THE LUMBER INDUSTRY IN WASHINGTON

CHUBB

INDUSTRIAL STUDY NO. 1

NATIONAL YOUTH ADMINISTRATION
JOHN H. BINNS, STATE ADMINISTRATOR

1195

THE LUMBER INDUSTRY OF WASHINGTON and the PACIFIC NORTHWEST

Including Logging, Sawmills, Shingle Mills, Plywood, Pulp and Paper, Specialties, Distribution

NATIONAL YOUTH ADMINISTRATION OF WASHINGTON

Industrial Study No. 1

by

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Washington Building
Tacoma, Washington

"Lumber Capital of America"

First Edition October 1938
Second Edition February 1939
Third Edition May 1940

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F O R E W O R D

Three hundred years ago axmen of New England, who had brought their trade and tools from Britain's forests, faced walls of pines that threw sunset shadows along unbroken leagues of the Atlantic shore. Westward was timberland continent. It was conquered by the laborious march of the axmen, the true trail-tamers of the American wilderness.

Far more than the musket is the ax of the pioneer woodsman a symbol of the advancement of our frontiers. With the ax the clearings were made and the logs hewn for homes. The settler's furrow followed the woodsman's swath. Cities were born from wood, as lumbering became the first industry of the Frontier.

The oldest homes that stand in America today are homes of wood. In them the work of the axmen of three centuries ago still lives.

More than a century ago the advance guard of this great army of peace reached territory that is now part of the State of Washington

By 1828 Dr. McLoughlin's sawmill at Fort Vancouver was cutting Douglas fir lumber with such effect that Governor Simpson of the Hudson's Bay Company urged the good doctor to advance timber before the fur trade.

Today the main forces of the lumber industry are concentrated on the West Coast of Washington and Oregon. Here, on twenty-nine million acres, remain five hundred and forty-six billion feet of timber. Lumbering is the bone and sinew of the region's economic life. So here the woodsman of American Tradition holds his own, at the western end of a continental march of three centuries.

The woodsmen of Washington are as brave a breed as were their forerunners, yet in their work and life they are as much in step with modern times as the men of motors and of steel. The machine rules in the Washington woods.

. . . . . .

The march of the axmen is at its end, on the Western shore of the continent. Here the trade that first began when Ug and Ag chopped trees with stone is at its last stand. It will survive, with the Washington forest managed as a crop and logging as a harvest.*

* - By James Stevens, Washington novelist and magazine writer, who wrote "Paul Bunyan". The Woodsmen of Washington, Washington Education Journal, October, 1937.

P R E F A C E

It is a real satisfaction to me to have even a small part in this industrial study of the lumber industry in Washington and the great Northwest. I was born and brought up in the heart of the timber country....I have seen the last of the ox-teams, the coming and the decline of high-lead logging, the liquidation process at its worst, disastrous forest fires, the famous "dark day", and the beginnings of sound reforestation practice.

Lumber was the first, and is still the greatest, industry in Washington. In spite of the mistakes of the past, our soil and climate are now repairing the damage; and proper management should assure a sound and stable development far into the future.

Thousands of young people in the Northwest will inevitably earn their livings in this industry.....Their lots will be easier than those of their predecessors. Wages and conditions of work have improved greatly and compare favorably with those in other industries. The high accident rate of early days has been reduced to a very low point....Despite the fluctuations to which the industry is subject, it offers a good livelihood to many of our youths who are seeking a chance to become self-respecting, self-supporting citizens.

. . . . . .

Many books, pamphlets and articles have been written about the lumber industry. There is no lack of technical treatises for the specialist or of beautifully illustrated brochures for customers and tourists. Phantasy and romance have been embalmed in fiction and verse....No one, until this study was made, had written a non-technical work which would give to laymen and students the answers to the practical, bread-and-butter questions related to this vast and many-sided industry.

The National Youth Administration in its efforts to train young people for private industry, discovered at an early date the dearth of such information for many industries and occupations. NYA in Illinois pioneered the fields with an excellent series. Ohio and Kentucky made valuable additions to the growing library of occupational studies. When directors of NYA visited Hyde Park in October, 1937, President Roosevelt urged that additional studies be made to cover the entire field of American industry. The beginning of this study was due to the suggestion which he made at that time. The purpose of the series has been well expressed in the preface to the NYA study, "The Rubber Industry in Ohio":

"1. To acquaint young persons with various occupations, so that they may have reliable information to aid them in planning their future work.

2. To make available in understandable form information about the country's leading industries, so that citizens may have

accurate and recent information about the kinds of work which are done and the workers who perform the necessary tasks.

3. To assist workers to comprehend the importance and relationship of employes in various occupations, so that they may understand how the conditions under which they work affect not only each individual worker, but all persons who depend on the work that they do."

The aim of the author and the editorial committee in this, the first study in the State of Washington, has been to give up-to-date, accurate, specific, non-technical information to and for young people seeking training for, or employment in, various branches of the industry. From it they should readily learn what they may reasonably expect to find in the way of rewards and limitations. It should be useful to students and out-of-school youth, as well as to vocational counselors in schools and employment services.

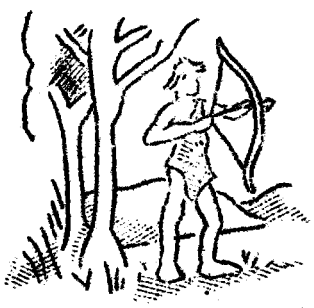
The technical processes involved in the various branches of the industry are so numerous and so complicated that the sections dealing with them may seem out of proportion to the strictly vocational information which follows. A choice had to be made between giving a sketchy, inadequate picture of the industry and a reasonably comprehensive one. Rightly or wrongly, the second method has been used in the belief that is is necessary to a full understanding of the latter portions of the work.

JOHN H. BINNS
Washington State Administrator
National Youth Administration

INDUSTRIAL STUDY of THE LUMBER INDUSTRY

I. INTRODUCTION

Wood and its manufacture are inseparably bound up with civilization....There is more truth than poetry in the saying that, since man's first appearance on the earth, trees have been his staunch and constant friends.....The age of wood began when primitive man fashioned the first crude implement from the limb of a tree. It proceeded as he learned to use wood for:



Fuel
Shelter
Transportation (rafts, canoes, boats, sleds, bullock-carts, chariots, Indian travoises)
Tools & utensils
Weapons
Trade

Further, the age of wood has been contemporary with all other ages through which man has passed from the dawn of history up to the present day.

WOOD AND CIVILIZATION

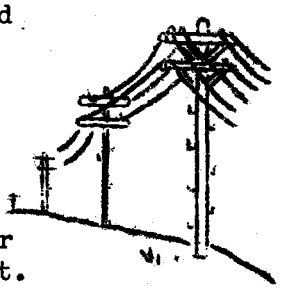
Wood carried the adventurous spirit of man out over the globe and pioneered the paths of progress. Actually, it founded this civilization, particularly here in America. You can scarcely turn a page in the early chapters of American history without seeing a picture of wood in some form....Wood built the stockades for refuge against hostile Indians.....Corn cribs and barns, both built of wood, protected crops and livestock.....Within the stout walls of log cabins the colonists and their children found shelter. They sat on wood chairs. They ate at wood tables. They slept on wood beds. Wood built the schools, churches, meeting places, and town halls, played an all-important part in the life of trade and commerce. The very first cargo sent back to the old land from Virginia was cedar logs.....Wood provided the ships and canal boats of the early days. It built the docks and wharves on which were loaded and unloaded the products of the farm, the plantation, and the sea. It built, too, the factories which soon began to spring up one after another in scores of fast-growing towns and cities along the Atlantic seaboard.

As "westward the course of empire took its way", wood again pioneered the paths of progress; this time clear across the continent. The gold-seekers and settlers, ever advancing westward and opening up

for posterity a vast new empire, made their journey in covered wagons built of wood. After them came the stagecoach; and the railroad, supported on ties of wood. And then the telegraph and telephone -- both striding ever forward on poles of wood.

LUMBER -- THE PIONEER INDUSTRY

Picture, too, the long trains of freight cars; cars, made of wood, bringing from the forest to the prairie huge shipments of lumber that quickly housed the in-pouring millions in the most economical, comfortable, and healthful of buildings. And down the rivers to mill and yard floated vast rafts of logs. Right to the far edge of the forest lands the logger and the lumberman pioneered with trapper and settler....Always the first manufacturing plant was a lumber mill....Lumber was the pioneer industry; carpentry the pioneer craft.



A. WHAT IS WOOD?

Because, in the beginning, the tree was "the symbol of life and the revelation of human destiny", and because of the place the product of trees has come to occupy in human affairs, it might be well to outline briefly what wood is. To most people wood -- being all about them, readily available and easily used -- seems a very simple and commonplace material. Actually, it is a very interesting and mysterious material.

1. Definitions

Webster's Collegiate Dictionary defines wood as "the hard, fibrous substance which makes up the greater part of the stem and branches of trees and shrubs beneath the bark, and is also found to a limited extent in herbaceous plants". J. S. Illick's "An Outline of General Forestry" reports a well known chemist as saying that "wood consists of a ground work of a starch-like substance known as cellulose, permeated by materials known collectively as lignin*, and it may also contain secretions such as resin, coloring matter, water, and small portions of minerals". Illick points out, however, that most foresters (and virtually all lumbermen) think of wood in terms of its uses and services, rather than its structural features and technical properties.

2. Chemical Composition

Whichever definition you prefer, bear in mind that the chemical composition is approximately the same for all kinds of wood; when dried at 300 degrees F, it is composed of:

Carbon.....	49%
Hydrogen.....	6%
Oxygen.....	44%
Organic Matter.....	99%
Inorganic Matter.....	1%
	100%

The inorganic matter makes up the ash when the wood is burned.

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* - See chemical section of this report for detailed discussion of lignin.

If you were able to take wood apart and examine it microscopically, you would see that it is composed of (1) cells (or fibers*) and (2) protoplasm (living matter), which disappears as cells become filled with water or air or both. Cells are smaller in hardwood than in softwood. Examine a cross-section of a log and you will usually find an outer layer of light-colored and an inner zone of dark-colored wood. The former is called sapwood and the latter heartwood. The sapwood is made up of active cells and the heartwood is essentially a dead core whose chief function is to hold up the stem and carry the tree crown.

MARVELOUS BOTANICAL FACTORY

As C. J. Hogue put it, a tree is a really marvelous botanical factory. "In its growth process, it pumps water and nutrient salts from the earth to all parts of the branches and leaves. In the leaves of hardwood trees and the needles of evergreen trees, the green coloring matter has the property of drawing carbon dioxide from the air, and in the presence of sunlight of combining the carbon dioxide from the air with water drawn from the earth to form a carbohydrate, which becomes the sap or the plant food. It has much the same chemical make-up as starch or sugar.

"From the leaves, the sap descends in the layer (called the cambium layer) between the bark and the wood, and new wood is formed: wood cells on the inner side of the cambium layer and bark cells on the outer side. There is no 'life' in the tree except in this layer. As each cell is formed it attains its full growth. There is no further life or growth in a cell once formed. Instead, new layers of cells are formed on each side of the cambium layer: wood cells on the wood side and bark cells on the bark side. And so goes the growth of a tree".

The wood of our common trees can be divided into two major groups -- those with pores (or porous woods) and those without pores (or non-porous woods). The pines, the spruces, the firs, the cedars, are common examples of non-porous woods. In pine, hemlock, and other coniferous woods, no pores occur; hence the name non-porous.

3. Properties of Wood

The principal physical properties of wood of interest to the average user are weight, strength, stiffness, toughness, hardness and shrinkage. These physical properties vary widely from species to species, and even from tree to tree.

HOW WEIGHT IS EXPRESSED

The weight of wood is usually expressed in pounds per cubic foot, or in pounds per thousand board feet, or by what is known as "specific gravity". If the specific gravity of a certain wood is expressed as .45 (for example, that of Douglas fir) it means that a given volume of the wood substance of this species weighs .45 times as much as an equal amount of water. Since a cubic foot of water weighs 62.5 pounds, a cubic foot of Douglas fir weighs .45 times 62.5 or 28 pounds, bone dry. The commercial weight would be governed by the moisture content and would range from 32 pounds well seasoned to 38 or 40 pounds green.

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* - Cells are sometimes called fibers, but fibers are really tissues or a chain of cells linked together.

It is the cell cavities which give wood its properties of lightness, insulation and non-conductability. (The cell cavities in wood act as dead air spaces and retard the transmission of heat, sound, and electricity.) Among the reasons why wood is the most common and advantageous building and construction material are:

a. It is fairly light.
b. It is the strongest known material in proportion to its weight.
c. Pieces of wood are easily fastened together.
d. It holds paint well because of its porous nature.
e. It transmits heat, sound, and electricity poorly.
f. It absorbs shocks and vibrations better than any other structural material.
g. It resists rust, acid, and salt water better than most of its substitutes.
h. It expands or contracts little on heating or cooling.
i. Its defects are usually visible on the surface.
j. It is highly ornamental.
k. It floats.
l. Its salvage value is high compared with original cost.
m. It is plentiful and comparatively inexpensive.

4. Factors Limiting Use of Wood

a. It cannot be drawn out into greater dimensions as metals.
b. It is limited in hardness.
c. It shrinks or swells with changes in moisture content.
d. It burns.
e. It decays.
f. It is subject to attack from insects.
g. It is variable in strength, even in the same species.
h. It splits easily along the grain.

Incidentally, the treating of timbers, poles, posts, and the like with creosote and the more recent development of mineral salt preservatives for lumber, timber, poles, and piling, delay and even stop decay and insect attack. Such salt preservatives also add slightly to fire resistance.

B. USES OF WOOD

"Wood", say Bennett and Older, in their book, "Occupational Orientation", "is the most important and universal material used in industry. Although substitutes have been produced, it is improbable that they will ever seriously compete with it as a basic raw material. In ease of manufacture, wood is unexcelled by any other substance. A non-conductor of heat and electricity, it is peculiarly adapted to the manufacture of a great many products. Although ten times as light as iron, it is nearly as strong, in proportion to its weight. Its lightness and flexibility, combined with its great strength, make wood especially adaptable in the manufacture of airplanes....The manufacture of wood will undoubtedly continue to furnish employment to a considerable number of our population for many decades to come." Especially is that true in view of the fact that wood is a renewable resource.

MORE THAN 25,000 USES

Twenty years ago, two thousand uses of wood could be enumerated: now, according to the Forest Products Laboratory, there are more than twenty-five thousand. To mention a few:

Radio cabinets -- from a small start a few years ago, the use of lumber in radio cabinets progressed at times to a point in excess of that which went into house-building....Movie films are derived from the cellulose in wood ....Millions of feet of lumber go into the make-believe world of movie scenes. (Lately, plywood has become a standby in Hollywood.)....Even mining and metallurgical industries lean on wood....Our network of railroads rests on wood cross ties and mainly wooden bridges...Tens of millions of telephone and telegraph poles extend instantaneous communication in all directions. And billions of wood fence posts dot and measure our landscape. Small wonder wood has been preclaimed by both public and private interests as "America's most versatile construction and industrial material." Look around you! Doors and window frames and sash are almost universally of wood, as is fully 85% of all household and office furniture.

MOST VERSATILE MATERIAL

A host of tools and agricultural implements are partially or entirely made of wood. The automobile industry is still a large wood user, either directly or in processed form. The majority of sporting necessities are wood-constructed. Wood goes into: chests, cases, trunks, boxes, barrels, crates, handles of all sorts, printing "furniture", musical instruments including pianos, picture frames, signs, airplanes, toys, toothpicks, matches, pencils, clothespins, utensils, tanks and silos, refrigerators, gates, pulleys, spools and bobbins, textile and other machines, boot and shoe findings, saddles, building scaffolds, water and electrical conduits, boats, sewing machines, the innumerable forms of wooden ware, laundry appliances-- and so on, from cradles to coffins. You can no more play than you can work without wood. No miracle of science promises to replace wood for mallets, bats, clubs, rackets, skis, billiard cues, bowling balls, and so forth.*

Wood is a material that is simply a useable form of elements that eventually return to their disunited conditions. (Carbon, hydrogen, oxygen.) Eternally producible wood, instead of being the target of substitutes, may become the universal substitute to piece out the dwindling supplies of non-replaceable inorganic materials, that is, composed of other than animal or vegetable matter; hence, not growing, inanimate.

ALL OF US CONCERNED

It is no exaggeration to say that on its forests, more than any other resource, depends the future prosperity of Washington and the Northwest. Wisely used, carefully protected against fires, wasteful exploitation, and the ravishes of disease and insects, our forests will last indefinitely. With immense water power possibilities (already under development at Grand Coulee and Bonneville), with ocean transportation, with tourists coming to our Evergreen Playground in ever increasing numbers -- indeed, the State of Washington spending $250,000 to encourage their coming -- it is not merely schoolroom philosophy but good business for each of us to preach and practice care in guarding against and reporting fires encouraging efficiency and economy in the use of wood. Lumber and lumbering settled this country. They can -- and must -- keep it growing and prospering.

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* - Moon and Brown, forestry authorities, summarize lumber uses as follows:

Construction Industries.	67%
Wooden Packages (boxes, barrels, crates, etc.) . .	15%
Industrial Uses and Export Lumber.	18%
TOTAL	100%

Lumber consumes about 51% of the total value of timber cut from the U. S. forests for commercial use; fuel wood, 28; and pulp and paper, shingles, specialties, the balance, accordingto "Americana".

DIRECT PRODUCTS

Fuel Wood
Christmas Trees
Acorns and Nuts
Fruit (Berries, Cherries)
Decorative Material

DECORATIVE AND DERIVED PRODUCTS

UNMANUFACTURED PRODUCTS

Pulp Wood		Fuel Wood
Extract Wood		Mine Timbers (Round)
Bark	LOGS	Poles
Resins, Gums		Piling
Sap (Maple)		Posts

SEMI-MANUFACTURED PRODUCTS

Wood Pulp	Lumber	Veneer Blocks
Tannins	Cross Ties	Cooperage Stock
Acids	Switch Timbers	Cants
Dyes	Beams	Flitches
Oils	Girders	Squares
Rosin, Pitch	Billets	
Charcoal	Bolts	

MANUFACTURED PRODUCTS

Wood Pulp	Lumber	Barrels
Cellophane	Timbers	Baskets
Rayon	Rafters	Boxes
Gun Cotton	Joists	Crates
Lacquers	Studding	Caskets
Vulcanized Fiber	Flooring	Tanks
Magazine Paper	Molding	Ladders
Newspaper	Paneling	Handles
Book Paper	Doors	Pipes
Wrapping Paper	Frames	Pencils
Tissue Paper	Lath	Toothpicks
Paper Plates	Shingles	Matches
Leather (artificial)	Fixture	Toys
Wood Flour	Furniture	Spools
Plastics	Plywood	Tool Handles
	Insulating Board	

From "An Outline of General Forestry".
By J. S. Illick

C. HISTORICAL HIGHLIGHTS OF LUMBER INDUSTRY

Shelter, next to food, is the most important necessity of mankind, especially in a country whose climate varies greatly in certain sections. The American nation has always been committed to the use of wood and it is likely to continue this custom, which has been handed down by centuries of tradition, as long as it is economically possible to do so.

1. Typically American

The lumber industry is distinctly and peculiarly American. In fact, the name "lumber" itself is an American-made name.* Always a pioneer industry, lumber has been first to last typically American -- an industry of great physical feats, prompt action, reckless daring. Some point out rather cynically that it has typified the American habit of ruthless exploitation -- needlessly destroying forests which would now be an asset to agriculture as well as industry in this day of faster, cheaper transportation. But such critics of the industry overlook some important facts.

ONCE BELIEVED INEXHAUSTIBLE

For one thing, even the scientists of a few generations ago pronounced our forest resources (come what might in the way of population and industrial expansion) as virtually inexhaustible. For another, the destruction of large stands of timber was sanctioned, even encouraged officially, for the clearing of agricultural land, especially in the central hardwood regions. And, again, no one could have foreseen how much the fortuitous destruction of timber by fire, wind, and insects would be increased by the rapid extension of the American frontier. And so it is at once fruitless and unfair to blame the lumber industry alone for the fact that this country, from possessing "inexhaustible" forest resources, now has only one great stand of virgin timber left. (That in the Pacific Northwest.) If anything is to blame, it is the whole American system of doing things heedlessly, "colossally", and with incredible speed.

2. A Migratory Industry

In the very nature of its enterprise, then, the lumber industry was a nomad among American industries. Sawmills followed supply, water, and population. Successively, the center of lumber activities was located in New England (which early became the headquarters of the ship building industry), the Middle Atlantic states, the Great Lakes region, and then the South (which is still one of the two greatest producing regions), and finally the Rocky Mountain and Pacific Coast region.

3. Mechanical Steps

For a good many years lumber, of whatever size or shape men needed, was manufactured entirely by hand. The only implements used

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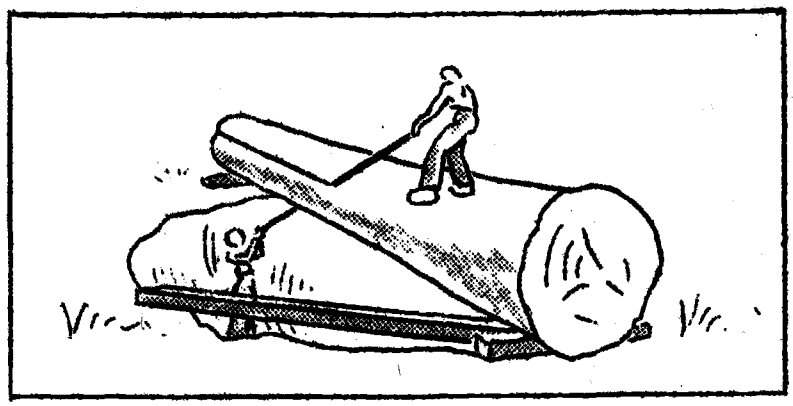
* - "Lumber" was the meaning for the rich treasure room of bankers of old. When we come to lumber of the Canadian (and Northwest) woods, however, we have a different meaning and derivation. To the early French settlers, the shady depths of the forest were "l'ombrage", easily corrupted to the English "lumber". -- Hargrave's "Origins & Meanings of Popular Phrases and Names".

to cut trees down and how them into boards, beams, or other shapes of wood were the ax and the wedge. And sledges were used to do whatever preliminary transporting was necessary. Step No. 2 was the development of the two-man saw and this brought the so-called whip-saw, or pit-saw, method into general use. Either the log was boosted onto high saw-horses, or a pit was dug so one sawyer could stand on top of the log and the other below it, cutting lengthwise. Illick records that this method continued until as late as 1860.



a. First American Sawmill

Our earliest sawmills were an adaptation of the European type, with the old familiar water wheel and simple sash-saw, cutting slowly and producing only a few hundred feet a day. Most early sawmills were also grist mills; that is, they ground grain when they were not cutting wood.

Authorities agree that Jamestown, Virginia, was the site of the first American sawmill and that 1625 was the date of its establishment. It was in 1631, at Berwick, Maine, however, that the first commercial sawmill was started. After that, for nearly a century, America had few if any mills which produced as many as 5,000 board feet a day.

DISCOVERY OF THE STEAM ENGINE

The discovery which gave the first big impetus to the lumber industry was the steam engine. But even that was not universally accepted overnight. Indeed, "it is reported," says Dr. Illick, "that the first steam sawmill in this country, erected in New Orleans in 1811, was promptly destroyed by a mob of angry laborers who assumed they would be thrown out of work by the application of steam power to the saws."

b. Saws Make History

In the next cycle of development it can be well said that lumber history was made by the invention of the circular saw and the band saw. Authorities credit a blacksmith -- Benjamin Cummings, who was born at Bentonville, New York, -- with hammering out the first circular saw in 1814. The introduction of the band saw in American sawmills dates from the Philadelphia Centennial Exhibition of 1876, when Henry Disston (whose name stands for saw progress and quality to this day) created a sensation by exhibiting his perfected band saw in actual operation. Band saws, gang saws, and circular saws are at once the symbols and the requirements of modern high speed production.

c. Big Scale Lumbering Began in 1840

Up to 1840, lumber was used chiefly to satisfy local home demand and for export. It was the development of the Prairie and Plains states -- many of which were short on timber and some of which had none at all -- which gave lumbering its greatest impetus after that time. "The first census giving the number of sawmills with considerable accuracy was issued in 1840. It recorded a total of 31,650 sawmills in the United States, of which 6,356 were in New York, and 5,389 in Pennsylvania, or more than one-third of the total in the country in these two states." (J. S. Illick, "An Outline of General Forestry").

d. First Northwest Mill

The first sawmill west of the Mississippi River was built in 1827, by the Hudson's Bay Company, at Fort Vancouver (which fort still stands in Vancouver, Washington). It was a whip-saw (or pit-saw) mill, with the saw pulled by Hawaiians, or "Sandwich Islanders", as they were called in those days. Much of the output was shipped to Hawaii. According to the American Guide, the first sawmill in Puget Sound began operating in the winter of 1846-47. It was the Simmons Mill at Tumwater. However, what George E. Griffith, of the U. S. Forestry Service, called the real "daddy" of the Pacific Northwest lumber industry got under way in 1850, when the first steam sawmill in the Oregon country cut its first board at the foot of what is now Jefferson Street in Portland. This little mill,* which turned out 500,000 board feet of lumber its first year, was built by W. P. Abrams and C. A. Reed (both from New Hampshire), in partnership with Stephen Coffin, who later became Mr. Reed's father-in-law. The mill was operated under the name of Coffin & Abrams. In 1852, Mr. Reed sold out his interest and moved to Salem, while Mr. Abrams continued the operation of the mill.

e. Factors in Northwest Expansion

From 1850 till 1900 lumbering was largely of local character in the West Coast region. Probably the most important factors in stimulating the lumber industry of the Pacific Northwest were: The completion of the Northern Pacific Railroad in 1882, the granting of lower freight rates to eastern markets in 1894, and the opening of the Panama Canal in August, 1914.

WASHINGTON LONG IN THE LEAD

Washington became the leading state in lumber production in 1905, and has held this place every year since, with the exception of 1913, when Louisiana was in the lead. In 1926, Washington produced more than 7,546,000,000 board feet, or 20% of the nation's total lumber demand -- and that was the high point of our lumber production to date. There are at present 423 sawmills in Washington, 107 of them producing more than 10,000 board feet per hour, most of the others producing less than 3,000 board feet** per hour. Everett and north to Canada has 63 mills; Seattle and vicinity, 64; Tacoma and vicinity 62; Olympia and Chehalis, 86; Grays and Willapa Harbor, 49; and Columbia River, Washington, 99.

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* - Oregon Historical Society

** - A board foot is the quantity of lumber contained in, or derived from (by drying and/or planing and/or working) from a piece of rough green lumber 1 inch thick, 12 inches wide, and 1 foot long, or the equivalent in thicker, wider, narrower, or longer lumber. This is abbreviated "ft. B.M."

How marked have been the shifts in the main sources of America's lumber supply can be seen from the following percentages: 75 years ago the Northeastern States produced more than 50% of the lumber supply in the United States. Today they produce less than 4%. Fifty years ago the Southern States supplied only about 10%. Now their production is more than 40%. A scant half century ago the Western States produced less than 10% of the nation's supply. Now they produce nearly 50%. So the ups and downs have proceeded.

A vital difference from the past is that the region of greatest productivity is now farthest from population centers. Still the per capita consumption is greatest in the State of Washington. In 1934, Washington consumed 26% of its own lumber production. And, with the United States as a whole showing a declining per capita use in recent years, it behooves this state, so dependent upon forest industries for employment, to sponsor and encourage research to develop new and larger uses for lumber. The value of such research has been demonstrated in the steady expansion in recent years of the pulp and plywood branches of the industry, both of which have been following this policy.

D. ECONOMIC IMPORTANCE OF THE INDUSTRY AS A WHOLE

You now have at least a rough idea of the way the American lumber industry, from a small beginning in colonial days, developed into one of the leading industries of our nation. But a few further facts are in order to show you what this industry means to America economically.

In 1935, the total U. S. production of Lumber (hardwood and softwood) amounted to 19,538,731 M board feet, an increase of approximately 26.1% over the 15,493,639 M board feet reported for 1934.

YEAR	BOARD FEET
1917	35,831,000,000
1923	37,165,505,000
1925	38,538,641,000
1929	36,886,032,000

(From 1929 production declined steadily until it reached 10,151,232,000 in 1932.)

YEAR	BOARD FEET
1933	13,961,134,000
1934	15,493,639,000
1935	19,538,731,000
1936	24,354,884,000
1937	24,650,500,000 (estimated)

1. Size of the Industry

The capital invested in the U. S. lumber industry in its narrowest sense is estimated at three billion dollars minimum and eight billion maximum, with the total of all forestry industries, secondary and primary, taking the total up to ten billion dollars.

In 1924 (the last year such a study was made) lumber's freight bill (including timbers and sawed ties) was approximately $408,500,000,

of which $309,700,000 was for primary haul and did not include charges for redistribution to consumers. For softwood lumber from Pacific Coast States, $88,906,144 was paid in freight in 1924 -- 7.3% more than any other region. Of 15 general industries, not including agriculture and the railroads, the lumber industry in the last decennial census, ranked fourth in the number of wage earners, fifth in the amount of wages paid, and ninth in the value of its product. The lumber and secondary woodworking industries of the United States represent $3,600,000,000 in value of annual products and 1,000,000 in number of employees. According to the 1929 census, the Forest Products Industry employed 866,599 wage earners, paid out a total of $926,201,000 wages and produced products valued at $3,531,282,000. It has been estimated that, with all the distributing agencies, associated industries, transportation, etc., more than one-tenth of our total population is dependent upon the forests, which next to agriculture, is our greatest single resource. The average number of wage earners in the Forest Products Industry had dropped to 454,171 and total wages to $289,097,000 by 1933; but there was a recovery which brought them back to 579,012 wage earners and $438,395,310 by 1935*.

MORE THAN A MILLION OF OUR POPULATION DEPENDENT ON FORESTS

2. Back of the Forests

At first rudely hacked, chopped, bent or burnt into shape, wood is now the product of mills which are equipped with the most efficient and powerful machinery that science and ingenuity of man can devise and perfect in this age of quantity production.

America now has individual mills that make a million feet of lumber a day -- equivalent to 100 five-room houses -- and at the same time dry, dress, tongue and groove, and mold a large part of it.

Back of the mills in the American forests is great equipment for cutting the trees and getting the logs to the mills. 30,000 miles of logging railroad (which is more railroads than most nations have), countless locomotives, donkey engines, tractors, trucks, chutes, flumes, dams, canals, tug boats, rafts, cable-ways, aerial trolleys, and horses wrest the heavy and bulky logs from their fastnesses in mountain and swamp and convey them to the gleaming, whirring saws.

E. ECONOMIC STATUS IN WASHINGTON

George E. Griffith of the U. S. Forest Service, in his forthcoming book, "Green Gold", points out that more wealth has been taken from the hills of Washington and Oregon in the form of forest crops than ever came out of the hills of the West in the form of yellow gold. He adds: "The best part of it is that, properly handled, the green gold of our forests is a renewable resource."

1. Two Northwest Forest Regions

The forests of Washington and Oregon are divided roughly into two regions, which differ as to climate and tree growth. These are succinctly described by George E. Griffith in "Green Gold" as follows:

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* - "Lumber & Timber Information" Revised March, 1938, National Lumber Manufacturers' Association.

"(1) From the slopes of the Cascades westward to the ocean are the dense coast forests of Douglas fir, Western hemlock, Sitka spruce, and Western red cedar. (The Cascade Range extends from British Columbia approximately to the California line.) Here are found some of the most magnificent forests in the world. For majesty and luxuriance of growth these lands are unequaled, thanks to our mild climate, generous rainfall, and generally favorable conditions." This is "the Douglas fir region", where there are over twenty-nine million acres of forest land bearing Douglas fir, West Coast hemlock, Western red cedar, and Sitka spruce.

"(2) East of the Cascade summit are the open park-like Ponderosa Pine forests, characteristic of the drier prevailing climate. Here are found extensive stands of the valuable Ponderosa Pine, formerly called Western Yellow Pine. Between these two types, at the higher elevations of the Cascade Range, are the alpine woodlands, largely of Mountain Hemlock and Balsam Firs. These alpine areas are of lower timber value, but are important for protecting the head waters of streams, for grazing, for wild life, and for recreation."

2. The "Big Four" in West Coast Trees

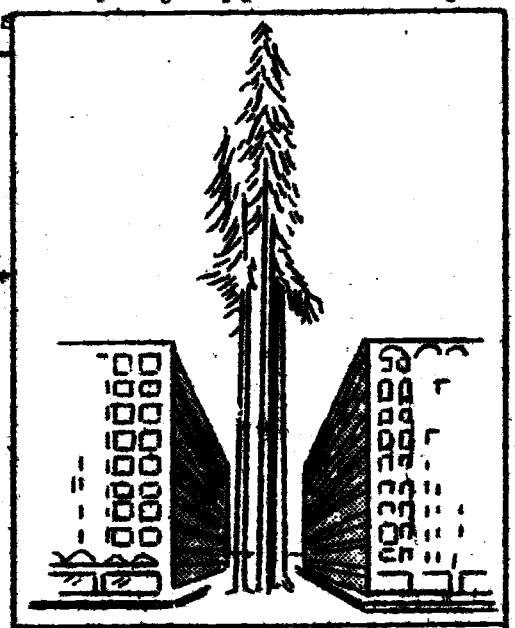
The U. S. Forest Service lists and describes some twenty-two different coniferous, or softwood, trees of real economic importance in the forests of Washington and Oregon. However, the "Big 4" commercially in the "Douglas fir region" are Douglas Fir, Western Hemlock, Western Red Cedar, and Sitka Spruce in the order named. All four are coniferous or cone-bearing trees. Indeed, it is in coniferous trees that the Northwest forest riches lie.

a. No. 1. - Douglas Fir (Scientific Name - Pseudotsuga taxifolia)*

This is the most common tree in Western Washington and Oregon. But common only in a numerical sense. In size, majesty, and volume per acre it is in a class by itself. Besides being the chief timber tree of the Northwestern United States, it is considered the strongest of the soft woods, being straight-grained, tough, and yet quite easily worked.

Douglas fir was first known abroad as Oregon Pine and is still largely marketed as such. However, the U. S. Forest Service has adopted "Douglas fir" as the official designation of this important wood. The name immortalizes the work of the famous Scottish explorer and naturalist, David Douglas, who, as field representative for the Royal

WHERE NAME CAME FROM



...Douglas fir trees grow almost twice as tall as a 10-story building...

* - Three languages were used in creating the scientific name for Douglas fir. Pseudo is the Greek word for false. Tsuga is Japanese for Hemlock. Taxi comes from taxius, Latin for yew. Folia is Latin for leaf. So Pseudotsuga taxifolia means literally: "a false hemlock with a leaf like a yew."

Horticultural Society, visited the Columbia River district in Oregon and Washington in 1827, and returned with seeds and numerous seedlings. While the tree is often called in the trade a pine, it is neither a pine nor a fir, but an individual species. Douglas fir is a conifer or softwood, in many respects resembling pine, and is superior to the true firs in size, strength, durability, usefulness, and all other properties. Douglas fir is noted for its large heartwood content, about 90% of the wood being heartwood. This large heartwood content is very important, because in any species, the heartwood is far more durable than sapwood; also it has little tendency to twist or warp, and dries more evenly because it has far less moisture than does sapwood.

According to a report of the U. S. Forest Service, Douglas fir is credited with being the most important of the American woods, being manufactured into every form of lumber known to the sawmill operator. For house construction Douglas fir is manufactured into all forms of dimension stock, and is used particularly for general building and construction purposes. Its strength and comparative lightness fit it for joists, floor beams, and other timbers which must carry loads.

The comparative hardness of the wood fits it for flooring, and it meets a large demand. Douglas fir grain-edge flooring is considered superior to that made from any other soft wood. Clear lumber, sawed flat grained, shows pleasing figures. It takes stain well, and by staining, the beauty of the grain may be more strongly brought out and a number of rare woods imitated. It is the standby of the Plywood industry of the Northwest.

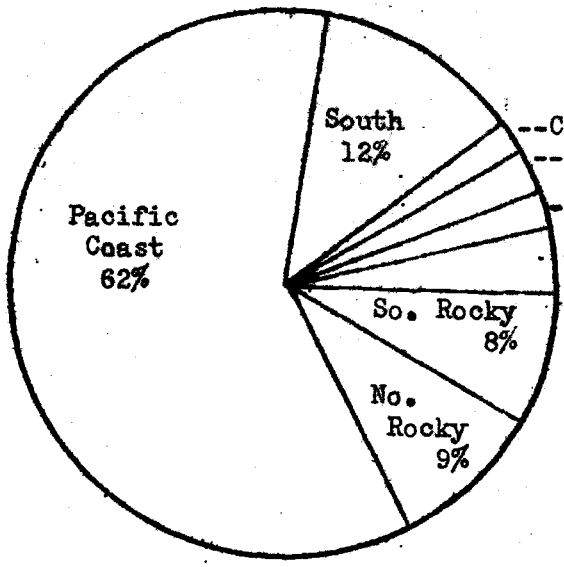
WIDE USE FOR CONSTRUCTION

The large size which these Douglas fir trees obtain makes it possible to secure from them timbers of the greatest dimensions required in modern construction, and probably it is used more today than any other construction timber. Douglas firs that are four, five, or six feet in diameter and over two hundred feet high are so frequently cut that they occasion no comment.

b. No. 2 - Western Hemlock (Tsuga heterophylla)

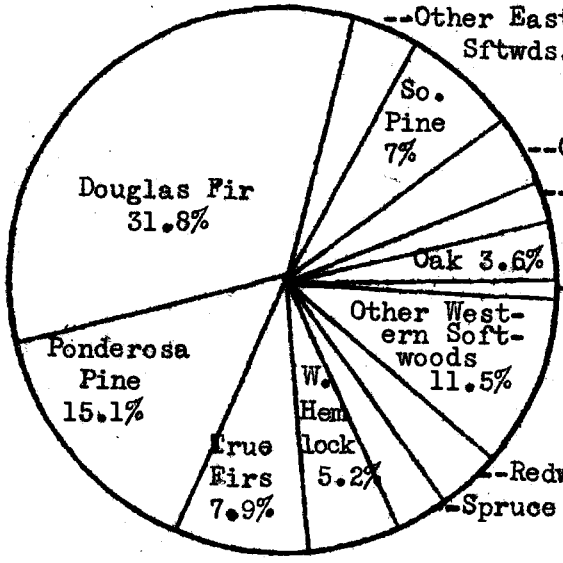
The West Coast hemlock differs greatly from the Eastern trees bearing the same name. It reaches a height of 160 feet and a diameter of five feet, and produces wood of an unusually fine quality. The "clear" is especially valuable for the finest grades of flooring, as under the most extreme use it shows little tendency to wear. It is one of the few woods that does not darken with age, and a floor of West Coast hemlock will remain bright and smooth for an indefinite period. In fact, it actually increases in beauty and appearance with age. Few woods are so enriched and so mellowed by the touch of time. It takes finish or paint exceptionally well. Exceedingly strong in proportion to its weight, it is valuable for general construction and is used extensively as a framing material and for sheathing, roofing, ceiling, and siding. It has been found admirably suited to the making of doors, sash, and furniture, due to its freedom from pitch. Railway companies have come to recognize its great value for car sides, and it is also much used for mine timbers. For the manufacture of boxes, packing cases, and other light construction, its light weight and great strength have placed this wood in the lead.

ALSO VALUABLE FOR GENERAL CONSTRUCTION



SAW TIMBER STAND BY REGIONS

	Million bd. ft.
Pacific Coast	1,041,628
Other West	272,344
South & Southeast	199,297
Central & Northeast	154,534
Total.....	1,667,803



SAW TIMBER STAND BY SPECIES

	Million bd. ft.	% of Total
Eastern Softwoods	174,598	10.5
Western Softwoods	1,311,252	78.6
	1,485,850	89.1
Eastern Hardwoods	179,233	10.7
Western Hardwoods	2,720	.2
	181,953	10.9
Total Saw Timber Stand Stand.....	1,667,803	100.0

Source: "Charting The American Lumber Industry", February, 1937

In the manufacture of sulphite paper it ranks exceedingly high; indeed, pulpwood is now the major use of Western hemlock.

c. No. 3 - Western Red Cedar (Thuja plicata)

Western red cedar is the largest and finest of the cedars. Second in size to the Douglas fir, the giant log yields wide, clear lumber that shows very little tendency to check (crack) or warp. It is particularly useful where lightness of weight, durability, or ease of working are desired. It is free from pitch and remarkably light, while its resistance to rot makes it especially useful where exposed to weather or moisture. It is extremely durable even when placed in contact with the soil. Western red cedar can be used for the most exacting work, and is unsurpassed in the manufacture of shingles, it being estimated that approximately 90% of all wooden shingles being used in the United States are made from this wood. Edge-grain shingles from this wood do not curl or twist and are guaranteed to last from forty to fifty years when nailed with copper or zinc-coated nails. For poles and posts, no wood offers equal advantages, and large quantities are used for this purpose.

d. No. 4 - Sitka Spruce (Picea sitchensis)*

The Western, or Sitka, spruce, which has gained nation-wide prominence from its use in airplane construction, is a strong, tough wood of great lightness. Like its associates, the Sitka Spruce is a large forest tree, sometimes reaching a height of 180 feet and a diameter of 12 feet. The best grades are found near the coast in Washington where it grows even more rapidly than Douglas fir. It is a clean, white wood, and the great size of the trees which grow in Western Washington makes it possible to secure large logs which yield a high percentage of extremely wide boards, entirely free from defects. On account of its uniform quality, this wood is especially valuable for sounding boards in fine musical instruments, such as violins and pianos. It is unsurpassed for airplane timbers. It is widely used for bevel siding, boxes, interior trim that is to be enameled, and as shop lumber. As a pulp wood, it is used in the production of the finest grades of paper.

GREAT SIZE AND EVEN QUALITY

The principal other West Coast woods are:

Port Orford Cedar

Port Orford Cedar is produced principally in the Coast region of Southwestern Oregon, the best timber of this species being found in Coos and Curry counties where it forms about ten to twenty-five per cent of the timber stand.

