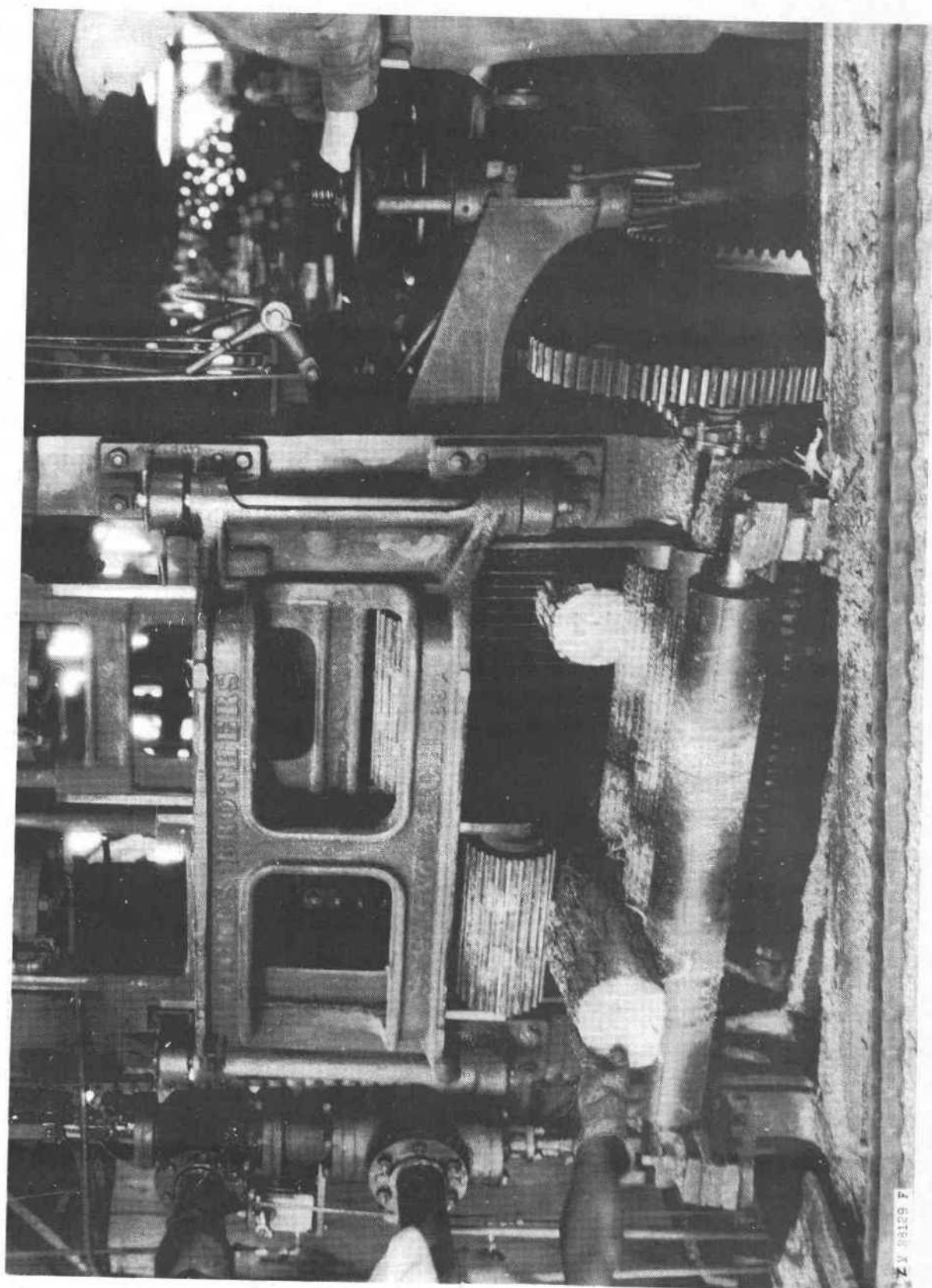


Fig. 6.--Sash gang sawing is one of the six methods used in sawing headstick material from small worked-out pine timber.

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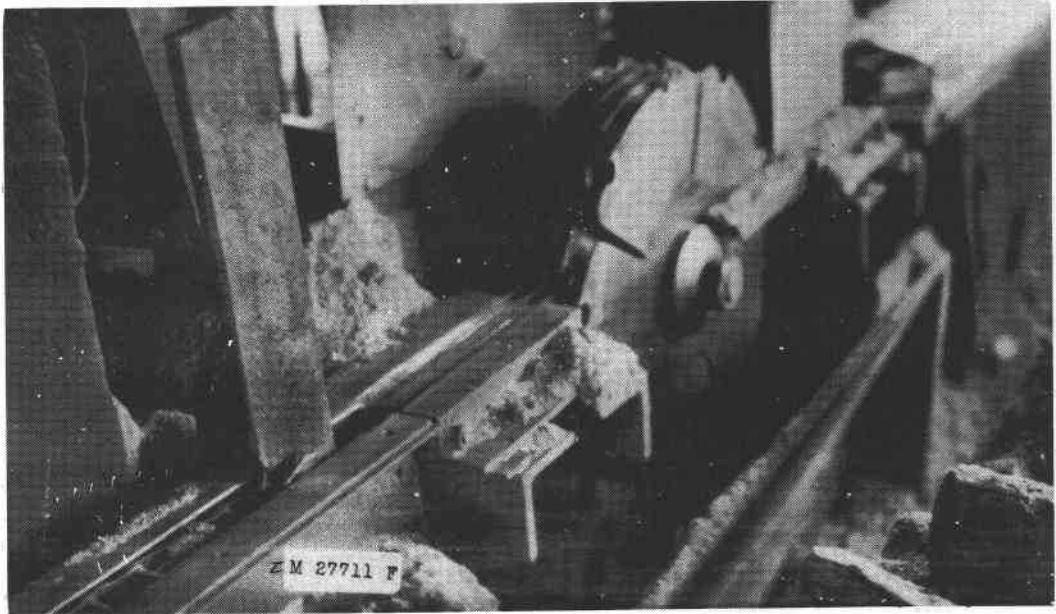