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* - Why are trees given Latin botanical names? For a simple and very practical reason: Latin has led to scientific accuracy. For instance, some trees have many common names, differing in various localities; but the scientific names are the same the world over and are understood by trained foresters and botanists everywhere. This leads to precision of thought and action.

The wood of Port Orford Cedar is of exceptionally high value. It is strong, but fairly light in weight, fine grained, of faint, yellowish white color, tinged with red. It has a distinct, aromatic odor; it is rather hard and firm, works easily, and is very durable. The large trees yield a high percentage of clear lumber.

Port Orford Cedar is used for battery separators, general interior and exterior finish boat construction, railroad ties, pattern stock, sash and door stock, turned work, and furniture, and in chests, drawers, closet linings, etc., shipped to Japan in the log or in square timbers, where it is used in conjunction with the Japanese white cedar.

Incense Cedar

Incense Cedar is native to the Cascades and Siskiyou mountains of southern Oregon. It attains its best growth between three thousand and six thousand feet elevation in regions of heavy precipitation and abundant atmospheric moisture.

The wood of Incense Cedar is comparatively light in weight, moderately soft, easily worked and durable. Its principal use is for pencil slats. It is used also for pattern stock and cabinet work, and in the general market for building purposes such as outside trim and interior finish. It is used somewhat as dimension lumber and for construction work and bridge planking where economy and durability are taken into consideration.

Noble Fir

Noble Fir, known to the lumber trade sometimes as "Larch", is produced principally along both sides of the Cascade mountains in Oregon and Washington, and to a limited extent in the Coast Range in Oregon.

Physically, it is straight, tall with a full cylindrical bole and a comparatively small open crown in its mature stage. In the clear grades it is used for interior finish, siding, flooring and sash and doors. Considerable amounts have been used for car siding and boxes. It is also used for boards and dimension lumber and for many industrial purposes.

White Fir

The principal species of White fir used commercially are Lowland fir and Silver fir. Their properties are similar, and they are used for the same purposes. They are found in Oregon and Washington, their principal stand being west of the Cascade Mountains.

The wood of Lowland fir and Silver fir is light and soft, but firm, moderately coarse-grained and straight. It works easily and takes a good finish. It is well suited to general construction purposes where high strength is not required. It is easily seasoned, is not brittle and does not splinter. It is adaptable for boards and shiplap, studding, exterior siding and general inside uses, for box shooks, and in the manufacture of pulp and paper.

Pine

Several species of pine are scattered throughout the Douglas fir region. These are principally White pine, with some Ponderosa pine, and Sugar pine in southern Oregon. The White pine is a true White pine, the species known commercially as Idaho White pine.

3. Leaders On The East Side

The four commercial leaders in the district east of the Cascade Mountains are: Ponderosa Pine, Western White Pine, Inter-Mountain Douglas Fir, and Western Larch.

a. Ponderosa Pine (Pinus ponderosa).

This valuable tree grows from Washington to the Black Hills but mainly in the states between the Cascade Mountains and the Rocky Mountains. Its wood is moderately light in weight, moderately low in strength, and ranks relatively low in shrinkage, according to the U. S. Forest Products Laboratory. It is easy to work, stays in place well, and has a uniform texture, being somewhat comparable in these respects with the white pines. The principal uses of Ponderosa pine are for sash and frames, doors, general millwork, building construction, and boxes and crates. Considerable quantities are treated and used for railway ties.

b. Western White Pine (Pinus monticola)

Grows principally in Northern Idaho, eastern Washington, and western Montana. It resembles northern white pine (of the Lake, Northeastern States and Appalachain region) so closely that the clear wood of the two is indistinguishable. Both are regarded highly for their workability. Western white pine is light in color, moderately light in weight, and straight grained. The soft, uniform texture of the virgin growth has won for it extensive use in building and millwork. It swells and shrinks a little more with changes in moisture than Northern pine, but both make a desirable wood for patterns. Second growth and lower grades of virgin growth are largely used for boxes and crates.

c. Inter-Mountain Douglas Fir (Pseudotsuga taxifolia)

Although the strongest and largest of this species grows in the coastal region of Washington and Oregon, the intermediate class grows in the "Inland Empire." (Washington east of the Cascades, northeastern tip of Oregon, Idaho north of Salmon River, northwestern Montana.) Douglas fir from the "Inland Empire" is often sold as larch and fir and most of the lumber sold as Douglas fir comes from the coast region, as U. S. Forest Products laboratory points out.

d. Western Larch (Larix occidentalis)

Is native principally to the Inland Empire. The heartwood is reddish brown, and the sapwood (usually not more than 1" thick) is yellowish white. In its natural color the wood finishes well but does not hold paint well, according to the Forest Products Laboratory. It is rated as moderately heavy, strong, stiff, and moderately good in shock resistance.

Western larch is used largely in building construction as rough dimension, small timbers, planks, and boards. It is a satisfactory wood for rough construction, and its use as an interior trim is increasing because of its pleasing appearance and ease of finishing. Planing mill products -- sash, doors, boxes, and crates take a small portion of it.

Of the 4,572,397,000 board feet of lumber produced in Washington in 1936, 4,051,220,000 (or 88.60%) was produced on the West Side of the Cascades, and 521,177,000 (or 11.40%) on the East Side of the Cascade Mountains. In 1937, the figures were: 3,904,000,000 board feet (or 87.63%) on the West Side; and 551,000,000 (or 12.37%) on the East Side; total 4,455,000,000. (1937 estimated)

4. The Northwest's Economic and Social Foundation

The Douglas fir region in Washington and Oregon -- lying between the Pacific Ocean and the crest of the Cascade Range, which extends from British Columbia approximately to the California line -- has 82% or over 29,000,000 acres, of its total area classed as forest land. Of these 29,000,000 acres about 6,000,000 acres have been logged. This region supports a timber stand estimated at 546,000,000,000 board feet. This and the Western pine region are the foundation of our economic and social existence here in the Pacific Northwest.

a. 19% of Total Timber

Of all the coniferous, or soft-wood, timber which remains in the United States and is merchantable, almost one-half is contained in Washington and Oregon. Washington has 19% of the total remaining timber and Oregon 26%. Of the two, however, Washington is the leading state in the amount cut annually. In fact, it leads the nation, as we have seen.

The most reliable statistics place the average volume of the lumber cut yearly from the forests of Washington at 3,600,000,000 to 5,250,000,000 board feet. The annual value of the Washington cut, in a normal year, approximates $200,000,000.

In Oregon, in a normal year, the average annual cut is worth approximately $125,000,000. Further, Oregon has for several years ranked second in the U. S. in lumber production. Thus is seen the great economic importance of the timber industry to that state also.

b. Principal Markets

The principal markets for Washington lumber, according to use, are: Home building, including farm homes, 42% of the total production; railroads, 16%; farm utility building, 12%; industrial building, 10%; industrial uses, 5%; export, 15% (from West Coast Lumbermen's Association folder on West Coast Woods and Their Uses.)

c. Social Value of Forests

Here it is well to point out that, besides furnishing employment to many people (18.6 persons per million board feet directly and 28.7 people per million board feet indirectly), our forests have other social values such as:

THE ECONOMIC HISTORY OF THE WEST COAST LUMBER INDUSTRY, 1926 TO 1937

	Production Million Feet (1)	Per Cent Of Capacity Used	Per Cent Of Capacity Idle	Shipments Including Exports Million Feet (1)	Average Cost of Production per M Feet (1)	Average Price per M Feet (1)	Gross Value Production Millions of Dollars	Price Index per cent (1)	No. of Sawmills Operating (1)	Estimated No. of Employees (2)	Wage per 8-Hr. Day (3)
1926	10,411	72.8	27.2	10,447	$21.10	$20.73	$215.7	100	Complete	75,617	$5.03
1927	9,988	69.9	30.1	9,745	20.48	19.74	197.2	95	Data Not	72,545	5.09
1928	10,182	71.2	28.8	10,385	19.46	19.28	196.3	93	Available	73,351	5.22
1929	10,377	72.0	28.0	9,964	20.42	20.63	241.1	99	706	74,756	5.26
1930	7,638	47.9	52.1	7,615	19.90	17.80	135.9	86	540	56,000	5.14
1931	5,368	33.6	66.4	5,633	16.20	13.55	72.7	65.4	432	37,228	4.16
1932	3,090	19.8	80.2	3,516	15.50	11.50	35.5	55.5	398	33,000	3.43
1933	4,653	30.2	69.8	4,653	16.20	14.55	67.7	70.2	425	40,059	3.60
1934	4,276	29.6	70.4	3,998	20.00	17.23	73.7	83.1	410	42,000	4.63
1935	4,766	35.4	64.6	4,891	19.28	17.28	82.4	83.4	435	45,000	4.89
1936	6,357	47.1	52.9	6,175	19.61	19.50	124.0	94.1	550	48,000	5.34
1937	6,323	46.8	53.2	6,547	21.24*	22.00	139.1	106.1	575	50,000	5.99

* - Estimated

(1) Reports and surveys of West Coast Lumbermen's Association.

(2) Estimated from Bureau of Census reports. Covers production Douglas fir region Western Washington, Western Oregon. Employment lumber industry in the pine regions of the two states not included.

(3) Compiled by Department of Labor and Industries, State of Washington, 1926 to 1935. Reports to West Coast Lumbermen's Association 1936 and 1937; average is combined logging and sawmill wage.

Industrial Facts Department
West Coast Lumbermen's Association.

16-A

Support many communities
Wild life depends on forests
Health resorts and sanatoriums are generally located in forests
Forests are used for recreation and rest (increasingly so in the Northwest).

Besides growing trees, forests also help to increase rainfall, reduce erosion to a minimum, and keep stream flow more or less constant, thus reducing flood water.

5. Forest Industries' Contribution to Economic Stability of State

In its detailed and authoritative report "A Master Plan for Forestry in Washington" (Dated December, 1936, and issued in January, 1937), the Washington State Planning Council summed up the importance of forest industries' contribution to the economic stability of this State as follows:

"The importance of the forest industries' contribution to (Washington's) economic stability may be seen in the following table for the year 1929:

Washington (Forest) Industries for 1929

Industry	Number of Establishments	Wage Earners*	Wages Paid	Value of Products
Lumber and Timber	772	58,570	$83,753,402	$262,621,000
Paper	15	2,774	3,667,255	28,429,000
Furniture	65	1,632	1,915,000	6,637,000
Planing Mills	129	3,600	4,472,917	23,463,000
Pulp	15	2,394	3,648,961	18,665,000
Wood Preserving	12	519	734,911	8,074,000
Wooden Boxes	22	451	449,053	2,197,000
Cooperage	5	519	645,337	2,089,000
TOTAL	1,055	70,459	$99,286,836	$352,175,000
All Washington Industries	3,672	114,830	$160,670,891	$795,561,861
Per cent Forest Industries to All Industries	28.73	61.36	61.80	44.27

(From Bureau of Census)

"In 1929 total production of lumber was 7,302,063,000 board feet. In 1933 it was 3,106,095,000 feet. The serious effects of depression in these industries upon employment and wages, the mortality in manufacturing establishments, and reduction of value of the product, are indicated in the following comparative table for 1933:

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* - Not including salaried personnel

Washington (Forest) Industries for 1933

Industry	Number of Establishments	Wage Earners	Wages Paid	Value of Products
Lumber and Timber	389	30,494	$26,043,493	$ 84,156,412
Paper	13	1,945	2,144,022	21,781,850
Furniture	33	999	683,116	2,553,212
Planing Mills	79	1,954	1,451,791	8,131,101
Pulp	15	1,993	2,134,311	18,875,465
Wood Preserving	10	291	223,116	2,331,660
Wooden Boxes	16	384	269,357	1,056,940
TOTAL	555	38,060	$32,949,206	$138,886,650
All Washington Ind.	2,307	67,752	$62,116,862	$331,225,041
Per Cent Forest Industries to all Industries	24.06	56.18	53.04	41.93

"According to the census of 1929, out of 1,563,396 population, 664,813 persons were earning a living. Of these 15.69% were occupied in agriculture and 12.8% in forest industries. Population directly and entirely dependent upon forest industries was 199,500, farm population was 304,737, and rural non-farm population 378,714. A large portion of the last class and certainly some of farm population also relied upon part-time employment in forest and mill. In the rendering of services to forest industries and their employees more men are employed and more persons supported than by direct employment. The U. S. Forest Service has estimated that for every million board feet of wood consumed yearly 18.6 persons are supported by direct employment (workers and their families), while 28.7 persons are supported indirectly in service activities. In the pulping industry the estimated figures are substantially higher.

DIRECT AND INDIRECT SUPPORT

"It is further estimated that under reasonably intensive forest management the combined lumber and timber products, pulp, paper, and other forest industries of Washington can maintain permanently 875,000 employees and dependents.

"These industries now create one dollar of every three paid for all products of the State. Two-thirds of all rail and water borne tonnage originating in the State is forest tonnage, and a considerable portion of freight inbound is for the use of these industries. And 80% of the value of products of these industries normally is distributed within the State for wages, supplies, taxes, construction and the like.

"There are indirect benefits from the forest. The beneficial effect of forest cover upon stream flow is well known; forests have an important bearing upon erosion, floods, and water supply for irrigation, power and municipal supplies. Washington forests present scenic attractions and opportunities for recreation not surpassed by those of any other state....Tourist business can be developed into a much larger enterprise than at present. Yet the value of outdoor recreation is not merely commercial. Of even greater value is its effect upon the physical, mental and moral well-being of our people.

Closely associated with and indispensable to complete development of recreation possibilities is conservation of wild life. Fish and game require the influence of the forest. Their value must be measured in terms of recreation and of food.

"All of these values can be impaired by wasteful and heedless exploitation of the woodlands. They can be sustained and greatly increased by wise management based upon far-sighted planning and public support.

6. Inventory of (Washington) Forest Resources

"With completion of the forest survey conducted by the United States Forest Service, we shall have, for the first time, reliable inventory and growth data covering the forests of Washington. For the region (the Douglas fir region) west of the Cascades summit the following data on commercial forest area and merchantable timber volume, by classes of ownership, are complete and final:

OWNERSHIP	FOREST AREA	MERCHANTABLE TIMBER
National Forests	3,239,422 acres	88,487,634,000 ft. log
Other Federal	186,606	3,461,963,000 scale
Indian Lands	203,153	4,137,396,000
State Lands	838,130	23,154,133,000
Municipal & County	329,259	2,335,320,000
Private	7,232,435	123,678,600,000
TOTALS	12,029,005 acres	245,255,046,000 ft. log scale

"In connection with the above it should be noted that the total land area west of the Cascades summit is 15,849,289 acres, of which 1,415,264 acres are in agricultural use; 1,008,567 acres are classed as non-forest other than agricultural, and 1,396,453 are rocky or subalpine scrub forest. Availability of commercial forests for early utilization is discussed further along in this report.

"Tentative estimates for the region (the Western pine region) east of Cascades summit are as follows:

OWNERSHIP	FOREST AREA	MERCHANTABLE TIMBER
National Forests	4,363,232 acres	14,510,000,000 ft. log
Other Federal	543,868	850,000,000 scale
Indian Lands	1,706,884	5,157,000,000
State Lands	596,820	4,820,000,000
Municipal & County	125,000	Cut-over -- barren
Private	3,152,000	9,909,000,000
TOTALS	10,487,804 acres	35,246,000,000 ft. log scale

"According to the U. S. Forest Service there should be excluded some two million acres of non-commercial forest land and the timber thereon. Such areas have, however, positive protection, grazing and recreational values. Estimated area of commercial forest then is 8,479,000 acres, and of saw timber 31,016,000,000 feet log scale.

"The total forest land area in the State, suitable for timber production, is estimated as 20,508,000 acres. At present this area bears saw timber of the principal commercially important species, as follows.....:

Species	Volume	Species	Volume
Douglas Fir	108,127,767,000 ft.	Larch	3,293,515,000 ft.
Western Hemlock	81,098,602,000	Other Pines	2,582,254,000
True Firs	36,155,276,000	Mt. Hemlock	1,395,392,000
Cedars	22,246,565,000	Engel. Spruce	1,058,009,000
Ponderosa Pine	16,537,735,000	Hardwoods	954,955,000
Sitka Spruce	6,728,776,000	Other Softwoods	324,000,000

TOTAL ALL SPECIES. . . . 280,501,046,000 ft.

"Included in saw timber totals above are large volumes of wood of species most suitable for pulping and manufacture into a host of cellulose products. Other large volumes of similarly usable material are contained in second growth stands. Estimated volume of pulping woods in western Washington is reported by U. S. Forest Service as follows:

Species	Sawtimber Stands	Second Growth Stands
Western Hemlock	159,601,000 cords	14,290,000 cords
Sitka Spruce	14,027,000	1,727,000
Engel. Spruce & Mt. Hemlock	3,200,000	316,000
True Firs	66,486,000	3,226,000
Cottonwood	196,000	844,000
	243,510,000 cords	20,403,000 cords

"The total then is 263,913,000 cords, of which 108,447,000 cords stand upon national forest lands and 155,466,000 cords are upon other public and private areas, largely the latter.

"In countries where forestry is well established the forest area is more or less evenly divided among mature stands, pole stands, and reseeding areas. In this State, after half a century of lumbering on a grand scale, more than half the forest area remains under primeval forest. The following summary presents a picture of the present condition of forest stocking. (DBH means diameter breast high.)

"Acreage of trees over 20" DBH on West Side and Old Growth type on East Side. . . . . 11,325,317 acres

"Acreage of trees under 20" DBH on West Side and Second Growth on East Side. . . . . 6,067,096 acres

"Acreage logged since 1920 or burned, non-stocked or poorly stocked . . . . . 2,735,629 acres

"Acreage of hardwoods. . . . . 356,171 acres.

"Indefinite though such a classification may be with regard to actual distribution of acreage among large and small second growth, fresh reproduction, and areas which may be expected to restock in the near future, it does show that the condition of our forest establishment is distinctly promising, if proper management can be established promptly throughout the state.

7. Potentialities of Tree Growth

"Forests do not stand still but undergo constant change. In mature stands the balance between yearly growth and losses from insects, disease, fire and wind often amounts to a net loss. In young stands growth usually predominates and large net gains result. Cutting for use naturally constitutes the greatest single drain upon the forest of Washington, but when conducted in old ripe stands such cutting may serve to convert such areas from storage lands to highly productive reforesting lands.

"Logging always has accounted for the greatest yearly forest drain. The record of timber cut for use as lumber, timber, pulpwood, piling and shingles since 1925 is reported (Census Bureau) as follows:

1925	7,027,325,000 feet	1931	3,907,997,000 feet
1926	7,546,239,000 "	1932	2,260,689,000 "
1927	7,325,862,000 "	1933	3,106,095,000 "
1928	7,305,277,000 "	1934	3,064,270,000 "
1929	7,302,063,000 "	1935	3,389,859,000 "
1930	5,502,129,000 "		

"In peak years Douglas fir constituted 71% of total output; Ponderosa pine 6%, and hemlock less than 2%. It is notable that in recent years the percentage of hemlock produced shows increase, notwithstanding the fact that pulpmills use large volumes of mill waste and large quantities of cordwood which are not included in computations of logging output. The development of a large pulping industry in this State is essential to complete utilization of our forests on a basis of sustained production.

8. Washington's Remaining Timber Stand

"The original timber stand of Washington must have been about 578 billion board feet. That has been depleted to about 277 billion feet, much of which cannot be logged economically enough at present to justify operation. This timber falls in three availability categories, as follows:

"In Zone 1 (Operable timber)	146 billion feet, log scale
"In Zone 2 (Reserve timber)	85 billion feet, log scale
"In Zone 3 (Remote timber)	46 billion feet, log scale

"If there were no such considerations as species, quality, comparative costs or administrative policies, and if growth were ignored, we might assume that this total stand of timber would supply our forest industries for 70 years, at present rate of cutting. Or we might declare that only about half of the remaining timber is operable, and only two-thirds of that is merchantable under present market conditions (100 billion feet), and therefore there is but 25 years of life, or less, ahead for these industries.

"Either conclusion is unreasonable. Changing standards of utilization and better logging methods will bring reserve and remote timber into the picture as it is needed. Limitations of cut on Federal lands will extend such supplies far into the future. Tree growth will add considerably to the amount that can be cut yearly, particularly upon the better lands classed as private.

"It is estimated by the Forest Service that current annual growth on the west side is 503,179,000 cubic feet and on the east side 86,998,000 cubic feet, or total 583,073,000 cubic feet. It is further estimated that, as mature tree crops are removed and their place occupied by young timber, growth may be built up gradually to more than 1,731,106,000 cubic feet. In terms of board measure sawtimber this would amount to more than six billion feet of lumber, plus several hundred thousand cords of usable pulpwood. By management of present stands so as to utilize progressively the growth factor there need not be diminution of annual production volume. On the contrary, annual production can be increased, providing outlets can be developed for the non-lumber species. It is impracticable to describe here the details of such integrated administration and technical management.

HOW VOLUME COULD BE INCREASED

9. The Problem in Brief

"In brief, the problem is to correlate the management of private, State and Federal forests so as to remove as much ripe timber annually as can be taken without upsetting the sustained yield balance for the State. Production from second growth stands should be restricted to a minimum. Every practicable measure for protection of growing and mature stands and for encouragement of new growth should be taken by all responsible agencies. As foresters become more skilled and as the business of growing forests gains stability, it will be possible to apply silvicultural practices so effectively as to provide permanent supplies of high quality timber by growth."

F. WHAT CONSERVATION MEANS

Wood being such a valuable and adaptable product -- of such paramount economic and social importance to the Pacific Northwest -- thoughtful people look naturally and increasingly to its sane and practical conservation. In plain terms what does conservation mean?

1. Original Meaning

Conservation originally meant "to preserve or reserve natural resources -- to withold from use, lock up, save for future generations, safeguard against wasteful exploitation, to halt excessive development, or set apart for restorative treatment", in the words of Dr. J. S. Illick, New York State College of Forestry at Syracuse.

"But gradually", continues Dr. Illick, "conservation has developed a broader and more purposeful meaning. It no longer means the locking up of natural resources, nor is it limited to reservation and preservation. Now, conservation has come to mean, wise, careful development, efficient handling, sustained management, and closely coordinated administration of all natural resources. On the basis of these new and rapidly developing meanings, conservation can now be defined as the planned and orderly use, development, and management, of all natural resources.....in the interest of human welfare.....Its basic principle is also expressed in the use of our natural resources by the greatest number of people for the longest time.... and by the control of forests for the permanent service of all such people."

BASIC PRINCIPLE OF CONSERVATION

Such conservation is a business -- just as much as farming -- indeed, it is a sort of long term farming. It deals with colossal plants, instead of small ones.

"Unfortunately, much of our past logging has been merely a liquidation of our forest capital," points out George E. Griffith. (If this were not true, would the bulk of the lumber using industry have been forced to migrate from New England to the Northwest, via the Great Lakes region and the South, leaving ghost towns in its wake everywhere? You can find them scattered here and there in the Pacific Northwest.) "In an earlier day, man looked at the extensive stands of forests in America and thought they would last forever. We know today that is not true, unless we change our method of harvesting these forests in line with the most progressive thinking of foresters and the industry."

And what does the most progressive thinking call for? Should we use substitutes and save our forests? Is that conservation? "Not at all," says George E. Griffith. "Theodore Roosevelt has defined conservation as 'wise use'. Therein lies the key to the solution of our problem. It has frequently been pointed out that much of the land in our Pacific Northwest will grow forest crops, or nothing. We must keep our land producing if we are to survive. So the answer is to use our forest crops to the maximum possible, but keep the land busy producing successive crops of forests. That is the policy followed by any successful farmer.

WISE USE

2. Meaning of Sustained Yield Management

"This method has been summed up by foresters in the term 'sustained yield forest management'. Just what do we mean by sustained yield? It is not some mysterious economic formula. It is the essence of plain common sense management. If a business man lives on his capital, he will

eventually become bankrupt. If he lives on his income, he continues successfully in business."

PRODUCE AS MUCH AS REMOVED

So, in contrast with the liquidation process of past generations, sustained yield means the application of business management principles to the forest problem. "Briefly, sustained yield means a system of forest management for given tracts of forest, by means of which the land shall continue to produce as much as is removed. It seeks to provide a reasonably fair balance between the average cut, or 'harvest' from a forest area, and its average producing capacity. This results in stablizing wood-using industries of the region dependent on the forest for raw material. A permanent supply of raw material is the foundation of good industry, and the regular harvest of mature forest products is the object of good forestry.

"When this can be brought about, it means the end of transient saw mills, deserted towns, and social disaster."

3. Future Necessity

In the "Columbia Basin Report", issued in 1936 by the Pacific Northwest Regional Planning Commission, and dealing with the four states of Washington, Oregon, Idaho, and Montana, the statement is made that "more than half of the productive area of the Columbia Basin states consists of forest land. Therefore, any plan which attempts to provide for the future welfare of the people of this area must necessarily include a forest program as one of the major themes. No national appraisement of resources can be complete which leaves out of account this forest area containing more than half of the remaining timber supply of the United States, and already furnishing 36% of the nation's lumber. No attempt to improve the social and economic status of the people of the United States can leave out of consideration this principal nucleus of an industry which ranks fourth in importance in the nation in value of produce and the number of persons employed. Finally no plan for the betterment of the people of the Northwest can be effective without providing for the permanent stability of an industry which supports roughly one-third of a regional population."

G. WHAT FORESTRY MEANS

When a world authority defines forestry as comprising "the sum total of all knowledge required for the best administration of the forest, with due regard to the interests of the owners in particular, and the interests of the commonwealth in general", are we to conclude that forestry and forest conservation (as discussed above) are one and the same thing?

1. Scope of Forestry

Yes, insofar as forestry conserves forests by insisting upon their wise usage. No, as regards the scope of forestry as a science and a profession. "In the early days, forestry concerned itself chiefly with the location of forest properties, the description of forest conditions, the study of tree habits, the growth of timber, the effects of forest fires, the uses of wood, and other closely related subjects. From this

restricted scope, it has grown until now its ramifications extend to almost all lines of human endeavor, including the use of forests for recreation, chemical utilization of wood for paper, rayon, cellophane, and artificial leather, the preservative treatment and kiln drying of lumber, the classification of land uses, the conservation of wild life, and emergency plans for human betterment."*

a. Far Broader Meaning

As matters stand today, forestry is a broad and many sided program, with forest preservation only a small part. Essential parts of effective modern forestry are: wood production (naturally) and the prevention of forest exploitation as well as forest deterioration.

ITS FUNDAMENTAL ACTIVITY

But it has a far broader meaning than that. Protection of forests against fire and other destructive agencies such as borers, fungi, and disease, is described by experts as its most fundamental activity. Reforestation is playing a leading role among forest activities in some parts of the country. In others tree planting is but a phase of the "comprehensive and coordinated technique" of forest management. Briefly, forestry seeks to make non-agricultural land as productive as possible. But, in general, forestry has become so diversified that some twenty different kinds are now recognized and "An Outline of General Forestry" divides it into five major branches:

Forest Protection
Silviculture (the art of producing and tending a forest)
Forest Management
Forest Utilization
Forest Economics and policies.

So, you see, forestry today is very much before the public. Plans for the proper use of our wild land, increasing interest in conservation, and discussion of scientific forestry requirements have turned the spot-light on the forestry profession. What does it take to enter and succeed in the professional grades of forestry?

b. More Than Good Education

Well, four years of college training and degree of bachelor of science is a requisite. But, while a college degree (based on certain biological sciences, lots of mathematics, engineering, business administration, chemistry, and forestry law) is a major requirement, there is more, much more to being a successful forester than "book learning". As trained and experienced foresters, like George E. Griffith, point out, "it is one thing to go on a camping or fishing trip for your vacation. And quite a different matter to be out in all different kinds of weather, cruising, and marking timber, perhaps in winter storms, fighting fires in the heat of summer, and doing all the other rugged, outdoor things that are the lot of the young forester. Dealing with many kinds of people in a courteous, diplomatic manner will be included in your duties. You will know the confinement of office work, making calculations, compiling statistics, drawing maps, and writing innumerable reports and working plans. You must have persistence and enthusiasm. You must be able to 'take it'."

ABLE TO "TAKE IT"

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* - J. S. Illick's, "An Outline of General Forestry".

c. Practical Qualifications of a Forester

Besides knowing trees -- their habits, characteristics, diseases, enemies (insects and other destroyers aside from fire), you must be a good woodsman, in the sense that our pioneer forbears meant by that term. That is, you must have more than a haphazard "bump of direction". You must know how to ride and put packs on horses. How to cook and keep house. Handle a canoe. Fight fires. Fix telephones. Do timber cruising, scaling, and make volume tables. You must understand contracts -- as, for example, when a private company buys lumber on a Government area under your surveillance. In short, forestry is "nobody's picnic". Which is undoubtedly one reason why there is increasing recognition of the value of the forester's service to the lumber industry.

In his salty and highly instructive book, "Now We're Loggin'", Paul Hosmer, himself a veteran woodsman, pays tribute to the forester in these words:

d. The Forester -- A Tribute

"The forester is a man of vast woods experience, learned in the ways of woodsfolk and his job is one calling for honor and integrity. He thinks more of government than most of us do, and does his level best to protect the country and preserve its resources. He is nowhere near as much interested in the problem of how to log a section the cheapest way as he is interested in figuring out a way of doing it without ruining the young trees which will be merchantable timber many years after he is planted among the daisies. America puts a trust in the forester and he never violates it. Future generations can thank him for the forests which will then be growing in the same spot where loggers are now working."

2. Occupations in The Forestry Service

Forestry -- except insofar as lumber companies employ foresters, directly and indirectly, in the management, protection and reforestation of their properties, and in the seasoning and treating of lumber -- is not a branch of the lumber industry as such. But production forests are possible only by the constant and effective practice of good forestry; so the interests of the forestry profession and the lumber industry are inseparably bound up together.

There are 3 major agencies directly concerned with the handling, development and protection of forests and forest crops in Washington and Oregon. These are:

The Federal Government.

The State governments (and Counties are also coming into the picture through reversion of tax-delinquent, logged-over lands).

Private timber owners.

Cooperation between these 3 forestry agencies is being constantly improved -- so much so that a steady advance is being made in the reseeding of west coast woods as well as in fire protection.

In this connection, the Federal Reforestation Act (Clarke-McNary Act) of 1924 has been called by experts like George E. Griffith "one of the most important steps along the lines of cooperation that has been taken in the history of American forestry."

Besides defining a national forestry policy and stipulating a nation-wide study of forest taxation, this Act provides for: (a) cooperation in protection from forest fires by Government, State, and private owners of timbered and forest producing lands; (b) forest planning on a cooperative basis between the Federal Government and the States; (c) enlargement of public ownership of forest land through gift, purchase, exchange, or reservation of the public domain.

(1) U. S. Forest Service is the Federal Government's agency for administering the terms of the Act and for handling all phases of national forestry activity.

This is a bureau of the U. S. Department of Agriculture and since July 1, 1905, has been known as the Forest Service. The Chief of the Forest Service works directly under the Secretary of Agriculture.

The National forests of the U. S. and Alaska are divided into ten Regions, with a Regional Forester in charge of each. The North Pacific Region, comprising Oregon, most of Washington, and a small portion of California is Region No. 6. Its headquarters are in Portland, Oregon.

Each of the Regions, in turn, is divided into units called National Forests. A Forest Supervisor is in charge of each National Forest. His staff includes an Assistant Supervisor, a Chief Clerk or other necessary clerical help and may include additional men such as specialists in fire control, road and trail construction, timber management, grazing administration, etc.

There are 20 National Forests in Region 6 -- 7 in Washington, 12 in Oregon, and one which extends partly in both states.

The smallest administrative unit in the Federal Service is the Forest Ranger District, which is a sub-division of the National Forest and is in charge of a District Ranger. If needed, a District Ranger may have an Assistant Ranger. During the summer fire season, the District Ranger has a short term protective organization consisting of lookouts, firemen, packers, road and trail makers, and protective assistants.

The State Forestry Organizations

Washington

Central authority is vested in the Division of Forestry, of the Department of Conservation and Development. The executive staff of the Washington Division consists of

-- State Supervisor of Forestry and his staff in Olympia.

-- A force of law enforcement officers and state fire wardens.

-- State fire wardens are assisted by cooperating forces employed by private owners and associations. All U. S. Forest Service Rangers are appointed Deputy State Fire Wardens, without extra pay.

The principal activities of the State forces are as follows:

Forest protection and forest fire prevention.

Enforcement of State forest fire laws.

Acquiring and administering state forest lands.

At the University of Washington, Seattle, the State maintains a College of Forestry. This College has a forest school, a tract of 2000 acres in the Puget Sound region 33 miles southeast of Tacoma, which is known as the Pack Forest, after the donor C. L. Pack. It is used as a demonstration forest where accepted forestry methods, present and future, can be graphically portrayed. It is an outdoor laboratory for forestry students and has besides young growth, old growth and cut-over land, a model forest which is an exact living replica in miniature of the Pack Forest, showing at a glance the method of management for continuous forest production. The main forest contains over 25,000,000 feet of standing timber.

Courses in forestry and range management are also given at Washington State College, Pullman. There -- on the campus through the Clarke-McNary Act, the Federal Government assists in the cost of operating a nursery where planting stock is raised for distribution at nominal cost to farmers for windbreak and shelterbelt planting.

There are 1,248,000 acres of State grant forest lands in Washington on which timber may be harvested. The State Board of Forestry administers over 300,000 acres (and the total is increasing) which cannot be sold.

Oregon

In Oregon the central forestry agency is the State Board of Forestry, comprised of the Governor of the State, the Dean of the Forestry School at OSC, and representatives from each of the following organizations:

Oregon State Grange

U. S. Forest Service

Oregon Forest Fire Association

West Coast Lumbermen's Association

Western Pine Association

Western Oregon Livestock Association and Oregon Cattle and Horse Raisers Association (jointly), and,

Oregon Wool Growers Association.

The executive staff of the Oregon Board of Forestry consists of

-- State Forester and his staff at Salem, Oregon.

-- A force of law enforcement officers and state fire wardens.

As in Washington, all U. S. Forest Rangers serve as Deputy State Fire Wardens, without extra pay, and there are a number of cooperating forces employed by private timber owners.

At Oregon State College, Corvallis, there is a state-maintained School of Forestry. Since 1926 this school has acquired 2200 acres for an arboretum and school forest. There experiments and studies are carried on with native trees to learn of their characteristics and habits of growth and promising new species are tried out.

The State of Oregon has a State Forest of some 70,000 acres, located in Coos and Douglas County, in the Coast Range. This is Oregon's first State Forest and it provides an excellent field laboratory for students from the State's School of Forestry. It is directly in charge of the State Forester.

3. Private Agencies

There are several private (that is, privately supported) associations which also figure largely in forestry matters in this region. Outstanding among these are:

ASSOCIATIONS FIGURE IN FORESTRY

The West Coast Lumbermen's Association, whose membership comprises 70% of the log production and 74% of the lumber output in the Oregon and Washington territory west of the Cascades. This organization was formed in 1911 through the consolidation of 3 local associations, first dating from 1902. Its headquarters are in Seattle. It has branch offices in Portland and Eugene, Oregon; San Francisco, Sacramento, and Los Angeles, California; and representatives in Chicago, New York, and Boston. Besides issuing a Forest Practice Handbook the WCLA functions afield in the promotion and coordination of good forest practices, issues fire weather forecasts, and conducts local educational meetings.

The Joint Committee on Forest Conservation, is an off-shoot of the above organization and has a distinct function in helping to promote the wise use of forest land.

The Western Pine Association, which dates back to 1903 and is composed of logging and sawmill operators in Eastern Washington and Oregon and in 8 other states west of the Rockies. Through its forest engineering staff, this organization furnishes member committees with technical assistance in supervising application of the forest practice rules for carrying out the Association's forest conservation program. It also maintains a forest research laboratory.

The Pacific Northwest Loggers Association, whose headquarters are in Seattle, is another long-established organization which contributes materially to the forestry progress of the Northwest. This Association is co-publisher of the Forest Practice Handbook.

Washington Forest Fire Association, Seattle, and Oregon Forest Fire Patrol Association, Portland; both are made up of private timber owners. Each cooperates with federal and state foresters in the protection of forests from fire, in the enforcement of forest fire laws, in education for fire prevention, and in studies for better handling of the forest.

Western Forestry & Conservation Association, which includes Washington, Oregon, Idaho, Montana, and Northern California in its territory and whose membership consists of representatives of that region's timber industry. Federal and State Foresters serve on its committees. This organization has made important contributions to the development of forestry in the Pacific Northwest, including "The Western Fire Fighter's Manual", which has become standard for practically all Western states, as well as many other parts of the country.

OTHER FACTORS — Other organizations which, while not forestry agencies as such, have made important contributions to both the study and the improvement of forestry in Washington and Oregon are: The State Planning Councils (Boards or Commissions) and the Pacific Northwest Regional Planning Commission.

We have already seen how forestry concerns everybody and what it means as a science and art. Now, what does it mean by way of occupations and opportunities -- especially for young people?

What are the duties in each branch of the service?

What does one have to do and how much money is necessary to attend school and take up forestry in preparation for the various lines of work in the service?

After employment in Government service is it possible for one to set up an office and start a business of his own?

What are the ordinary chances for advancement?

What are the openings that will probably exist in the near future?

What are the colleges that specialize in this training?

a. Range of Duties

Duties in the Forest Service range from laborer, foreman, warden, tower-man, to state forester, regional forester, associate forester, forester, and chief forester of the United States in the Department of Agriculture. Conditions of work in the forest service are about as follows:

Not more than eight hours may be considered as the average day's work except in emergency.

The United States Civil Service requires the applicant to be of sound physical health but remediable defects and curable disease will not bar an applicant permanently. Park Ranger requirements specify that "the applicant must be in sound physical condition, and good health, able bodied, and capable of onduring hardships and performing severe labor under trying conditions". Vision must be 20/40 in both eyes combined and not under 20/50 in the weaker eye.*

b. The Forest Ranger

The forest ranger must be a man possessed of a large number of qualifications. Much of his time is spent in the woods, "frequently with very few comforts or even conveniences, and so he must be naturally a man of strong physique and healthy constitution. A vigorous body is necessary not only for the rough life the forester has to live, but for the hard manual labor in which he must so often engage."

Most of the positions in the United States Forest Service are under Civil Service and for all these professional positions it is well to have a college education in forestry or allied lines.

Under professional service in the Department of Agriculture, the United States Civil Service Bulletins indicate that the psychologist (one who has charge of public relations between the service and the public) and Junior Forester shall have successfully completed a four-year course leading to a Bachelor's Degree: (1) in a forestry school of recognized standing; or (2) in the forestry department of a college or university of recognized standing; and (3) in addition, he should have a Master's Degree in Forestry.

The Junior Range Examiner must possess essentially the same qualifications. An assistant technician must complete at least two years in a college of recognized standing in work prerequisite to the degree in forestry, botany, agronomy and soils, range management, entomology.

* - 20/40 means that an individual can read a line of letters at twenty feet, from such letters as should be read with normal vision at forty feet. Normal vision is 20/20. That is, the lines that are read at twenty feet are supposed to be read when the one examined is twenty feet from them.

plant pathology, or engineering. Certain combinations of training and experience in technical forestry may be substituted for the above provisions. However, in practice, the Civil Service Commission has not in the past few years placed many, if any, applicants who have not completed four years of College work.

PROFESSIONAL FOREST SCHOOLS IN UNITED STATES*

SCHOOL	LOCATION	1937-38 ENROLLMENT
Univ. of California (1914)	Berkeley, California	374
Colorado State (1911)	Fort Collins, Colorado	371
Connecticut State (1923)	Storrs, Connecticut	15
Duke University (1930)	Duke, North Carolina	45
Univ. of Georgia (1906)	Athens, Georgia	258
Harvard University (1904)	Petersham, Massachusetts	4
University of Idaho (1909)	Moscow, Idaho	392
Iowa State (1912)	Ames, Iowa	275
Louisiana State (1925)	Baton Rouge, Louisiana	177
Univ. of Maine (1903)	Orono, Maine	195
Michigan State (1903)	East Lansing, Michigan	350
Univ. of Michigan (1903)	Ann Arbor, Michigan	177
Univ. of Minnesota (1900)	St. Paul, Minnesota	450
Univ. of Montana (1914)	Missoula, Montana	277
Univ. of New Hampshire (1911)	Durham, New Hampshire	85
N. Y. State, at Syracuse (1911)	Syracuse, New York	530
North Carolina State (1929)	Raleigh, North Carolina	209
Oregon State (1910)	Corvallis, Oregon	497
Penn. State (1903 - 1906)	Penn. State, Pennsylvania	466
Purdue University (1926)	Lafayette, Indiana	170
Utah State (1927)	Logan, Utah	377
Washington State (1907)	Pullman, Washington	165
Univ. of Washington (1907)	Seattle, Washington	445
Yale University (1900)	New Haven, Connecticut	34
TOTAL.		6,338

According to the Civil Service Examiner in Tacoma, Washington, few and fewer forestry appointees are selected who do not have college degrees. Promotions are usually made within the service. For example: a Junior Forester is eligible to qualify as a Forester (either for state or national government).

c. Salary Schedules in U. S. Forest Service

Salary schedules in the U. S. Forest Service are as follows:**

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* - "An Outline of General Forestry", 1936, as revised to date.

** - From a pamphlet entitled, "Forestry as a Profession", prepared by Edward A. Sherman, Assistant Chief and Advisor, U. S. Forest Service.

Forest Supervisor	$3,800 - $5,400
Assistant Forest Supervisor	3,200 - 3,800
Logging Engineer	3,800 - 5,400
Chief Lumberman	3,200 - 3,800
Associate Forester	3,200 - 3,800
Associate Range Examiner	3,200 - 3,800
Assistant Forester	2,600 - 3,200
Assistant Ranger Examiner	2,600 - 3,200
District Forest Ranger	2,300 - 3,200
Junior Forester	2,000 - 2,600

Salaries in forest service under most state organizations are similar to those under the National Government.