Fig. 7.--Circular gang sawing with wing saws is one of the six methods used in sawing headstick material from cores and small worked-out pine timber.

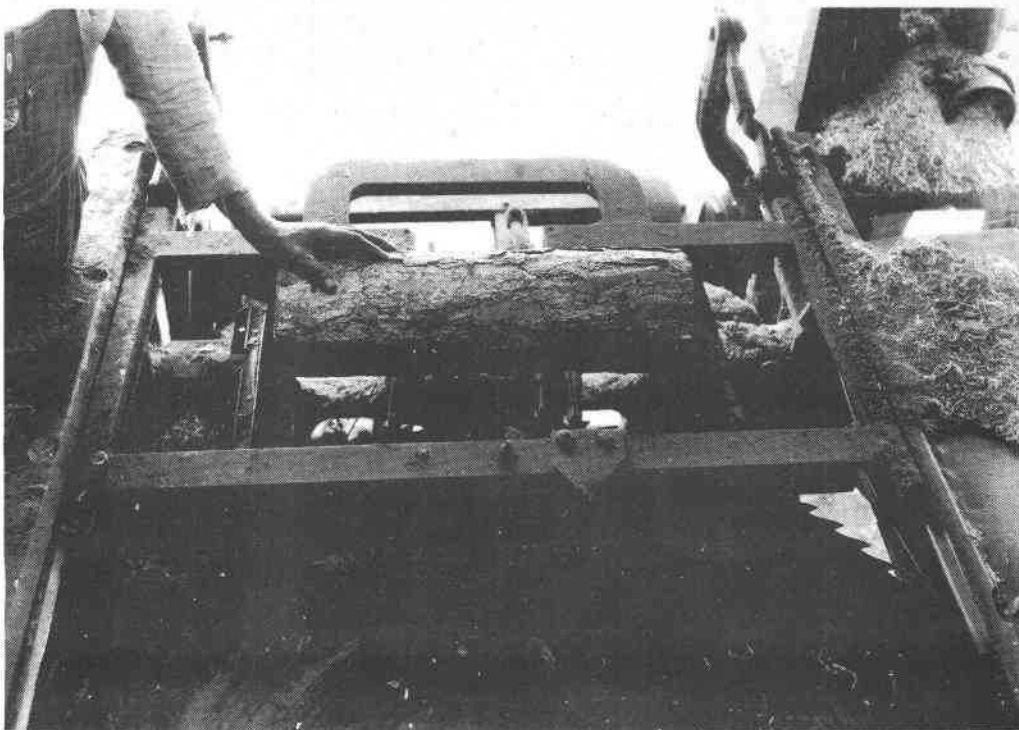


Fig. 8.--A shingle saw for producing headstick material from veneer cores and small worked-out pine timber is one of the six common types of equipment used.

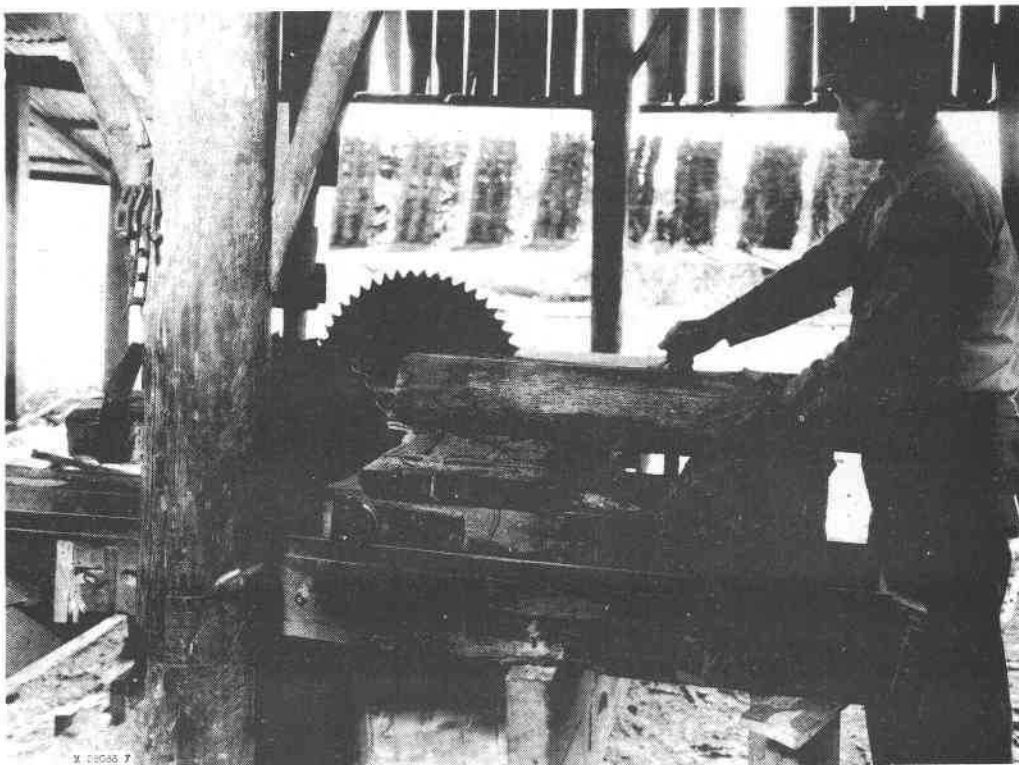


Fig. 9.--Crude bolter saw and carriage for cutting headstick material.





Fig.10.--Small black gum veneered to a 3-3/4-inch core at one mill.

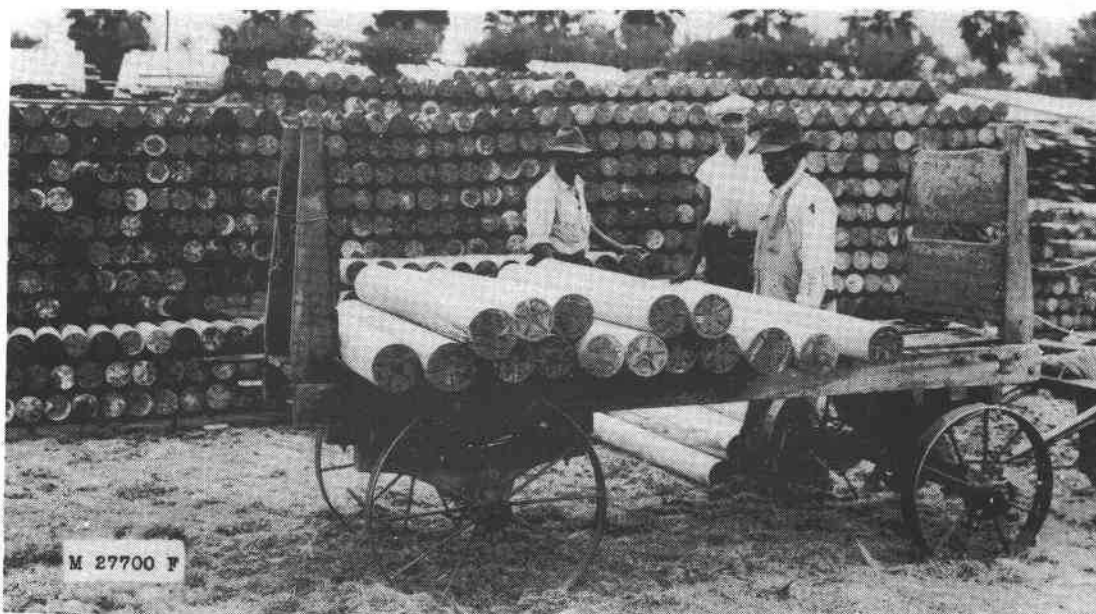


Fig. 11.--Veneer cores being piled prior to manufacture into excelsior.

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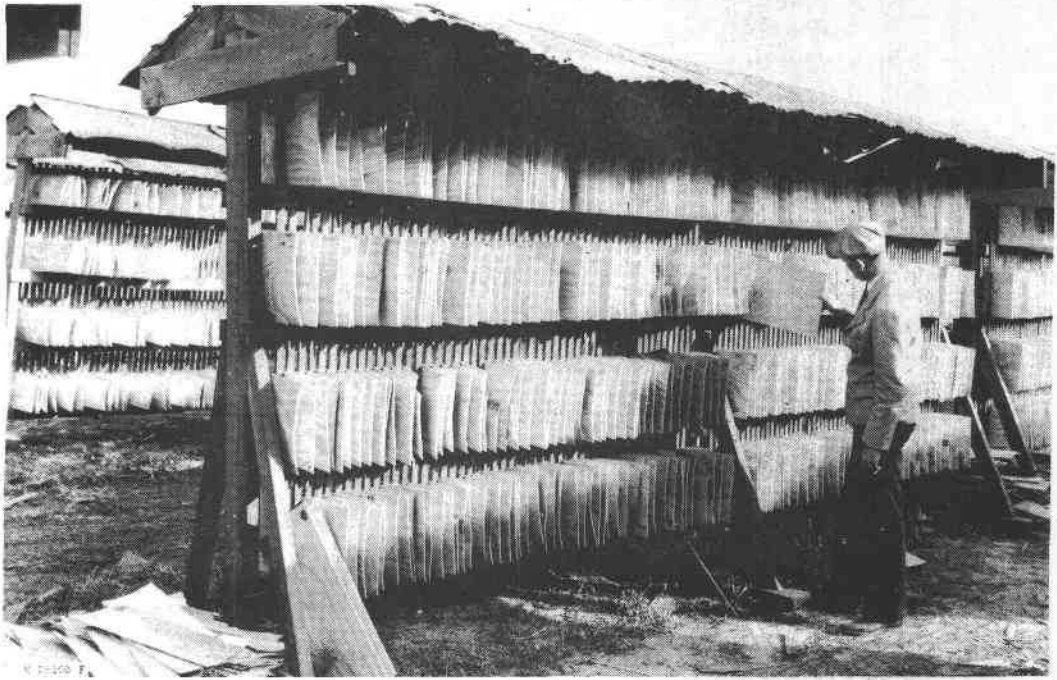


Fig. 12.--Air seasoning rotary-cut yellow pine veneer from large choice bolts.