In the forest service under the Department of Agriculture, there are employed engineers, mechanics, draftsmen, towermen, foremen, laborers, and other craftsmen and laborers of a non-professional character. These positions are filled by Civil Service examinations. Examinations for these branches of the service are "non-assembled". A man in his respective line is rated according to the work he has done and the experience he has had which would fit him for the position he seeks. His ability and the length of time he has served in his line of work is determined by the Civil Service examiners calling for and receiving references from those who know his ability. Once an individual receives a rating on this basis, he is eligible for service until a new examination is announced. If employed he remains in the service or on the list as long as he keeps in touch with the service. Unfortunately, most positions held by unskilled and semi-skilled men are seasonal. There are men, however, in government forestry work who have been employed quite regularly for the past twenty years or more. It is difficult for an individual to rise from an unskilled or semi-skilled position to one of professional standing unless he is able to attend college or take further academic work.

FIRST--- LOVE OF THE WORK

Entering any branch of forest service either federal, state, or private, one should first have a love for this work. He must enjoy the great outdoors and be willing to endure hardships and become interestedly acquainted with nature. The chances for advancement are very good after one gets a start in the service. Salary schedules are available to all and by making a good record it is the usual procedure for the individual to be advanced as vacancies occur where he is qualified.

d. Occupations in Forestry

A bulletin recently published by the University of the State of New York schedules the following "brief list of the principal occupations in forestry including professional and non-professional":

GENERAL FORESTRY

Foresters
Associate Foresters
Regional Foresters
State Foresters
Commissioners
Superintendents
Managers
Rangers
Inspectors
Technicians
Directors
Supervisors

FOREST UTILIZATION

Wood Superintendents
Woodland Managers
Logging Foremen
Logging Engineers
Timber Operators
Appraisers
Scalers
Inspectors
Graders
Sawmill Manager
Plant Manager
Kiln Engineer
Preservation Engineer
Salesmen
Technologists
Physicists
Chemists
Paper Mill Foremen
Technicians
Assistants
Salesmen
Agents

RECREATION AND PARK ENGINEERING

Park Superintendents
Recreation Superintendents
Landscape Architects
Landscape Engineers
Seed Collectors
Engineers
Mechanics
Draftsmen
Purchasing Agents
Guards
Guides
Tower Men
Wardens
Foremen
Laborers

RECREATION AND PARK ENGINEERING (cont.)

Highway Foresters
City Foresters
Naturalists
Guards
Guides

EDUCATION EXTENSION AND RESEARCH

Deans
Directors
Professors
Instructors
Assistants
Library Workers
Extension Specialists
Editors
Technical Assistants
Silviculturists
Ecologists
Botanists
Biologists
Entomologists
Dendrologists
Curators
Chemists
Engineers
Game Specialists
Pathologists*

Emergencies arise once in a while where unskilled or semi-skilled employees are used in semi-professional service.

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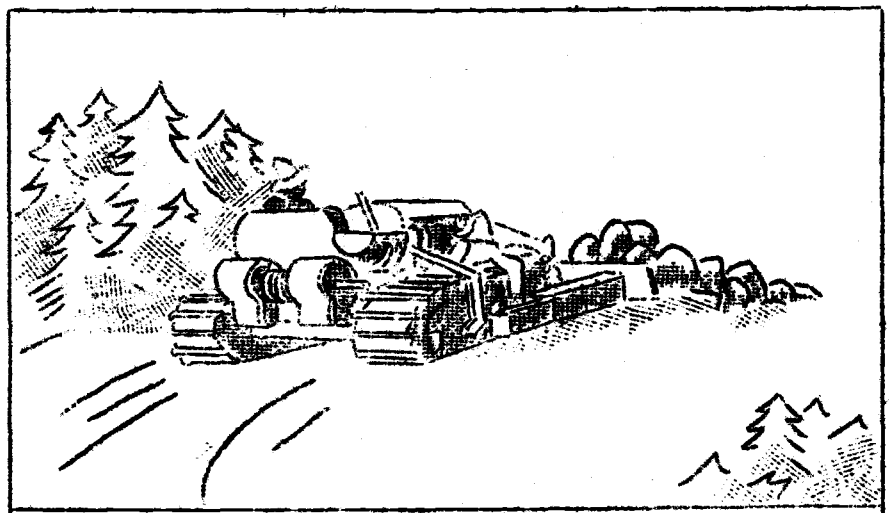
* - "Vocational Analysis of Forestry and Related Occupations", issued by the National Youth Administration of Wisconsin.

There is likely to be an ever increasing personnel in the forestry service because the United States has within its border 615,000,000 acres of forest land. About 162,000,000 acres are in state forests and parks. Reforestation, when it is more generally undertaken, as it appears it will be, will open many vocational possibilities. In Prussia 143,000 persons are employed in this work, or the equivalent of one person to each 167 acres of land. In Switzerland there is one person employed to every 100 acres of land. "With the growing agitation and current legislation for flood control, prevention of soil erosion, development of water reserves for the benefit of river navigation and the preservation of fish in lakes, rivers, and their tributaries, with a definite realization of the helpful effects of forests on an adequate supply of rainfall and the retention of soil moisture, the future of forestry and its related occupations as a profession or vocation seems to be very bright and the outlook encouraging."

FUTURE OF FORESTRY BRIGHT



...."Caterpillar" Diesel tractor building a logging road -- pushing a bulldozer....

H. TOPICS FOR DISCUSSION

1. It has been said that wood actually founded modern civilization -- at least in America. Explain briefly how and why that is so.

2. How can wood be most simply defined? How do foresters and lumbermen think of it?

3. What do you consider the most important properties of wood?

4. Why is wood "the most important and universal material in industry"? And why is it our most versatile industrial product?

5. What do you consider the most significant development in the lumber industry's growth? Nationally? In the Pacific Northwest?

6. Summarize briefly the economic importance of lumber; nationally, in our region.

7. Describe and roughly bound the so-called "Douglas Fir Region". What is its area? What trees are the "Big 4" commercially? Can you give their scientific names and some distinctive characteristics of each? Which is most important?

8. Why is this region the Northwest's economic and social foundation?

9. How large a factor are the forest industries in Washington -- in proportion to all Washington industries? As regards wages earned?

10. How many people are supported per million board feet of lumber -- directly, indirectly?

11. How much of Washington's original timber stand remains? What is needed to make the condition of our forest establishment "distinctly promising"?

12. What is the basic principle of modern conservation?

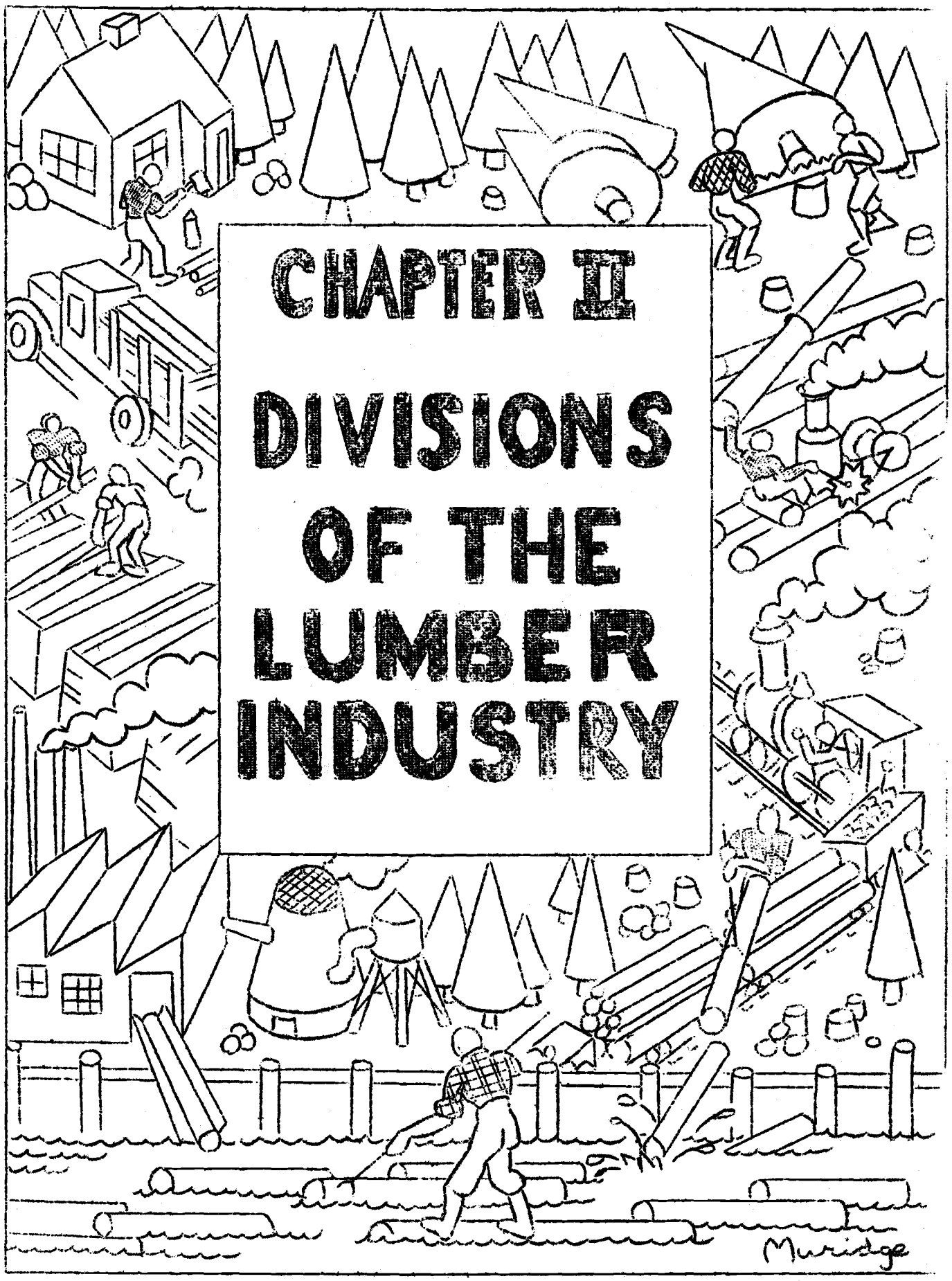
13. What does "sustained yield management" mean?

14. What is the distinction between conservation and forestry? Outline briefly the scope of the latter.

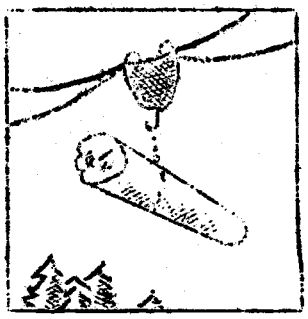
15. Why is forestry such a "red-blooded" profession?

16. What are the general requirements for a professional course in forestry?

17. What work is available in forestry to the unskilled or semi-skilled man?


CHAPTER II
DIVISIONS OF THE LUMBER INDUSTRY
Muridge

II. DIVISIONS OF THE LUMBER INDUSTRY



Just where the lumber industry, proper, ends and the general group of forest industries begins is indeterminable. Neither in the woods nor in manufacture is there any plain boundary. What the U. S. Census calls the primary "Timber Products and Lumber" industry embraces establishments operating logging camps, straight sawmills, shingle mills, cooperage stock and veneer mills, and planing mills operated in conjunction with sawmills. This leaves chiefly the pulp and paper division and the specialty manufacturers to comprise the secondary industries.* To keep this study from becoming too complicated, we shall show first how logging (the basic operation) is done in the Northwest woods; next, how a modern sawmill turns logs into lumber and "finishes" them; then go through a shingle mill; and follow with short descriptive analyses of the plywood and veneer industry, the pulp and paper industry, specialties, and sales distribution as they are conducted in the Northwest. A separate section will specify and discuss the occupations in each of these seven branches in whatever detail seems warranted.

NO HARD AND FAST LINES

In general, it can be said that lumbering proper comprises the following more or less distinct branches:

The ownership and management of standing timber;
Logging, or falling, the timber and cutting it into logs, or shorter sections known as bolts;
Sawing and manufacturing the logs into lumber, including its seasoning, surfacing, and finishing into special forms;
Wholesale and retail lumber distribution; and
Remanufacturing lumber and timber products into various classes of wooden goods.

But it is necessary to be much more specific than that. Where, for instance, does the comparatively new and flourishing plywood industry fit in the picture? What about the growing chemical utilization of Northwest woods? What are the possibilities for new industries involving the processing of wood? The best way to answer such questions -- and at the same time make a survey of the occupations in this industry -- is to describe and analyze the main lumber operations in their natural order.

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* - According to the National Lumber Manufacturers' Association, boxes and crates consume annually about 15% of the total lumber cut in the United States. Annual "normal" consumption of lumber in furniture manufacture is estimated at about 1,200,000 M feet. The 60 or 70 industries using lumber as their raw material, make from it some 4,000 different products.

A. OWNERSHIP OF TIMBER

Obviously, the ownership of timber is a highly specialized field -- so much so that a detailed discussion of it has no place in this report. Enormous sums of money are invested in important tracts of timber. Often standing timber must be held for a considerable length of time before it can be marketed. The management of such property requires lawyers, accountants, surveyors, timber cruisers, forest engineers, and other specialists, many of whom have devoted a lifetime of study and training to this particular field.

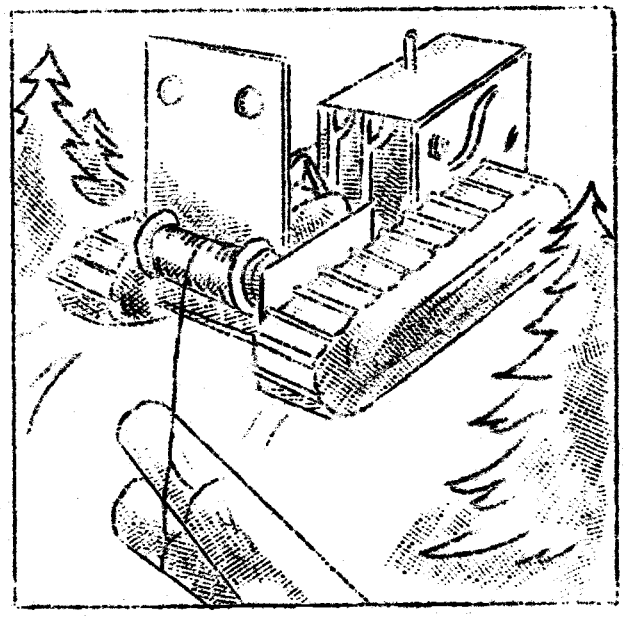
THE TIMBER CRUISER

Timber cruising, for example, is a profession where "many are called but few are chosen". The timber cruiser is the man who cruises, or sizes up, a given forest and estimates the volume of standing timber in it. In the old days he made his estimates entirely by eye, depending upon care and experience and knowledge of the locality for accuracy. Your modern timber cruiser, besides possessing an accurate knowledge of the topography (or lay of the land), must be able to obtain actual measurements of definite portions of the forest. This may be done by measuring all the trees in a strip and matching one strip against another; or it may be done by selecting sample plots which are typical of the forest as a whole, counting all the trees in them and arriving at the total volume by carefully measuring an average selected tree or trees. He and his helpers must be able to run compass courses, record exact distances to roads and streams, do surveying, make rough sketch maps, take notes on topography, estimate growth, grades, species, yields, and so on. In short, timber cruising involves exceptional responsibility and takes long experience as well as special education. The same is true with the professional grades of forestry; but forestry, as a whole has many more ramifications and hence more opportunities for young men of limited education and experience, as we have seen.

B. LOGGING, THE BASIC PART

There is much more to logging than such terms as "the harvesting of the forest" or "first stage in manufacture" serve to imply. In reality, logging embraces a whole series of operations -- covering harvesting activities from the felling of trees to the delivery of logs at the sawmill -- and it is this series of steps which is known collectively as "logging". And the logging of such large size trees as the Douglas fir, West Coast hemlock, and the Western red cedar and Sitka spruce presents many problems and calls for the highest kind of engineering knowledge. What's more, labor of the skill that is needed for the various stages of logging these trees commands high wages. It should be noted, too, that logging is not confined strictly to the production of saw logs. True, that is the major part of its operation; but logging also includes a variety of other activities such as the production of pulpwood, cross ties, poles, posts, mine timbers, veneer logs (for plywood manufacture), and other miscellaneous forms of forest products. When cost records of both large and small producers are examined, it is found that at least one-half of the total cost of putting lumber on the market is represented by "logging operations".

Modern logging methods are entirely different from those of early days and even of a few decades ago. In Colonial times oxen were used for both "skidding" and hauling logs. Later horses and mules took over the heavy work. During the Civil War period, railroads met the demand for logs at big mills. But, since World War days, the tractor and the motor truck have revolutionized logging methods. Tractors (varying from 15 h.p. to 90 or more) have largely replaced animals. Powerful motor trucks -- some of them with Diesel engines -- some with integral bodies and others with logging trailers -- are commonly used to haul logs from one to sixty miles or more to the saw mills.



Tractors have demonstrated their versatility as well as their efficiency in modern logging operations. Their value is enhanced by the fact that they can be (and are) used in building roads, plowing furrows for reforestation, cutting out fire lines, and in many other ways besides skidding logs. Moon & Brown report that there are several thousand tractors* in use in the woods for logging operations; more east of the Rocky Mountains than west -- so far.

Motor trucks have superseded the log wagon and in many cases the logging railroad, chutes, flumes, winter sled hauling and even water driving in parts of the country. The truck is a valuable adjunct because it provides a flexible unit and is widely used by lumber companies to haul logs in the open market, a few logs being secured from widely scattered farm lands and small tracts of timber.

While motor trucks have come to fill an important place in logging in recent years -- logging being so preeminently a problem of transportation -- it is well to remember that railroads still convey the largest volume of logs to the sawmills, especially in the Pacific Northwest. According to Moon & Brown, there are over five hundred separate logging railroads in the state of Washington alone.

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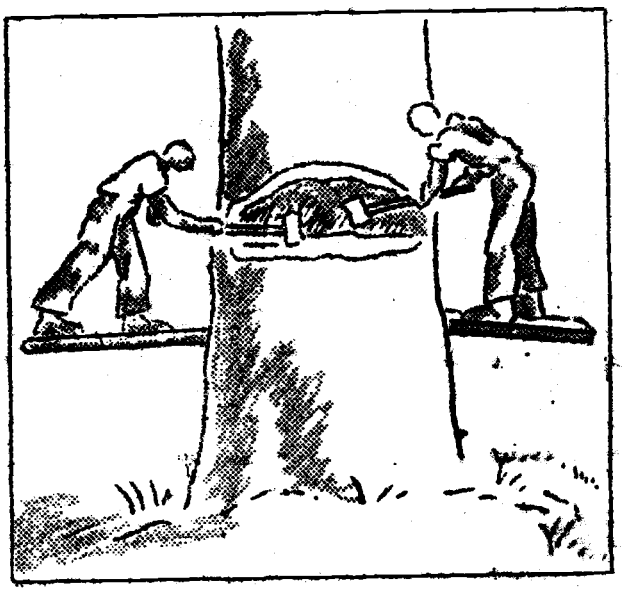
* - For young men who are mechanically inclined, there is and will be an expanding field, with the lumber industry and elsewhere in the driving, servicing and repairing of tractors. The same is true of trucks.

So we see that the logging industry is to a large extent mechanized. Practically all logging operations (except the "falling" of trees, which is nearly all hand work with ax, wedge, and saw) are now carried on entirely by machinery. Cable logging, truck and tractor transportation, stationary and portable engines, gasoline and electric locomotives are now the rule rather than the exception. Hence, a knowledge of machinery is not only valuable in present day logging; it is fast becoming a necessity.

Just how is logging done in the forests of Washington and Oregon? Generally, it is done over timber tracts of large area in the Douglas fir region. The first step is the "logging engineering" or planning and layout of the operation, and opening up the tract with roads. An accurate large scale topographic map is usually made and this, combined with the cruise of the timber, is carefully studied to determine the best logging methods. The location of roads, "landings", and boundaries of "settings" or logging areas is planned on the map and then surveyed on the ground. The major transportation system may be railroads or truck roads or combinations of the two. The main road may start from the mill, from a river or a tide-water where logs may be dumped for sorting, rafting and towing to the mill, or from an existing railway or highway. The road and camp are constructed and spar trees or landings and cutting boundaries marked. A "logging engineer" is usually in charge of all this work, under the general direction of the logging superintendent.*

Next to go into the timber are the "fallers" (who cut down the trees) and the "buckers" (who cross-cut them into log lengths.) Their work is organized and supervised by a "bull bucker".



FIRST LOGGING STEP

In actual logging the first step in the Douglas fir region is the falling of trees -- or, in other words, cutting them down. Two men usually work together in the work, using axes, wedges, and a cross-cut saw. Let's watch a pair of expert "fallers" as they get to work harvesting a big tree.

First they cut a notch in one side of the tree with axes, to govern the direction of the fall of the tree. They then saw <u>toward</u> the notch from the opposite side -- this so the tree will positively fall away from them -- and drive wedges behind their saw as it cuts into the trunk. The wedges gradually pry the tree off balance and force it to fall in the direction of the notch.

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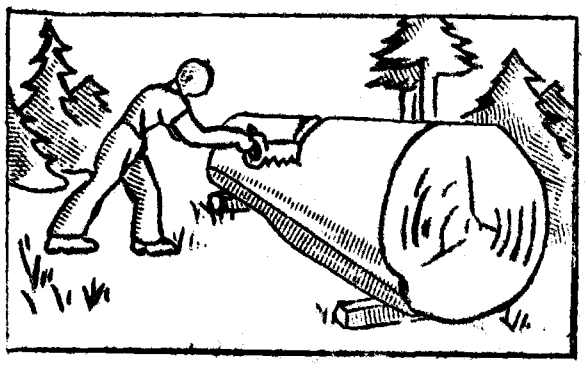
* - Such extensive preliminary engineering and the employment of a logging engineer as such may, however, apply more to large scale operations.

Not only must they be capable of throwing a tree in a definite direction without breaking it, but they must also have the knack of taking advantage of the ground to place the tree where the logs will be easiest to handle, and, so far as possible, to avoid damage to young growth and other large trees.

Falling, our giant of the forest gathers momentum quickly, setting up a loud, crackling roar as it nears the ground and breaks loose from the stump. The instant the tree starts to fall, a resounding shout of "TIMBER-R-R!" comes from our fallers as a warning to anyone who may be near so that he can be free of the falling giant or of small trees which may be struck by its fall. With a resounding crash the great tree comes to earth -- and its journey from growth to use is on!

The second step in actual logging is "limbing", or chopping the limbs from that portion of the bole of the tree which is to be made into logs. (Sometimes called "knotting" in the fir country). Next comes "bucking", or sawing the tree into standard lengths* for transportation to the sawmill. On the Pacific Coast, it is universal practice for the bucker to work alone. In the East, the bucking crew is made up of two men with a crosscut saw, an ax, a sledge, and several wedges. But in the Northwest the different members of the bucking crew work singly. Each has his ax, his wedges, and perhaps a sledge; but one handle has been removed from his crosscut saw.



"LIMBING" AND "BUCKING" NEXT

Besides being able to do a good day's work alone, a bucker must know how to saw through a tree without splintering or "slabbing" it. An inexperienced bucker can easily spoil more timber in a day than his wage will amount to. Sometimes, when transportation will permit, the usable length of the tree is taken out in a single length, and bucked at the mill.

The bucker's tools are an ax, a saw, several wide wedges, a sledge, and a bottle of oil. The "bull bucker", or bucker foreman, usually measures the trees and marks where they should be cut with an ax.

Snags are felled also in the usual Douglas fir operation, as a measure of fire protection. Clean logging, with blocks or strips of seed trees left standing, is established forest practice throughout the region.

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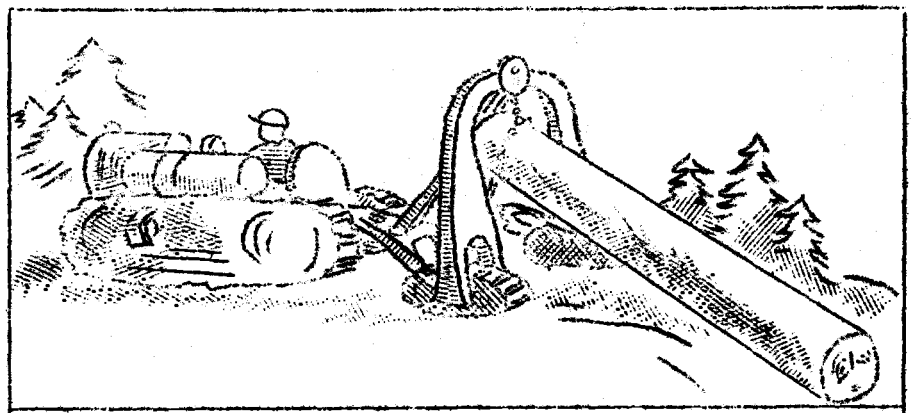
* - Standard lengths in the Douglas fir region are generally 24 to 40 feet long, with an average diameter of from two to four feet and weighing several tons.

"SKIDDING" AND ASSEMBLING

After the logs are bucked the next operation is to "skid" or "yard" them (i.e. drag them over the ground) to the "landing" or loading point. There are three methods of skidding: (1) With animals --horses and mules; (2) by tractors, which have come into wide use in all parts of the country; and (3) by power skidding (including "high lead" or high-line logging), widely used in the big timber of the Pacific slope. "Big wheels" and tractors are largely used in the Western pine region's spaced timber, with "jammers" for loading "short logs" on cars. Loggers call the Western pine region "short log country", and the Douglas fire region "long log country".

Tractors have proved their economy and efficiency in skidding. Moreover, they are less damaging to young growth and the stand of timber remaining (very little more than horses, experts say) than power skidding; and have replaced the latter system in many national sales in California for reasons of good forestry practice as well as economy. The most common forms of tractor logging are: Direct skidding in log or tree lengths, skidding with pans (a pan is a flat toboggan-like sheet of steel upturned at front to prevent logs from gouging into the ground), hauling with truss-wheel bummers, (a skidding device consisting of crawler type wheels supporting a low bunk upon which forward ends of logs are loaded), hauling with slip tongue and hydraulic high wheels, and hauling with fair-lead arches mounted on caterpillar treads.

The fair-lead arch is the logging accessory most commonly used with the tractor in the West. It consists of a steel arch hooked to the draw bar of the tractor. Logs are pulled to the arch and the "choked" ends elevated to reduce ground friction by a cable wound on a drum mounted on the rear of the tractor. According to U.S.D.A. Technical Bulletin No. 511, the damage caused to young growth by pans is almost the same as ground skidding, while arches do more damage. Direct skidding with horses does by far the least damage to the forest of any method of logging.

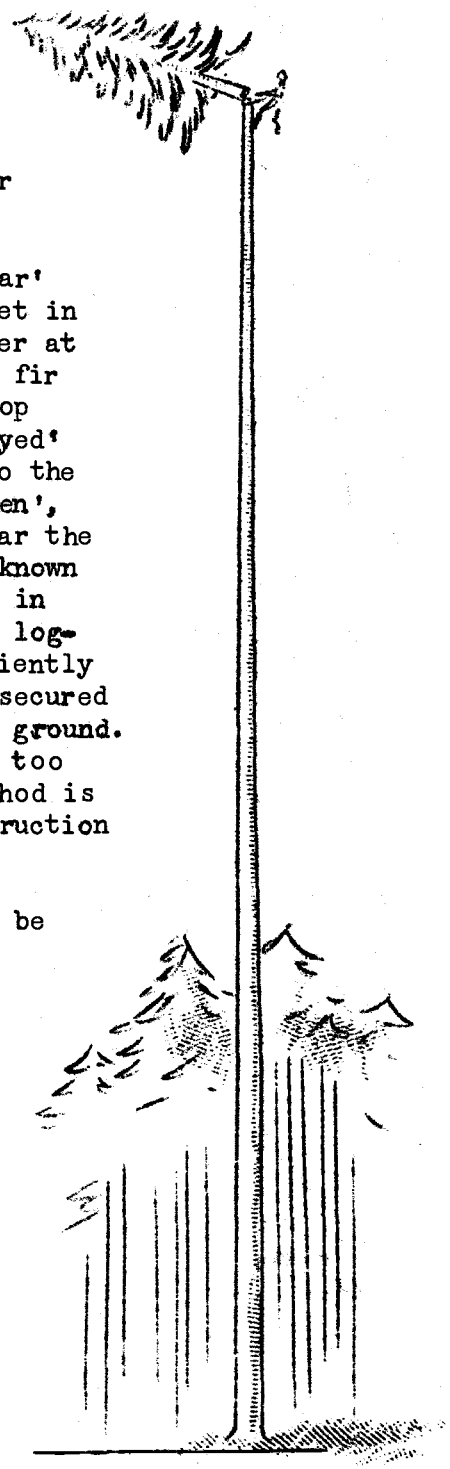


...Latest and most commonly used accessory in western (tractor) logging -- the fair-lead arch...

Since the advent of the powerful diesel tractor and arch, a few years since, tractor logging has expanded rapidly on the Pacific Coast. These machines can economically handle even the huge redwood logs of California. The only limitations of the tractor are topographic, and in rough, mountainous country with steep, rocky slopes, "donkey" or moving cable power logging will continue to be used.

The high lead process consists of the operation of a log-pulling cable from block and tackle at the top of the spar tree. It is this method which is graphically described in the West Coast Lumbermen's Association's pamphlet, "Logging In The Douglas Fir Region". Says this bulletin:

"The logs are now ready for assembling at the loading point. At this point, which may be as far as 1,500 feet from the point where the tree has been cut, is a powerful yarding engine which draws in the cable to which the logs are attached. The type of engine most used is operated by steam and is known as the donkey engine. It develops tremendous power in proportion to its size, and can bring in a log weighing many tons. Sometimes the engine used for this purpose may be operated either by gasoline or electricity or oil.



"At the loading point is a pole or 'spar' tree, which may be 100 to 150 feet tall, 3 or 4 feet in diameter at the base and 12 to 18 inches in diameter at the top. It is generally a Douglas fir tree from which the limbs and the top have been cut. It is braced or 'guyed' with several heavy cables running to the ground and secured to stumps or logs called 'deadmen', buried in the ground. The spar tree or mast is near the loading platform and is rigged with huge pulleys, known as blocks, through which run cables, or lines used in hauling in the logs. This is known as 'high-lead' logging. If the ground, or logging 'show', is sufficiently favorable, a 'ground lead' may be used, the block secured to a stump and the yarding cable running along the ground. But, usually, the ground is too rough, or there are too many stumps and fallen logs, and the high lead method is used to lift the front end of the log free of obstruction as it is pulled over the ground.

"SPAR TREE" IMPORTANT

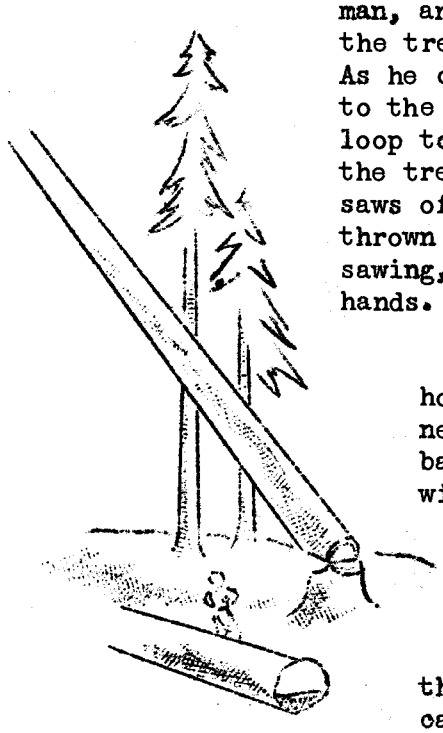
"Where a gully or draw or valley is to be crossed, or in very rough country, an 'overhead' system may be used. In this method there is another spar mast 500 or 1000 feet away, or across the valley. This other spar is shifted from time to time until all the selected trees within the radius of the cable have been removed. A heavy cable runs from one to the other, and a carriage to which are attached the lighter cables or wire rope for drawing it back and forth rides along the big cable between the two masts. A cable is let down from this carriage, attached to a log and drawn up to lift the log partly or entirely from the ground.

"OVERHEAD" SYSTEM

"It is in connection with the clearing of the limbs and tops from the spar trees and fastening the rigging to them that one of the most hazardous tasks in logging is performed. This work is done

by a man known as a high climber or high-rigger who is the steeplejack of the woods. He is one of the best paid and the most expert of all wood workers. His equipment consists of an ax, a saw, and a climbing belt and cable loop. (An inch hemp rope with a 1/8" steel core).

"The high climber goes up a tall tree selected for a spar mast, trimming off the limbs as he ascends. His feet are equipped with the spurs of a telegraph or telephone lineman, and the cable loop is around the tree fastened to his belt. As he climbs he jabs his spurs into the tree, then pulls himself toward it by the cable loop to give it play, then throws the loop farther up the tree. When he reaches the designated height, he saws off the top. While doing this the cable loop is thrown around the tree below the point where he is sawing, enabling him to lean back and work with both hands.



STEEPLEJACK OF THE WOODS

"When the top starts to fall he catches hold of the loop and braces himself. This is necessary because when the top falls it kicks back and the top of the mast swings through a wide arc. After this, and aided by men on the ground, the high climber fastens the necessary equipment to the spar tree.

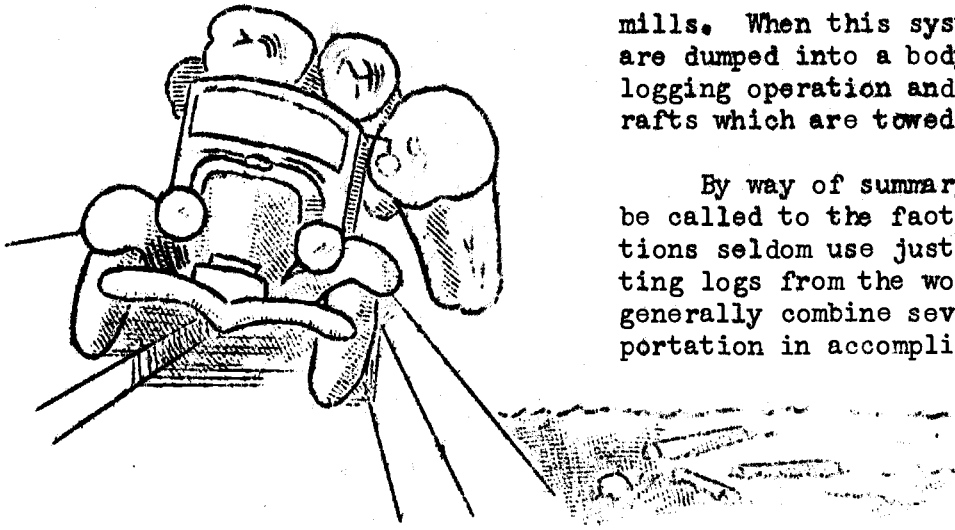
"TIMBER-R-R!"

"The logs are made ready for carrying to the loading position by placing around one of the ends a small steel cable. This cable is called a 'choker' and is made secure to the cable from the spar mast or let down from the carriage on the overhead line. When the cable has been made fast to the choker, a signal is given to the engineer of the engine at the loading position. He sets the machinery in motion and the log is drawn to the engine, where it is either loaded directly onto a car or truck or placed on a pile of other logs until they are loaded.

"Where the character of the ground will permit, caterpillar tractors are coming into more and more extensive use, to do the entire yarding to the loading point, or to supplement the high lead or over-head lines, extending the yarding limits, and reducing the number of spar mast settings required.

"A loading engine operates the loading device, an 'A' frame derrick or a swinging boom attached to the spar mast at the loading position. Tongs let down from the boom by means of cables are fastened to both ends of the log which is then picked up, swung over a car or truck and let down. Sometimes the logs are loaded by rolling them up a skidway, or by use of a complete machine unit called a skidder. From one to six logs, depending on their size, make a load.

"When a truck is loaded, or enough cars to make up a train, they are taken to the mill where they are dumped into the storage pond. Some logging companies use water transportation to move their logs to the



mills. When this system is used, the logs are dumped into a body of water near the logging operation and made into large rafts which are towed to the mills."

By way of summary, attention should be called to the fact that logging operations seldom use just one means of getting logs from the woods to the mill but generally combine several means of transportation in accomplishing that result. Sometimes as many as seven different kinds of conveyances are employed. When conditions are favorable (including an extended down-hill run and a plentiful supply of water) some operations use slides, chutes, and flumes to supplement other means of log transportation; and logs can be driven loose, rafted, or flumed considerable distances. One flume in California is 55 miles long. Rafting is still employed in the larger streams and estuaries (arms of the sea) of the North Pacific Coast. But for longer distances, the hauling is usually done by trucks, or on railroads, the latter transporting the greater share of the tonnage to our larger mills, as we have already seen.

AS MANY AS SEVEN MEANS

Dr. Joseph S. Illick, in "An Outline of General Forestry", called attention to a final trend in logging which is of too much significance to omit from a comprehensive report. "The traditional logging practice in the United States", says Dr. Illick, "has been to cut out and get out without making any provisions for forest renewal. Everything was cut that would yield a profit, and what did not yield a profit was left in the woods. In recent years, however, an earnest attempt has been made to replace this practice of excessive and careless forest exploitation with better logging practices. The method that has been developed is generally known as selective (partial) logging. At first its main objective was to determine the limits of profitable logging, but gradually the attention was also given to the perpetuation of good tree growth, and now the emphasis is gradually shifting to the development of the best and most economical logging methods from the viewpoint of sustained forest growth. Selective logging can be done in such a way that fifteen to twenty years after cutting it is possible to come back on the same area and make another cutting. It makes possible not only the continuation of logging operations but also contributes to sustained land values and to a greater economic and social security of forest communities." This system, however, is more adapted to pines, which grow wide apart, than to Douglas fir which will not restock well in shade but reproduces best in dense growth on cleared lands, from blocks of seed trees.

SELECTIVE LOGGING

POSSIBLE TO COME BACK

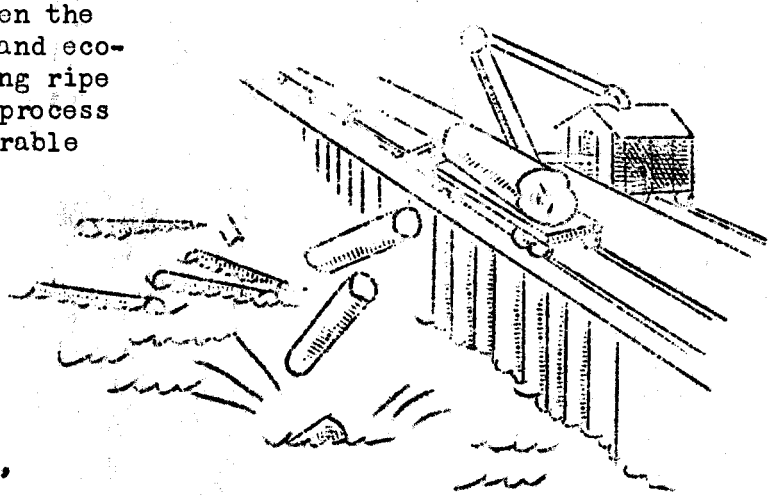
C. SAWMILLS AND LUMBER MANUFACTURE

The first lumber manufacturing enterprises in Washington (and the Douglas fir region) were small, simple sawmills that produced only rough, green lumber. At first 5,000 to 10,000 board feet per day was top performance. Now, with the improvement in mechanical facilities and by multiplicity of machinery, the typical mill is a large, complex plant composed of many units and equipped to turn out lumber products in a variety of conditions and forms in large quantities. The West Coast Lumbermen's Association is authority for the statement that over 80% of the lumber now produced in the Douglas fir region is manufactured in plants ranging in daily producing capacity from 75,000 to more than a million board feet. The usual size of the large type is probably from 150,000 to 200,000 board feet in an eight-hour shift. "Mill and crew are arranged to yield continuously so much in timbers, planks, boards, flooring, ceiling, siding, and numerous patterns and various specialities. Every man, every machine is only a cog in the wheel; everything must go like clockwork; for, if one fails, dozens of men must remain idle."

A LARGE COMPLEX PLANT

THREE TYPES OF MILLS

The early Northwest mills were principally "cargo mills", so called because they were built to supply lumber by the vessel load to domestic and foreign ports. (60% of our mills are still on tidewater). Today, three main types of mills are recognized: Cargo mills, rail mills, and a combination of the two. There are, however, numerous so-called "tie mills", small portable outfits devoted mostly to the production of railroad ties, which (collectively) are a factor in Washington and Oregon lumbering. Such units can go into timber it wasn't profitable to take out when the country was first logged and economically cut the remaining ripe trees into ties. In the process they also produce considerable side cut -- ties are cut from the middle of the logs and the side cut comes from the outside. It is safe to say that the majority of ties produced in the Douglas fir region are turned out by this type of small, mobile sawmill.



In certain respects lumber making differs fundamentally from other kinds of manufacturing. For one thing, both the quantity and the quality of a lumber mill's product varies of necessity. In most industries all you have to do to increase the output of a particular item is add to your personnel, machinery and supplies. But that is far from true in lumber. And for the simple reason that no two logs are ever identical as to size, quality, or characteristics. That being the case, it is impossible to produce the same number, size and grade of pieces from two trees even though they are the same age and were grown and harvested together.

Another peculiarity of lumber manufacture is that the grading of lumber -- selection to fit a certain purpose or specification -- affects both the handling and the output of a log.

When logs come in from the woods they are stored either in "yards" or log ponds -- generally the latter. Some log ponds, located along rivers, or in tide water, are used to store several million board feet. At inland points, artificial ponds must be provided. In the Puget Sound country it is unnecessary to provide "hot ponds" -- ponds where exhaust steam from the sawmills keeps the water from freezing in the winter but this is done in New England, the Midwest, and the Inland Empire. Water storage is the general practice for two important reasons: (1) and most important -- manipulation, transportation, and selection. Water makes it quick and easy to select, grade, and start logs on their journey through the mill. Single handed, a boom-man with a pike pole can push a log weighing tons around in a pond; whereas, he could not even budge the same log on land; (2) water helps keep logs from decaying and cracking and also protects them from possible damage by fire and insects. If kept very long in salt water, however, logs are subject to damage from the little marine parasites known as teredos. Incidentally, West Coast hemlock cannot be stored as long in water as Douglas fir and most other varities. This because the hemlock has a relatively high moisture content to begin with and will eventually sink.