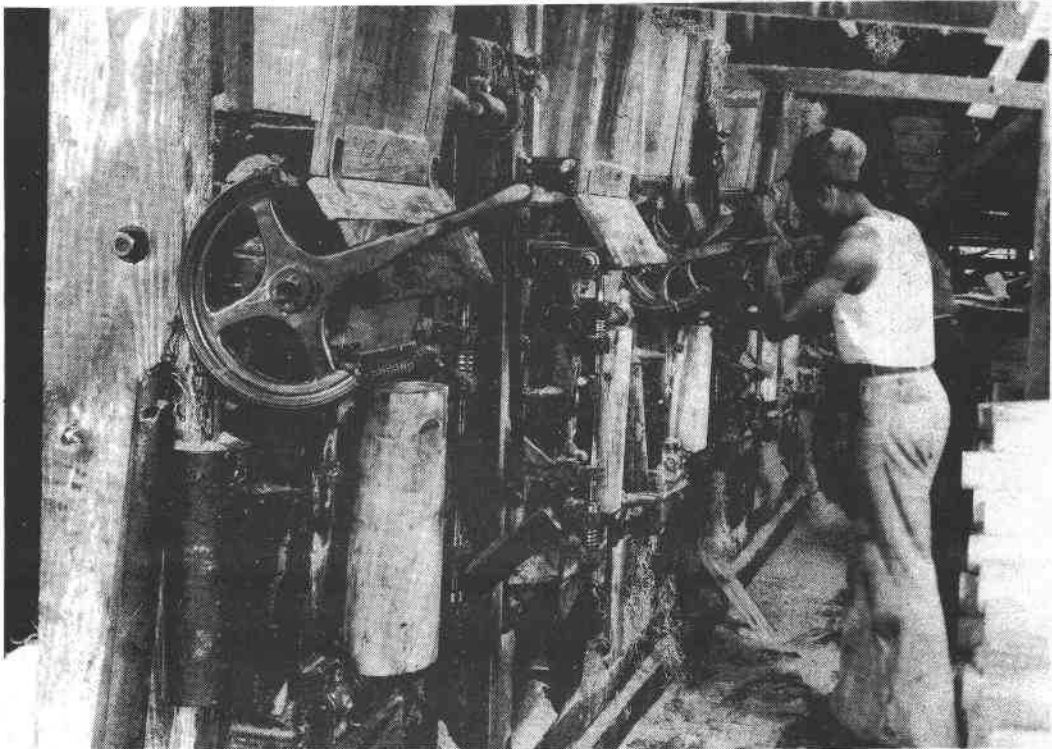


Fig. 13.--Excelsior being made from yellow pine and hardwood cores.



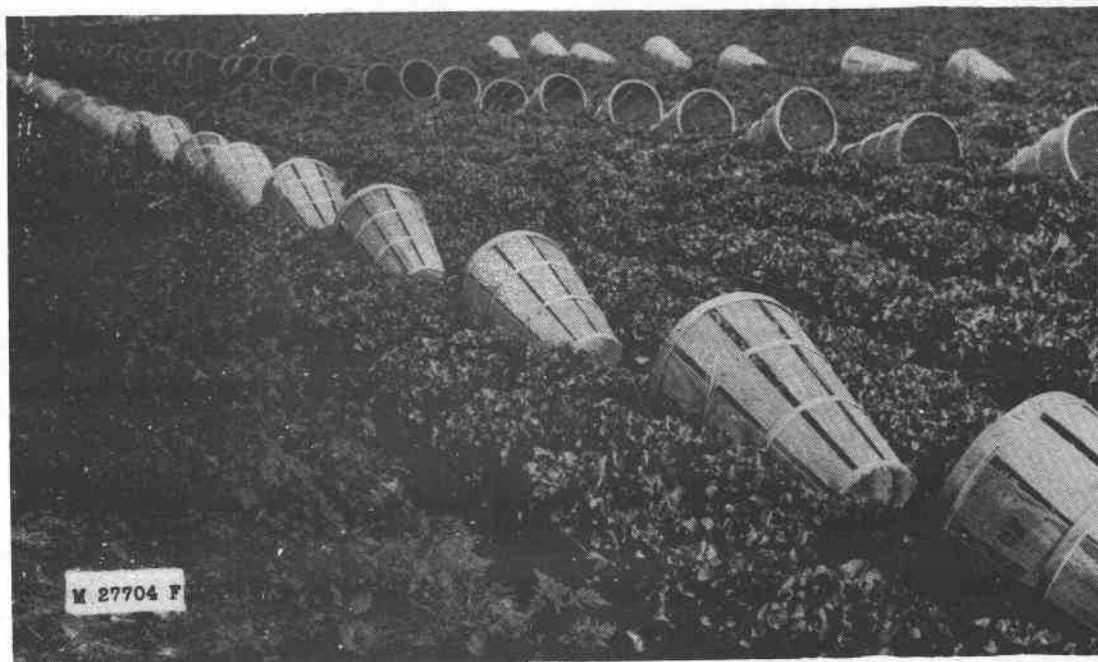


Fig. 14.--Hampers in a bean field.