HOW LOGS ARE STORED

"Owing to the great size of Douglas fir, West Coast hemlock, Western Red cedar, and Sitka spruce logs, the mills (in Washington) are of heavier construction and equipment is heavier and stronger than in other lumber producing regions. The necessity for giant machines is apparent when it is seen that logs weighing three to five tons are elevated 30 to 40 feet, reduced to large cants or slabs, these cut into smaller sizes, and the resulting pieces trimmed to the desired lengths, all in a space of five or six minutes. At the same time, one to three tons of sawdust, slabs, and waste wood and bark are mechanically conveyed to the heating plant, the lath mill, and refuse burner, or 'hogged' (chopped fine) for fuel and other forms of manufacture."

GIANT MACHINES NEEDED

Who having seen it, ever forgets the tremendous sweep and power of a modern sawmill? A visit to one of the typical Washington mills, especially at night, remains one of the most thrilling experiences in modern industry. In the distance, the "song of the mill" is not unlike the hum of a huge airplane motor, rising to high notes as the saw strikes the knots, then dropping as it sings its way through the soft wood.

THRILLING EXPERIENCE

The massive logs, which have been stored in the mill pond until wanted, are dragged up an inclined trough, known as a "log slip", by an endless chain conveyor called a "jack ladder". The chain catches the logs one by one and draws them onto the log deck where a small supply is kept ready for sawing. Here the "log scale" is obtained and recorded for the measure of day-by-day production.

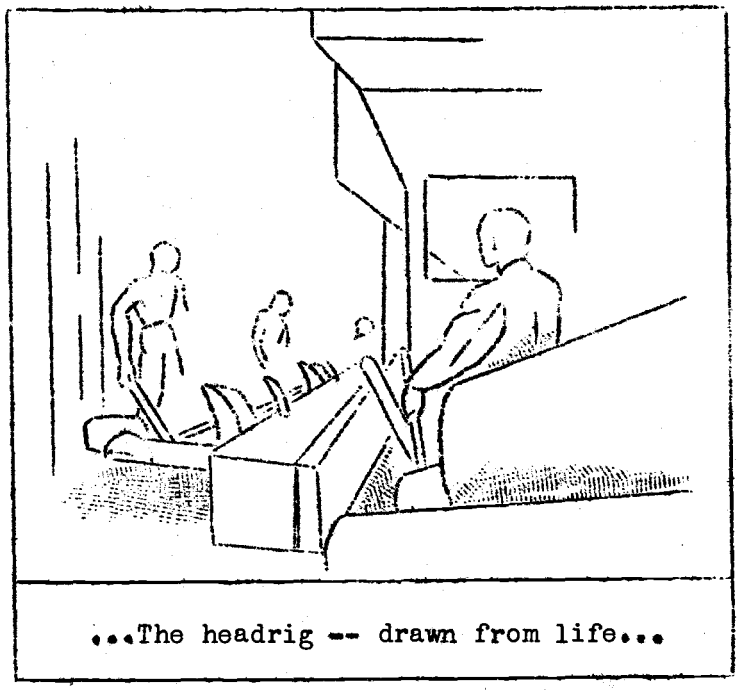
From the log deck the logs, one at a time, are literally kicked into place on the log carriage. This is done by steam "niggers" -- steel prongs which spring out with a kick like a monster mule and duck silently

back out of the way of succeeding logs, or by "gooseneck" turners manipulated so as to prong and pull the log instead of kicking it.

AFTER CLAMPING, NEVER ANY STOP

From this point on there is no stop. The mighty logs are kicked rolling onto the big carriage, there to be adjusted as quickly and lightly as saplings, instead of hulking bulks whose weight could crush like a landslide. The struggle goes on between the gigantic product of natural forces and the mechanical powers brought into play by Man.

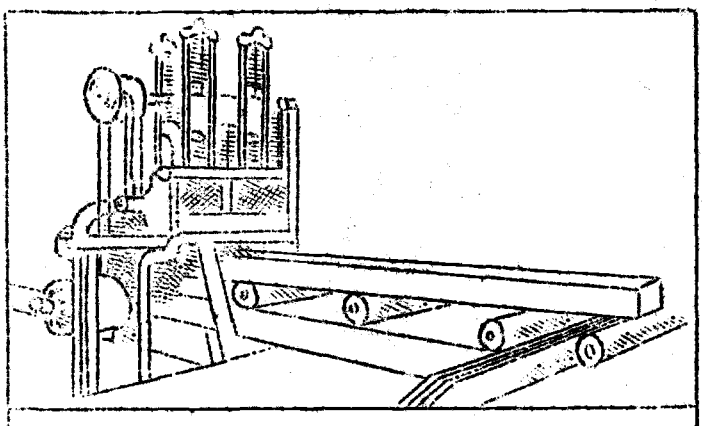
In much less time than it takes to describe it, the mighty log is rolled, placed and clamped firmly against headblocks on the carriage. The clamping is done by mechanical "dogs". The carriage is manned by two, four, or more men (setters and doggers), who, on signal from the sawyer, see that the log is adjusted so that the desired widths will be cut. The carriage (controlled by the sawyer) begins its terrific shuttling to and fro over steel rails, alternately moving the log against the teeth of the great band saw and then taking it back for another cut. The log is mechanically turned on the carriage as slabs are cut first from one side, then the next, then "clears" from the fine-grained outer wood until the log is reduced to the form of a square -- to go out of the mill as a large square timber, or to be still further reduced to the "makings" of dimension lumber. One by one, the wide, thin slabs or flitches fall away before the head saw's powerful and relentless onslaught. The Douglas fir sawyer cuts according to the order on the board, and also according to grade; while the pine sawyer cuts for grade alone.



...The headrig -- drawn from life...

THE RELENTLESS BAND SAW

The band saw (usually called the head saw because it saws logs on the headrig near the entrance of the mill) is like a long steel belt passed around two wheels several feet in diameter, one placed directly above the other. This belt is of thin steel and is toothed. The commonly used bandsaw is 50 to 60 feet in length, 12 or more inches in width and is capable of speeds up to 10,500 feet (or nearly 2 miles) per minute. As the wheels rapidly revolve, the steel belt moves up one side and down the other. The side of the saw travelling down is used in sawing. The teeth move so fast that they do not show and the saw looks like a motionless steel band standing upright. The saw revolves but does not move from its position. Instead, the log is moved against it by the carriage. Each time the



...The gangsaw headrig...

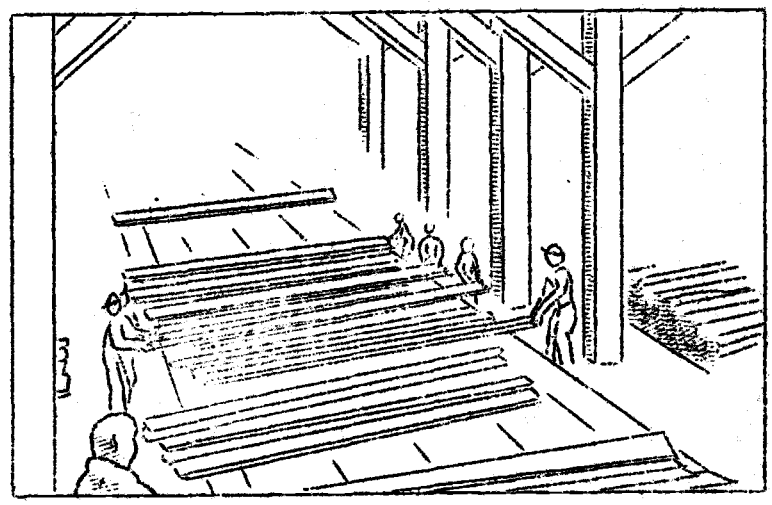
carriage comes a slice is taken from the log. Sometimes band saws, for smaller logs, have teeth on both edges and are able to cut a slab from the log on the backward as well as the forward trip of the carriage.

One is impressed with the rapidity, yet careful precision, of the whole milling operation. Again and again, as the operation proceeds, the need for alertness and stamina is evident. Yet, always, the visitor marvels at the multiplicity of labor-saving devices. The long, wide flitches, or slabs, with bark on their edges, stalwart in themselves, fall upon live rolls and fairly scoot along to the point where they are met by a battery of small circular saws known as an edger. These trim the rough edges and make parallel cuts 8", 10", and 12" in width.

Other saws will cut off uneven ends and cut long pieces into shorter lengths in trimming out knots and cutting to various lengths required. These saws are known as trimmers. Usually they are set up in a row, two feet apart, operated automatically by the trimmerman who sits at a keyboard and brings down the desired combination of saws as the lumber passes under them on moving chains. There may also be "re-saws" to split heavy pieces into thinner ones.

HOW GANG SAW WORKS

Some cuts, known as cants after they are sawed to dimensions by having their edges trimmed, go to the invincible gang saw* which, cutting vertically with many uniformly spaced blades, transforms them by up and down strokes into one inch or two inch strips. Sometimes gang saws are used to cut small-second-growth logs with small tight knots into boards of 1" and 2" dimensions.



The lumber is passed from one piece of equipment to another by means of an elaborate system of rollers, chains,

* - Swedish gang saw headrigs were introduced into the Northwest by Axel H. Oxholm, formerly of the U. S. Department of Commerce and now Managing Director of the Pacific Forest Industries.

and chutes. Most of the rollers are "live". That is, they are kept revolving by power. Indeed, from the time logs enter the mill until conversion into boards and piling in the yards, the lumber is moved by live and dead rolls, endless chains, conveyors and moving platforms. By means of this conveying equipment, sizes and grades can be segregated largely without the use of hand labor and routed to any place desired.

When the lumber has been cut to required sizes it passes to a long grading table, where it is carried by moving chains past the graders, who mark the grade on each piece with a crayon. It is then pulled out and stacked on low trucks or in small piles.

SORTING AND GRADING

The work of grading is both strenuous and important. It is also bewildering for the visitor to follow. Suffice to say, that grading begins with the first cuts from the logs and never ends until the planing mill is through. Every sawyer -- indeed, every man in the mill, from boom to green chain -- grades the log in its process of manufacture into lumber. The man who puts grade marks on the boards as they go by on chains must be especially sharp-eyed, alert and experienced. The sawyer up at the headrig is the "man responsible for the lumber". But the grader is the man responsible for its classification.

Grading continues on through tallymen and inspectors in the yards. Moreover, grading classes are held in all centers of the industry.

Various types of equipment are used to convey the piles of lumber from one place to another. Sometimes an overhead monorail carrier system is used. In some cases, particularly in large mills, bridge cranes are utilized. Or the work may be done by lumber carriers; vehicles commonly called "straddle bugs", which straddle a pile of lumber, lift it with adjustable arms and carry it swiftly to the part of the plant where it is wanted.

Through the trimming, grading and sorting processes the wood (now lumber) moves swiftly on to the remanufacturing department, and thence the clear* lumber and a goodly portion of the "common" go into the dry kilns. There the first pause occurs -- a deliberate, scientific, extremely careful stacking and treating, adjusting the lumber to its new environment, increasing its life and usefulness. This pause is for seasoning.

TWO METHODS OF SEASONING

Why does lumber have to be seasoned? Well, lumber fresh from the saws contains considerable moisture. When piled suitably a large part of this moisture will evaporate -- in due time. This method is known as "air seasoning" and generally requires four to six months or more. The drying process is speeded up, however, by placing the boards for various lengths

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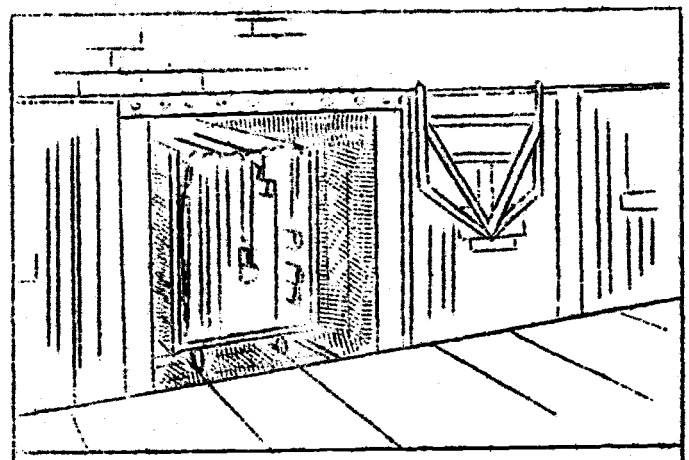
* - Clear lumber is that free, almost entirely, from knots. It always comes from the outside because it grows up around where the limbs used to be on the small tree.

of time in artificially heated and humidified kilns. This process is known as "kiln drying" and usually takes from two days (48 hours) to several weeks depending on the thickness of the stock.

All the large modern mills are equipped with batteries of these dry kilns. They resemble huge cooking ovens. In them the temperature is kept at a very high point by automatic controllers (in the same manner as the temperature is regulated in air-conditioned houses), while the air is kept circulating with pumps at the same time. Moreover, the relative humidity, which at any given temperature is the most important factor in controlling the rate and extent of drying, is also regulated and maintained at the most desirable level. Between the tightly closed ends of these oven-like rooms, the green boards are scientifically dried by steam heat so as to reach the consumer in perfect condition. The operation requires much skill and the men entrusted with this responsibility are highly paid experts -- usually graduate engineers.



...Large mills have batteries of kilns...

The theory of kiln drying is that: (1) Moisture passes from the interior of the wood to the surface; and (2) moisture evaporates from the surface. Heat hastens both processes.

The drying schedule of one operator for 8/4 West Coast hemlock shop stock starts heat at 160 degrees to 170 degrees Fahrenheit and 90% relative humidity. This is continued for twelve hours. Then he adds 10 degrees heat each twelve hours thereafter until 190 degrees is reached and the humidity is held at 90%. Beginning on the 7th or 8th day, the relative humidity is gradually decreased to 25%, depending upon how the stock is drying. The heat, however, is held at 190 degrees until the stock is uniformly dried to 7% moisture content, which usually takes from ten to twelve days. 1 x 4 hemlock flooring strips may be kiln dried in 96 hours, but the relative humidity is started at 70% and reduced only to 35% at 24 hour intervals.....In other words, kiln drying is a highly scientific process and one involving constant watchfulness.

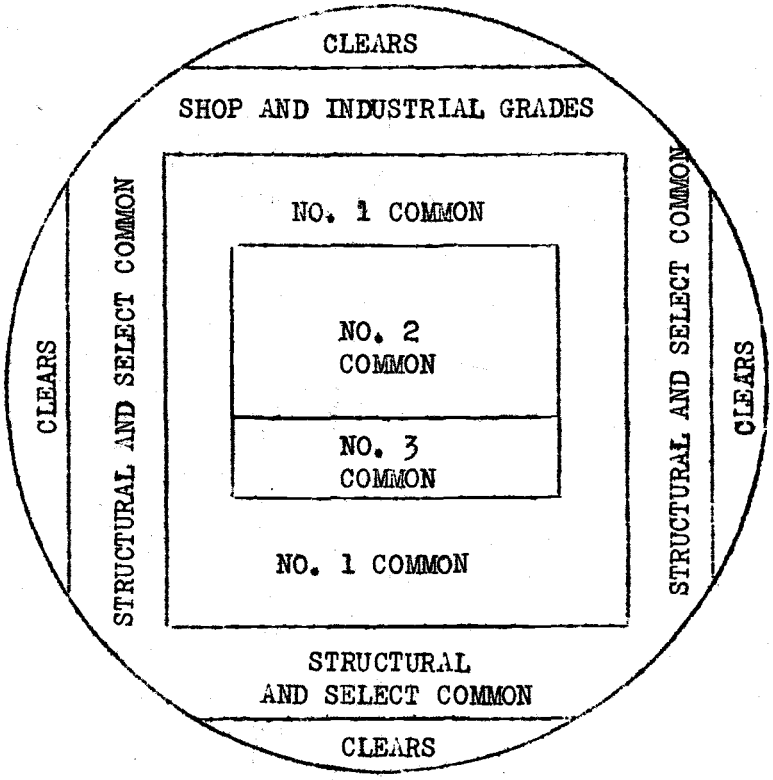
THEORY AND PRACTICE OF KILN DRYING

Besides shortening the time of seasoning, from as much as six months and a year to a few days or weeks, kiln drying often turns out a product more suitable to careful processing than air drying. It saves money by reducing the amount of lumber it is necessary to carry in stock. It reduces injuries to lumber such as checking (cracking) and warping, honeycombing, staining, or insect attack, which may occur in air seasoning. It hardens the resin by evaporating the volatile matter. It makes wood more suitable for gluing or painting; because wood that is thoroughly and uniformly dried has little tendency to shrink or swell after gluing or painting.

The illustration shows the kinds and the amounts of lumber which can be taken from the average Douglas fir and West Coast Hemlock Log as these are manufactured into lumber.

The entire center section, or heart, of these logs contains common lumber; the area near the outside edge is where the lumberman gets the higher grade structural and clear lumber.*

AVERAGE DOUGLAS FIR AND WEST COAST HEMLOCK LOG

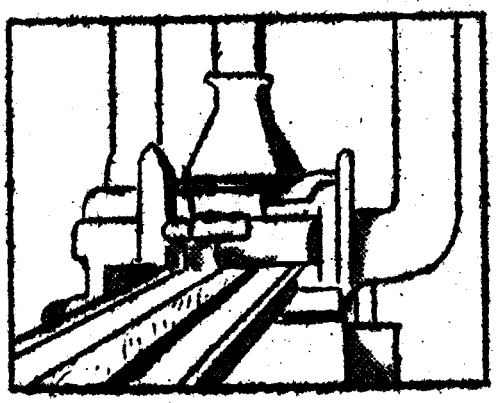


* - From "West Coast Lumber Facts"

When the lumber emerges from the dry kiln, or the air seasoning shed, further grading and selection take place and the resulting product is in readiness for the exact refinements to follow, in the planing mill.

While planing is sometimes done in other mills or by the retail lumber dealers, all large, permanent sawmill plants have a lumber mill proper and a planing mill. The planing mill, however, does a great deal more than merely smooth the (saw-rough) surfaces of the boards. By special request, they may be cut and shaped for different purposes. There are many kinds of machines, from hand saws to turning lathes, to perform the many operations through which the lumber may pass. To the visitor, the planing mill again may look and sound like a monster maelstrom of spinning wheels, whining knives, scooting rollers and never ending conveyors. But here, actually, the battle of huge elemental forces is past. Careful concentrated skill now replaces the surging, swelling din of the sawmill. Master craftsmen, long trained at their chosen work, attend the great, swift machines, adjusted to a hair's breadth in accuracy, refining the rough stock into perfectly finished commercial grades. Quality is upheld by the quick, sure eye of graders of uncanny expertness. One process succeeds another in rapid succession through the mill. Sometimes, modern "planers", or similar machines, work the lumber into patterns with grooves, beveled sides, for flooring, siding, molding, etc. These machines can produce many different patterns and shapes.

PLANING IS CONCENTRATED SKILL



The process of manufacture has been completed. Transfers are made by cranes, small tram cars or electric trucks. Planed or patterned lumber -- "finished" items -- are assembled in standard bundles and stored and sold in this form, undergoing another inspection during assembly. Even the boards which are just planed smooth are loaded by careful workers and grading again is checked.

With regard to degree of manufacture -- lumber is classified as rough, surfaced, and worked. There are 3 groups of the last: (1) Matched -- to make a tongue and groove joint; (2) shiplapped to make a close rabbeted or lapped joint; (3) patterned lumber -- that is, worked to a patterned or molded form. Yard lumber is divided according to quality or grade into select and common lumber. The former is subgraded as A, B, C, D; and the latter (common), as Nos. 1, 2, 3, 4, and 5.

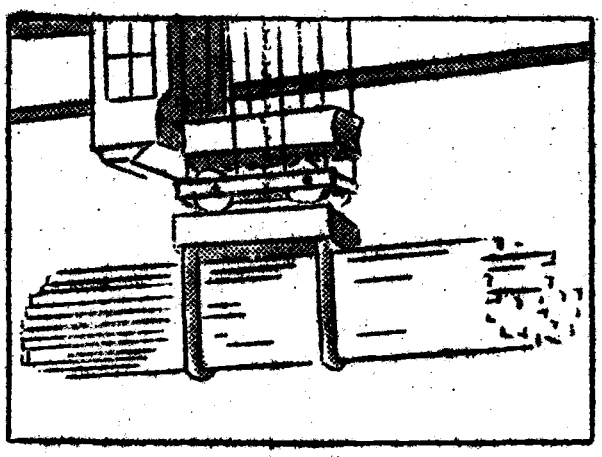
Lumber grades in the Douglas fir region are written by the West Coast Lumbermen's Association and the grading and grade marking at the mills is done under Association supervision. Inspections are made and certificates of inspection issued by both the Pacific Lumber Inspection Bureau and the West Coast Lumbermen's Association. No one can study lumber production in the Northwest without noting that grading is of first importance, from cruiser to headrig, to shipping dock, to retail yard, to construction.

As a sidelight on this phase of production -- grading classes were started in December, 1936, as a joint project of PLIB and WCLA, and have followed through continuously to date. Classes have been held in 26 lumber producing cities (9 in Oregon and 17 in Washington). The total enrollment in these classes is 3,300. The classes are open to all mill employees desiring to become familiar with the expert grading of lumber.

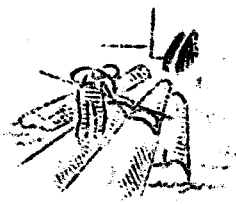
Lumber is shipped from the mills in the Douglas fir region by railroad, truck or ship. By one or another of these methods it goes to every state in the Union and more than sixty foreign countries. Practically all Western pine is shipped by rail.

LOCATED FOR EFFICIENCY

Space limitations do not permit description of the lath mill, machine shop, saw filing shop, electric shop, motor truck garage, the storage sheds and yards, big refuse burners, etc., which are part and parcel of practically every big mill. But it should be pointed out that the main mills and the auxiliary units of a modern saw mill plant are well located for efficiency and linked up for advantageous transportation as well as production. Most sawmills supply their own primary power (steam) from sawdust and other waste materials. Power is now commonly applied through electric machinery in the larger mills.



D. SHINGLE MAKING

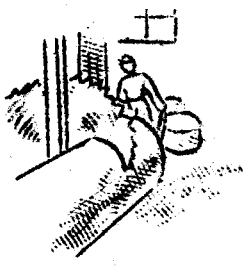


Wood shingles for roofing purposes have been employed in the United States from the time of earliest settlers, the first shingles being hand rived. About the middle of the 18th century, machinery was devised for their manufacture and the use of shingles of wood became widespread. From early times, shingles were utilized not only for roofing but for covering the side walls of dwellings, barns, and other buildings. Sometimes the manufacture of shingles is done by an auxiliary unit; but, more frequently, a separate mill carries on this rapid-fire and exacting operation.

The production of red cedar shingles in the Pacific Northwest has been carried on for more than half a century. Shingle production has tended to concentrate more and more in Washington and Oregon (and British Columbia) because this general area is the commercial range of the red cedar tree.

The Western red cedar's freedom from checking and warping, combined with light weight and extreme durability under all sorts of exposure, make it the ideal shingle wood. Sometimes the large cedar trees are felled before other logging begins, particularly in smaller operations. Then instead of "bucking" the trees into log lengths, the loggers cut them into short sections (a trifle longer than 48" or 54", as the case may be). Next they split the sections into bolts. Such cedar bolts resemble overgrown cordwood in appearance and are made for more convenient transportation to the mill in the absence of heavy logging machinery.

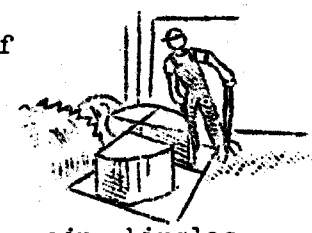
However, by far the greater portion, better than 95%, of the cedar used for shingles comes to the mill in the form of logs. (Logs are brought to shingle mills by train and truck both, with an increasing trend toward trucks. The large organizations, which operate shingle mills in conjunction with sawmills, generally do their hauling by rail. Smaller, exclusive shingle mills almost invariably use trucks.) They are handled from storage pond to "log haul" and "headrig" just as other massive logs are handled, except that power cutting machinery is commonly used on rafts in the ponds. This is to provide lengths which will produce the grades of shingles wanted with a minimum of waste.



Also, instead of a band saw, a great circular saw (as large as 10 feet in diameter) cuts the log into 16, 18, or 24 inch lengths with precision, the length of the section being determined by the spacing of the steel stop that is used. This type of saw has inserted teeth or bits which cut through the log rapidly and which plane the sides of the cut smoothly as they go through. Some cedar logs are so large that even a 10-foot saw is too small to go through. In that event, a very large auxiliary steam-driven drag saw is usually provided.*

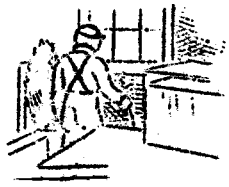
* - Acknowledgement is made to Bror L. Grondal, Professor, Forest Products, College of Forestry, University of Washington, who assisted both in describing the shingle-making process and in checking this section.

The next operation consists of quartering, splitting, and re-quartering the short log sections into blocks of convenient size for the shingle machines. Every effort is made to produce blocks that have a true-edge-grain face. What is the meaning of edge-grain and why is it important in shingle making? "Edge-grain" means vertical-grain -- that is, shingles in which the annual (growth) rings of the wood, as viewed in the butt end of the shingle, are approximately at right angles to the face of the shingle. In other words, the flat sides of the shingles are parallel to the main axis (stem) of the log. As expansion and contraction of edge-grain (or vertical-grain) cedar is less than half as much as that of flat-grain, vertical-grain shingles give much the best service. A shingle of cedar cut in this manner consists of alternate bands of spring and summer wood, crowded together and running in the same direction as the longitudinal face of the shingle. As spring wood shrinks, or expands, less than summer wood, the total shrinkage, or expansion, across the face of the shingle is reduced to a minimum.



Prior to 1931, about 75% of U. S. shingles were flat-grain shingles; that is, shingles in which the grain is parallel to the face. The new grading and packing rules were adopted December 1, 1931, and now about 60 to 70% of all shingles made in the United States are edge-grain shingles.

Upright machines are now used, almost universally, to cut shingles. With such a machine, one sawyer can edge and grade the shingles cut from a single block. His job is among the busiest and most hazardous of mill operations. In the United States shingle-cutting machines are operated at 30 to 40 clips a minute. Further, in order to produce the highest grade shingles, he must watch the block closely and periodically readjust it. His upright machine is equipped with a carriage which shuttles rapidly back and forth and carries the block past a thin-gauge, razor-edge circular saw, which cuts off a shingle smoothly at each stroke. On each return stroke of the carriage, pawls engage with the feed rolls between which the block is firmly held, the upper feed roll and the lower feed roll being alternately turned so that a tapered shingle with the butt either up or down is cut at each stroke.



The sawyer picks up each shingle as it comes from the saw, places it on a "spring-board" with the butt firmly held against a guide which is exactly at right angles to the blade of a second circular saw. Then he presses the springboard down so that the overhanging edge of the shingle is clipped smoothly off. Flipping the shingle over in his hand, he repeats the process, making another smooth edge parallel to the one first cut. Finally, the sawyer drops each shingle into the proper chute depending upon the grade. The chutes lead to packing bins below.

Quality shingles are triple inspected: (1) by the sawyer as he makes them (2) by the packer as he packs them, and (3) by the foreman or superintendent. And this triple inspection is checked by an official inspector, when the mill belongs to an association of producers such as the Red Cedar Shingle Bureau. This inspector is paid by and responsible only to this Bureau and permits no labeling of shingles that do not measure up to rigid standards. As a result, the average bundle from a mill belonging

to such a bureau, does not merely meet the minimum requirements of the rules, but represents a good average above this minimum. Technical knowledge and practical experience are requisites for this important work and inspectors are chosen with great care.

Shingles are sold and shipped as green, air-dried or kiln-dried. Shipment of green shingles is largely confined to deliveries made by water; but for rail shipment the process known as kiln-drying has been generally adopted. In this process, the weather conditions are absolutely controlled -- as we have seen in kiln-drying lumber. Air-seasoning is accomplished by stacking the shingles in the yard or under a shed roof. Besides drying shingles to a uniform moisture content, the dry-kiln process sterilizes the wood completely, making it clean in every sense of the word.

As shingles shrink in the drying process, the bundles become rather loose. This is overcome by placing the bundles one by one in a solidly constructed frame in which pressure is uniformly exerted upon the ends so that the shingles are wedged tightly together under the band-sticks.

UNIT OF MEASUREMENT

For many years the term "thousand" was the unit by which shingles were manufactured and sold. This unit has been superseded by the unit of "square". A square consists of four bundles of shingles which, according to whether the shingles be 16, 18, or 24 inches in length, when laid so as to expose a corresponding fixed length of the butt, or thick end, 5, 5½, or 7½ inches to the weather, will cover a hundred square feet of surface. One "thousand" shingles is equal to 1.25 "squares". (From U. S. Tariff Commission Report No. 96.)

From 1908 to 1912 production of shingles in the United States averaged about 16,000,000 squares annually; and from 1915-18 about 10,000,000 squares. For the 11-year period 1919-29 the average was about 8½ million squares. By 1932, the low mark of record, it had declined to 3,662,000 squares. Oregon and Washington production in that year was 3,426,000 as reported by the Washington-Oregon Shingle Association. The ratio of production by Washington and Oregon mills to total domestic production of shingles increased from 62% in 1908 to approximately 95% in 1932.

POTENTIAL CAPACITY

A recent survey made by the Red Cedar Shingle Bureau, disclosed 303 shingle mills in Washington and Oregon and 250 in British Columbia*. Collectively, they contained around 900 shingle machines. (There may be 1200 machines when business is good and there is night and day operation.) On a basis of each machine producing 25 squares per 8-hour shift per day, the aggregate capacity, figured on 250 days per year single shift operation is 5,625,000 squares. By operating two or three shifts per day, the capacity would be doubled or tripled. Approximately 10% (or 55) of the 553 were combination mills, which produced both lumber and shingles.

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* - The latest directory of Washington State Products and Manufacturers published by the Manufacturers' Association of Washington, lists a total of 104 (combination and separate) shingle mills in Washington alone.

According to figures from the Red Cedar Shingle Bureau, total rail shipments from Washington, Oregon, and British Columbia, were 5,361,863 squares in 1937. An idea as to the United States' market for these shingles is indicated as follows: 505,264 squares, or 8.40% of the entire rail shipment, were shipped to Texas. This demand has been created because other roofing woods and materials do not seem to last in Texas climate. Red Cedar shingles outlast their nearest rival there by approximately a 50% longer time. RAIL & CARGO SHIPMENTS

Other leading domestic markets, according to percentage of the 1937 output, were as follows:

STATE	SQUARES	PER CENT
California	400,347	6.657
Minnesota	398,154	6.621
Iowa	330,388	5.494
Kansas	266,546	4.432
Washington	250,958	4.173

CARGO SHIPMENTS - 1937 (By Boat)

TERRITORY	SQUARES	PER CENT
Alaska	668	.011
California	210,264	3.496
Gulf Ports	85,667	1.424
South Atlantic	9,034	.150
North Atlantic	165,853	2.758
Honolulu	47,754	.794
Mexico	275	.005
TOTAL CARGO SHIPMENTS	519,515	8.638

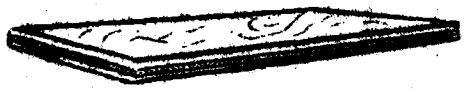
The grand total output of Red Cedar Shingles from the Pacific Northwest was 6,014,070 squares in 1937. This represents 83% of total United States consumption.

The problem of selling shingles is unique, among all forest products. It is not a matter of developing new uses -- after all, shingles are used only for roofs and outside walls -- but a problem of how best to meet the competition of composition shingles, metal, and tile roofing. And, despite competition, uses of cedar shingles have registered a growth in recent years.

In some cases, shingles are bought from the mill direct by large users and especially from small mills. But the majority of west coast shingles -- which are in turn the bulk of the nation's supply -- are sold via wholesalers and retail lumber dealers. The retail dealer performs a distinct service in carrying a supply, ready for delivery in any quantity from a bundle to a carload.

E. PLYWOOD AND VENEER INDUSTRY

While the plywood industry can be considered the "baby" of the vast lumber and timber products industries, it is in every respect a husky infant. As Alexander V. Dye, Director of the U. S. Bureau of Foreign & Domestic Commerce, points out -- not only are the methods of production and manufacturing processes being improved, but new uses are being found daily, and new mills are being erected to provide for a steadily growing demand.



Many of the softwoods and hardwoods are used in the production of plywood, but 85 to 90% of all plywood manufactured in Washington and the Northwest is made from Douglas fir.....Cottonwood, spruce, hemlock, a little redwood, less cedar, and some Philippine hardwoods (for outside veneers) make up the other 10 to 15%. But the business as a whole is known as the Douglas Fir Plywood Industry. Indeed, so important is the industry nationally as well as regionally, the U. S. Department of Commerce has published a separate (illustrated) booklet called "American Douglas Fir Plywood and Its Uses".....The State of Washington leads in plywood production, as it does in the output of lumber proper.

WHAT PLYWOOD IS . Douglas fir plywood, as defined by the U. S. Department of Commerce, is an engineered wood board or panel and consists of an odd number of sheets of Douglas fir veneer* placed crosswise and bonded together under hydraulic pressure with water-resistant glues which are stronger than wood itself. The result is a strong, serviceable panel, generally ranging in size up to four feet wide and eight feet long, and even greater dimensions when desired. The raw material is utilized most efficiently. (Indeed, because there is so little waste, both in making and using, plywood is termed by its producers as "the last word in timber conservation".) The better veneers are used in the faces of the panels, while the lower-grade materials are placed in the cores (center plies) and cross-bands**. Moreover, by crossing the grain in alternate plies, two inherent advantages of plywood are developed.

First, the strength is obtained because the strength of the wood along the grain is capitalized in both directions. Second, shrinkage is minimized to a negligible amount because, although wood tends to shrink crosswise, it has almost no shrinkage lengthwise. In plywood, this cross-grain shrinkage is minimized by the bonding of the adjacent longitudinal grain.

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* - One ply or sheet of wood as it is cut or peeled from the log is veneer; 3 or more plies bonded together constitute plywood.

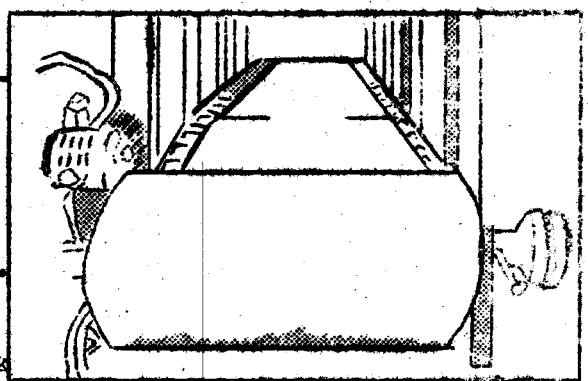
** - The plies which are laid at right angles to the faces are usually called "cross-bands".

Thus we have in plywood a product that is strong, rigid, and split-proof, in large panels of practically any thickness from 1/8 inch to 1 3/16 inches in standard sizes; a product with negligible shrinkage and pleasing appearance, whether finished naturally, stained, or painted. It is easily worked, has considerable insulation value, and is economical to use, not only from the standpoint of initial cost and upkeep, but also, and perhaps principally, because of the great labor savings effected in the ease of handling the large panels.

HISTORICAL BACKGROUND

Although rather new on the Pacific Coast, the modern plywood industry has in its origin -- in its background -- much romance of absorbing interest. Ultra-modern in many of its applications, present-day plywood has antecedents in the very ancient art of veneering, efficiently practiced some thousands of years ago. Few other industries can trace their histories almost to the beginning of craftsmanship and on through the ages as can the plywood industry. In the days of the bloom of civilization in China, carpenters and furniture makers used to shave blocks of wood and then use the "shavings" (or veneers) for the surfacing of furniture and other decorative purposes. The beautiful antique Chinese woodwork, so greatly admired today, bears witness to the efficiency of these ancient craftsmen. Specimens of early Egyptian furniture, built on the plywood principle, have survived the intervening centuries and now repose in our museums. Some of the mummies of Egypt were buried in cases made of plywood and veneer. Daniel Webster's prayer desk is a notable American antique which is made of plywood. It has a rack to hold his prayer book.

The development of plywood on a commercial scale took place only in comparatively recent years. It was made possible by the introduction of machinery to replace manual skill once employed for the slicing of veneers and also for their gluing into composite boards. The first attempts at producing plywood mechanically were made in France -- it was done with veneer saws for cross-cutting planks into sheets of minute thickness. That process wasted almost as much as it yielded. The first mechanical veneer slicer, invented by Garand in the 60's, made the manufacturing of plywood practicable. Garand replaced the saw by a stationary knife -- but the size of the veneer, or slice, was still dependent on the size of the log or plank used for conversion. In the 70's, Garand produced the first rotary veneering lathe; and it was then that the foundation of the plywood industry as we know it today was laid.



...Like unwinding a great roll of newsprint.....

The principle of the rotary lathe is to place a bolt or block (up to twelve feet long) between two spindles and to rotate it against a knife equipped with a special mechanical device to insure an even pressure. As the log is turned, the veneer is removed from it by the knife -- and thus is unrolled a lengthy band of wood with an unbroken surface, equal in width to the length of the log.

Douglas fir plywood made its bow at the Lewis & Clark Exposition in Portland and is said to have been first manufactured in the Northwest in 1905, at a plant located at St. Johns, Oregon. This first plant was closely followed by others at McCleary, Sedro-Woolley, and Tacoma, all located in the state of Washington. The first plants were largely plywood departments of door factories. They produced door panels and it was originally thought plywood was good for little else. Any stock left over was sold for what it would bring. From this humble start, the plywood industry of the Northwest has spread until today there are twenty-one large, modernly-equipped mills -- nineteen in Washington and two in Oregon. They are located as follows:

LOCAL HISTORY

6 in Tacoma	2 in Seattle
3 in Olympia	1 in McCleary
3 in Grays Harbor (Hoquiam & Aberdeen)	1 in Longview
2 in Everett	1 in Coquille, Oregon
1 in Vancouver, Washington	1 in Portland, Oregon

Whereas the original Northwest plant made just two grades in 1905, the 21 plants of today make 6 basic grades of plywood, with thicknesses ranging from 3/16" up to 1-3/16", in increments of 1/16", and sizes ranging from 12" (increasing by 2" units) to 30" wide; also 36", 42", and 48" widths. Lengths range from 48" to 96".

The six standard grades as designated in the revised edition of the Technical Bulletin, Douglas Fir Plywood Association, 1938, are: (1) G2S (Good 2 Sides) which is the highest grade of Douglas Fir Plywood. Faces are in one piece, of 100% heartwood, and are practically clear veneer. Uses: for natural or lightly stained finishes, where both sides of the panel will be exposed to view.

SIX STANDARD GRADES

(2) G1S (Good 1 Side). One face is as good as the faces of the G2S grade, while the opposite face or back is a "Sound" face, as described under the next grade. Uses: for highest quality of wall paneling, ceiling, partition, or other surface where only one face is exposed, or where the back is only occasionally exposed. Light or dark stains, lacquers, waxes, etc., offer a variety of finishes.

(3) SO2S (Sound 2 Sides). Each face is smooth and free from knots, splits, checks, or pitch pockets, etc. The smooth surface is suitable for painting. Sapwood, streaks or discolorations, shims and neatly made patches are permitted. Patches and shims are inconspicuous and usually unnoticeable except by experienced workmen in the mill. For use where both faces of panel are to be exposed (as in booth partitions) and where: (a) minor blemishes will not be objectionable in the natural or stained finish, or (b) faces are to be painted.

(4) Grade Wallboard. Really a S1S (Sound 1 Side) Panel. One face is equal to the face in a SO2S panel, while the back contains sufficient defects, such as knots, splits, pitch pockets, etc., as to render it unfit for patching. Probably the most popular plywood grade, where only one face is to be exposed. Suitable for walls, ceiling, partitions, or other surfaces that are either to be painted, or papered, or to have a natural or stained finish in which minor blemishes will not be of serious consequence.

(5) Grade Sheathing. This is an unsanded plywood made only in 5/16" and 3/8" thicknesses (3 ply) and 5/8" thickness (3 or 5 ply); 32" or 48" wide and 96" long. One face shall present a solid surface except that the following may be permitted: (a) not more than 6 knot holes, not over 3/8" in greatest dimension; (b) splits not more than 1/16" in width; (c) not more than 2 strips of paper tape. There may be any number of patches and plugs in the face, but the face may not be of such quality that, if sanded, it will pass for a wallboard face. No belt sanding is permitted. No tape is permitted in the glue line. The back shall contain solid knots or knot holes or pitch pockets, splits and/or other defects in number and size that will not seriously affect the strength or serviceability of the panel. Suitable for sheathing, subflooring, walls, and roofs, or temporary structures where strength and rigidity are required.

(6) Grade Concrete Form Panels. Panels manufactured with special highly water-resistant glues, and designed to give numerous re-uses and smooth unblemished surfaces. For concrete forms and where water-resistant service is desired.

PLYWOOD PRODUCTION RECORD BY YEARS

The Douglas Fir Plywood Association, headquarters in Tacoma, gives the production record of the industry from 1925 through 1936 as follows:

1925	153,262,608 sq. ft.	1931	235,900,042 sq. ft.
1926	172,966,900 " "	1932	200,708,354 " "
1927	206,209,980 " "	1933	390,430,455 " "
1928	275,711,204 " "	1934	383,769,327 " "
1929	358,424,918 " "	1935	490,855,083 " "
1930	305,000,000 " "	1936 (estimated)	700,000,000* " "

In other words, the production average for the years 1925 to 1929, inclusive (when building construction throughout the country was at its peak) stood at 233,000,000 square feet per annum. But note that during the next 5-year period (even throughout the depression) the Douglas fir plywood industry not only held its own but kept on gaining. Indeed, its remarkable gains during 1935 and 1936 place it as one of America's fastest growing wood-fabricating industries. The 700 million feet produced in 1936 represent a 40% increase over 1935, and a 350% increase over 1925.

As they now stand, the Douglas fir plywood mills have a combined annual capacity of one billion square feet of fir plywood for innumerable uses. To visualize the annual production of this comparatively new industry, one may reflect that one billion square feet of plywood, if made up in panels 3/8" thick and 4' wide, would form a continuous ribbon 48,000 miles long and would encircle the earth at the Equator nearly two times.

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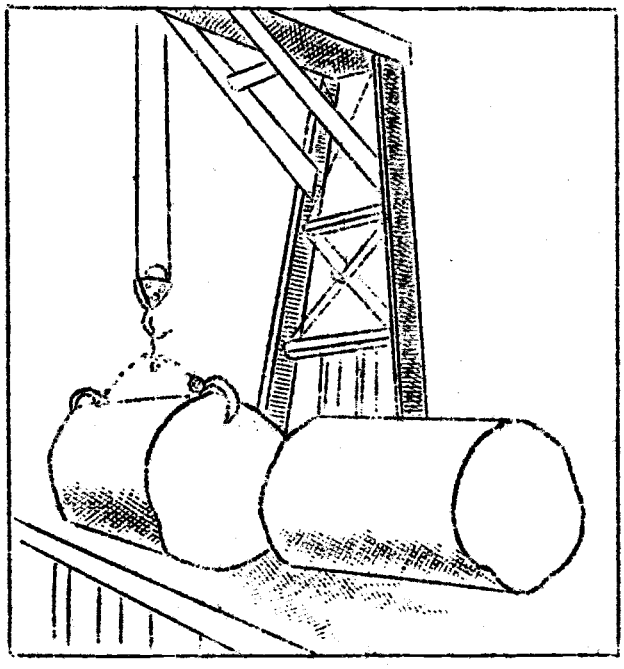
* - It takes approximately 1 foot of log to make 2½ square feet of average width plywood. Therefore, log consumption in the Douglas fir region in 1936 was approximately 700,000,000 sq. ft. divided by 2.5 or 280,000,000 feet, log scale.

It is estimated by the Douglas Fir Plywood Association that the Douglas fir plywood industry now directly employs 5,000 people in its own mills, with another 1,000 intimately associated with the production of materials used in plywood manufacture. It states that in round figures $25,000,000 represents the industry's capital investment, with an annual payroll of $7,500,000. Raw materials and supplies constitute annual purchases of $7,500,000.

The manufacturing process, as carried on in the Northwest, is so carefully yet interestingly described in "American Douglas Fir Plywood and Its Uses" as to warrant step-by-step quotation here:

"The Douglas fir plywood industry is the consumer of the choice 'peeler' logs of the region. (Rich soil, heavy rainfall, lack of severe winds, and other favorable silvicultural conditions of the region produce Douglas fir trees having wood of uniform ring growth, light weight, light color, and extraordinary strength. From these choice logs, those for plywood manufacture are selected. The logs chosen must have a minimum diameter of 3 feet at the small end, and must be free from limb knots and certain other exterior defects. The cross-cut at the end must indicate that the log contains a minimum of sap and a maximum of clear, soft heartwood).



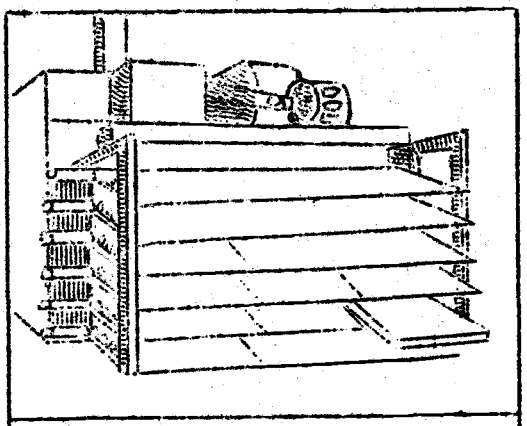
"The 'peelers' are brought to the plywood plant by rail or water and are placed in the mill's log pond. These logs, usually 30 to 40 feet long, are then sawed into blocks of the desired length, 6, 8, 10, or 12 feet, depending upon the length of the panels into which they are to be manufactured. The blocks are lifted to the log decks by large electric cranes, and the bark is removed.

"The veneer blocks, ranging in diameter from 3 to 8 feet and in length from 6 to 12 feet, and weighing several tons each, are now ready for the lathe. Again the power crane lifts the block and it is centered in position on the lathe. This lathe rotates the block against a long, keen-cutting blade, and a sheet of smooth veneer is cut from the entire length of the log. This wide ribbon of veneer is cut or peeled (hence the name 'peelers') from the block much the same as unwinding a great roll of newsprint paper.

"From the lathe the veneer is carried on conveyor lines across tables to the clippers. These clippers cut the sheet of veneer to the desired lengths by a simple 'guillotine' operation. Skillful operators are required at the clippers, for it is here that pitch pockets and other defects are cut from the sheet, and the operator must be able to judge quickly the best way to cut out these defects with the greatest efficiency.

"From the clippers, the pieces are conveyed to the tables where they are sorted and graded as to quality. After sorting, the sheets are then conveyed to the dryer.

"Large mechanical dryers, of either the conveyor or roller type, 4 to 6 lines high, remove the moisture from the 'green' sheets in from 5 to 30 minutes, depending upon the thickness of the veneer. The drying process is an exacting operation. Veneer pieces for plywood must be dried to a definite moisture content, and the uniformity of drying is reflected in the quality of the finished panel.



...Drying is an exacting process...

"Long outfeed conveyors receive the veneer from the dryers and the material is once again sorted, according to width and grade. The lower-grade material goes directly to the core rooms where it is cut in required sizes for use as center sheets, or cores, of three-ply panels, and for centers and cross-banding of panels of greater ply; the remaining stock is sorted into 'sound' and 'good' plywood faces. Narrow strips are routed to the taping department where they are carefully matched, jointed, and taped into larger pieces. The strips of tape, made of strong paper or cloth, temporarily hold the smaller pieces together until they reach the glue room. In finishing the panels, the tape is removed.

"The bonding glue is next applied to the sheets. First, the face veneer is laid down and then the crossbanding, or core veneer, with glue on both sides, is laid upon it with the grain at right angles to that of the face, and succeeding sheets, whether crossbands or faces, follow according to the number of plies desired in the finished panels. Each veneer is placed in such a position that the grain of the succeeding veneer is at a 90 degree angle to the previous one. These freshly glued panels are built up into bundles about 36 inches high, with heavy retaining boards at the top and bottom; and heavy boards, called 'cauls', are interposed between sets of panels to insure uniformity of pressure. The bundle of panels is then conveyed to the heavy hydraulic press, where pressure ranging from 100 to nearly 200 pounds per square inch is applied. The amount of pressure varies with the type of glue being used. Retaining clamps are applied to maintain the pressure for a period of hours until the glue sets, after which the clamps are removed.

GRAINS AT 90 DEGREE ANGLE

"In the pressing operation of plywood manufacture, both cold and hot types of presses are used. The cold press is used generally in the protein type of glue, whereas the principle of resin glues in hot press operation is that the resins, while under heat and pressure, first become plastic and enter the fibers of the wood and then permanently set.

"Modern methods and the exacting needs of the Douglas fir plywood industry have brought about the development of many types of satisfactory adhesives, each of which has characteristics particularly suited to operation methods and ultimate use of the finished panel.

"The principal glues now in use are: Protein glues, which include casein and soybean, and synthetic resin glues. These constitute by far the largest portion of Douglas fir plywood adhesives. The step-by-step operations in the use of each type of glue would entail exhaustive explanation, but the essential characteristics necessary for a successful adhesive are: (a) that it may be applied to the veneer in a uniform thickness, (b) that it have a definite penetrating power to enter the open structures which make up the surface texture, (c) that it will not pass through the cell walls to damage the faces of the finished panel with stain, (d) that when dry it will have resistance to the attacks of moisture, and (e) that it will be mechanically strong and will not deteriorate with age.

PRINCIPAL GLUES

"The glues more commonly used in liquid form are applied with a power-driven spreader comprised of two rollers, somewhat like a clothes wringer, usually corrugated, with adjacent reservoirs to supply a continuous layer of glue to the rollers. The amount of glue applied to the veneer is controlled by the spacing of the rollers. The temperature of the glue mixture is accurately controlled. The glue spreaders are frequently cleaned and the supply kept fresh. Pointed metal fingers are used to deliver the glue-covered sheets of veneer and to keep them from following around the spreader rolls. From the spreader; each glued sheet is conveyed to the stack of other sheets and placed with the grain running at right angles to its neighbor sheet, as heretofore described.

TEMPERATURE CONTROLLED

"Although plywood made with cold water-resistant glues has proved its serviceableness in concrete form work and other severe uses, there has been an increasing demand for Douglas fir plywood that would be permanently waterproof for exterior uses involving high moisture hazards, such as outside walls of houses, sign boards, and linings for refrigerator cars. Accordingly, several plywood manufacturers are now producing resin-glued plywood in which the veneers are bonded by means of hot-pressed resin glues, universally recognized as the ultimate in waterproof adhesives. This new departure in Douglas fir plywood, already proved through many years of experience in the U. S. and Europe, opens up entirely new fields for the giant fir plywood panels. This 100% waterproof, permanent product for exterior service supplements the standard plywood panels so successfully employed for a host of interior uses and for less permanent exterior purposes, and makes Douglas fir plywood available as an all-service material.

WHAT HOT PRESS MEANS

"The pressing and clamping process has been described in a preceeding paragraph. When the glue has set the clamps are removed and the rough panels are passed on to the trimmer; there cut to accurate, finished sizes and conveyed to the sander for surface finishing. This operation is accomplished usually by a large eight-drum, motorized, sanding machine which smooths both surfaces of the panel and reduces it to precision thickness.

"A final and careful inspection takes place as the smooth panels are delivered from the sander. At each sander is stationed an inspector of the Douglas Fir Plywood Inspection Bureau; these workers are independent of the mill personnel, and are under direct supervision of the Bureau. Their trained eyes see to it that each panel is accurately classified according to established commercial standard grading rules adopted by the industry and accepted as the basis of understanding in the trade.

"The panels found to contain surface imperfections are routed to the patching room where such defects as pitch pockets, checks, splits, etc., are removed and insertions of patches and shims correct the appearance. These panels are in every respect strong and serviceable. The alterations are difficult to see and are readily covered with paint or other decorative materials. After sanding, all finished

THE PATCHING ROOM

panels are conveyed to clean storage rooms and stacked according to size and grade. An increasing percentage of the plywood is wrapped in protective covering in convenient bundles. From the storeroom the panels for domestic sale are loaded out for shipment to all parts of the country. The plywood for export trade is shipped to concentration depots, or warehouses, cooperatively maintained by the industry, where it is packaged for especially rough handling incident to export shipping."

The ever-expanding uses of plywood would make a long list. Articles made of it touch the lives of nearly everyone, for it is used in the production of many things, from small household articles to great engineering and architectural projects.

USES MULTIPLY

One of the important uses, developed by architects, builders, and engineers, is that of making concrete forms. Its light weight and large size panels make erection easy and fast; its smooth surface imparts an even finish to the hardened concrete; it may be bent without heating or soaking, for curved shapes; and its strength, toughness, and high salvage value permit many re-uses either of the same form or as parts of other forms. Extensive use of Douglas fir plywood is being made for constructing floor and wall units. As roof sheathing it provides a smooth surface for many types of roofs. In Tacoma, as recently as March, 1938, virtually an entire house was built out of plywood, with a saving in man hours that occasioned national comment.

The substantial beginning that has been made toward mass production (pre-fabrication) of all-wood houses in modern wood-working shops with precision machinery points to a great utilization of plywood, with its many made-to-order features (such as strength, rigidity, insulation value, permanence, beauty, and economy of waste and labor.)

Plywood panels are sold to the trade in exact dimensions. Therefore, in figuring the amount of plywood for a given job, it is not necessary to discount any amount for loss in the measuring standard.

Douglas fir plywood is successfully used in a wide range of interior construction features: lining, inside boxes, panels, attics, basement game rooms, photographic dark rooms, clothes closets, fumigating

chests, a base for linoleum, etc. Garages, farm buildings of many kinds such as poultry houses; office buildings and industrial structures all use plywood. Great exposition buildings -- where speed of erection, safety, decorative possibilities, low cost, and high salvage value are paramount, find this engineered wood product invaluable. Automobile and truck bodies and house trailers use millions of square feet of plywood. Specially constructed plywood with metal faces and edges is used in the latest streamline trains. Some movie sets, representing whole villages, are made almost entirely of plywood -- both interior and exterior sets.

It has a wide range of successful application in industry, chief of which are for millwork, cabinet-making, door manufacturing, and automobile making. Pleasure boats are largely built of plywood.....Toys, recreational equipment, convention and bazaar display booths, patterns, maps, models, large containers for shipping goods and furnishings....So the long list grows.

Known abroad as Oregon pine, Douglas fir plywood has found wide acceptance in the markets of the world. It gets preferential treatment by foreign buyers because of its uniformity, exceptionally large panels, and because its makers have done painstaking research in glues and other phases of production.

THE EXPORT MARKET In the past, the American market has absorbed about 85% of the total production, says the U. S. Bureau of Foreign & Domestic Commerce, while 15% has been exported to foreign countries throughout the world, with export demand on the increase.

The export market is being stabilized and developed by the orderly merchandising of the product through the industry's cooperative sales agency, headed by the internationally known Axel H. Oxholm, of Tacoma. The Pacific Forest Industries, Tacoma, Washington, representing all Northwest mills, was organized under the Webb Export Act in 1935 for that purpose. Through this sales agency millions of square feet of Douglas fir plywood flows into the world's trade channels. This organization also sells its products to independent exporters. At strategic ports in the Northwest, the Pacific Forest Industries maintains warehouses, with stocks and facilities to handle export orders that may range from a few thousand square feet to several millions. Export shipment requires special packaging of the panels, and this work is done by mechanical bundling machines, with capacities to prepare cargoes on short notice. Each panel is trademarked and grade marked and the designated quality is thereby certified and guaranteed.

The inspectors of the Douglas Fir Plywood Association Inspection Bureau have direct supervision of the grades of the plywood for export as well as for domestic trade. They act independently of the mills and are under direct supervision of the Inspection Bureau. A sworn statement in regard to grades and quantity involved in each shipment is supplied to the foreign buyer for his protection.

"Plywood", says the Bureau of Foregin & Domestic Commerce, "is an unusually flourishing industry. Large capital investment, trained operating personnel, guided by intensive laboratory research and engineering skill, healthy and safe working conditions with high wage scales, indicate

a continued development of the industry as the demand increases for its product. In the manufacture of Douglas fir plywood is an industrial craftsmanship that meets the exacting world demands of beauty, strength, the ultimate of forest conservation, and the development of an industry on a sound basis of economy and durability".

SENSIBLE CONSERVATION

Plywood authorities assert that the future of the industry depends in no small degree upon sensible conservation of its raw material. By sensible conservation is meant stringing out the supply of old-growth timber. That, in turn, means cooperation with timber owners and loggers to prevent the needless cutting of large trees beyond market requirements. It also means, experts within the industry maintain, stopping the export of logs of the peeler type (logs which are the cream of the Northwest forests and require from 200 to 400 years to grow in their natural state). In this connection, it is pointed out that there is but $2 to $4 worth of labor per ton in logs exported; whereas, there is $20 to $25 worth of labor in every ton of plywood exported.

ECONOMY FACTORS

Also, the industry should now begin to consider the utilization of smaller logs and the employment of a greater variety of species, in the opinion of its closest students. Further, it must concentrate on greater economy in the use of all raw materials. This will mean: (a) further elimination of waste in plants; and (b) developing uses for cut-to-size plywood. The latter development will call for a better utilization of defective panels.

A case in point -- pertaining to the development of more uses for low grade plywood and the education of consumers to more efficient grade uses -- is the current effort of the industry to promote a market for sheathing made of plywood.

Qualified observers say that there is an opportunity, too, in plywood mills to make further improvements in machinery and to apply the saving in labor to a greater refinement of the product. This refining might mean, for example, more effort in sorting plywood according to grain and color. This so as to increase the value of the product for architectural uses. It might also mean the development of chemical processes to increase the usefulness of plywood for specific purposes -- such as fireproofing, decay-proofing, termite-proofing, moisture-proofing, and the resistance to certain destructive chemicals.

OTHER POSSIBILITIES

Continued progress in making glues waterproof and decreasing their cost is another projected step in this direction. Others are: The development of processes for metal coating and the covering of plywood with other materials, such as synthetic resins.

Another trend which is adjudged of particular importance to the industry is in the field of finishing methods; and, perhaps most important of all, is research and experiment to overcome the tendency of grain raising. (Sometimes you see otherwise perfect panels where the grain stands out or "raises" so prominently it hurts rather than enhances their beauty.)

Pre-fabrication offers a vast field for plywood, not only in building construction but also for innumerable industrial uses. The large business already developed in cut sizes for the automobile industry is a good example.

At present, hundreds of tons of sander-dust are accumulating every working day in Northwest plywood mills; and, with few exceptions, no better use has been devised for it than a form of plastering material. But this field shows signs of expansion.

IMPROVED CUTTING TECHNIQUE — Improved technique, say the experts, will ultimately result in the cutting of smoother and thinner veneer than is possible today, thereby increasing the utilization of high grade peeler logs.

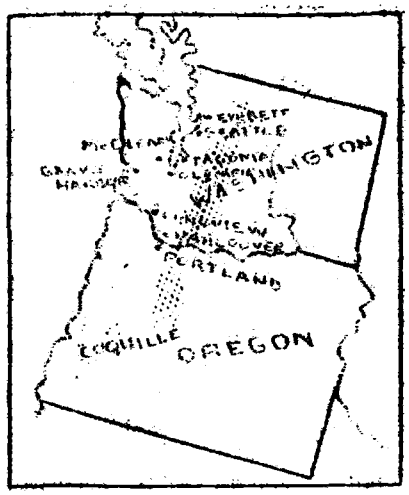
The problem of equalizing the dark and light-colored spring and summer wood (in all large trees), which often results in a "too flashy" appearance, will unquestionably be solved.

NO ABRUPT CHANGES — Being so far away from its principal markets, its geographical location is against the Douglas fir plywood industry; and it will probably always have a handicap of relatively high freight rates to contend with. But if the industry economizes in the use of big logs now and thereby strings out the supply of them, there will be no abrupt falling off in its growth. On the contrary, authorities think that, with such conservation, plywood's development will be perpetual. They add that the future of the industry lies definitely in developing the business within the mills already set up, rather than by expansion through more plant capacity.

TIMBER CONSUMED IN MANUFACTURING VENEERS
(Source National Lumber Manufacturer's Association "Lumber & Timber Information")

1929 -- Total United States.	1,112,910,000 ft.	(log	scale)
1931 -- Total United States.	696,350,000 ft.	"	"
1933 -- Total United States.	700,340,000 ft.	"	"
1935 -- Total United States.	829,080,000 ft.	"	"

It was brought out at the 1937 Chemurgic Conference in Spokane by Chairman Kizer, of the Washington State Planning Council, that over 21% of all rotary-cut veneer produced in the United States comes from the mills of the Pacific Northwest.



F. PULP AND PAPER INDUSTRY

The manufacture of pulp and paper is among the ten leading industries of the United States -- in the value of its product, though not in terms of employment. (In Canada, it is No. 1, both in the value of its products and the number of wage earners employed.) The United States' per capita consumption of paper is around 222 pounds a year. From 85 to 90% of all the paper manufactured in America is manufactured wholly or in part from wood.* Incidentally, pulp making and paper making are two different processes; pulp is largely chemical, paper largely mechanical.

Originally the manufacture of paper was dependent entirely upon rags; that is, the matting of the fibers in rags. But, some fourteen years after the invention of the wood grinder in 1840 -- by the German Keller -- manufacturers began to mix wood pulp with rag pulp. This was first done, not to replace rags, but merely to substitute wood substance or a portion of the rag content in many papers. And it was not until wood pulp papers appeared in the 80's that the pulping industry as we know it today and the modern varied uses of paper began.

Now, besides papers, such articles as cellophane, rayon, paper dishes, drinking cups, artificial leather, roofing felts, conduit pipes and many other articles in which its identity is not obvious, are made from wood. (Plastics -- moulded things -- are the fastest growing example.) Making wood substance available, or modifying it, for such articles usually calls for chemical treatment.

There are 1,250 pulp and paper mills in the United States and Canada**; and the latest report of the "Pacific Pulp & Paper Industry Annual" lists 18 mills producing pulp in Washington and 8 in Oregon. (6 in British Columbia.) Of the Washington pulp and paper mills, three are located in Everett, three in Port Angeles, three in Longview, and one each in Tacoma, Hoquiam, Bellingham, Camas, Vancouver, Millwood, Port Townsend, Shelton, and Anacortes. There is a pulp mill at Tumwater which, at the latest report, was idle. The entire output of an additional Tacoma mill is bleached and dried at Shelton. The rated capacity of the Washington mills in tons per 24-hour day is 670 tons of mechanical pulp, 2,665 tons of sulphite pulp, 740 tons of sulphate pulp, and 60 tons of soda pulp. The rated capacity of the Oregon mills is 670 tons of mechanical pulp, 492 tons of sulphite pulp, and 125 tons of sulphate pulp. There are 10 mills in Washington producing paper and 4 mills producing board, and one rag roofing.

LOCATION OF MILLS

In Oregon there are 5 mills producing paper and one producing sulphite specialities.

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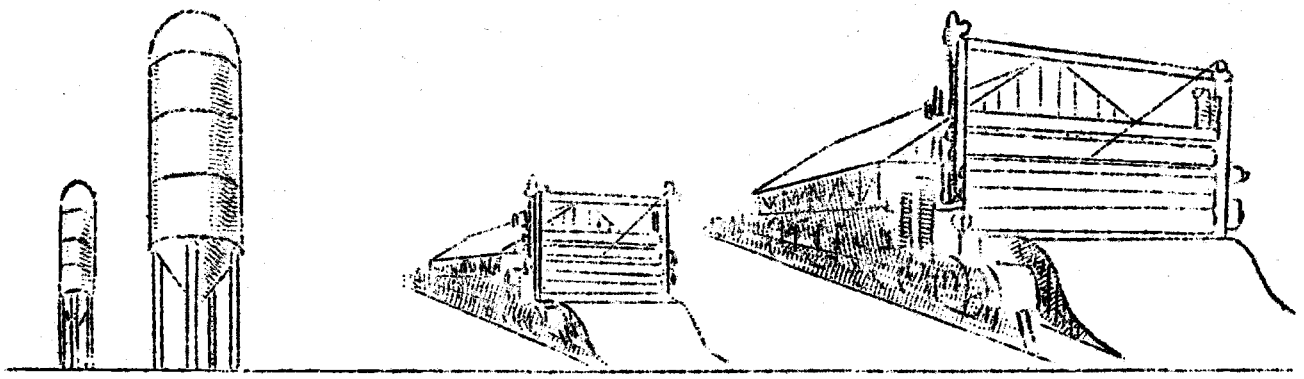
* - "Pacific Pulp & Paper Industry Annual"

** - J. S. Illick's "Outline of General Forestry"

COMPARATIVE GROWTH OF PACIFIC COAST PULP AND PAPER INDUSTRY - 1923-1936



1923 1936 1923 1936

TOTAL DAILY CAPACITY ALL GRADES PULP
1923 - 2,045 Tons
1936 - 6,797 Tons. Increase: 232%

TOTAL DAILY CAPACITY ALL GRADES PAPER & BOARD
1923 - 2,056 Tons
1936 - 4,897 Tons. Increase: 138%

Source: "Pacific Pulp & Paper Industry Annual", July, 1936.

DRAMATIC EXPANSION

A dramatic illustration of the expansion in this field is seen in the fact that, as late as 1925, only 8% of the nation's wood pulp came from the Pacific Coast region; whereas, our latest figures* show that this region now produces 22% of the nation's wood pulp.

It was in 1866 that the pulp and paper industry of Washington and Oregon began with the establishment of a small pulp mill near Oregon City, Oregon. This mill used rags and straw and produced 1,500 pounds of paper per day. In 1885 the mill was moved to Camas, Washington, the present site of one of the world's largest pulp and paper mills, and became the first groundwood mill in the region. Oregon's first groundwood mill was built at Young's River Falls, near Astoria, a year later. At the present time the pulp and paper industry is the second most important in the region, ranking next to lumber (according to the U. S. Department of Agriculture, Division of Forest Products, Portland.)

The same authority says that in 1910 the pulp production of Washington and Oregon amounted to 100,000 tons; in 1928 it was 550,000 tons; in 1934, 950,000 tons and in 1936 had reached nearly 1,200,000 tons. In 1936 Washington ranked second in pulp production in the United States with about 900,000 tons and Oregon seventh with around 300,000 tons.

FIRST IN PULPWOOD

In quantity of pulp wood consumed Washington ranked first in the United States in 1936 with 1,509,000 cords and Oregon seventh with 424,000 cords. It takes approximately 1,000 feet (log scale) to make a ton of chemical pulp; and, by log scale, around one billion 450 million feet of wood are now used a year in Washington for pulp**.

TREND IS TOWARD LOGS

The Division of Forest Products, U.S.D.A., at Portland, points out that "up to about 1930 sawmill and other remanufacturing waste formed a large portion of the pulpwood consumed in this region. According to a survey by the Forest Service in 1929, the consumption of waste for pulp amounted to 504,000 cords. During this same year the total regional pulpwood consumption amounted to nearly 1,250,000 cords, of which waste from sawmills and remanufacturing plants constituted 40%, logs 48%, and forest wood (cordwood size) 12%. Of the total reported 1934 consumption, 1,485,000 cords, waste material constituted 14%, logs 60% and forest wood 26%.

"The decrease in the use of mill waste and the increase in the use of logs and forest wood is notable. Many pulp mills were established on the assumption that a large portion of their wood requirements could be obtained in the form of mill waste. The marked curtailment in the production of lumber from the pulp species subsequent to 1929, resulting in the reduction of the quantity of mill waste available, forced to pulp mills to turn to logs and forest wood. Because of the lack of breakdown equipment, they attempted to fill the shortage with forest wood alone; but this source proved inadequate. As a result, many of the pulp

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* - "Pacific Pulp & Paper Industry Annual"

** - R. B. Wolf, Weyerhaeuser Timber Company

mills either installed equipment for reducing logs to cants of suitable size for grinders and chippers, or contracted for such breakdown. Of the 1929 log sales of the pulp species only 3.5% by volume entered into pulp production; in 1934 the proportion was 64%. In 1929 the footage of logs used for pulp amounted to 57 million and in 1934 to 546 million. Although the supply of pulp species logs was apparently one-third as large in 1934 as in 1929, the proportion purchased for pulp increased nearly 18 times."

PURE WATER NEEDED

One of the principal requirements of the industry is a large supply of clean, pure water. Another is an abundance of cheap power. With a virtually unlimited supply of water which is not only clean but free from minerals and impurities; with 43% of the nation's undeveloped hydro-electric power -- and three exceptionally large projects under construction, one at Bonneville on the lower Columbia near Portland; another, the Ruby Dam on the Skagit, a municipal project for Seattle; and a third on the upper Columbia at Grand Coulee -- it is only reasonable to expect that further expansion in the pulp industry is most likely to take place here in the Pacific Northwest.* Especially is this a safe conclusion when it is recalled that "Western Hemlock and Sitka Spruce constitute the backbone of the present pulp and paper industry, and the great bulk of these species is in Western Washington and Western Oregon, close to tide water. The principal stands of Western Hemlock are in Western Washington and Northwestern Oregon. Here the present supply is 24,000,000,000 cubic feet of wood."**

WITH AVAILABLE FACILITIES

"The significant thing about the present supplies from the viewpoint of the chemical industries, is not the total supply but the supplies that are available as by-products of the logging operations and sawmills and therefore easily assembled by the facilities that the lumber man has already constructed.

"It is hard to tell how much of the entire remaining supply of wood (in the Pacific Northwest region) will be taken by the sawmills and converted into lumber and how much used by industries that convert it into pulp, plastics, and derived products of one kind or another. But there seems to be no reason for any serious competition between the sawmills and the chemical industries for a raw supply of forest products for many decades."***

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* - While cheap water power will undoubtedly be an important factor in the development of Northwest industries, it should be pointed out that hogged fuel with fuel oil is still the cheapest power for pulp mills, according to a recent army engineers' report on pulp and paper industry of the Northwest.

** - Thornton T. Munger, Dir. Pacific NW Experiment Station, before Pacific Northwest Chemurgic Conference, Spokane, March, 1937.

*** - Ibid

At the outset it should be pointed out that pulp for paper and other products can be made from every species of tree. But some trees are much better for paper making and they are usually referred to as "pulpwood species". In the Pacific Northwest region we consider the pulpwoods to be hemlocks (2 species), spruces (2 species), balsam first (6 species), and Northern Black Cottonwood. To this might be added Douglas fir, for some of it goes into board and rough papers by the sulphate process, and the industry could fall back on this tree to a greater extent if better (pulpmaking) species were lacking. However, West Coast hemlock and Sitka spruce are now the pulpwood standbys. R. B. Wolf, Manager Pulp Division, Weyerhaeuser Timber Company, and an authority on both the manufacturing and sales problems of the industry, says: "Western Hemlock and Fir are the best pulpmaking trees; here or anywhere."

PULPWOOD SPECIES

For the benefit of those who are not familiar with the processes involved in manufacturing pulp, it is well to recall certain fundamentals in the composition of wood itself: The approximate chemical composition of wood is as follows:*

Substance	Approx. Percent of Total Wood
1. Cell Wall components	
(a) Cellulose	50%
(b) Carbohydrates (other than cells). . .	20
(c) Lignin	22
	92%
2. Extraneous material	8
	100%

Such authorities frequently refer to the cell wall components as "wood substance". As common as it is, speaking quantitatively, cellulose has so far defied the efforts of chemists to assign a definite formula to it. Basically, however, its formula is thought to be similar to that of starch. It is the fact that pure cellulose is very resistant to most chemical treatment which makes it valuable as a raw material. Next to cellulose, lignin is the most abundant and widely distributed substance in nature, and it must be taken out of the cellulose in wood before white paper, rayon, or many other cellulose products can be produced.

"Lignin is best defined as the non-carbohydrate fraction of wood, after it has been freed of tannins, resin, fats, and other extraneous materials. Its exact chemical composition is unknown and, as yet, no important uses have been developed for it. Lignin constitutes one of the world's greatest industrial wastes."**

Wood is converted into pulp by two different methods:

1. Mechanical.

2. Chemical.

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* - Illick's "An Outline of General Forestry."
** - Illick's "An Outline of General Forestry". This statement is already subject to qualification in that one lignin product is being used on the market extensively for road surfacing. In Germany many products (from cow feed to

Mechanical pulp, or groundwood, is produced by grinding the whole log, freed from bark, on a natural or artificial grindstone in the presence of water. This process utilizes the entire wood substance and produces a very short-fibered pulp, the use of which is limited to the principal ingredient of newsprint and as a comparatively cheap filler in the production of boards and other papers. (Seven mills produce mechanical pulp in Washington and 3 in Oregon.)

There are three chemical processes:

THREE CHEMICAL PROCESSES

(1) The sulphite, or acid, process.

(2) The sulphate, or alkaline, process.

(3) The soda (which is also an alkaline chemical process).

Both the acid and the alkaline pulping processes have for their object the removal, from the original wood, of the bulk of the non-cellulosic material by chemical means, leaving as a residue the original cellulose of the wood in as pure a state as possible. The solid content of the growing tree comprises roughly 50% of cellulose, which exists in the form of fibers, cemented together by the substance known as lignin, together with varying amounts of sugar and other materials closely resembling cellulose but lacking a fibrous structure. The total amount of the non-cellulosic material, as we've seen, represents about 50% of the entire wood substance. All of this non-cellulosic material is removed in the process of producing chemical wood pulp.

"The present annual production of chemical wood pulp in the Pacific Northwest amounts to approximately 1,117,000 tons of which 848,000 tons are produced by the acid or sulphite process and 269,000 are produced by the alkaline processes. Since we recover slightly less than 50% of the cellulose from the original wood substance, this means that the Pacific Northwest produces annually, by the sulphite process, approximately 850,000 tons of waste non-cellulosic material; while the alkaline processes account for the production of some 280,000 tons of waste non-cellulosic material.

"Considering the by-products of the chemical pulp industry purely from the point of view of stored-up solar energy, the waste from the acid pulping process of the Northwest is equivalent to the fuel value of approximately 1,300 tons of bituminous coal per day, and the non-cellulosic material produced in the manufacture of pulp by the alkaline processes is equivalent to about 380 tons of bituminous coal per day.

"However, the field offers attractive possibilities for research and development, and the solution of the problem of efficient economic disposal of this waste liquor will be a great contribution to the conservation of our natural resources."*

1. Sulphite Pulp Process

In the sulphite process the active pulping chemical is sulphurous acid and its calcium salt (calcium bisulphite) in acqueous (watery) solution

* - R. S. Hatch, Dir. of Research, Weyerhaeuser Timber Company, before Pacific Northwest Chemurgic Conference, March, 1937.

Hemlock and spruce are the species of woods usually employed in this process -- at least on the West Coast. At present, sulphite pulp has more varied uses than any other. Combined with mechanical pulp it is used in nearly all cheap papers to give them strength. Bleached, it is used either alone or in various mixtures with rag fibers to make writing, bond, and ledger papers. Also, soda pulp or waste papers may be mixed with it to produce book paper. The bulk of all U. S. rayon is made from it.

Pacific Coast mills in 1936 produced 668,316 tons or 38%, of the nation's sulphite pulp, exceeding by 219,892 tons its nearest regional competitor, New England. 371,730 tons were bleached and 296,586 were unbleached sulphite.*

2. Sulphate Pulp Process

The sulphate process in an alkaline chemical process in which the source of the alkali is "salt cake" (sodium sulphate, from which the process gets its name). The active ingredients of the sulphate liquor are caustic soda and sodium sulphide. (In making the pulping liquor, the sodium sulphate is changed to sodium sulphide.) These chemicals remove the cellulose from the other wood constitutents in much the same manner as does alkali alone except that the presence of the sulphide renders pulping less destructive to the strength of the cellulose. As a result, the fibers are made available in a purer state, with greater length and are therefore much stronger. Hence this process is particularly adapted to making unusually strong pulp. In fact, the name Kraft -- which in this country is applied to the strong, tough papers such as are used in paperbags and wrapping papers, as well as the pulp and the process -- means "strength" in German. Sulphate pulp is also used for container boards, artificial leather, and for such varied articles as aprons, overalls, and other washable fabrics. Recently, the sulphate process has been increasing in importance in this country for several reasons: (a) Practically all coniferous woods may be employed; (b) it lends itself particularly to the pulping of such resinous and pitchy woods as Southern pine; (c) the process may be modified so as to produce pulp capable of bleaching.

MAKES STRONG PULP

In this connection, recent developments in Washington have shown sulphate pulp, (made from hemlock) to be suited to a growing variety of uses -- from tissue to high grade business and writing papers. Experimentation indicates that it may fit into the rayon picture in the comparatively near future.

Pacific Coast production of sulphate pulp in 1936 was 197,743 tons, of which 13,732 tons were bleached and 184,011 were unbleached sulphate.

3. Soda Pulp Process

There is only one mill in Washington employing the soda pulp process, it being adapted more to the pulping of hardwood. The materials employed in this process are water, lime, and caustic soda (sodium carbonate or soda ash) which in boiling form a caustic soda. This process depends

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* - "Pacific Pulp & Paper Industry Annual", May, 1937.

upon the solvent power of the caustic soda to convert the non-cellulosic components of wood (lignin) into soluble form. The soda process is the oldest chemical process but is gradually giving away to the sulphate process. What pulp is produced by the soda process, is generally mixed with sulphite pulp to give it strength. Soda pulp has a short, chunky fiber which is used largely as a filler for magazine, book and writing papers to give them a good printing surface. The wood species used in this process are the broadleaf varieties such as poplar, aspen, basswood, maple, birch and chestnut, although certain conifers have been used.

The grand total of all grades produced by Pacific Coast mills in 1936 (including 270,395 tons of groundwood, or mechanical pulp) was 1,156,452 tons, an increase of 14.4% over 1935 and 25.8% over 1934. The only region to exceed the Northwest was the South, with a grand total of 1,246,962 tons, largely sulphate and mechanical pulp.*

The process of taking a tree, a highly complex natural product, embodying all the structural variations to which a product of nature is subject, separating from it the desired cellulose, and bringing forth an end product that is as uniform as the tree is variable, really is a remarkable achievement. But to the men in the industry it is merely the day's work to strive toward perfection. The pulp mill of today is a finely designed and finely built instrument compared with what was called a "modern" mill a few years ago. The industry bows to none in its search for the "irreducible minimum" in processes -- it seeks to simplify so that costs may be lowered while its finished products more closely approach perfection -- and so the equipment of yesterday is reduced today and probably will be simplified still further tomorrow. Like plywood, this branch of the forest products industry is "doing things and going places".

REMARKABLE ACHIEVEMENT

Fundamentally, the process of producing sulphite pulp is the same for both paper pulp and viscose pulp (used in making rayon). Up-to-date (sulphite) pulp manufacture follows these general lines on the West Coast: The seasoned logs are brought in, largely in rafts, and conveyed up a chute into the wood-preparation department. There they are carefully inspected to eliminate unsuitable or decayed wood -- which might contaminate the chips -- and to make sure all dirt and bark have been removed. Then the logs are cut into short blocks or sticks for chipping. These blocks are fed to chippers and reduced to small chips averaging 3/4" to 7/8" long in most American mills. Some writers have gone so far as to assign a 1/8" thickness and 1/4" width to these chips, but that is hard to do in practice. Actually, length is the governing factor and there is no practical way of controlling width or thickness.

PREPARED FOR CHIPPING

A disc, fitted with 4 sharp blades, revolving some 300 times every minute, does the chipping. A small percentages of fines are obtained, a considerable quantity of correct size chips and some oversize. They all go onto a chain conveyor which passes them on to a belt conveyor. This

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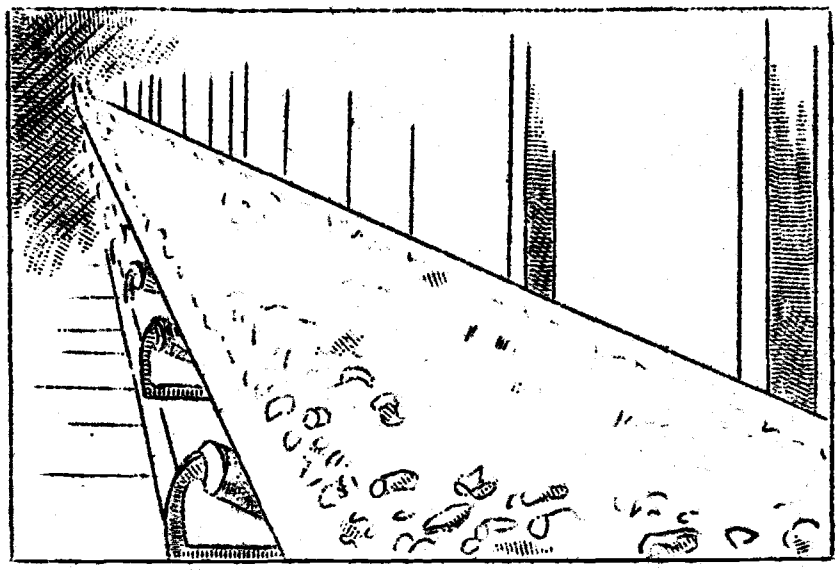
* - "Pacific Pulp & Paper Industry Annual", May, 1937.

discharges them into hoppers above each of 4 shaker-type screens. The hoppers are of sufficient size to take care of peak loads, and at the same time distribute chips to the shaker screens at a uniform rate, so as not to overload the screens.



Sawdust goes through the screens onto conveyors for fuel. Slivers, splinters, and oversize chips shake off onto one conveyor which goes to the chip crusher. There the oversize chips are sized properly and returned to the screen. Uniformity in chip length is an important factor in the production of quality pulp. All refuse is routed to one main conveyor which carries it to a "hog" which turns it into hogged fuel for the power plant.

In some mills the correct size chips pass on a belt conveyor over a weightometer which automatically records and totals their weight. Then they go by belt to the chip storage bins, possibly in another building. From storage in such a mill they are taken to the top of the digester building, by a conveyor as long as 445 feet. There they are turned over to another belt conveyor running the full length of the digester building. As chips drawn from storage and conveyed to the digesters pass over another weightometer, the operator has a record of the weight of the chips going into each digester.

Generally, however, the chip storage bins are directly above the digesters (or cooking tanks) and the chips are fed into the digesters by gravity. (The feed is controlled by a sliding gate which leads into a hopper which in turn fits right into the throat of the digester.) In that case, the chips are not weighed as they are utilized; instead, the digester is completely filled with chips.

The acid solution for "digesting" the chips is obtained by completely burning pure sulphur in rotary or stationary ovens with the required air. Coming from the combustion chamber at 1800 degrees F, the resulting gas is cooled to room temperature. Then it is introduced into tall reaction towers filled with limestone -- towers typically 100 feet high, built of reenforced concrete and lined with acid-resisting tile -- where it meets a stream of water. The result is sulphurous acid combined with calcium dioxide from the limestone. A certain amount of free sulphurous acid is also produced and that is necessary to complete the chemical reaction which is to take place in the digesters. Thus is made the sulphite liquor.

THE COOKING OPERATION

The sulphite digesters are huge steel boilers lined with brick. In capacity, they vary, holding from 12 to 60 tons of dry chips -- common usage calling for 24 to 30 tons. They also hold from 20,000 to 60,000 gallons of acid.

Now the sulphite liquor is introduced into the digester containing the wood chips. Both are furnsihed in pre-determined proportions, depending on the kind of wood and the pulp desired. The digester contents are heated in three ways: (1) By direct steam; (2) by indirect steam; or (3) by a combination of both. Indirect steam embodies the use of an enclosed heater, or heat exchanger, through which the liquid is moved by forced circulation. In this way, the steam does not come in contact with the acid. Generally, the pulp mills of Washington and Oregon use the indirect method of heating for the first part of the cooking and finish with the direct injection of steam. This is to keep the concentration of the acid as high as possible, especially during penetration.