Fig. 15.--Cypress field boxes in a grove.

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drying yard by a fourth man. The lumber was uniform in thickness and not excessively rough on the surface. A cord of 63-inch bolts cost \$4 delivered, or \$8 per thousand board feet, assuming two cords to the thousand so that the total cost was \$8.475 per thousand for labor and material. This is cheaper than headstick lumber produced on the average small sawmill at container plants, and considerably cheaper than headstick lumber purchased on the open market. Lumber for headsticks on the open market ranged from \$15 to \$25 per thousand at 6 mills and averaged \$18 per thousand.

If future manufacture of containers is to use a higher percentage of worked-out timber some of the above methods or improvements upon them will be used in addition to new developments in slicing and resawing to produce thin stock. No attempt is made here to inform operators how to slice or resaw pine and hardwoods at a cost comparable with rotary veneering choice logs. The answer to that question can only be obtained through experimental work at Madison, and in the field by the manufacturers themselves. The engineering college of the University of Florida has been urgently campaigning throughout the state for public support of a research laboratory at Gainesville to which industrial problems of this and other types may be brought.

Experimental work on bending hamper and basket hoops is also necessary. When a hoop breaks in bending, the hamper or basket machine must be stopped and the hoop replaced or otherwise bound down. Such delays are costly. In former years when evergreen magnolia (Magnolia grandiflora) was more abundant in the state, because of desirable bending properties, it was used almost exclusively. Being practically white it was and is desirable from a color standpoint. Sweet bay (Magnolia virginiana australis), which is also whitish in color, and the sapwood of red, black, and tupelo gum are being used as substitutes for evergreen magnolia with not too good results. Possibly the gums are so cross-grained that treatments of any kind will not help them, but research ought to determine the point. The sapwood of red gum is a rather unattractive color and would be more desirable if research could brighten it as well as enable it to bend without breaking.

### Seasoning

Headstick and Hamper Bottom Material.--Headstick and hamper bottom material is seasoned in a variety of ways by manufacturers of containers. If it is cut in long lengths by a sawmill it is generally piled in the customary manner for

lumber, namely, on foundations with stickers across the piles between layers. For more hasty seasoning long boards or flitches may be stood on end and leaned against racks criss cross.

Much short hamper bottom lumber is dried in circular piles (Figures 16 and 17). This type of pile is very firm and does not tumble down, but it requires considerable space, and depends for its drying upon wind currents across the pile. Raising such piles off the ground on foundations, such as the veneer cores shown, helps to increase circulation of air and to reduce blue staining of the lower layers.

It is now commonly known that by certain methods of piling, the temperature within a lumber pile can to some extent be controlled. Air within the pile cooled by evaporation of moisture from the lumber is replaced by warmer, drier air from the outside. The cooled moist air has a tendency to move downward in the pile, and the higher the pile the greater the circulation induced by this downward drop. By placing each board directly above the one beneath leaving adequate space between boards from the top of the pile to the bottom, circulation of air is freer, particularly if a high foundation is provided.

Figure 18 suggests a system for seasoning short headstick material. A height of 8 feet is indicated to induce greater downward circulation. The higher the pile, however, the more difficult the drying at the bottom of the pile. Moreover, if higher than 8 feet 2 men would be needed for piling. One man by standing on a simple scaffold, such as a board resting on stickers jutting out from the pile could readily pile as high as 8 feet. If the two half units piled close together do not exceed 6 feet in width and if a space of 3 feet is left between units, drying should be satisfactory.

Figures 19 and 20 show the drying of headstick material on a large scale. In Figure 20 the foundations are high, the space between piles is wide, approximately 5 feet, and the alignment of pieces is good. The piles, however, are rather wide for thoroughly seasoning the material in the center, as the only circulation provided for is that from wind currents across the piles. The pieces are placed so close to one another in each layer that vertical circulation which is so essential to good air seasoning is almost entirely eliminated. Much of the fuzziness in surfacing and otherwise working headstick stock and much of the blue stain could be avoided by more carefully planned methods of seasoning.