The cooking is regulated by means of a temperature time curve similar to the kind seen in greenhouses. From 8 to 15 hours are required for the cooking operation; and a pressure of about 75 pounds and a temperature of from 135 to 140 degrees Centigrade are maintained. Being the main step in the whole process, this cooking operation is tested chemically every hour at least. When these tests indicate that the chips have undergone their required degree of cooking, the blow-off valve at the bottom of the digester is opened and the whole pulp mass (liquid and all) is blown into large pits, or vats. These vats are equipped with perforated wooden bottoms through which the acid is drawn off. The wood pulp remaining in the vats is then washed several times in soft pure water.

HOW ACID IS DRAWN OFF

The most important part of the cooking operation is to obtain complete penetration of the acid into the chips before reaching the higher temperatures.

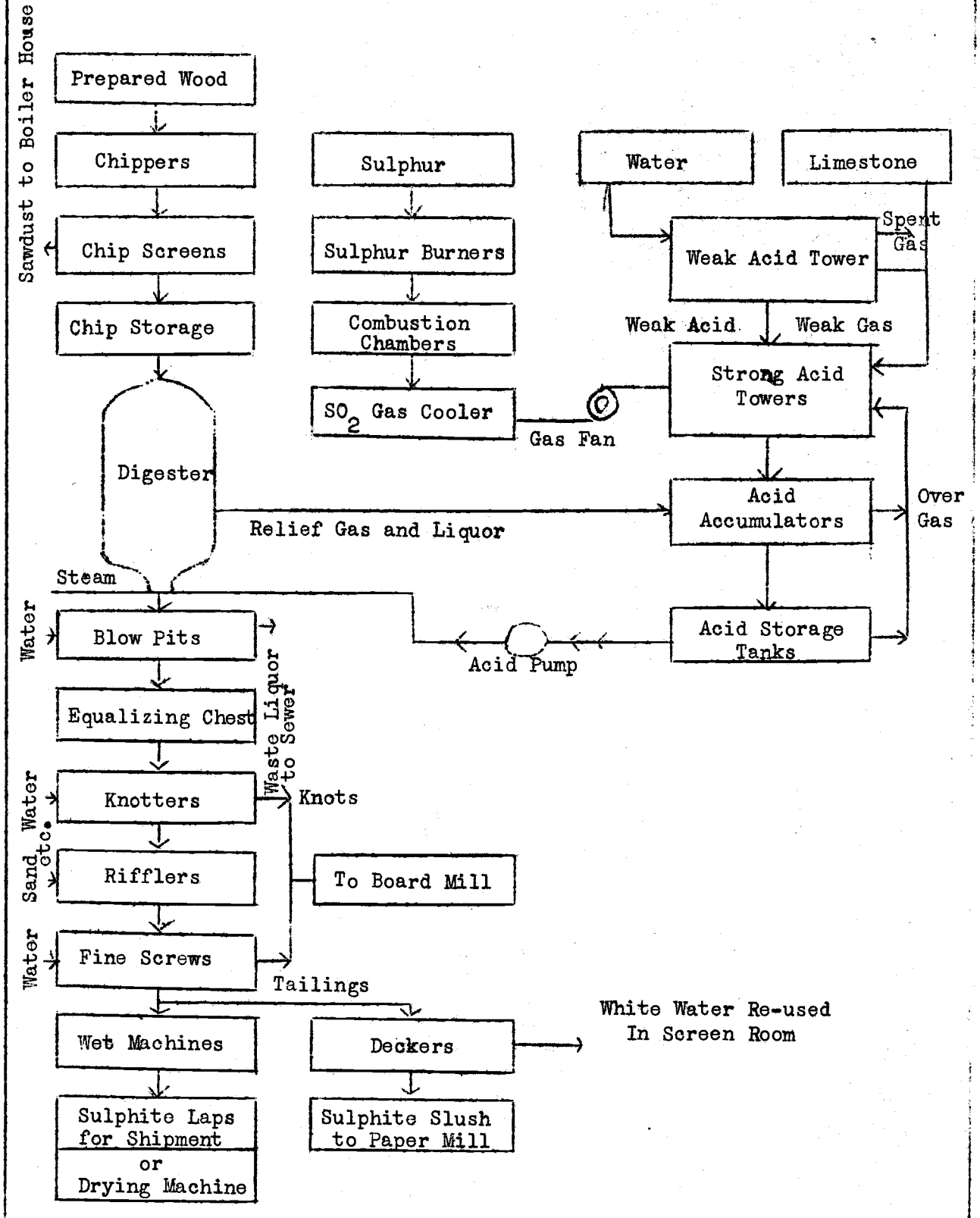
The indication of the termination of cooking is generally noted by the operator in the color of the liquor as the "cook" progresses; and by the smell, as well as the chemical tests. (SO2 Test)

The final color, generally, ranges from a deep red to a dark red, depending on the degree of cooking the mill requires. (For instance, in making rayon pulp, the operators generally blow at a real dark color; but, for the harder, unbleached pulps, they blow at a lighter shade.)

Knots not removed in the wood-preparation department, and possibly uncooked chips, are separated from the wood pulp by diluting the pulp to approximately 1/4 of 1% and permitting it to flow, under steady agitation, over screens with slots 8/1000" or less wide.

Another way of removing knots is by means of a revolving screen with a perforated drum on the outside. The accepted stock goes through the perforations, which are around 1/4" in diameter, and the knots and the like are discharged at the end. The idea is to always remove the big (unacceptable) particles first for the very good reason that further agitation would break them up and there would be more slivers to contend with later on.

SULPHITE PROCESS
(Taken from Eng. J. 16:183, 1933)



From "Wood Chemical Industries of Washington".

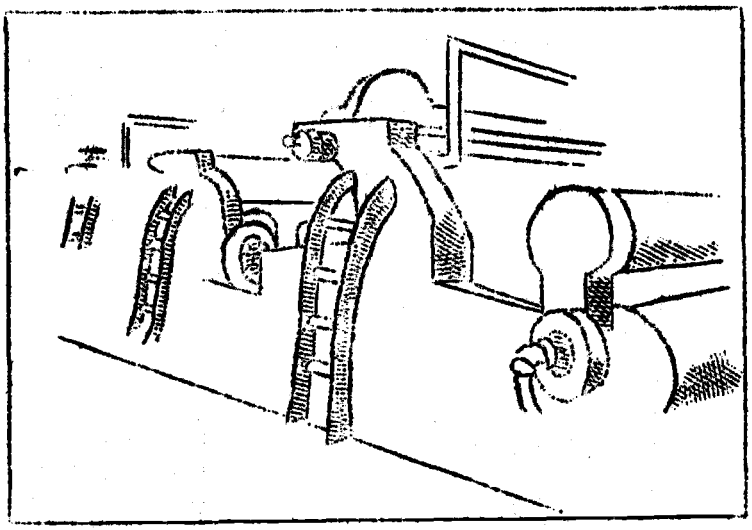
Fine particles of grit, sand, scale from pikes and other metallic substances are settled out by permitting the diluted pulp, at about 1/4 of 1% consistency, to flow over a large area at a slow rate, in which area this foreign material is settled out by means of riffle boards or by long-nap felt at the bottom.

Next the pulp is re-concentrated. The resulting product has a faint yellow color. In other words, it still has a small amount of lignin and other foreign material in it; and these impurities must be removed to reach the degree of purification desired.

This is done in the bleaching department where the final purification takes place. There the pulp is treated with a solution of hypochlorites. This is repeated several times, the pulp being also subjected to intermediate washings; and, finally, the lignin and colored matter are oxidized by the bleaching agent and converted into soluble compounds which are removed by the washing. So very delicate is the bleaching process, however, that the highest grade wood-pulp may be easily spoiled in the bleachery unless the most exacting control is exercised. The bleaching process should be, and is, as carefully controlled in making paper pulp as rayon pulp.

BLEACHING PROCESS IS DELICATE

After thorough washing, the bleached pulp is again made to flow over screen plates to be thinned out once again. These plates have 7/1000" openings and after the pulp passes through them it is ready to be converted into blotter-like sheets or boards as required by the paper or viscose manufacturer.



If you have ever seen the making of a sheet of paper you have a good idea of the way this operation is carried out. The pulp flows over an endless wire and is gradually formed into a sheet. This sheet must be considerably thicker than paper, however; around 35/1000" to 40/1000". What's more, it must be uniform as to thickness, weight, moisture, and density. Here again it is easy to spoil otherwise satisfactory pulp and rigid control from slush-pulp to the finished sheet is required. After it is formed into a sheet the pulp goes through several rotary presses where the excess water is gradually squeezed out. Then the still damp pulp-sheet passes over a number of heated cylinders (which may or may not be glass enclosed) and comes out of the far end dried to the exact degree required. Finally, it is cut in square sheets with a machine of the paper-cutter type; and these sheets are carefully inspected, counted, stacked, baled under pressure and wrapped. (The pressure simply to make more compact bundles.) Then they are ready for transport.

RIGID CONTROL OF STEPS

In the sulphate process (as developed by newly equipped or modernized mills in Camas, Longview, Port Townsend, and Tacoma) the routine of manufacturing pulp, from wood preparation department to bale press, follows the same general lines as the sulphite process. The major differences are in the digesters which do not have to be brick-lined because the active chemical is an alkali instead of an acid. Also, the digesters are generally smaller. Some are tumbler digesters; that is, they revolve and in that way get perfect circulation of the chemical through the chips. Further, the pipe valves do not have to be copper or lead; or, in other words, acid-resisting. In modern mills, however, it has been found that chrome nickel acid-resisting steel is profitable to use in the sulphate process; this because of less frequent replacements. (Nothing in recent years, by the way, has had more influence on the production of sulphite pulp than the discovery of acid-resisting stainless steel.)

In some of the new bleached kraft mills, digesters are lined with brick in order to get away from contamination from iron. Such a precaution is important in making rayon pulp. (Rayon is made from just as pure cellulose as it is possible to get, for the reason that any little impurities affect the making up of fine threads. Hence, the extra precaution in eliminating the iron content of ferric oxide which may be carried along with the pulp fibers.)

Another major difference in sulphate (from sulphite) pulp making is, of course, in the chemical. The active cooking agents in the sulphate process are sodium hydroxide and sodium sulphide.

There is little difference in the cooking operation. In the sulphate process the cooking is generally carried on at a much faster rate; that is, 1 1/2 to 7 hours. Most of the mills in the section cook from 1 1/2 to 3 hours. The matter of heating the digester contents follows very closely the sulphite method.

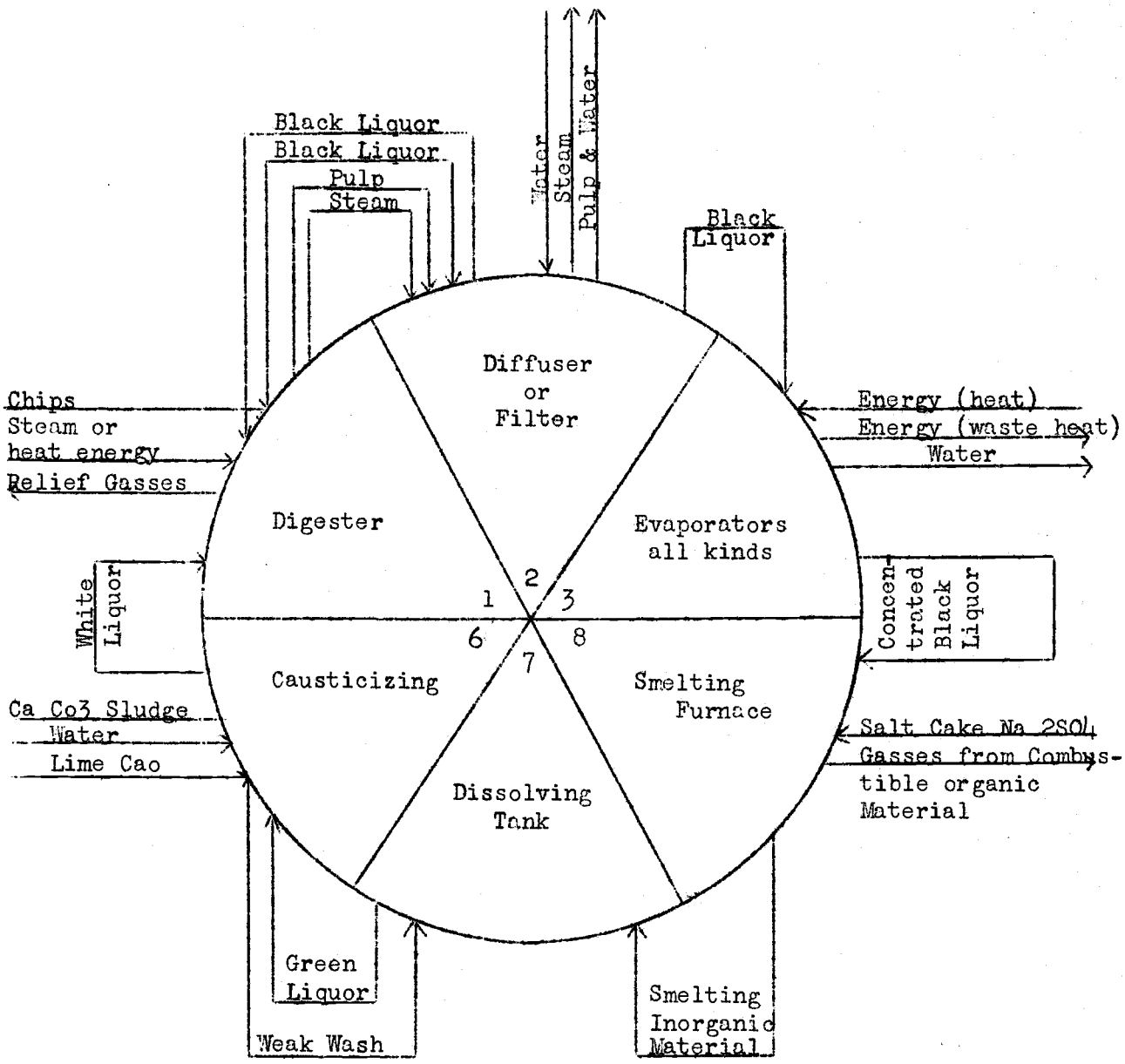
The termination of cooking is noted by a sample of pulp being blown out of the digester and the degree of de-ligninfication noticed.

Washing is done in two different ways: In most instances the digester contents are all blown into one common steel blow tank, or container, and from there washed over vacuum filters. Otherwise, each digester is blown into a separate steel container and the liquor drained from that. In either case, the concentration of the pulp liquor is held at the highest point; that is, around 12 degrees Baume. This liquor is then concentrated further by evaporation of the water, up to as high as 40 degrees Baume. It then contains around 60% solids.

The two washing methods are for separating the liquor from the fiber. The solids in this liquor are composed of organic and inorganic materials. The organic is the dissolved lignin and sugars of the wood; the inorganic material is the soda content of the liquor which is recovered by burning the organic material, leaving the inorganic matter to smelt together at high temperature, (around 2000 degrees F).

This inorganic smelted matter is run into steel tanks and dissolved in water. It is then what is commonly termed green liquor and contains sodium hydroxide, sodium sulphide, and sodium carbonate. The sodium

CHEMICAL FLOW - SULPHATE



This shows what happens to the cooking agent in a sulphate mill from the time it enters the digester until it returns back to the digester, after being recovered up to as high as 92%. The chemical "make-up" (restoring the 8 to 15%) is added at the smelting furnace where the salt cake (sodium sulphate) is changed to sodium carbonate and sodium sulphide. Notice closely the direction of the arrows.

carbonate is changed in form to sodium hydroxide by causticising it with calcium oxide (quick lime). This, in turn, produces the correct cooking liquor; or, as it is commonly termed, white liquor. (See accompanying diagram picturing the chemical flow in the sulphate process from white liquor and back again to the same.) Sulphate mills in the Northwest recover as high as 85 to 92% of the soda contents in their cooking liquor. Most sulphite mills do not recover any chemicals in the liquor after it is blown from the digesters.

Not only casual but professional visitors are impressed with the scrupulous cleanliness ("good housekeeping") of a modern pulp mill. Except for the wood-preparation department -- which is itself cleaned up between shifts -- there is no dirt and no debris to be seen anywhere. So much water is used in the various stages of manufacture -- 16 million gallons a day in Tacoma's largest mill, for example -- that there are apt to be splashes of water here, there, and elsewhere on the concrete floors in parts of the mill. But care is taken to provide for drainage. Workers in some mills wear standard uniforms, generally white.

Why is cleanliness so important? Obviously, the air must be kept free from dust, as during the settling, washing, and drying operations the pulp is exposed to the air for varying lengths of time. And, naturally, outside particles must be kept away from a product in the making of which so much care is taken to remove impurities.

One cannot but be impressed also by the amount of study and money that is being devoted to the problem, heretofore alluded to, of recovering chemicals and other usable non-cellulosic materials from the liquor resulting from pulp manufacture. The sulphite waste liquor oontains a certain amount of fermentable sugars which may be converted into alcohol. This, however, accounts for only about 3% of the total organic solids in the waste liquor and use must be found for the tons of unfermentable organic material which is left. Some use is being made of evaporated waste liquor as a road builder. Other suggested uses are as a binder in the manufacture of briquetted fuel, as a binder in the manufacture of foundry cores, and for the manufacture of various types of glues or cement. It also has possibilities either as the original material or as the chemically modified substance for the production of plastics, the use of which is increasing constantly.....We have already seen how sulphate mills recover from 85 to 92% of the chemical used in cooking their pulp, and how they burn the organic material in lignin in doing so. They are constantly experimenting, also, to eliminate entirely the smell which heretofore has been a necessary concomitant of sulphate pulp making.

CONSTANTLY EXPERIMENTING

When paper is made -- either in the same mill that makes the pulp or in other mills -- the steps, after bleaching, are as follows:

The pulp is washed, thickened, then sent to the beater room, where it is treated mechanically to refine the fibers.

After that, alum, resin, and other chemicals may be added to give body to it and make it impervious to ink.

HOW PAPER IS MADE

In the refiner it is made still more uniform. In the machine chest it is stirred to the right consistency, then conducted to a stuff box, whence it flows through an exactly adjusted gate onto the fourdrinier -- a fine wire screen belt -- which is moving fast and permits the water to drain off.

The pulp is now an endless ribbon, damp, soft, and white. At this stage it is stamped with a water mark. Next, it is rolled onto belts made of woolen felts where the water is squeezed out; then it is wound over steam rollers and dried. Finally it is wound in rolls, bundled, or baled.

It is interesting and significant to note that the paper industry is the only great industry which has changed its raw material, in large part, within a human generation. Rags are still used in large quantities for the production of high grades of paper (for use where durability and permanence are essential) but more than 90% of the paper produced in this country is made from woodpulp.

Rayon Manufacture

A decade ago woodpulp found its only use in the manufacture of paper. Paper is still the major market, but each year the rayon industry consumes an increasing quantity of high grade bleached sulphite pulp. Today approximately 80% of all rayon produced in the United States is made from bleached sulphite wood cellulose.* No rayon plant is in existence in the Pacific Northwest -- there is none west of Cleveland so far -- and so a detailed description of the manufacturing process will not be undertaken here.

Suffice to say, however, that 4 chemical processes are now in use for making rayon:

(1) Viscose process

(2) Acetate process

(3) Cuprammonium process

(4) Nitrate, or nitro-cellulose, process.

In order of volume the viscose process, introduced in 1906, is much the most important; next is the acetate process. Almost 90% of the world's rayon production is made by the viscose method (according to the United States Department of Commerce Committee on Wood Utilization). It is estimated that a ton of bleached sulphite pulp will produce 1,500 pounds of rayon.

Starting with purified pulp, the steps in making viscose rayon are as follows:

* - "Pacific Pulp & Paper Industry Annual", May, 1937

RAYON BY VISCOSE PROCESS

(1) Cellulose sheets are mercerized (treated to make stronger) by steeping in a caustic soda solution (sodium hydroxide) in a steeping press.

(2) Sheets are shredded into "crumb" resembling white sawdust.

(3) Crumb is aged in open pans with time and temperature controlled.

(4) Liquid disulphide of carbon is added. Temperature, concentration and time of reaction are carefully controlled. Crumb turns orange and becomes xanthate.

(5) Xanthate crumb is dissolved in a weak caustic soda solution and becomes viscose, resembling strained honey.

(6) Viscose is ripened; and, during the aging process, filtered several times to remove the dirt, fibers, and other impurities.

(7) Viscose is spun into thread. The spinneret, a platinum cup perforated with fine holes, is placed on the end of a feed pipe immersed in acid. Immediately, as the viscose passes through the spinneret holes, the acid hardens it, and it is drawn off in the form of tiny threads by a spindle. Each hole forms a filament and the many filaments are twisted into a thread by a revolving spindle.

(8) Yarn is reeled into skeins, washed, inspected, and bleached.

(9) Finished yarn is again inspected and wound on cones or spools and shipped in skeins to fabric mills.....It is interesting to note that none of several chemicals used in the process remains a part of the final product.

<u>Acetate rayon</u> is made in this manner:

(1) Bales of purified cellulose pulp are opened.

CELLULOSE ACETATE RAYON

(2) Cellulose is steeped in pans with acetic and sulphuric acid.

(3) The steeped cellulose is mixed with acetic anhydride which reacts to form a solution, known as acid dope, of cellulose acetate in acetic acid.

(4) The acid dope is aged in tanks.

(5) Water is added, free acetic acid is carried off, and acetyle cellulose or cellulose acetate precipitates. This is dried and then resembles clean white rice. It can be stored indefinitely.

(6) The granualar cellulose acetate is dissolved in acetone and then filtered. This solution is known as spinning dope.

(7) In the spinning operation this dope is extruded through a spinneret located at the top of a vertical tube. As the thread descends the acetone is evaporated by a current of warm air; with the result that a dry thread, consisting of several filaments, emerges from the tube, where it is wound on a spool, or bobbin.

(8) The yarn on the bobbin is a finished product.

Note: At present, said W. C. McIndoe, Assistant Chemist, USA Corps of Engineers, Portland, at the 1937 Northwest Chemurgic Conference, the acetate prooess is using only cotton linters for its cellulose. But patents are in existence for the utilization of wood pulp in place of linters.

When stripped to bare essentials, the end product of a rayon plant is yarn if the solution is extruded through small holes; is sheeting (cellophane) if extruded through slots; and is a molding powder for plastics if precipitated in granular form. In making films for motion pictures, the process is the same (in both processes) up to the point of casting or extruding. At that point the viscose (or solution of cellulose acetate in acetone, if the acetate process is being used) is run through a narrow slot forming a film. That film goes through three or more coagulating baths, a desulphurizing bath, and is finally coated with a solution of pure glycerine and dried. Then it is either sold as uncoated film or passed on to the coating process.

HOLES DETERMINE END PRODUCT

"If the present rate of increase in the production (of rayon yarn) holds for even three more years, the U. S. will be producing annually 70% more than this year's (1937) record and double the 1936 yarn production before 1942 is past. Also, the 1935 production of 277 million pounds fell 21.5 million pounds short of domestic consumption. The rate of increase in production of cellulose plastics is far greater than that for yarn, more than doubling in a single year.

NEARLY HALF WOMEN

"The rayon industry uses 51.5% male and 48.5% female labor.....Other things being equal, the lower cost of materials and far cheaper power and fuel here in the Pacific Northwest should handily overcome the eastern advantage of slighty cheaper labor.....Any rayon yarn production would tend to stimulate rather than compete with our existing textile industries in wool, cotton, and flax on account of the great variety of mixed fabrics possible.

"For plastics we have existing Pacific Coast markets in transparent wrappings (perhaps of fruits and vegetables), in paints and lacquers, and as plastics for the automobile assembly and aeroplane manufacturing plants. Also, rayon has come into the market just recently as the cord and fabric for automobile tires. The nearest market for that use is in the rubber tire plants of California.

"Moderate amounts of rayon yarn are being shipped to the Pacific Coast now for weaving in our local textile markets. From almost any site in the Northwest we could expect to dominate the market west of the Rockies;

export, perhaps, to Mexico, the Orient, and Australia; and reach New York or New England markets with any excess production."*

Wood flour (which results when the end product of the rayon process is precipitated in granular form) is occupying a place of rapidly increasing significance in the highly important field of molded products (plastics). The instrument panel of your automobile, and its steering wheel, also its window frames, are apt to be in large measure a wood flour product. When milady powders her face she may use Northwest wood flour, and when she walks across her kitchen floor on linoleum she may walk on Northwest wood flour. Likewise, when a land clearer dynamites a stump, an ingredient of the explosive is wood flour. When a banker signs a check, the fountain pen he grasps may be a wood flour product.

In making bakelite and similar plastic materials -- which are in turn molded into items of everyday usefulness from radio parts to steering wheels, to fountain pens -- the wood flour is combined with resin to form a hard, water-proof, acid-proof substance which will not warp and is not affected by heat or cold.

There are many different kinds of plastic materials which require wood flour to improve their molding qualities and increase the toughness and strength of the final product. Of these, the pheonolic resin type is the most widely used. Various trade names such as Bakelite, Resinox, and Textolite, signify such a plastic.

The powdered resin, a Hardening agent, a lubricant (and a dye material if desired) are ground together through a ball. Proportions may be:**

	Per Cent By Weight
Resin	45.0
Hardening Agent	4.5
Lubricant	1.0
Dye	0.5
Wood Flour	49.0
TOTAL	100.0

Wood flour is added and blending continued until a uniform mixture is obtained. The mixture is then sheeted out on hot rolls to the desired consistency, ground to powder form, and then sent to be molded. Hydraulic presses of steel, with chrome-plated platens (or molders) are used for forming the articles. Heat is applied to the platens by steam, gas, or electricity. Pressure is used from 2,000 pounds per square inch upward. The time required depends upon the powder used and the size and shape of the article. Advantages supplied by the wood flour, according to Doumani, are: (1) Plastic presses more accurately in the mold, (2) articles come out with a high polish, (3) they have higher dielectric (non-conducting) strength product, and (4) articles take and retain lacquers firmly.

MAKING PLASTICS

75% of all wood flour now comes from White Pine, the remaining 25% is made from Spruce, Hemlock, Poplar, Maple, and Birch.

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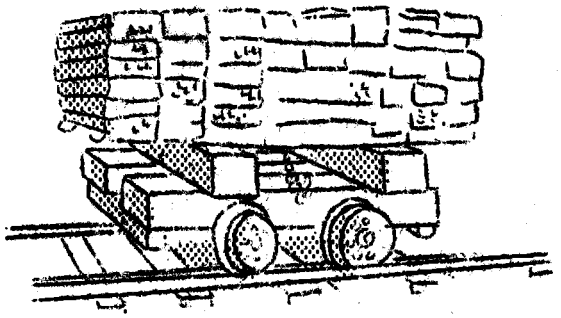
* - W. C. McIndoe, Asst. Chemist, Corps of Engineers, USA, Portland, Oregon, before Northwest Chemurgic Conference, Spokane, March, 1937.
** - Thomas Doumani in "Wood Chemical Industries of Washington".

G. REMANUFACTURE AND SPECIALTIES

In addition to general lumber, shingle, pulp and paper, and plywood manufacture, Washington also possesses a large variety of remanufacture and specialty factories -- including those making such articles as cross arms, fir conduit, columns, doors, sash, box shooks, berry crates, egg cases, broom and mop handles, rug poles, tent stakes, wood containers, fir car sills, framing, decking and stringers, bridge material, silo stock, piano keyboards, garage doors, beehives, furniture, etc. There is in Oregon a plant which manufactures insulating board from wood.



In addition there is a sizeable industry, statistics of which are virtually impossible to assemble due to the many private agencies operating, in Christmas trees. Around 10 million Christmas trees, valued at approximately 5 million dollars, are sold annually in the United States and Washington ranks with the leaders in supplying them. Most of our Christmas trees come from natural-grown forests. It is worthy of note, however, that trees for this special purpose are being increasingly grown in private plantations and that the Christmas tree business resulting is reaching attractive proportions. Besides giving owners a good use for land which might otherwise be idle, this business has the advantage of giving employment to people at a season of the year when they might otherwise be unemployed. The growing of holly has the same advantage.

CHRISTMAS TREES

Fuelwood is another important factor in the composite picture of the lumber industry, representing around 28% of the total wood consumption in the United States. Hogged wood from sawmills is widely used in the Northwest for fuel. Firewood is usually measured in cords; a cord is 8' long by 4' high and is made of pieces 4' long. The annual consumption of fuelwood in the United States is about 61 million cords; and of this Washington supplies around 5 million cords.

FUELWOOD IS FACTOR

FURNITURE MAKING IN WASHINGTON

Furniture making is an important business in Washington, there being 56 firms making everything from unfinished furniture to camp, garden, and juvenile furniture. Some factories specialize in one item, such as kitchen queens; others make everything in furniture to set up housekeeping. There follows a brief study of furniture manufacturing in a typical, though rather sizeable, plant.

The departments in such a plant include: Receiving Department where wood, metal, fabric, and other materials entering into the manufacture of our product are received; Dry Kiln where the wood is put into large ovens and thoroughly dried; Designing Department where the artist plans the furniture to be made and has with him draftsmen, interior decorators, blueprint men, and occasionally "free lances" who make up designs for all kinds of household articles; and finally, the Manufacturing Department where all the furniture is made.

FURNITURE OCCUPATIONS

The occupations in the Manufacturing Department include: Cutting the stock of wood on table saws, scroll saws, band saws, etc., each according to the special purpose to which it is to be put. Grooving, fluting, and rabbetting are done by the shaper; turning and making special designs are completed on the lathe; surfacing and polishing the wood is begun on the lathe and finished on the sander; staining, waxing, varnishing, or shellacking is done before the parts of furniture are put together, finishing of surfaces is completed after the parts are assembled; boring the wood for screws and the like is done by machine; the joining of parts is completed by the joiner, the mortiser, and tenoner; veneering or finishing of parts for varnish is the last operation before assembling. Assembling the parts into a piece of furniture is done by the joiner, fastening with nails, screws and/or glue. Upholstering or finishing comprise the final operation before the pieces are put in stock and they are done by individuals specializing in this work.

The Shipping Department is where the furniture is wrapped, packed to prevent injury, and shipped to retailers.

MANY OPPORTUNITIES

The occupations that have just been hinted at in this outline are usually rather permanent because people must have furniture. During the depression many people made their old furniture do and did little buying. The outlet for the manufactured products tended to dry up, throwing many in this industry out of work. With business upturn, there should be many opportunities for both young men and women for profitable employment in furniture manufacture. (See appendix of this book for complete alphabetical classification of Lumber and its remanufactures, by types and numbers of concerns and their geographical locations.)

H. THE DISTRIBUTION OF LUMBER

When the first sawmills were erected in Washington, lumber was sold by the mill owner to the user of lumber within a small trade area.* It was a common practice for a builder to order beforehand what he wanted from the mill owner, so the mill could have it cut for him when he was ready for it. The mill owner in the early days was often a farmer, or a man of other business.

FIRST SOLD NEARBY

The mill was set up to take care of the owner's needs, after which he sold lumber as an accomodation to neighbors. Soon mills were taxed to the limit to supply the local trade of Washington's growing communities.

It was not long before trading vessels began picking up lumber for distant ports. One of the earliest mills was one built by William Cannon, a millwright from the first Astor Party on the ship, Tonquin. This sawmill was built near Camas, Washington, across the Columbia River from Portland, Orogon. Power for the mill was furnished by an overshot waterwheel. Beside supplying for Vancouver and local trade it shipped timber to the Hawaiian Islands and California. This was during the period when Fort Vancouver was building at about the close of the third decade of the last century.

HISTORY AND ROMANCE

A pioneer in the export of lumber on the Puget Sound was Henry Yesler. He arrived on the Sound in 1852, worked as a carpenter and millwright for a short time, then went to California where he engaged in mining.

"There he learnod something of tho attractions of tho Puget Sound country and porcoiving that California would, for a long time to come, furnish an oxcollent markot for the timbor that tho Sound could so abundantly supply, ho returned north to build a mill and ongago in tho lumbor trado." History of Washington, by Snowdon, Volume 1, pago 477.

He built tho first stoam sawmill on Puget Sound. This mill was locatod noar whoro Pionoor Squaro is in Seattlo, Washington. (Pionoor Squaro is locatod in tho heart of Seattle's businoss soction.) Shortly after erocting his mill he was turning out 15,000 board feot of lumber per day. Whilo his original plan was to mill lumbor for oxport trado, much ovor 50% of his output was usod locally. Tho mill employod Indian laborors successfully.

FIRST MILL ON PUGET SOUND

To indicato how tho avorago mill startod tho rocord of Nicholas Delin, a nativo of Swodon, is horo outlinod. In 1852, one yoar boforo Yeslor ostablishod his mill, Delin socurod a half soction of land at the hoad of Commencomont Bay whoro Tacoma, Washington, now stands. Ho intorostod Michaol T. Simmons, tho buildor of tho first sawmill on Pugot Sound at Tumwator in 1847, and Smith Hays in his projoct and built a small wator

UP AND DOWN WITH TIDE

* - Wo havo alroady soon, howovor, that tho very first mill in Washington, built by Dr. McLoughlin of tho Hudson's Bay Company, in 1827-28, shipped much of its output to Hawaii.

power sawmill. During the five years Mr. Delin ran this mill he shipped two boat loads of lumber to San Francisco. Among many difficulties he had to overcome in his milling operations one was, he had to locate his mill low enough so that the water fall would run the machinery. This was so low that high tide water backed up and stopped the mill. However, many millions of feet of lumber was produced by this mill for the fast growing community.

The above examples are typical of hundreds of sawmills that sprang up all over what is now the State of Washington. To indicate how rapidly a lumber center grew into a city the following quotation is taken from a magazine, -- TACOMA ILLUSTRATED in 1889:

"Now in 1889 there are nearly a score of mills in Tacoma, their total output being 1,100,000 to 1,500,000 feet a day.
During the year ending June 30, 1889, the output of mills in the city was about 210,000,000 feet. Most of it was Douglas fir, some cedar, and a little spruce.
More than half of this enormous output was consumed in the city itself and the remainder shipped to various parts of the world, including Great Britain, Australia, China, Japan, Peru, Chile, the Argentine, and Southern California by water, and there has been an average of over a dozen large ocean vessels loading lumber at Tacoma every working day last year (1888). Some of these vessels have for a long time been engaged regularly in the business."

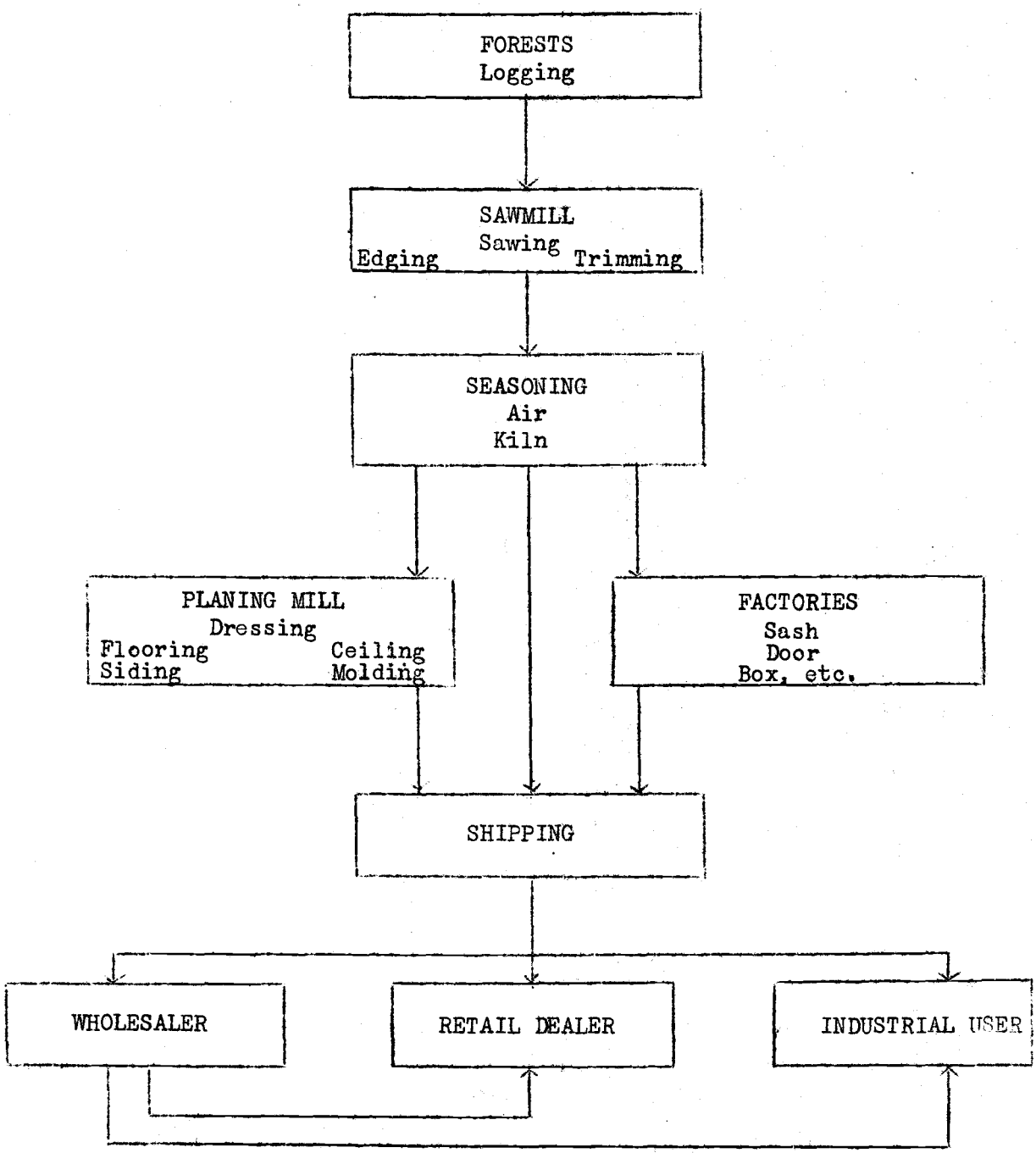
EARLY TACOMA MILLS

After railroads came to the Northwest, shipments began to be made to more distant parts of the United States. Before much lumber was manufactured in Washington the large eastern centers were obtaining what they used from: First, the New England States, Maine, New Hampshire, Vermont, and others; second, the Great Lakes area, including Michigan, the largest producer of that district; and finally from the Southern Pine region, which includes Louisiana, the largest producer of that section. Some hardwoods also come from that part of the country. But, in 1935, the lumber consuming centers used more Northwest wood products than those from any other part of the world.

Mills often pile up stock, when timber is easily available, and as a result can find no immediate market. A man then contracts to buy the products of several mills, makes up a carload lot or several carload lots, and ships to large buyers at a profit to himself. In this way was established the wholesaler, who today is an important cog in the machinery of distribution to retail yards. Even the United States Government recognized the wholesaler as necessary in lumber distribution because the War Industries Board contracted for and bought much lumber from him during the War. Over 70% of marketed lumber is distributed to retail yards by the wholesaler.

ORIGIN OF WHOLESALER

Over a decade ago, big mills began to establish sales departments and to compete with wholesalers. Offices were first established in large centers of population, but later the sales promotion manager was moved close to the mill where he could keep in close contact with stock on hand. Branch offices were left in large centers and salesmen put out, some on salary, others on commission. Much opposition at first was developed among wholesalers against these organizations, but now they are well established.



THE FLOW OF LUMBER FROM FOREST TO CONSUMER

-- from "The Development of American Industries"

Brokers in lumber established themselves by becoming throughly acquainted with lumber markets and with lumber supply. Often a broker will negotiate sales with dealers and buyers in foreign countries. He finds a buyer for lumber of certain specifications. He then gets in touch with mills; and, locating what is wanted, turns the order over to the mill or mills that can fill the order and takes a discount or charges a commission for his services. A discount is made to a wholesaler, and is usually 8% of the mill price. A commission is allowed to a commission salesman, and is normally 5%. The additional 3% allowed the wholesaler is accounted for by the financial or credit responsibility assumed by the wholesaler. In other words, the wholesaler bills the customer and collects, while the commission salesman leaves that to the manufacturer.

AND THE BROKER

The jobber is a man who buys large lots of lumber which he believes he can sell at a profit. Sometimes he contracts for the "run of the mill" for a specified time, which means he buys all the mill puts out at agreed prices. He must have capital with which to begin business and with which to buy lumber. He sells to retailers, large contractors, and sometimes to wholesalers. He takes advantage of the fact that in his trade area there are times when lumber must be had to fill orders quickly and that retailers do not care to have too heavy a stock on hand. Retailers are willing to pay more for their lumber to keep down their inventory. Large jobbers have from three to eighteen million feet of lumber in each of their yards at all times. Many jobbers are found in the middlewestern, eastern, and southern parts of the United States.

WHERE JOBBER FITS IN

These three classes of distributors are compared, to give a clearer idea of the activities of each. The wholesaler buys lumber at the mill at a price on which he hopes to make a profit, often before he knows where he is going to sell it. When he finds a satisfactory market he orders it shipped from the mill to the buyer which may be a retail yard, an industrial user, large contractor, railroad or the government. The broker often finds the buyer first and places the order with the mill, receiving a commission on the wholesale price for his work. Sometimes through his contacts with the market he will try to sell the lumber of a mill that is overstocked.