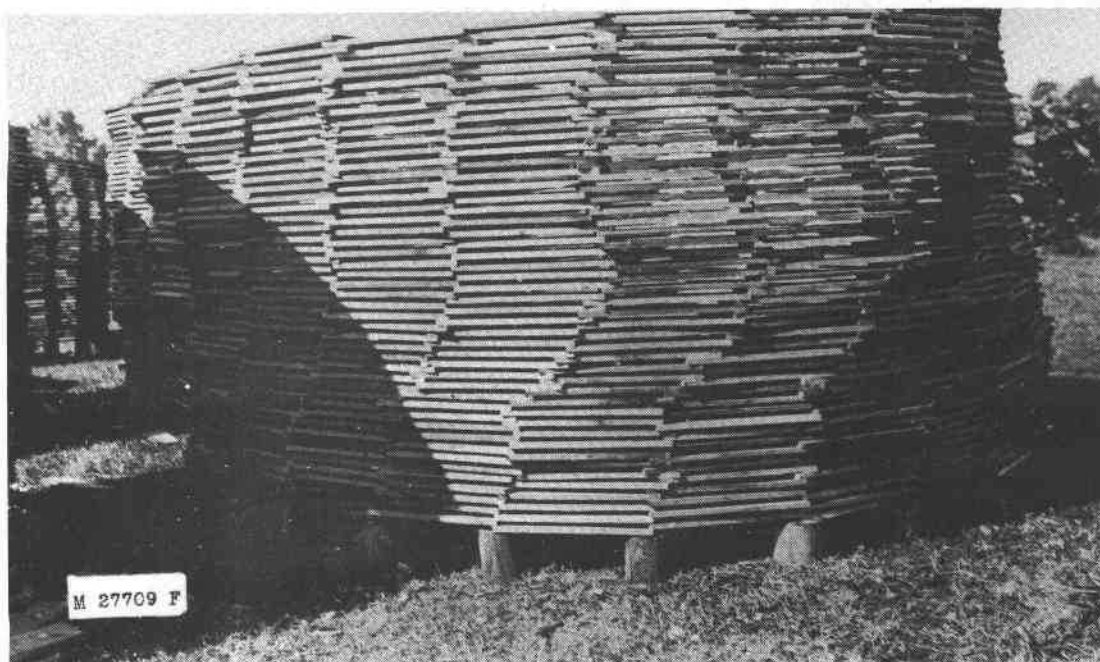


Fig. 16.--Placing the first layer on ends of veneer cores permits freer circulation of air and discourages blue stain in lower layers.



Fig. 17.--Air circulation is not as good when hamper bottom stock is laid on the ground. Lower layers may blue stain.

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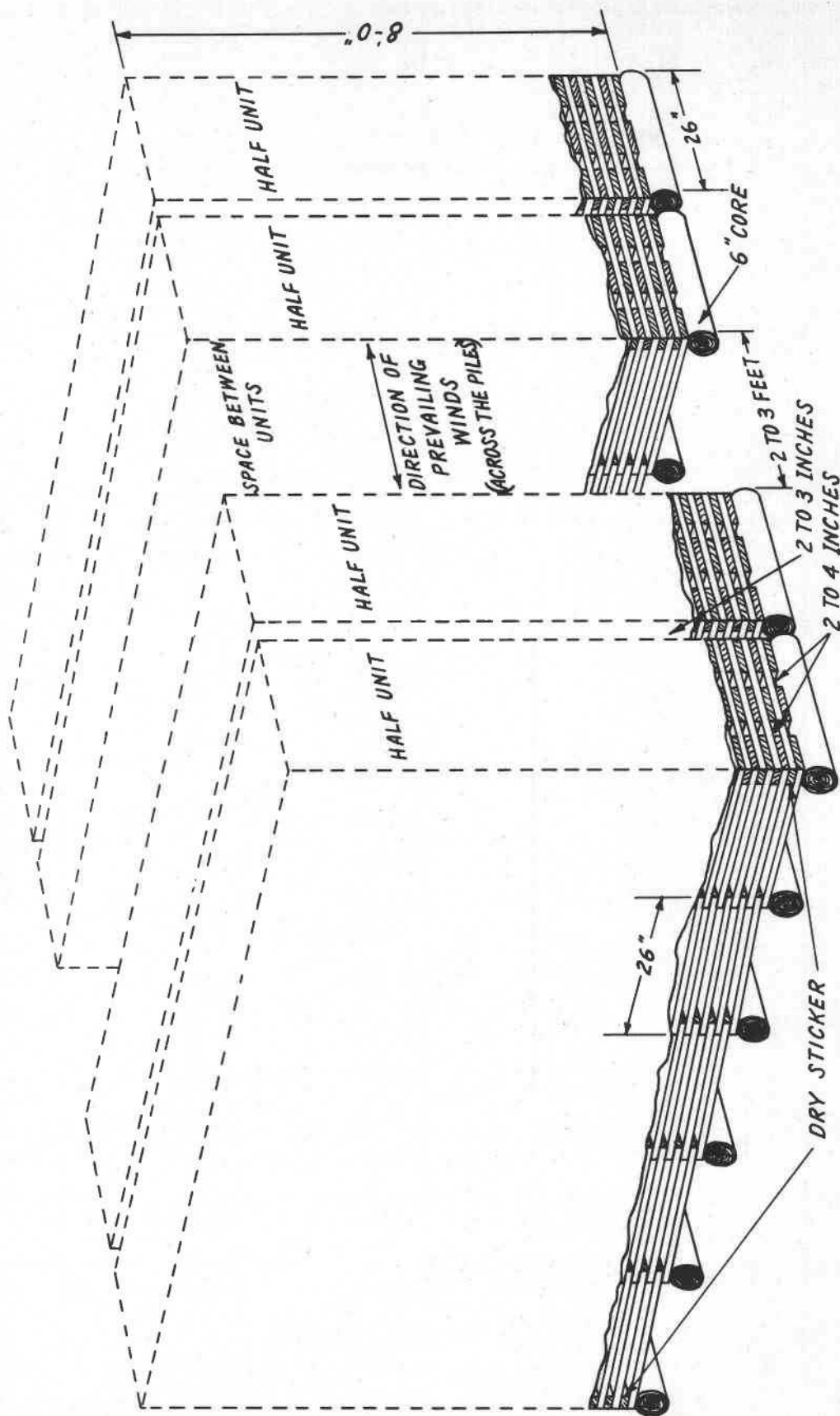


FIG. 18.  
 SUGGESTED METHOD FOR AIR SEASONING HEADSTICK MATERIAL



Fig. 19.--The lumber is too close to the ground,  
and wind currents across the yard are  
impeded by the stickers.

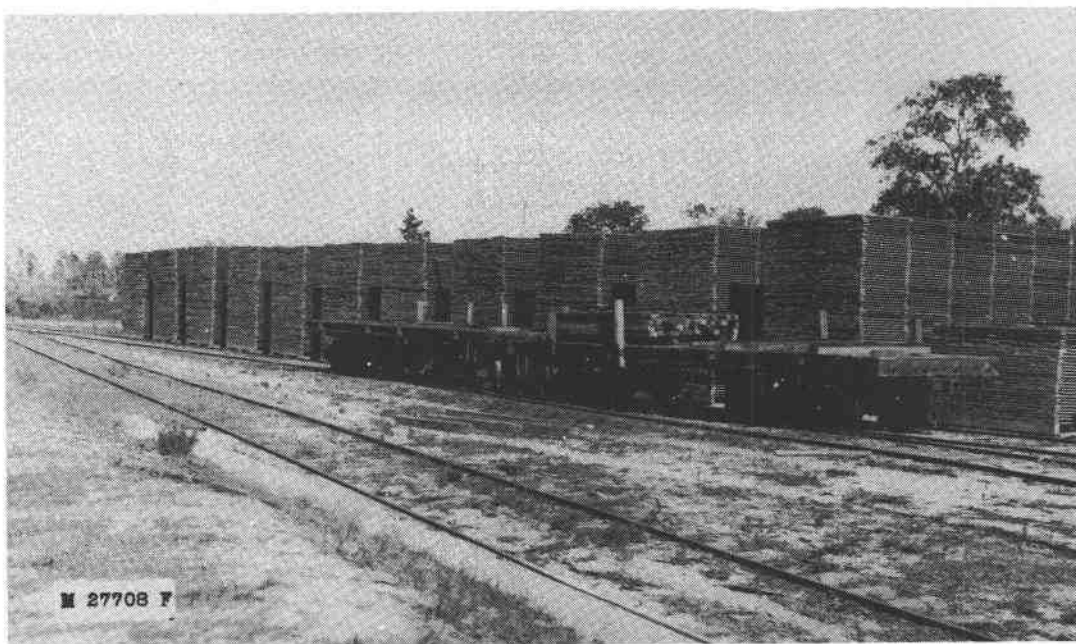


Fig. 20.--The foundations are high and the space between  
piles is adequate, but the piles are too wide  
for good drying inasmuch as the pieces in each  
layer are so close together (Fig. 21). They  
do not permit vertical circulation.



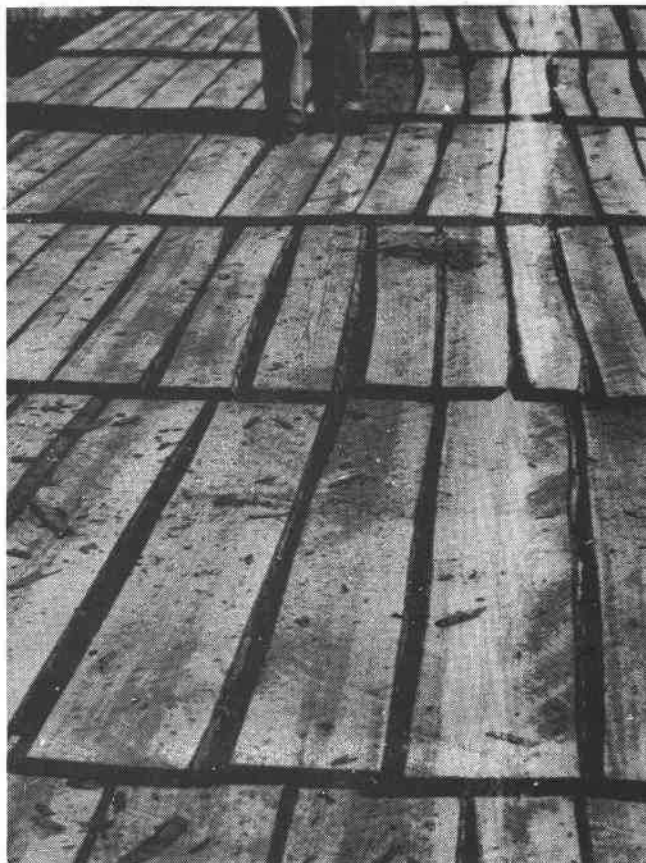


Fig. 21.--There is practically no vertical movement of air in headstick material piled this close together.