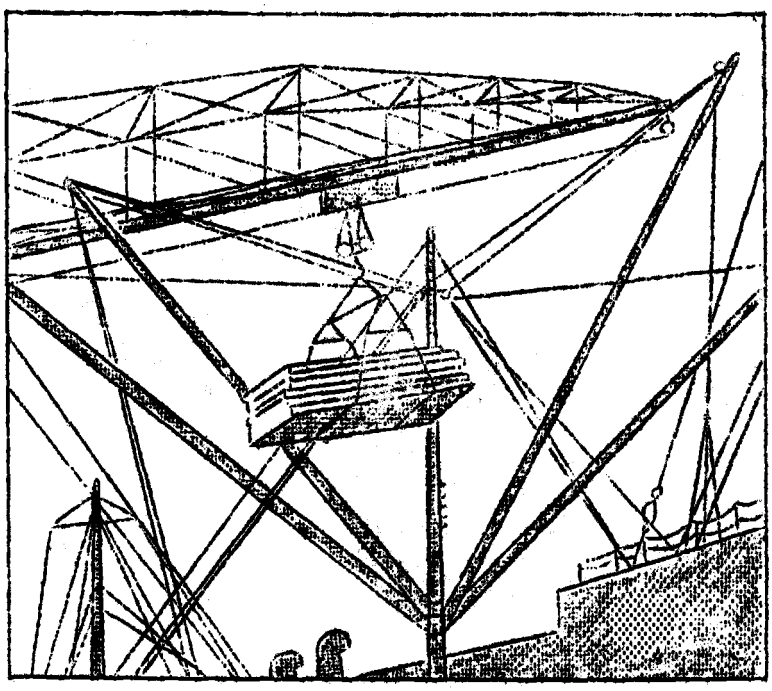
FUNCTION OF BROKER

The jobber buys "job lots" from mills and puts them up in his yard to resell to retailers and others who need lumber in his trade area.

The wholesaler operates from an office in a lumber consuming center such as St. Louis, New Orleans, Chicago and New York. The jobber locates in a trade area where there are many retailers and others who will need lumber on short notice. The wholesaler sells to markets throughout the country and to foreign export agents and buyers, while the jobber operates in a limited trade area where quick delivery can be made from his yard at an advantageous price.

In the Southern Pine section there has developed what is known as the lumber exchange. Several mills combine to set up a sales organization which accepts all orders coming to any of these mills. The exchange then places orders equitably among member mills. A copy of each

order is sent to each member of the exchange. A certain charge is made to cover the cost of operating the exchange and if a surplus is left over it is distributed to the member mills.



Lumber is sold to the consumer by retail lumber yards. All except very large contractors, the United States Government, state governments, and railroads buy their lumber from retailers.

Lumber yards may be classified as "independents" or "line yards".

The independent lumber dealer buys wherever he can get the lumber which is in demand in his district. According to the size of the yard, he buys from a wholesaler, a manufacturer's representative, or from a jobber.

A "line yard" is a unit of a group of yards, with a lumber buyer representing all of them. This buyer contracts for carload lots from mills according to the needs of his yards. He also cares for the distribution of this lumber to the respective yards to the greatest advantage in freight rates.

"INDEPENDENTS" AND "LINEYARDS"

The type of personnel in "independents" and in "line yards" is practically the same with the exception of the management. In a small "independent", the owner, manager, yard man, piler, and truck driver may be one man. His wife or a girl with training in lumber may be the office force. Most "line yards" have at least a manager-office-man and a truck driver. The manager acts as salesman and advertising man, as well as lending the bookkeeper and truck-driver assistance when needed. The manager of the "independent" buys his own lumber from a jobber or wholesaler; while the "line yard" manager reports to the company buyer what his needs are, and the buyer uses his own judgment in buying for the yard. The average lumber yard has a superintendent or yard foreman, lumber pilers, truck drivers, lumber graders, a bookkeeper or bookkeepers, a salesman, or salesmen, and a buyer.

A manager, if he is not the owner of the yard, usually receives a salary starting at $100 per month in a very small place, to $300 per month in large centers, plus, in most places, a commission on sales made from the yard. Sometimes the yard foreman shares in this percentage of profit.

A retail lumber salesman during good times earns from $1000 to $5000 per year in commissions as well as a small guaranteed income. The bookkeepers, laborers, and others receive wages comparable to similar occupations in other industries.

ANGLES OF EXPORTING

Foreign trade in lumber and forest products is largely in the hands of foreign brokers who are interested in marketing American lumber only insofar as it can meet competition with other countries in price and quality.

At one time there were a few large exporting mills which operated sailing vessels to ports all over the world. But each mill seemed more interested in competing with other mills than in developing foreign markets. Consequently, few effective distributing organizations have been developed in this country as exist in European countries, such as the Swedish Lumber Exporters' Association.

Now that steamships carry most American lumber in foreign trade, a middleman or export agent with offices in seaport centers is necessary. The export agent buys and assembles the shipment and arranges tonnage, vessel clearance, insurance, etc.

Many export merchants are in business in this country who have connections with foreign brokers to whom they look for lumber orders. These they place with mills or with export agents.

More and more, as time goes on, large mills are making contacts with foreign brokers through their sales organizations. Some have offices in Liverpool, Antwerp, and other European cities.

The only exceptions to the haphazard way of marketing lumber and lumber products, followed by the American industry, are (1) The Douglas Fir Export Company, with headquarters in Seattle, which was organized under the Webb Act and which sells lumber (proper) in all export markets. It is controlled by and represents a majority of the Northwest sawmills interested in export trade; (2) The Pacific Forest Industries, Tacoma, Washington, for the foreign distribution of plywood. This organization was set up shortly after the Webb Act was passed by Congress in 1935, and represents all northwest mills. The export shipment of plywood requires special packing, consequently this marketing organization has ware- houses in principal ports on the Pacific Coast. Mechanical bundling machines are used to prepare cargoes on short notice. Each panel is trade-marked and grade marked, so the designated quality can be certified and guaranteed.

SPECIAL PACKING

Plywood is sold to the entire world by the Pacific Forest Industries and shipments range from a few thousand feet each to several million feet each, and cargo lots.

FOREIGN DISTRIBUTION

Lumber distribution within European countries is handled by brokers working in close cooperation with buying organizations. American export to Europe suffers because of the fluctuating of American prices. In Europe prices are kept at a uniform scale during the season. Usually a scale once set will prevail throughout the year.

United States export of soft wood lumber led the world in 1930, but is exceeded in number of board feet shipped at the present time by Finland, Russia, Canada, and Sweden. Some reasons are that: foreign tariffs have excluded American lumber and the war in China has had a demoralizing effect on our Far East trade; while trade with South America has been held up without much promise for the immediate future.

Lumber exports from the United States amount to about 6.8% (1936) of the country's production. They fell from an average of over 8% in the years 1925 to 1930.

EXPORTS IMPORTANT

Although foreign trade in lumber may seem small compared to domestic consumption, it is very important to the lumber business because it takes care of a surplus that would be a drug on the market. For this reason the State Department has recognized the national lumber industry as "fundamentally an export industry".

UNITED STATES LARGEST USER

The United States is not only the largest manufacturer of lumber and lumber products, but is by far the largest lumber consuming country in the world. The following will give a comparative idea of per capita lumber consumption for past years in this country and per capita consumption in other countries:

UNITED STATES ONLY

1906....523	bd. ft.	1932.....94	bd. ft.
1921....262	" "	1933....116	" "
1923....362	" "	1934....114	" "
1929....274	" "	1935....146	" "
1930....190	" "	1936....177	" "

Pre-war consumption per capita (Approximate):

UNITED STATES AND OTHER COUNTRIES*

United States.....	450 bd. ft.
Canada.....	450 " "
Sweden.....	220 " "
Germany.....	150 " "
England & France....	120 to 140 bd. ft.

Some figures on the distribution of lumber in the United States will give us an idea of the markets. The United States Forest Service estimates average rail haul from the mill to the place of use in 1914 to be 360 miles; in 1924, 725 miles; at the present time the average rail haul to the Northeastern states is 840 miles; to the Lake states 910 miles; to the Central states, 1515 miles. The average rail haul from the Pacific Northwest to the Eastern market is 2,600 miles; and the average water haul is 6,000 miles.

HAULS BY RAIL & WATER

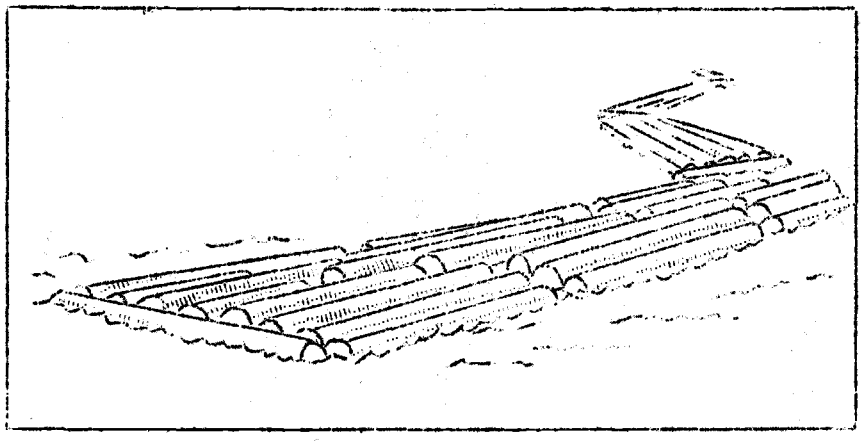
* (Re-arranged from the United States Forest Service figures as quoted in "Lumber and Timber Information" -- 6th Revision, March, 1938, National Lumber Manufacturers' Association.)

TOPICS FOR DISCUSSION

1. Describe briefly the work of a timber cruiser.
2. Name one or more important changes which have taken place in logging in recent years.
3. What is the first step in actual logging and how is it done?
4. Describe the functions and "rigging" of a spar tree.
5. In what respects does lumber manufacturing differ fundamentally from other kinds of manufacturing?
6. Describe briefly the handling of a log through a modern sawmill.
7. What is the theory of kiln drying?
8. From what parts of a log do the different kinds of lumber come?
9. Describe shingle making briefly. What is a "square of shingles"?
10. Give a non-technical definition of veneer and plywood.
11. What machine is the foundation of the plywood industry as we know it today?
12. What are the principal glues used in making plywood?
13. What are two inherent advantages of plywood and how are they developed?
14. What are the two main pulping processes? Define briefly but specifically their chief object.
15. What determines whether the end product of rayon manufacture is yarn, cellophane, or moulding powder?
16. What are plastics and what are some of their common uses?
17. How sizeable a business is trade in Christmas trees? Fuel wood?
18. Tell briefly the major steps in furniture making.
19. How is lumber distributed?
20. What is the difference between a jobber, a broker, and a wholesaler?

CHAPTER III

OCCUPATIONS, QUALIFICATIONS, AND WORKING CONDITIONS



OCCUPATIONS, QUALIFICATIONS, AND WORKING CONDITIONS

Besides being typically and distinctly American, the lumber industry has another peculiarity that is prevalent throughout its various branches -- its workers seldom switch to other occupations as long as they can find anything to do in lumbering. "Once a lumberman -- always a lumberman." The days of "great physical feats and reckless daring" may be largely over; but it is still a fascinating business. From the echoing depths of a great forest to the surging din of a great mill, it "gets in the blood." Possibly the smell of fresh-cut lumber -- as hard to dislike as it is to describe -- has something to do with it. Then, there is the fact that, even with the introduction of powerful and automatic machinery, lumbering still has more action and less monotony than most harvesting and manufacturing operations. Moreover, the human touch, exemplified by Paul Bunyan, the legendary hero-inventor of the lumber industry, has never been lost. Workers are inclined to stick with the company of their choice or their fathers' choice. It is also true that many old employes are kept on the payrolls of logging camps and sawmills, long after the peak of their usefulness has been passed. Certainly lumber is not a hard-boiled industry in this respect. (See Paragraphs on Age and Physical Qualifications.)

A FASCINATING BUSINESS

Logging will appeal most strongly to one who has been accustomed since his early years to an outdoor life and who is familiar in a general way with either manual labor or some mechanical trade.

The best opportunities for young men who wish to make lumbering a life work appear to be with the large companies, since they have organizations in which employment is more continuous and in which there is the greatest possibility of advancement. The large companies are more apt to employ the college-educated youth in an engineering way. Small lumbering concerns offer but little inducement in that regard; and some observers think the smaller outfits hold but little promise in any regard, unless a way is opened to secure an interest in the business. Other authorities, however, maintain that the uneducated youth stands a better chance to get farther with a smaller concern. Certainly, the lumber industry is one of the few remaining industries where the small operator remains an active and important factor.

WHERE BEST OPPORTUNITIES ARE

LOGGING OCCUPATIONS

In a study made in September, 1933, from complete pay-roll reports of 43 mills having 16,793 employees, the West Coast Lumbermen's Association arrived at a total of 374 different occupations in west coast logging camps and saw mills. This was apart from jobs and trades in plywood, separate shingle mills, pulp and paper, and other forest products. However, this survey was confined to Federal Classification No. 4 -- mills having a daily 8-hour capacity of 100,000 board feet or more -- and it would be misleading to put the 374 jobs down as typical of all logging and milling outfits in the region, or of any one organization, for that matter.

VARY WITH OPERATIONS

Also it would be confusing for the reason that in some of the larger camps -- and larger mills -- the list would show 2 or more classifications of men doing much the same work.

Briefly, the number and variety of occupations vary with the size of the operation and also with the equipment; and no one mill or no one logging operation can be cited as typical in every detail. Moreover, it is not possible to cite absolute authority as to certain occupational titles. For example: The classifications hook tender and head rigger, in logging, may be synonymous, depending upon the organization; and sometimes it is difficult to make sharp distinctions in authority or function in mill operations.

This explains why a hard-and-fast classification of jobs in lumbering has never been -- and probably never will be -- made. What follows is a careful attempt, based upon both direct observation and the most authoritative information available, to give the reader the set-up of occupations and duties in Northwest logging camps and sawmills, in as nearly typical a fashion as it is possible to do so.

In following the whole series of forest operations which begins with the felling of trees and extends to the delivery of logs at the sawmill (and is known collectively as logging), we have seen a good many of the following workers in action. Therefore, duty summaries and definitions will be supplied in detail only where the name of the occupation or trade may be somewhat obscure to laymen; or, where the importance of the position warrants more than casual mention. In some cases, the name of the occupation alone is sufficient for the reader to appreciate what the worker does.

WORKERS BY PROCESSES

Management

On the management side of logging, the general manager is the official who dictates the policies and superintends the operations. Of necessity, he outranks all others in the forest in authority and general usefulness. Nobody in the organization works any harder than he does and nobody puts in longer hours. Supplying enough logs for a mill that may turn out 200,000 or a million feet of lumber each 24 hours, is a job the size of which few people appreciate. The field man, whose responsibility this gigantic task is, is the logging superintendent. In the woods he is usually referred to as the "bull of the woods". Nine times out of ten he knows more about numerous trades and occupations than the man who invented them. From cruising to locating logging railroads for efficiency and economy; from repairing tractors to handling locomotives and fighting forest fires, he personifies action and resourcefulness. According to tradition, he can be blindfolded and tossed into the middle of a virgin forest at midnight without disturbing his sense of direction. In short, he is the king cog of the logging machinery. The foremen get their orders directly from him.

Next to the Superintendent the man most important to the success of the logging operation (at least in large operations) is the logging engineer. He accurately maps and cruises the timber, plans the layout of the operation, makes logging cost analyses to determine marginal value areas, trees and logs, locates and construots the roads, and in the more progressive operations seleots the blocks of seed trees to be left to naturally regenerate the cut-over areas. He is usually a graduate of a four year college oourse in logging engineering with extensive experience in logging, surveying and construction.

General Office

Occupations in the general office are listed as supervisory. Naturally, they may be fewer in number where the company is engaged in logging only; but, where the company does both logging and manufacturing, the following positions under the head officers are apt to be found, employing numbers which vary according to the size of the organization.

Assistant superintendent
Auditors and assistants
Sales Manager
Bookkeeper
Timekeeper
Timechecker
Payroll clerks
Office clerks
Telephone operator
Invoice and billing clerk
Retail store help -- only in larger operations
Stenographers
Janitor

LOGGING

Occupation	Description	Reported Average Wage*
Cruiser	Also known as estimator, timber rider, etc. An expert lumberman who estimates the volume of marketable timber on a tract of land by walking over the tract, measuring sample trees or all trees in a sample area with scale and special hand measuring devices, and calculating the volume of the sample trees from prepared tables or by his own judgment. Calculates the total volume in the tract from the volume of sample trees or area (old usage: "land-looker").	
Transitman	Surveyor who uses transit. Member of the logging engineer's crew who operates a surveying transit.	
Chainman	Member of engineering crew who measures distances and sets survey stakes.	
Rodman	Member of engineering crew who handles the level rod.	

* - Low and High from Weighted Averages, Reported Hiring Wage Schedules -- Washington & Oregon Logging Camps, Not Including Columbia River, and Columbia River Logging Camps, Washington, & Oregon.

Occupation (Camp Maintenance)	Description	Reported Average Wage
Camp Foreman	General Foreman under superintendent usually referred to as "the push".	
Baker	Bakes bread, biscuits, pie, and other bakery goods for loggers.	$120 - $125 (mo.)*
Bed Maker	Makes beds in bunkhouses.	$75.73 - $85.26 (mo.)
Bull Cook	Splits wood and does general chores around camp kitchen. Old usage: "chore boy"; slang: "crumb boss".	$75.73 - $85 (mo.)
Cook -- Head	In charge of all cooking and eating supplies.	$151.50 - $216.50 (mo.)
Cook -- Second	Assists head cook; "boiler", "sizzler".	$82 - $130 (mo.)
Disher - Flunkey	Combination waiter and dishwasher especially small camp.	$75 - $86.26 (mo.)
Dishwasher	Washes camp dishes.	$67.50 - $85 (mo.)
Kitchen Helper	Miscellaneous kitchen duties.	$77.50 - $84.94 (mo.)
Waiter-Waitress	Waiting table. Some camps employ waiters and some waitresses.	$67.50 - $85 (mo.)
Light Plant Man	Operates camp electric lighting plant -- power furnished by gas or steam engine.	$85 - $87.50 (mo.)
Drag Saw Man	In larger camps, his job is to cut wood for cookhouse and bunkhouses.	$5.20 - $6.44 (da.)
(Logging Shops) Master Mechanic	Chief mechanic -- may supervise both shop and field mechanics.	$7.65 - $10 (da.)
Blacksmith ("Iron Burner")	Does blacksmithing, repairing, and reshaping metal objects and tools of all kinds. Occasionally welding.	$6.40 - $7.70 (da.)
Blacksmith Helper	Assists blacksmith, cleans up shop, fires forges, etc.	$5.42 - $6 (da.)
Car Repairman	Repair and maintenance of railroad cars of various kinds.	$5.40 - $7.20 (da.)

* - Where monthly rates are shown, board and bed are included; on all other rates the employee pays board and bed. Board runs $1.20 - $1.35 per day and bed $1 to $1.06 per week.

Occupation	Description	Reported Average Wage
Boiler Maker	Repair and maintenance of steam boilers. (Only in largest outfits.	
Carpenter	Manifold duties from camp constructions, alterations, and relocations to bridge building.	$6.20 - $7.52 (da.)
Carpenter Helper	Assists in above duties.	$4.80 - $7.60 (da.)
Cat. Mechanic	Helps keep caterpillar tractors in repair.	$6.80 - $7.57 (da.)
Donkey Doctor	Colloquial for mechanic. Looks after donkey engine maintenance and repair.	$6.53 - $9 (da.)
Auto or Gas Mechanic	Repairs autos and trucks and may help with tractors. Also repairs gas donkeys.	$6.80 - $7.57 (da.)
Car Repair Helper	Helps repair railroad cars and "bunks" or 4-wheels trucks on rails. Only in larger outfits.	
Machinist-Lathe	A machinist experienced in lathe work.	$7 - $7.68 (da.)
Welder	There is considerable welding on machinery and other equipment around larger logging camps. In smaller camps, blacksmith does the welding.	$6.40 - $7.70 (da.)
Shop Helper or Machinist Helper	Assisting in shop.	
(Cutting Crews) Bull Bucker	Head bucker or marker. A fore man who supervises and assigns tasks to buckers and fallers; specifies log lengths and marks them off on felled trees; also specifies rates for falling and bucking. Does no marking except in small camps.	$6.97 - $9.47 (da.)
Bucker	Cross-cutter. Man who follows faller and bucks logs into desired lengths, using 7½ foot cross-cut saw. Carries bucking ax, wedges, maul, bottle of oil. Has either an 8 foot	$5.76 - $6.30 (da.) .22½ - .346 (contrac

Occupation	Description	Reported Average Wage
Bucker (cont.)	or a 50 foot tape for measuring or marking. Works under contract and by the day. Always works alone in Northwest woods.	
Bucker-Windfall	Same as green timber bucker only works on "down timber".	$5.20 - $5.98 (da.)
Faller -- Head	First faller or first sawyer. Takes lead on how undercuts are made, wedges driven in, etc., exercising supervision over second faller. Fallers work in pairs and frequently operate from springboards. (See Glossary). Cut down trees with saw, cutting toward notch on opposite side.	$6.32 - $6.69 (da.) (Contract cedar M, fir M. hemlock M. spruce M .29½ - .37)
Faller -- Second	Same as head faller, except that head takes lead. Second also works from springboard. (On contract, same rate for both classifications.)	$6 - $6.53 (da.)
Filer -- Head	Has charge of filing saws.	$6.64 - $8.25 (da.)
Filer -- Second	Assistant to head filer	$6.14 - $8.25 (da.)
Scaler (Fallers & Buckers)	Computes contents of the felled and bucked logs by means of a scale stick, graduated in inches and converted into board measure. The results are used to determine contract earnings of fallers and buckers. In common practice, the fallers' and buckers' scale is usually 35 to 50% in excess of the corresponding water scale for the same timber.	$5.81 - $8.02 (da.)
(Yarding & Loading) High Lead		
Hook Tender (Side Push)	Yarder boss. A foreman who plans and supervises work of chokermen and rigging slingers and other members of the crew engaged in yarding logs. Directs stringing of the yarding lines into position for bringing in logs. Picks guy line stumps and directs any other ground rigging necessary.	$8.99 - $10.08 (da.)

Occupation	Description	Reported Average Wage
Rigging Slinger - Head	Second to hook tender in yarding crew; directly in charge of chokermen. Spots rigging, tells chokermen how to put choker on and where. Selects logs to be yarded. Gives orders to signal man. Chases hangups of logs. Must have knowledge to splice line.	$6.81 - $7.85 (da.)
Rigging Slinger - Second	Assistant to head rigging slinger. Chases hangups; moves haulback blocks and is general utility man on yarding crew (apt to be only in larger camps).	
Chaser	Duties are unhooking chokers at the landing, replacing chokers and sending blocks or other necessary equipment back to the yarding crew.	$5.80 - $6.30 (da.)
Choker Hole Digger	Digs hole beneath log at point where cable (choker) is to be placed. (In some regions known as gopher man.) Often has to blast holes with explosives. (Choker is a length of wire rope, with hook on one end, eye or ring on the other to which skidding rigging and lines are attached.)	$5 - $6.30 (da.)
Choker Setter	Chokerman. Under direction of rigging slinger, places choker about the logs to be dragged to yard.	$5.72 - $6.24 (da.)
Donkey Engineer or Yarding Engineer	("Donkey Puncher"). The general term used to designate a skilled worker who manipulates control levers and throttle valves and operates any of the various sizes and types of donkey engines (in high lead logging). Greases and oils many moving parts and makes minor repairs. Usually specifically designated according to type of engine operated, or its point in the logging process, as:	$6.73 - $7.76 (da.)
Engineer Loader	("Loading Punk") Manipulates donkey engine levers and controls movements of cables and boom used to hoist logs from ground and load them on cars or trucks -- under direction of the head loader.	$6.73 - $7.83 (da.)

Occupation	Description	Reported Average Wage
Engineer Duplex	Manipulates two reversible engines, one for each loading line in loading logs on cars and trucks. Has a more complicated job than loading punk.	$7.15 - $7.87 (da.)
Engineer Swing	Is also a donkey puncher, doing the same type of work, except that his engine is situated any given distance from the yard. Has superseded ENGINEER-ROADER in Northwest, as skid roads are very seldom used.	$6.26 - $7.89
Fireman	Fires or stokes the boiler of various sizes and types of donkey engines. Usually specifically designated according to type of engine in logging process as FIREMAN-LOADER, FIREMAN-YARDER, etc.	$4.98 - $5.83
Handy Man	General helper in yarding and loading crews.	$6.16 - $7.53
High Climber-High Rigger	Climber, squirrel man, topper. Steeplejack of the woods and one of their highest paid workers. Cuts limbs and tops from tall, straight trees selected as spar trees to which skid rigging is to be attached; uses climbing spurs and safety belt to climb trees. Notches under limbs so they will cut off without pulling wood from tree. Installs a system of cables and blocks (pulleys) used in power skidding operations; performs tasks such as fastening blocks to spar tree with cable or chain, threading the various cables for the skidding engine through the blocks and fastening guy wires from spar trees to stumps or other solid objects on the ground. From safety standpoint, it is up to him to judge whether rigging is correctly attached and safe to use.	$8.50 - $10.20
Hook-on Man	Same as chokerman, except that he works on the swing yarder. He unhooks logs at outer spar and hooks on another cable to take them to the yarder crew.	$5.80 - $6.20

Occupation	Description	Reported Average Wage
Knotter	Saws and chops limbs from boles (trunks) of felled trees to prepare them for cutting into logs and skidding. Elsewhere than Northwest known as brutter; in the pine region as limber.	$5.30 - $5.45 (da.
Loader - Head	Also known as first loader. A foreman who supervises the work of second loaders and other members of crew loading logs onto cars and trucks; selects those logs in yard that will best fit together and make one load; signals engineer-loader when to pick up logs.	$7.58 - $9.05
Loader - Second	Also known as tongman or tong shaker. Under direction of head loader, works on ground in loading logs upon railway cars, trucks, and other vehicles. THIRD-LOADER, occasionally mentioned, whose duties are similar but a little less responsible. In a number of camps, he brands logs (ownership brand) and takes place of the knotter.	$6.19 - $7.02
Rigger - Head	Does work of high climber. Supervises the rigging of spar trees. (See skidder operation for further duties.) (In Columbia River and Oregon sections, under "slack line or high lead", the term head rigger means head rigging slinger and not high rigger or high climber as is the case in Washington.)	$7.20 - $9.35
Rigger - Second	Extra rigger, ground man. Helps rigger or high climber to install cables and blocks, performing tasks that can be accomplished on the ground, such as assembling the cables and blocks, threading the cables to the blocks and fastening guy wires to stumps. Occasionally required to climb trees where two men are needed aloft.	$6.32 - $7.44
Rigger - Third	Under high lead operations classed as rig-up helper. A subordinate in a crew of men engaged in installing blocks, cables, and other rigging used in skidding logs; works under head rigger, performing manual tasks	

Occupation	Description	Reported Average Wage
Rigger - Third (cont.)	requiring little skill such as carrying blocks and cables to riggers, threading cables through the blocks, and tightening guy wires.	
Signal Man ("Whistle Punk")	Signal man who is called whistle punk in Northwest regardless of system of signaling used. Stationed where he can see the rigging crew (rigging slinger and chokerman) he blows the whistle on the donkey by means of a jerk wire or electric contact to signal the donkey engineer what line to pull on. Often the first job held by the young man going into logging. "Now We're Loggin" cites one toot in Oregon and two in Washington, both meaning the same thing -- "get out of the way!" But there is some dispute about this, consensus being that one toot is either stop or go ahead, two toots pull back.	$4.91 - $5.50(da.
Sniper	Rounds off ends of logs with ax so they will skid more easily.	
(Yarding & Loading) Skidder		
Chaser (Skidder)	Duties the same as under high lead although more complicated because there are more cables.	$5.75 - $6.40
Choker Setter or Chokerman	Duties the same as under high lead.	$5.50 - $6.20
Engineer Duplex	Duties exactly the same as in high lead.	$6.50 - $8.48
Fireman	Same duties as under high lead.	$5.20 - $6.04
Hook Tender	Nearly always called head hooker in skidder operations. His work is similar to head rigging slinger under high lead. He handles large hooks on end of skidding line to which chokers are attached and is directly in charge of chokermen.	$8.48 - $9.23
Hook Tender - Second	Assists head hooker. Handles the second hook, called a slip hook, which slides along the cable.	$6.43 - $7

Occupation	Description	Reported Average Wage
Leverman-Loading (Swing Boom Engineer)	Controls the levers on the loading engine which has a knee-throttle. An A-frame boom is used in loading logs and the leverman controls its movements in lifting logs and putting them on cars and trucks. His work includes maintenance of his engine.	$8 - $10.48 (da.)
Leverman-Yarding (Skidder Engineer)	Work same that of donkey engineer only he has more levers to operate.	$8.80 - $10.48
Loader - Head	Work same as loader head under high lead.	$8.16 -$8.96
Loader - Second	Unhooks tongs from logs which are on cars or trucks. (In high lead, the head loader does this).	$6 - $6.64
Rigger - Head	A foreman in charge of the skidder crew. Duties same as hook tender in high lead except that he has a bigger crew and earns more money.	$9.36 - $10.50
Rigger - Second	He has charge of third riggers and installs cable and block on tail spars.	$7.50 - $8.96
Rigger - Third	Duties the same as under high lead.	$5.50 - $6.20
Signal Man (Punk)	Duties the same as under high lead.	$5 - $6.20
(Cat Operation)		
Foreman	In general charge of cat crew and is responsible for maintenance.	$7.75 - $8.90
Cat. Operator "Skinner" or "Puncher"	Operates caterpillar tractor when used for skidding and other purposes. May, e.g. push bulldozer on grading for railways.	$6 - $8.20
Cat. Doctor	Colloquial for caterpillar tractor mechanic.	
Cat. Hostler	Services caterpillar tractors, with gasoline and oil; cleans tractors; watches them during night or while idle.	
Hook Tender	Same duties as under high lead.	$6.40 - $8.60
Chaser	Same duties as under high lead.	$5.20 - $6.20
Choker Setter	Same duties as under high lead.	$5.20 - $6.13

Occupation	Description	Reported Average Wage
(Logging Miscellaneous)		
Crane Engineer	Operates crane which loads logs; sometimes dumps them. Also loads gravel. Crane also used to repair bridges.	$6.37 - $10 (da.)
Crane Hooker (hd. load)	Head loader when crane is loading logs. In charge of crane work in general. Does hooking onto logs and supervises that, too.	$5 - $8.94
Crane Hooker - Second	Assists crane hooker, hooking onto logs, loading gravel, repairing bridges, etc.	$4.80 - $6.44
Engineer Snubber	Operates an engine (snubber) to pull and lower loaded cars on grade too steep for operation of locomotives.	
(Train Crews)		
Brakeman - Head	Charged with assembling and braking of trains.	$6.66 - $7.42
Brakeman - Second	Does braking and assembling.	$5.56 - $6.64
Locomotive Engineer	Operates railway locomotive.	$6.89 - $7.71
Locomotive Fireman	Stokes railway engine boiler.	$5.20 - $5.96
Night Watch - Hostler	Takes care of locomotives in roundhouse.	$5.30 - $5.98
Sand Man	Dries sand for use in locomotive stopping.	
(Railroad - Const. & Maint.)		
Grade Foreman	In general charge of railroad construction crew.	$6.56 - $7.86
Grader	Member of crew which builds up grades with shovels and sticks. Heavy grading now mostly done with power shovels, bulldozers and cats.	$5.13 - $7.40
Shovel Engineer	Runs steam or gas shovel in making railroad grade.	$7.48 - $9.56
Pit Man	Ground man for shovel engineer. Utility man in railroad construction work -- such as oiler for power shovel, installing grade flags.	$5.40 - $6.60

Occupation	Description	Reported Average Wage
Powder Man ("Powder Monkey")	Blaster where there is need to blast rock on grades, remove stumps, etc. Removes obstructions such as stumps and rocks from line of railroad construction and skid roads (the latter are very seldom used in Northwest); slits sticks of dynamite and inserts detonator (either fuse or electric type); inserts explosives in holes, including stick that contains detonator, and tamps in place with wooden pole; must know how to place dynamite with relation to tap roots, etc., to avoid "windy shots".	$6.20 - $7.44 (da.)
Powder Packer	Carries powder from storage points on railroad grades to place of blasting. General helper to powder man.	$5.13 - $7.40
Jackhammer Man	Drills holes in rock with pneumatic drill for blasting and railroad construction work.	Rate about the same as Powder Man
Section Foreman "King Snipe"	In charge of section crew preparing road bed and surfacing track and gauging track, also track maintenance.	$5.86 - $6.56
Section Man ("Snipe", "Jerry" or "Gandy dancer")	Member of crew maintaining and repairing track under Section Boss. Crew includes tamper, jackmen (use jacks to raise tracks after gravel is spread.)	$4.88 - $5.12
Steel Foreman	In charge of laying ties and steel track. Also picking up rails and ties and re-laying them.	$6.60 - $7.08
Steel Man	Member of crew laying rails and ties. Steel crew consists of SPIKERS, BOLT-UP MAN, and NIPPER, (raises tie to rail when needed).	$5 - $5.80
Track Walker	Man who patrols track and makes temporary repairs.	$4.88 - $5.47
(Miscellaneous - General)		
Boom Foreman	In charge of booming or making a raft.	$7.60 - $8

Occupation	Description	Reported Average Wage
Boom Man	Walks on logs in the water, poling them into position with pike pole and binding them together with chains and other fastenings to make a raft or boom to be towed to sawmills. Sorts logs by species. His counterpart at mill releases logs on arrival.	$5.38 - $7 (da.)
Engineer Tugboat	Operates engine which drives tugboat which tows logs, rafts, and does miscellaneous work at booming grounds. Makes minor repairs, as all engineers do.	
Fire Chief	Not a title as such; either assistant superintendent or foreman, or a man appointed to work with fire warden. If there is a fire he takes charge.	
Fire Warden	Sees that all fire equipment is in place and that fire hazards are being taken care of; watches weather, etc.	
Maintenance Man	General upkeep of equipment. Common labor rate.	$4.80 - $5.01
Mucker	Any person who uses "muck sticks" or shovels. May rake or shovel bark and other debris from log landing to facilitate loading of logs for transportation to mill.	$4.80 - $5.01
Ax Man	A general term used to designate a worker who uses an ax to cut trees and logs preparatory to making firewood, clearing ground for construction work, clearing brush for surveying parties, etc.	$4.80 - $5.01
Night Watchman	Watches engines, equipment, and other property -- but only in larger camps.	$4.80 - $5.01
Bridge Repairman	Bridgeman, carpenter; does repair work on bridges and trestles on train logging roads.	$6.20 - $7.52
Pile Driver Foreman	In charge of crew constructing bridges and trestles.	$7.03 - $9.76
Pile Driver Engineer ("Hammerman")	Operates pile driver engine.	$7 - $8.09

Occupation	Description	Reported Average Wage
Pile Driver Man	Member of pile driver crew in building bridges and trestles. Places planks, braces, and other structural parts and bores holes and bolts bridge members. Sets piles (Pile driver crew consists also of a CHOCKER MAN, who blocks hammer up when it is not driving, a "NIGGER HEAD" MAN, who handles additional lines on pile driver, and GROUND MEN, who set the piling.)	$5.20 - $6.88 (da.)
Brush Burner	Sets fire to piles of brush and tends fire to prevent a spread. If it spreads, he digs circle around fire, shovels dirt, etc. Brush is burned on calm days immediately after snow or rain.	$4.80 - $5.01
Brush Piler	Piles brush and limbs removed from felled trees to facilitate logging operations and cleans up logged-over area as a preventative against forest fires. The brush is piled according to established principles to prevent spread of fire and killing of seedling trees when brush is burned. May be same man as brush burner.	$4.80 - $5.01
Splicer	Attends to splicing of cable.	$6.19 - $7.02
Swamper	Clears ground of underbrush and other obstructions preparatory to construction of logging roads, landings, etc.	$4.80 - $5.01
Pumpman	Operates steam-driven or gas pumps, pumping water to donkey engines and camp.	$5 - $5.80
Speeder Man	Manipulates starting and control devices to operate gasoline-driven speeder (motorized handcar) as a messenger, transporting men, visitors, equipment, etc., on logging railway.	$5.14 - $6.32
Woodbuck	Fuel man, woodchopper, or getter. Chops, saws, or splits wood with an ax and carries it for use in camp or at donkey engine.	$5 - $7.10
Wood Splitter	Splits wood for and with woodbuck.	$5 - $5.60

Note: In the Pine ("short log" or "big wheel") country various and sundry of the occupations differ somewhat in duties and still more in terminology. Example: Jammer Engineer, Fireman, and Hook-on Man; top loader; bunch teamster; big wheel teamster; skidding teamster; barn boss or stable dog; cant hook man. Cutting crews fall and buck together and are called sawyers. Waiters are called cookees.

LOGGING QUALIFICATIONS

EDUCATION: Average logging worker does not have to have more than a grade school education; and many veterans had less than that. However, more high school and college graduates are going into logging than was the case before the War.

TRAINING: Jobs are so diversified in the woods, that there is no such thing as a period of apprenticeship in its true sense, but more of a try-out system. (A foreman will find a promising youth on certain work and will pick him for something else. He might go from whistle punk, for instance, to choker setter; thence to rigger, etc., as per knack and liking). Experienced men, for example, cannot say how you get to be a good faller -- work which involves practice and the knowledge of how to wedge up trees, even "fall" against the angle as in hillside logging. It is one of the technical jobs where a man has an inherent knack which added to experience makes him efficient. A mechanical ability to swing an ax and skill in keeping tools sharp are also involved. Such things may have been learned from cutting fuel. The young faller may start as assistant faller and work up, watching wedging technique, etc. It is said that training in logging is about 90% practical experience; the rest is obtained from hand-books and catalogues rather than school books.

ADVANCEMENT: Advancement to the beginner in the lumber industry, logging or manufacturing, is not rapid; and, therefore, it holds more promise to the young, single man than to the older man whose responsibilities and financial requirements are greater at the beginning. As in the case of the sawmill division, it is universal practice in the logging industry to make promotions out of the ranks.

SEX: No other industry is so exclusively and everlastingly a "man's game" as logging. The logger is famed in verse and story as the original American he-man and hard-boiled egg. Sometimes women cooks, waitresses, and bed makers are employed around headquarters camp. The last report of the State Department of Labor & Industries (1934, when report was discontinued) gave 58,678 woman hours in logging and sawmills, most of which were served in clerical work.

AGE: Logging in general is a young man's game. Recruits all come from the younger men; robust youngsters of 18 and 20. Highclimbers and riggers, in particular, must be young men. Many fallers and buckers, however, are older men.

RACE: There is now a mixture of races of all origins in the woods. Early logging was done by French Canadians; then Scandinavians and a few Japanese. There are still many Scandinavians, some Irish, Austrians, and Poles.

PHYSICAL & MISCELLANEOUS: Logging, especially felling timber, is hard work and as a rule requires men of robust constitution who can stand up under hard physical labor performed in the open and in all kinds of weather. Loggers must as a rule be skilled in the use of an ax, cross-cut saw, and like tools, or be competent mechanics, although considerable unskilled labor is employed in each camp. Power logging, common in the Northwest, affords an excellent opportunity for active young men with mechanical ability, since skilled operators are required to run the skidding machines, tractors, etc., and keep them in repair. Men who have had experience in railroad construction or operation will find a promising field in the logging division.

TO BECOME SKILLED (Length of time): Varies sharply with different occupations. It takes a long time to become a good faller, bucker, rigger, or mechanic. Some fallers have spent 30 years in the woods, taking from a year to 10 years really to master their trade. The same is largely true of buckers.

WORKING CONDITIONS IN LOGGING CAMPS

Time was when logging camps were crude, uncomfortable and unsanitary establishments. That day is past. Now most camps are provided with up-to-date equipment and rate as first-class living centers. They have sometimes permanent, sometimes portable buildings. They have well-equipped commissaries, maintained by the company; and sometimes elaborate bunk houses, dining rooms and kitchens. Reading and motion-picture rooms constructed on flat cars are not uncommon. At times, the portable camps are long, narrow buildings designed for derrick and flat-car moving. The comforts of good eating*, of living, and entertainment supplied to the loggers add materially to the investment and costs. Some lumbering firms have complete camp trains on their logging railroad equipped with bunk cars, kitchen cars, dining cars, office cars and even stable cars for the horses.

Conditions -- from the days when the loggers "went into the woods in October with their blankets on their backs, lived on beans and salt pork for seven months, worked in snow up to their suspender buttons twelve hours a day with the mercury 30 below, slept in a bunkhouse with 32 men and 64 socks, lived in ice water from the waist down from March to May each spring when the snow melted and the drive came down the river" -- are indeed changing.

A CHANGING ORDER

As Paul Hosmer further points out in "Now We're Loggin'", the veteran logger, "famed in verse and story as the original he-man and ten-minute egg.... accustomed and trained to hard, dangerous work"-- is still in our midst, but each year the type decreases.

"He is losing his identity", says Mr. Hosmer, "to the coming generation of young, aggressive and up-to-date youngsters who are migrating to the western lumber centers from the forestry schools and logging colleges. These young men are gradually usurping the old-timer's place; they study his methods, improve on them, suggest this, that, and the other thing, and throw monkey wrenches into the machinery in general....This new type of logger, fresh from the forest school, may be inclined perhaps to over-reach himself on sundry things and subjects; but, at the same time, he is earnestly interested in learning the lumber business from the ground up and isn't afraid of giving an honest day's work for value received. Numbers of other young men are coming into the camps, armed for the most part with a good high school education, and

* - Western logging camp meals besides being the biggest on earth are also among the finest known anywhere. "Everything in the way of food", and "more different varieties of groceries for breakfast than the Ritz-Biltmore serves for an Embassy dinner" are in no sense exaggerations, as the following recollection of a (Washington) logging camp meal should suffice to show: Pork chops and steaks cooked to a turn; three or four vegetables besides potatoes; a green salad plate; a pitcher of celery; jam, jelly and pickles; hot rolls; coffee, tea or milk; pudding made from a nationally advertised brand of gelatine; your choice of several kinds of pie -- but why go on! (This was in no sense a holiday occasion; but a regular, "ordinary" evening meal.)

are taking an active interest in the study of modern logging methods. The old order is passing....The only way you can recognize the veteran woodsman now is the manner in which he handles a double-bitted ax or a certain expertness he displays in the manipulation of a peavey."