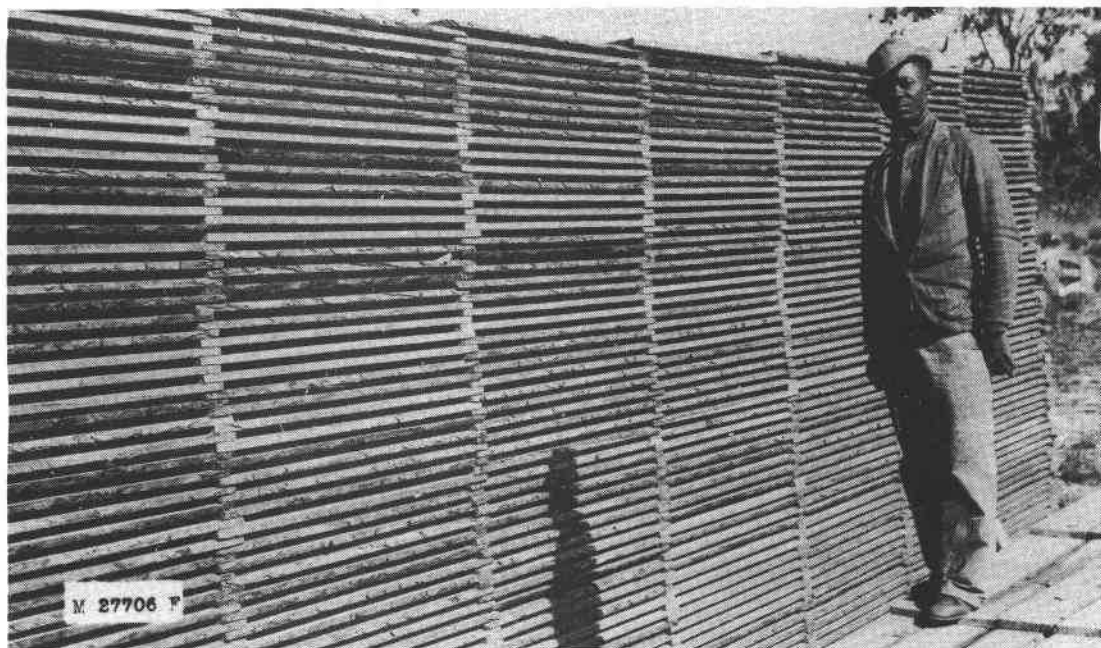


Fig. 22.--The same type of piling as shown in Fig. 20. Seasoning takes place only from wind currents across pile.

The presence of blue stain in yellow pine containers robs them of that attractive yellow look of freshness, and undoubtedly has its bad effect on the subconscious mind of the consumer. A number of manufacturers of containers are letting blue-stained material slip by into their containers. It may seem wasteful to reject material because blue-stained, but better than rejection is to prevent blue stain in the first place.

Where blue stain can not be conquered by improved methods of seasoning, dipping in some of the newer effective stain preventatives will help. Dipping is being done with more or less success by a number of container manufacturers, but it is suggested that seasoning methods be improved before the expense of dipping, though not prohibitive, is added.

### Veneer

A good share of veneer is still dried on racks in the open air or on racks in kilns. Loss through cupping, twisting and splitting is high in either case. During warm dry weather veneer dries rapidly outdoors, but in wet weather it often mildews and stains before it dries. The old types of progressive or tunnel kilns with fans pushing or sucking air are not drying veneer as satisfactorily as it should be dried. Several manufacturers with the hot roll type of drier which dries veneer in 30 minutes are really getting good results in uniformity of moisture content, in flatness of stock, freedom from stain, and low waste. Manufacturers unable to afford the flat roller dryer can, however, do much to improve seasoning. The modern forced circulation compartment kiln for example, is effective and not too expensive.

## Conclusions

1. (a) Approximately 145 million board feet of wood is used in Florida each year for containers to ship fruit and vegetables grown in the state. The pine used is either choice timber, mostly loblolly, for veneer, or small to medium-sized trees, mostly worked-out longleaf and slash pine, for sawn stock.

(b) A considerable quantity of wood is used for the many packing houses in the state, platforms, packing, company offices, as well as for the sheds, barns, and other buildings of the growers and for the car bracing used to bind together the shipments in freight cars.

(c) Considerable pitchy pine is used in orchards to "fire" on frosty nights. Oil and charcoal burners of one type or another are being used where pitchy wood is not easily available. Yellow pine excelsior is used on the beds of trucks which haul fruit in bags. Large numbers of stakes, now of cypress, are used to hold erect tomato and pepper vines and fruit trees in the early stages. Innumerable ladders with yellow pine rungs and cypress rails are made in the citrus region for use in picking fruit.

2. The demand for containers in Florida may be expected to increase if the fruit and vegetable industries, both well established, continue their expansion.

3. Intelligent state-wide planning will consider the use of a higher percentage of worked-out turpentine timber, abundant from Fort Myers to the Georgia state line. For the success of the naval stores industry, a dominant one, it is essential that worked-out timber be removed from the stands so that the next crop of smaller pines can grow.

4. Small worked-out pine costs considerably less per thousand board feet than choice veneer pine or hardwoods. Veneer bolts themselves cost 3 dollars more per thousand board feet in the south central part of the state than in the northern part.

5. Experimental work in slicing, sawing, resawing, and handling worked-out pine should be conducted in an effort to meet the cost of the traditional rotary-cut veneer container. (Sawn and resawn crates are made with success for the citrus industry in Texas, Arizona, and California.) This should go along with the veneering of smaller bolts to smaller core diameters now being done by several manufacturers.

There is also room for improvement in present methods of manufacturing headstick and hamper bottom material.

6. There is room for improving present methods of air seasoning and kiln drying container material. Blue stain can be prevented to a larger degree.

7. Buyers and sellers of veneer bolts should consider using the cubic foot as a measure instead of the board foot, Doyle rule.

8. There is need for experimental work to determine if gum hoops can be made more pliable without reducing the strength and thus reduce the loss in material and time occasioned by the breaking in bending of hoops for hampers, baskets, and tubs.

9. Wooden containers for shipping vegetables, because they can be exposed to the weather and to the moist contents without injury, should be able to hold their own against substitutes indefinitely. Wooden containers for citrus fruits, because not exposed, might meet with competition from substitutes sooner, but not until the substitutes can be produced as cheap, as strong, and as attractive to the consumer as the bright-colored wooden container.