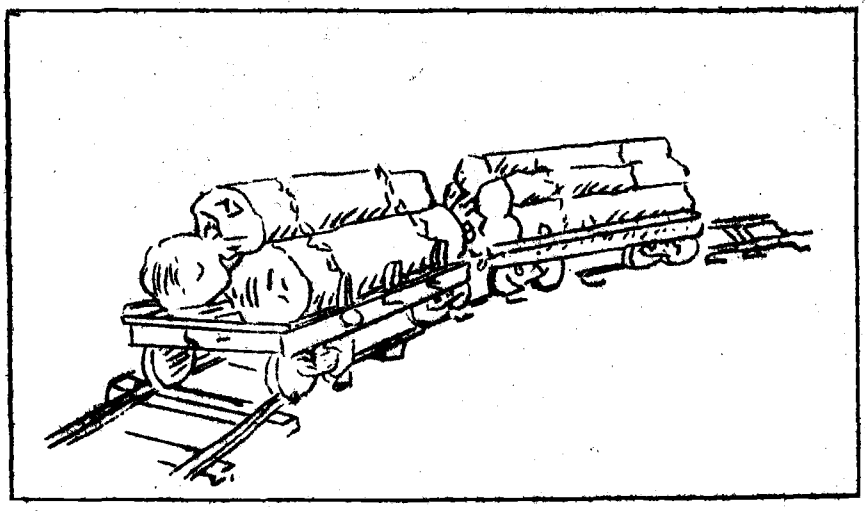
HOURS: 8-hour day, 40-hour week.

EARNINGS: The present average wage in the lumber industry (including both logging and manufacturing) is 77¢, 62½¢ minimum.

SEASONALITY: Logging is very little given to seasonal fluctuation in the Pacific Northwest, when times are good. Every few years, in January and February, snow and freezing temperatures close some of the higher camps for a month or so, but, in general, the climate is no bar to steady operation..... In the pine region the logging is largely done at high altitudes where more snow falls. As a result, pine loggers resort to what is known as "cold decking" -- during the summer they deck, or stack up, logs where they will be available to the mills in winter.

HAZARDS: Records of non-fatal compensable claims (published by State Department of Labor and Industries) show that in 1934 injuries from axes and adzes led all other hazards -- 349 as against 284 from falls caused by slipping or tripping, and 195 from cross-cut saws. Falls from logs (including jumping, slipping, and tripping) injured 164, as against 176 injured by falling trees. The highest number of permanent partial disability injuries (49) came from falling trees, limbs, and snags, leading axes and adzes by 3.....By occupations, buckers and choker setters, chasers and hook tenders filed the greatest number of claims for non-fatal accidents -- 599 for buckers and 600 for the other group. In 1935, a total of 82 fatal accidents were reported in logging in Washington. (The total fatalities for all classes of industries reporting was 255.) To an increasing degree, however, hazards are being constantly lessened.

Of the 30,406 men who worked in both logging and sawmilling in 1935, 42.2%, or approximately 12,832, were employed in the logging division; so the ratio of logging fatalities to total employed in the state was approximately 1 to 156.



WASHINGTON LOGGING & SAWMILLING EMPLOYMENT STATISTICS

1929-37, INCLUSIVE

(Man hours worked and payroll totals are the actual figures reported by the State Department of Labor and Industries. The number employed calculated by the Lumbermen's Industrial Relations Committee, Inc., and adjusted to Biennial Census of Manufacturers.)

YEAR	EST. NO. EMPLOYED	MAN HOURS WORKED*	PAYROLL TOTALS
1929	57,032	123,909,320	$81,553,306
1930	42,745	92,870,096	$59,654,883
1931	28,022	60,186,208	$31,321,763
1932	18,000	38,366,352	$15,737,660
1933	24,720	46,956,593	$21,111,714
1934	24,278	46,117,693	$26,685,549
1935	30,406	51,275,686	$31,327,416
1936	41,565	70,094,084	$46,872,300
1937	41,206	69,489,975	$52,227,263

(* - 9-year average, 1929-37 inclusive, based on total hours reported in Logging and Sawmilling, Department of Labor and Industries, shows 57.8% for sawmilling and 42.2% for logging.)

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AVERAGE ANNUAL WAGE - - WASHINGTON LOGGING & SAWMILLING

(Arrived at by dividing total annual payrolls, from Dept. of Labor & Industries, by the estimated figures for employment.)

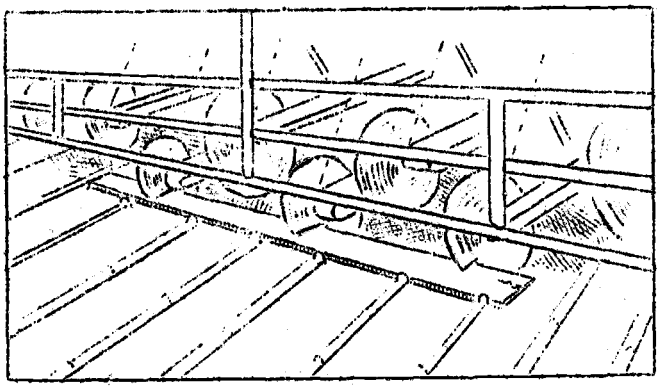
1929.....$1430
1930.....$1395
1931.....$1118
1932.....$ 874
1933.....$ 854
1934.....$ 910
1935.....$1030
1936.....$1128
1937.....$1267

SAWMILL OCCUPATIONS

In following the manufacture of lumber, step by step, we have seen a good many of the different workers in the following list in action. As was the case in logging, the name of the occupation alone is sufficient for the reader to appreciate what various mill workers do. However, many occupational terms need explanation and definition.

Management

Naturally, the executives of the company -- who shape its policies and see that they are carried out -- head this division. Some are charged with safeguarding the finances of the company. Others are responsible for sales. The large sawmills in Washington, for the most part, have well-organized employment departments, usually with an employment manager in charge. These departments judge a man's qualifications both by personal interview and by means of application blanks. Sometimes the head timekeeper -- who has one of the busiest and most responsible jobs in the office -- does the hiring. In smaller mills, particularly portable mills, the superintendent or foreman usually hires new workers without an organized set of records.



Some of the largest mills have a cargo superintendent who looks after the cargo docks and water shipments. This is not a common occupation, however. Cargo lumber is handled differently from that shipped directly out of a mill -- in that it goes out in sling loads mostly, around a thousand feet to a sling.

The office personnel has already been detailed under General office in our Logging section.

Production

In the mill proper, the superintendent and foremen are the responsible heads -- the men who dominate the orderly confusion of a modern sawmill. The mill superintendent is responsible for everything to do with manufacture. Also, it has been well said that there are no schools in which one can learn by the correspondence method to be a mill foreman. The business has to be learned by actual experience and out of the thousands of good mill-hands only a few are so qualified as to make good foremen. Few men put in longer hours and few have a better working knowledge of machinery -- a better instinct for sensing "grief" amidst whirring carriages, flapping belts, singing saws, hundreds of live rolls, dozens of conveyors of various description.

Only one other man approaches the foreman in his knowledge of machinery; and that is the millwright. He knows -- has to know -- what it takes to make a sawmill go. And keep it going. He is the maintenance man. He and his helpers are responsible for continued operation of equipment.

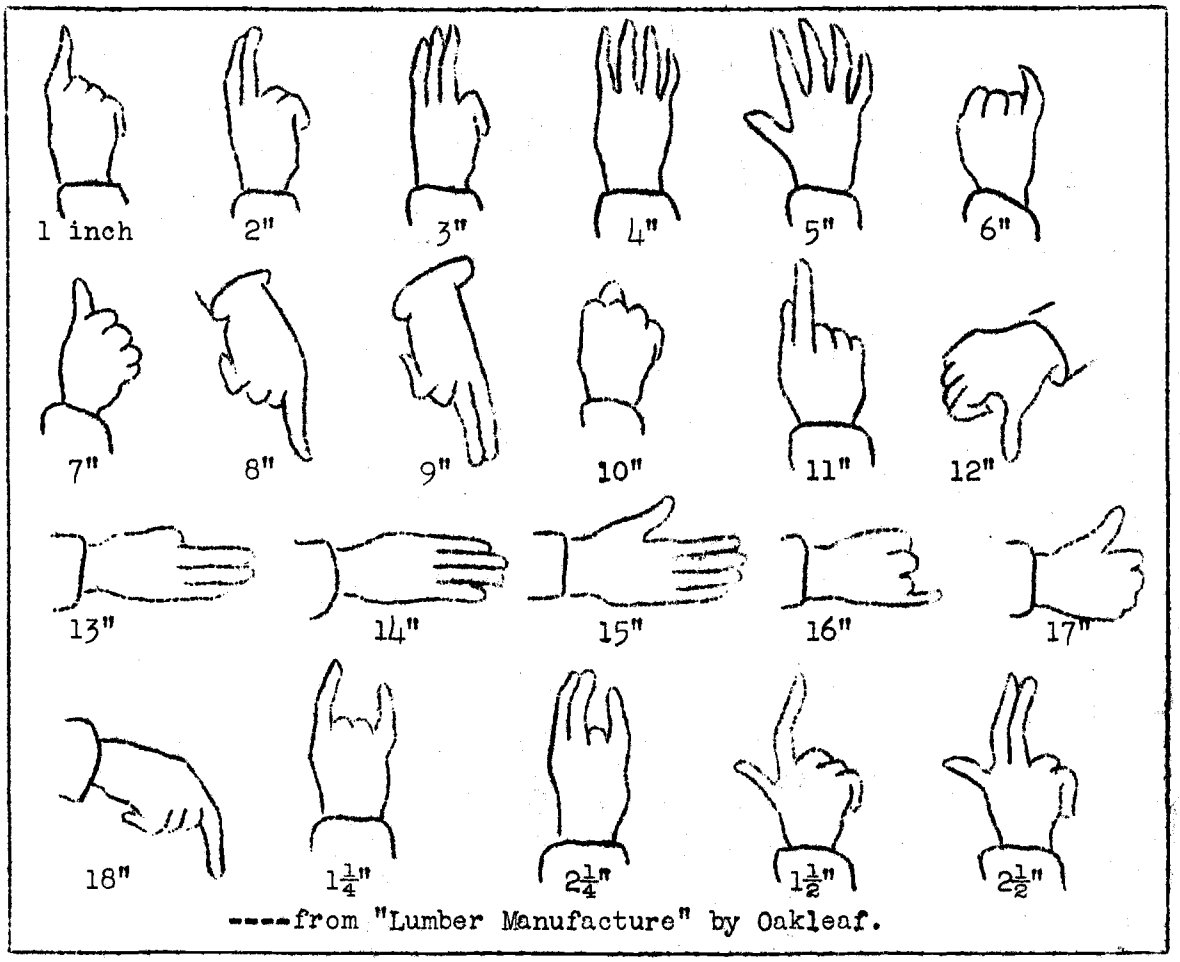
Other key men are the filer -- the highest paid worker in a mill next to the foreman -- the head sawyer ("the man responsible for the lumber"), the edgerman, the trimmerman, the marker or grader, the gang sawyer, the re-sawyer, the green chain boss, and the kiln foreman, yard superintendent and foreman, planer foreman. Almost invariably they are the men who have won promotions through experience rather than special preparatory study.

The work at a sawmill plant is extremely varied in character and ranges from that requiring highly technical and mechanical ability down through every degree of skill to work which can be performed by a low grade of common labor. The wage scale likewise shows a wide range. The highest technical positions, such as head filer in a large mill, may command $12 a day and up.....For a better understanding of the milling process, the various occupations listed below are arranged as nearly as possible in the order of their appearance as the wood progresses through the plant from log to various "finished" or "unfinished" products.

Occupation	Description	Reported Average Wage*
LOG POND		
Head Boomman	In charge of log pond. (Not in all mills)	
Boomman	One or more assistants to the boom foreman, who walks on logs in the water, or works from a plank or catwalk, poling logs into position with pike pole and selecting them for movement to the slip.	$4.40 - $7.80 (da.)
Tripperman	Assists in unloading logs from cars at some sawmill ponds by knocking stakes from cars with a maul, unhooking binding chains and performing similar tasks so logs will roll off when car is tilted, or be in readiness for crane to kick off into water.	
Raftsmen	In charge of breaking up rafts. (Not in all mills.)	
Boatman	Rows about sawmill pond in flat boat or poles about on a raft, segregating logs according to size with pike pole and floating them to slip. (Not in all mills.)	
Slip Man	Directs logs to elevator chain in log slip.	$4.60 - $6.60
SAWMILL		
Mill Foreman	In general charge of mill operations under superintendent.	$7 - $10.80 (Mo. $150 - $250)

* - Low and high from Reported Hiring Wage Schedules, Washington Rail & Cargo Mills, Washington Rail Mills, Oregon Rail & Cargo Mills, and Oregon Rail Mills.

SAWYER'S SIGN LANGUAGE



----from "Lumber Manufacture" by Oakleaf.

Occupation	Description	Reported Average Wage
Rock Sawyer	Largely obsolete as work is now done with pressure washing equipment. In charge of small saw operating ahead of head saw, cutting through bark only, to remove accumulated rock and dirt.	
Log Deck Man or Scaler	Scales logs. Keeps log deck full.	$4 - $6.60(da.)
Headrig Sawyer	In charge of head saw and log carriage. Responsible for economical cutting of log into flitches, cants, and timbers. One of the most responsible and second highest paid worker in a mill.	$7 - $13
Setter	Adjusts log to edge of carriage to regulate depth of cut, as directed by signal from head sawyer.	$4 - $7
Dogger, Head	Supervises fastening log on carriage.	$4 - $6.64
Dogger, Second	One or more assistants to head dogger.	$4.60 - $5.68

Occupation	Description	Reported Average Wage
Off Bearer	Directs flitch or cant as it drops from log to rolls. ("Tail Sawyer" in pine mills.)	$3.80 - $6.08 (da.)
Swamper	Clears refuse from carriage and rolls.	$3 - $5.20
Lever or Button Man (Control Operator)	Routes cants, timbers, etc., to proper destination by raising or lowering live rolls by means of hand lever or electric buttons.	$4.80 - $5.80
Resaw Sawyer	Resaws cants according to specific needs.	$5.40 - $7.60
Resaw Line Up Man	Lines up pieces for resawing.	$4.80 - $5.96
Pony Sawyer	In charge of small band, or circular, saw for cutting logs too small to handle economically on headrig -- and for cutting cants coming from head saw.	$7.20 - $11.12
Pony Setter	Duties relatively same as those listed under head sawyer setter.	$5.20 - $7
Pony Dogger, Head	Duties relatively same as those listed under head sawyer dogger, head.	$5 - $5.80
Pony Off Bearer	Duties relatively same as those listed under head sawyer off bearer.	$4.80 - $5.44
Pony Trimmerman	Operates small trimming saw, working with smaller material.	
Edgerman	Cants from headrig feed to edger to have edges squared up. He sets and controls edgers. Must be capable of sizing up cants as they come to his machine and cutting them to best advantage. An important key job.	$4 - $9
Edger Spotter or Lineup	Lines up cants in front of edger and assists edgerman.	$4.80 - $5.80
Edger Off Bearer	Removes product that has been run through the edger.	$3.60 - $6.20
Slasherman	Certain edgings go to slasher who operates a bank of saws, cutting to salvage lengths.	$4.80 - $5.36
Trimmerman	Also a key job. Operates bank of adjustable trim saws, cutting product to most economical lengths and taking out defects. Handles only better grade of lumber that is to be trimmed to specified lengths.	$3.60 - $8

Occupation	Description	Reported Average Wage
Trimmer Spotter	Straightens lumber on trimmer to facilitate movement under saws.	$3.20 - $6 (da.)
Marker	Marks lumber for grade.	$5 - $7.75
Lumber Straightener	Straightens lumber so that it will hit "green chain" evenly.	
Automatic Trimmerman	Looks after automatic trimmer.	
Head Filer	In charge of keeping all saws sharp and properly straightened. There is more to filing than sharpening teeth; saws have to be hammered flat. Also welding. Head filer is highest paid worker in mill.	$7.10 - $14.80.
Filer Helper	Crew of 6 or 8 men working in file room, straightening and sharpening head saws, circular saws, gang saws, blades, etc.	$5 - $8.60
Saw Fitter & Helper	Removes and replaces saws used about the mill.	
Gang Crane Operator	Operates small crane for handling heavy cants and timbers through gang saws.	
Cant Hooker	Works with gang crane operator. Places hook on cants or timbers for lifting.	
Gang Line Up Man	Line up of cants and timbers for passing through gang saws.	$4.80 - $6
Gang Sawyer	Supervises operation of gang saws; adjusts saws, etc., for proper cutting.	$5.35 - $7.40
Jump Saw Man	Trims timbers to lengths.	$5 - $6.48
Jump Roll Man	Operates jumps rolls on sorting table to divert lumber (as marked) to different parts of mill for further manufacture; e.g., may pull off stock for the resaw. (Transportation of green lumber from operations behind headrig for storage or further refinement is done via the "green chain".)	$4.60 - $5.68
Green Chain Boss	Foreman of green chain. Has indefinite number of chain men, sorters, and pullers under him, depending on extent to which manufacturing goes, and one or more tally men. They sort and tally according to length, width, thickness, grade. (Green chain is "sorting table" in pine, and "green chain men" are "sorters".)	

Occupation	Description	Reported Average Wage
Green Chain Marker	On green chains, does grading, marking, and grade-marking. Marks each piece of lumber for quality established by grade. Important key work. (Where grading or inspection is done for issuing a certificate, it is done by inspectors of the West Coast Lumbermen's Association and the Pacific Lumber Inspection Bureau.)	$4.80 - $7.08 (da.)
Green Chain Tallyman	Tallies lumber moving over green chain, in yard, or on shipping dock.	$5.40 - $7.20
Green Chain Puller "Human Mule"	Removes lumber from green chains for piling, dry kilns, or further manufacture.	$4.60 - $6
Crane Operator	Operates bridge or monorail, or railroad type of crane for rapid handling of lumber to cars or to planer and return. After lumber is sorted and in bins, it is picked up by monorail crane operator who keeps mill clear. Bridge cranes are in storage end of large mill.	$5 - $7.60
Crane Hooker	In each case, crane operator has a man who puts bunks under loads and sees loads are properly picked up with cable or steel arms; he is called the hooker; also general work in dress sheds.	$5 - $6.20
Jitney Driver	Operation of small type of (electric or gasoline) tractor that pushes or pulls loads.	$4.80 - $6.65
Carrier Driver	Carrier operator. The lumber carrier is generally a motor carrier which straddles a load of lumber, raises it with hydraulic lift and deposits it where needed. Commonly called a "straddle-bug".	$3.80 - $6.85
Hostlers & Repairmen	Attend to carrier repairs and maintenance.	
Teamster	Drives team.	$5.20 - $5.40
CARGO OR TIMBER DOCK		
Foreman	In charge of dock.	
Crane Man - Timber Dock	In charge of crane for handling and loading timber. Hammer-head type crane on docks for cargoes; and bridge crane for transport from mill.	$5 - $7
Cargo Dock Labor	General work around dock.	$4.80 - $5.60

Occupation	Description	Reported Average Wage
LATH MILL		
Foreman	In general charge of lath mill operation, in some mills.	
Lath Mill Bolterman	Shoves slabs through bolter machine which cuts into bolts.	$4.80 - $6.40 (da.)
Bolter Off Bearer	Takes bolts from machine.	
Lath Feeder	Feeds bolts to lath machine.	
Lath Mill Stock Picker	Picks suitable slabs out of conveyor.	$4.80 - $5.60
Lath Mill Puller	Throws waste onto conveyor and suitable pieces onto another conveyor which carries to lath machine. Also may help grade. May be same as stock picker. Hard, fast work.	$5 - $6.28
Lath Mill Tier	Ties the laths in bundles for shipment.	$5 - $5.56
Lath Mill Cont. No. 1 per M	Works on contract.	$1.25 - $1.63
Lath Mill Cont. No. 2 per M	Works on contract.	$ .60 - $1.50
Grader	Grades the product into No. 1, 2, and 3 laths.	
DRY KILN		
Dry Kiln Foreman	Foreman in charge of dry kilns.	$6 - $7.76 (mo. $150 - $230)
Kiln Operator	Operates dry kiln and supervises seasoning.	$5.12 - $7.60
Kiln Stackers	Stack lumber in loads for transfer to dry kiln.	$4.60 - $5.96
Kiln Unstacker	Unstacking lumber of cars coming out of dry kiln.	$4.60 - $6
Kiln Grader or Marker	Lumber is always re-graded after dry kilning; markers re-grade.	$5.28 - $6.40
Switchman	Controls movement of loaded kiln cars coming in and out of kiln.	
Labor	Push off men, pullers, and bunk spotters, used in process of unstacking kiln cars. General labor employed in and around dry kiln.	$3- $5.20

Occupation	Description	Reported Average Wage
DRY SHED	Lumber from dry kilns and loading to cars for shipment is stored in dry sheds. (Surfaced, dressed, planed first.)	
Dry Shed Straw Boss	Foreman of dry shed. Sometimes called control man and may run crane.	$5.20 - $7.20 (da.)
Dry Shed Loader	Loads dry lumber, spots "bunks", sorts on dry chain.	$4.60 - $5.40
Dry Shed Unloader	Unloads dry lumber.	$4.60 - $5.60
Sorter	Pulls from dry chain for transfer to planers.	
Lumber Piler	Stacks lumber for air drying.	$3 - $6.04
Tallyman	Tallies lumber in yard, or on dock and grades.	$4 - $7
Car Loader	Loads cars at shipping dock.	$4 - $5.88
PLIB Inspector & Crew	Inspect and tally lumber as assembled for orders.	$6.20 - $7.80
Checkers	Check carrier loads as delivered to boat or barge.	
PLANING MILL		
Foreman - Planing Mill	In charge of planing mill.	$6.80 - $10.80 (mo. $150-$215)
Filer	Sharpens all planer saws and knives.	$7.10 - $14.80
Planer - Set Up Man	In charge of adjusting planers, renewing knives, etc.	$4 - $7.85
Planer - Stickerman	Operates sticker machine which runs lumber to pattern. Sticker is used to make flooring, dropsiding and the like.	$5 - $7.40
Planer - Feeder	Feeds lumber into planers.	$3.60 - $6.60
Planer - Grader, Dry	Grades dry machined lumber.	$5.20 - $7.20
Planer - Grader, Green	Grades green machined lumber.	$4.40 - $6.80
Planer - Trimmerman	Trimming.	$3 - $6.30
Resaw Man, Lumber Piler & Cleanup Man	Additional re-manufacture in connection with planing and handling and cleaning up thereafter.	$5.40 - $7.60 $3 - $6.04 $3 - $5.20
Planer - Tier	Bundles, ties, and sorts high-grade lumber behind planers.	$4.80 - $5.40

Occupation	Description	Reported Average Wage
Planer Puller	Pulls lumber from back end of planers.	$4.60 - $5.80 (da.)
Pigeon Holers & Rackers	Sort, pigeon hole, and rack lumber for storage.	
Moulder Feeder	In charge of machines producing mouldings.	
Moulder Set Up Man	Sets up and adjusts moulding machines for various patterns.	
Sizerman & Helper	In charge of sizer operations; surfacing of medium and large sizes.	
Oiler	Keeps machines properly lubricated.	$5 - $6.60
DRESSED SHEDS		
Crane Man, Hooker	General work in dressed shed.	$5 - $6.20
Cleanup Man	Cleaning up of dressed shed.	
Shed Labor	General labor in and about dressed shed.	
YARD		
Foreman - Yard	In general charge of yard operations. Sometimes in large mills, superintendent in charge of all work outside sawmill, particularly in pine, where no green lumber is shipped.	$4 - $11.20 (Mo. $160-$325)
Lumber Piler	Piling and unpiling lumber.	$3 - $6.04
Yard Man	Miscellaneous handling of lumber, from green chain and timber chute, to car or ship. (Dryloaders in pine.)	$3 - $9.60
Repair Man	General repairs around yard.	
Timber Deck Man	Where timbers are cut and go right through a mill without further processing, he labels, stamps, and tallies. May do further trimming with circular saws.	$4.60 - $6.08
SHIPPING		
Shipping Clerk	In charge of all shipping.	
Shortage Clerk	Assistant to shipping clerk and filling short items. In some mills he makes general check-up on orders on which sawyer, edgerman, etc., are working.	

Occupation	Description	Reported Average Wage
Tallyman, Pick Up Men & Carloaders	Employed in gathering and loading material on order.	$4 - $7 (da.) $4 - $5.88
Dispatcher	In charge of all carriers.	
GENERAL & POWER HOUSE		
Chief Engineer	In charge of all mechanical operations of plant.	$6.60 - $10.80
Operating Engineer	In charge of operating engines, etc.	$4 - $8.60
Fireman	Firing boilers, etc.	$5 - $7.20
Oiler	Oils engines and machinery.	$5 - $6.60
Electrician	In charge of all electric wiring and equipment.	$6 - $9
Electrician Helper	Assists electrician.	$5.40 - $7
Millwright	In charge of all mill construction, repairs, and maintenance. Head millwright has very important key job.	$5.60 - $8.80
Millwright Helper	Assists millwright.	$5 - $7
Machinist	Repairs and adjusts machinery.	$6.20 - $8.80
Blacksmith	Assistant to chief engineer. Does blacksmithing and may do welding.	$6 - $8.52
Blacksmith Helper	Assists blacksmith.	$5 - $7
Pipe Fitter	Assistant to chief engineer, fitting steam pipes, etc.	$5 - $7.40
Carpenter	Assistant to millwright in construction, wood alterations, repairs, etc.	$5 - $7.40
Carpenter Helper	Assistant to carpenter.	$4.80 - $6
Night Watchman	Employed at mill gates or about plant for protection against fire and theft.	$3 - $5.20
General Laborer	Assisting in and about mill.	$3 - $5.20
Clean Up Foreman & Helper	Keeps refuse clear of all machines throughout the mill to facilitate operation and reduce fire hazard.	
Hog Tender & Assistant	Supervises operation of hog machine which grinds up waste for fuel.	
Truck Drivers	Operating trucks around plant or for local deliveries.	

SAWMILL QUALIFICATIONS:

EDUCATION: Very little formal education is required to get a start as a laborer at average pay.....In manufacturing, and handling lumber fast figuring is required. (Not grading, or sawing, etc.)

TRAINING: No special training is needed on common labor jobs. However, experience is imperative in key occupations. Carefulness is essential, both as regards producing and handling lumber and observing safety precautions. Need for these varies, of course, with different jobs and different machines. The average worker gets training that fits him to work in any lumber region and several types of wood-working mills. Common labor in handling lumber is not, however, robot labor. It demands physical aptitude and skill.

ADVANCEMENT: It is universal practice in the sawmill industry to promote out of ranks. In the event of a business boom, promotion chances would be best for men already working in the mill. Workers do not move up very rapidly even in boom times. The exceptional worker does, as sawmilling is yet an individualistic industry in its labor. Natural filers, sawyers, graders, go up fast.

SEX: While lumber is distinctly a man's field and the lumber industry proper employs no women -- other than clerical workers, stenographers, switchboard operators and a few miscellaneous office helpers -- women are now very satisfactorily filling places in plywood mills, box factories, and other wood-working establishments, which were formerly filled exclusively by men.

AGE: Workers are apt to stick longer than in logging camps, although there are some drifters in city mills. In a typical (large) mill a survey, made in August, 1937, showed that of 597 men, the average age was 48½ years. 109, or 18-3/10%, were 60 years old or over. Which tends to refute the "forty on the shelf" idea prevalent in some industries. The lumber industry does not lay men off at any definite age, due to the high value placed on experience. Instead, the tendency in many cases seems to be to give elderly men, who have spent their lives in the trade, every consideration; even to keeping them on, in numerous cases, when the peak of their usefulness has been passed. With modern machinery, older men can stand in one place and do a job, such as tallying or grading. However, experience gets the call, especially in grading. Another large company reported that the men on its payroll have, collectively had 60,000 years of employment. (By and large, this is an outstanding characteristic of the lumber industry).

RACE: A remark was once made that "if the Swedes in Washington and Oregon alone were killed off more than 1,100 sawmills and logging camps would have to shut down". Certainly the Scandinavian is a fixture around lumber camps and sawmills, having proved himself a high-type lumberman and citizen. Substantially all employees are of the white race.

PHYSICAL & MISCELLANEOUS: Sawmill employees must, in most instances, be robust. They are not as a rule exposed to inclement weather to the degree as loggers. A high degree of mechanical skill is required of saw filers, sawyers, mechanics, and the like: but the great part of sawmill work does not demand mechanical skill of even an average degree and consequently such work can be satisfactorily performed by labor which has had little previous experience. In most positions the man who is of average intelligence and has the ability to quickly adapt himself to new lines of work will prove successful.

WORKING CONDITIONS IN SAWMILLS

The majority of modern sawmills are well lighted and well ventilated. Both hand and machine workers have to work, in numerous instances, where the air contains particles of sawdust and where there are deafening sounds from sawing, sizing, and planing machines. But, on the whole, sawmills are healthy places to work, some of the work being out in the open. The majority of mills have well organized and active safety committees and a few make a practice of giving a reward for safety suggestions.

TO BECOME SKILLED (Length of Time): Varies greatly with type of work. It take years to become a good head sawyer; and grading takes long experience plus a knack. Dry kiln operation requires special training. The general run of jobs take 6 months to a year to become reasonably expert.

HOURS: 8-hour day, 40-hr. week.

EARNINGS: Wage scale of filers and head sawyers (best paid workers in sawmill) varies with size of mill from $1 to approximately $2 per hour. The general run of skilled and semi-skilled work in most mills earns largely the same rate -- 62½¢ per hour minimum; 77¢ per hour, average. One (large) mill cited actual earnings of key and common jobs for 1937 as follows: (1937 was a recovery year; but not a peak year.)

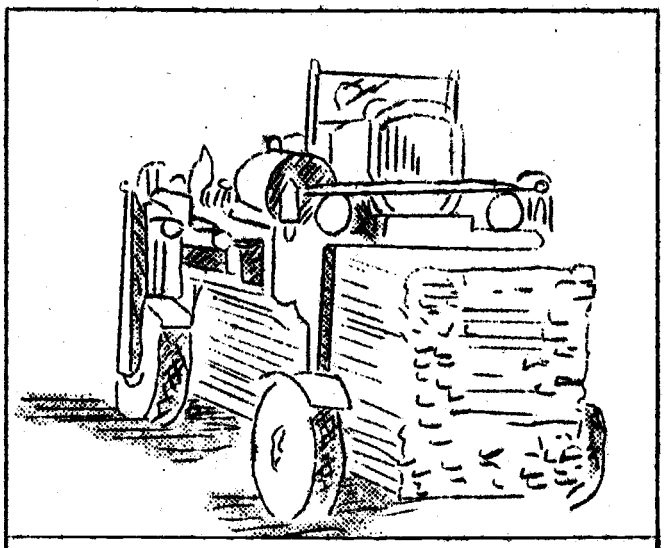
Laborer	$ 988.88
Chainmen	988.73
Feeder	1148.50
Set-up Man	1387.66
Grader	1181.33
Edgerman	1467.09
Trimmerman	1257.76
Head Sawyer	2036.45
Carrier Operator	1200.00
Tallyman	1226.35
Millwright	1635.00
Filer, Asst.	1337.08

These earnings based on a 199-day year; may have been affected somewhat in individual instances by special conditions affecting parts of the mill. (See page 112 for Washington average annual wage, logging and sawmilling combined.)

SEASONALITY: The sawmill business is not seasonal because of weather conditions -- a mill can, and does, operate in weather that would shut down logging operations. At all plants, however, some forms of work such as piling, trucking dry lumber to the planing mill, and loading cars may be discontinued during short spells of inclement weather. The actual sawing of lumber, in the Douglas fir region seldom ceases except when the entire plant closes down, since the work is largely done under cover and men, therefore are sheltered. If business conditions justify, a modern sawmill in the Northwest can run every day, even day and night. It is, however, customary in the sawmill industry to shut down during the Christmas holidays for a general overhaul of the mill; and sometimes there is a short shut-down around July 4 for inventory ....Business conditions tell the story as to operating time. One large Washington mill ran 199 days in 1937; the highest number (23) in March, the next highest (22) in June, the next highest (21) in September; and the fewest (10) in December.

HAZARDS: Records of non fatal compensable claims (published by the State Department of Labor & Industries) show that by far the largest number of injuries in Washington sawmills, in 1934, were caused by falling timbers and lumber -- miscellaneous injuries while handling -- 305 causing temporary disability; 40 permanent partial disability. The next highest cause was falls caused by slipping and tripping, 158. Contrary to what might be expected, power saws, edgers, planers, and the like were involved in only 86 accidents, three less than from lifting and handling heavy materials.....In 1935, a total of 26 fatal accidents in sawmills was reported. (City and county operation and maintenance ranked next to sawmills with 18 fatal accidents in 1935.) Total fatalities reported by all classes of Washington industries were 255 in 1936.....In 1935, the total of non-fatal accident claims for all Washington industries was 15,367 -- 2,885 in logging and 2,059 in sawmills. Next highest total was for plywood, box and furniture manufacturing with 780.

Of the 30,406 men who worked in both logging and sawmilling in 1935, 57.8% or approximately 17,574 were employed in the sawmill division; so the ratio of sawmill fatalities to total employed was approximately 1 to 676.



...."THE STRADDLE BUG"...

OCCUPATIONS IN SHINGLE MILLS

As we have already seen, some of the larger sawmills operate shingle mills in conjunction with (but as separate units from) their lumber manufacturing plants. Such shingle making units are known as combination mills and constitute around 10% of the total number of shingle mills in Washington, Oregon, and British Columbia. In that event, the mill superintendent is the operating head and has under him various bosses, planing mill boss, yard boss, and the shingle mill boss.

Management

However, the majority of shingle mills are separate organizations; and many of them are such relatively small outfits that the manager may of necessity be the foreman, millwright, filer, and trouble shooter, all rolled into one. There are opportunities in the office end of the typical shingle mill, however, for: Timekeepers, clerks, store helpers, traffic men, salesmen, and sales management.

The crew* in a typical shingle mill again starts with its boomman (or boommen) and the slipman who constitute the pond crew and are responsible for getting the giant logs up the slip, or chute, into the second story of the mill, with the aid of pikes and a power-driven conveyor chain known as a "log haul". Next we have the

Deckman -- who may scale logs before they are cut up. Uses a picaroon (handled instrument with sharp pointed prong) for moving logs.	72½¢ per hour
Cutoff Sawyer -- who may have help from a drag saw operator. He operates a large circular saw that cuts the logs in 16, 18, or 24 inch lengths.	80¢ " "
Knee Bolter -- so called because he uses his knees in shoving cedar bolts into a saw where they are split into quarters and cleaned of all dirt and bark. Not in all mills.	
Splitter-man (or bolterman) -- puts block on power splitter and splits the block into quarters and then slides them on conveyor with hookaroon. This power splitter is fed with steam feed. It can split more than one block at a time and is sometimes called a parbolter. Some mills have both a knee bolter and splitter saw or parbolter in operation.	80¢ " "
Block Piler (1 to 3) -- takes blocks off conveyor and puts them on block table for shingle sawyer. (One block piler will supply about four machines).	70¢ - 74¢
Upright Sawyer -- (With filer, is highest paid worker in mill.	No. 1;30¢ per sq. Nos. 2&3; 24¢ "

* - Contrary to popular conception, not all workers who have anything to do with the actual making of shingles are called "shingle weavers".

Only packers, sawyers, knot-sawyers, and knee bolters are correctly called "shingle weavers".

Upright Sawyer (cont.) -- Usually paid by the square.*) There is one sawyer to each machine. Number of machines vary from 1 to as many as 25 or 30. Shingles are sawed and clipped by sawyer and he also grades them -- Nos. 1, 2, and 3. He has 3 shingle packing bins below him and puts shingles into chutes according to grade.

Packer (1 under each machine) -- Re-grades as he packs. After packing he binds the bundle with band-sticks and band-irons and throws bundles on packing bench. — Packing, all grades, 21¢ per sq. (There may be some variation for special sizes).

Tallyman -- Tallies the bundles, 4 bundles per square, and puts them on conveyor, which takes them to dry kiln. Tally for the packer is also tally for the sawyer. — 73½¢ per hour

Truck Loader -- At kiln end of conveyor -- piles bundles on kiln trucks. Pushes trucks into kiln. (Average of 300 squares per kiln.) — 70¢ " "

Kiln Foreman -- In charge of dry kiln. Looks after temperature and relative humidity and supervises loading of shingles in cars after they come out of kiln. (Shingles are dry kilned 6 to 8 days.) — 78¢ " "

Head Loader -- Responsible for condition of shingles as they go in cars (not in all mills). Bundles are examined for any defects and faulty bundles are laid out. Sees that car is properly locked and sealed. He is helped by

Loading crew (3 or 4) — 62½¢ " "

Head Filer -- Keeps saws sharp. Shingle saws are changed every 2 to 4 hours. They are usually pointed up (sharpened with file right in the machine) every hour and a half. In any mill operating 8 machines or over, the filer has a varied number of helpers called — 93½¢ - $1.45

Fitters -- who fit and file and sharpen saw blades under Head Filer. (may be called filers).

Millwright -- Responsible for maintenance. Does all repair work. — 89½¢ " "

A separate shingle mill has a boiler room and power plant, with

1 Engineer. He is usually the chief electrician, too, although a few mills have special electricians.

* Fair average is 20 to 25 squares (80 to 100 bundles) a day.

1 Fireman

1 Night Fireman

1 Night Watchman

However, the engineer, firemen, and night watchman may be part of central power plant personnel.

SHINGLE MILL QUALIFICATIONS:

EDUCATION: Men who have had very little formal education can find work in shingle mills. In fact, very few "shingle weavers" have had more than a grade school education.

TRAINING: The common labor jobs require no special training -- but there are few common labor jobs. The top jobs, particularly those of upright (or shingle) sawyer, filer, and packer, require intensive training and a great deal of experience. It is particularly difficult to break in as a shingle sawyer. The expert acquires a sort of mechanical uniformity, or "automatic" dexterity of motion to his gait. And it is this regularity of gait which really determines his speed. Also packing is hard to do -- right -- especially in view of the fact that it includes grading. What the customer may find is more or less laid at the packer's door and bundles are marked so Bureau inspectors can tell which packer they came from. The filer has to be an all-around mechanic.

ADVANCEMENT: As a rule, packers develop into shingle sawyers and filers are developed from sawyers. Occasionally a relatively inexperienced man who wants to file makes the grade, but he must have exceptional ability. On the whole, the best field for young men in the industry is filing. The situation is such that if business were booming there would be a real shortage of filers. The industry needs particularly to break young men in for filing; and the attention of mechanically-inclined youths is especially directed to this opportunity.

AGE: The average age in the industry is believed to be around 50 and there are many workers 60 years old or better. As indicated, the industry is not breaking in enough young men, particularly the mechanically-inclined who can develop into filers.

SEX: During the War, women were employed in shingle mills in the Northwest -- but there are none today, except a relatively few in office occupations.

RACE: No one race predominates.

PHYSICAL & MISCELLANEOUS: A man has to be fairly "skookum" (the industry's term for husky and agile both) to work on the deck and handle blocks; but, in sawing, packing, and the like the chief needs are alertness and agility, plus the ability to master the rhythm that determines gait. Lots of small men are rated as "speedballs" in shingle mills.

TO BECOME SKILLED: (Length of Time) Some men have greater manual dexterity and natural rhythm of gait than others; but, as a rule, it takes a year to 2 years to become skilled in sawing and packing. A sawyer improves on his gait during the next 4 years. In other words, it may take 5 years to reach peak performance. It takes about the same length of time to become an A No. 1 Packer.

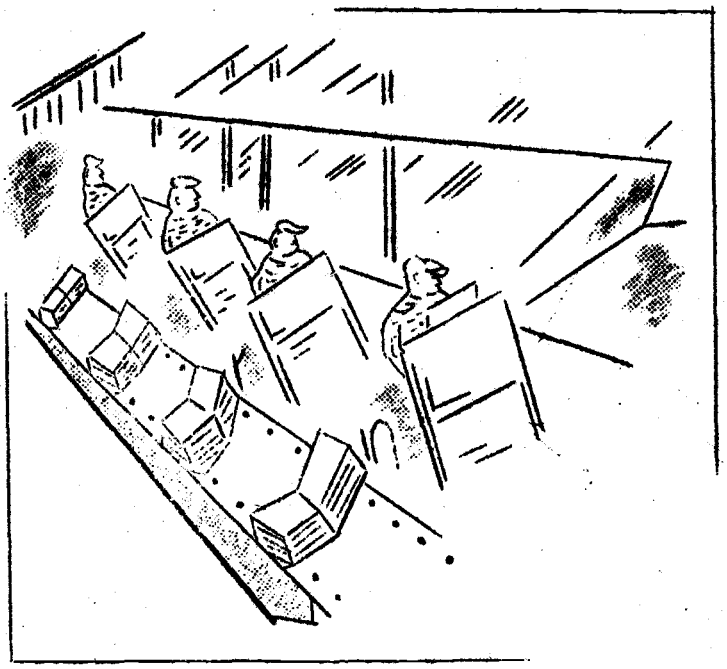
WORKING CONDITIONS IN SHINGLE MILLS

Working conditions vary greatly in the different shingle mills. Some are ship-shape; others are not such "good housekeepers". One of the largest mills in Washington has gone so far as to install a type of light which shines a beam or mark right on the line where the shingle sawyer is to cut.

EARNINGS: Packers and sawyers are paid by piece work. Under the present scale, packers average close to 90¢ an hour and sawyers, according to ability, around $1.25 per hour. Filer's rate varies according to size of mill, ranging from $1.50 to $2 an hour. Minimum pay 62½¢. The average operating time is around 250 days per year, single-shift operation.

SEASONALITY: A flurry of snow stops a few mills occasionally; but, with a steady demand, the average Northwest shingle mill can operate the year round. Seasonal fluctuations in other parts of the country, due to the effects of weather on building, do, however, have their effect on shingle manufacture.

HAZARDS: In the old days, the shingle mill was one of the most hazardous of all industrial places to work. Many of the veteran sawyers, particularly, are minus 1 or 2 fingers. But accidents in recent years have not been numerous. There are safeguards on the big saw, on the springboard, and elsewhere in all mills. Most mills have safety committees and most districts have a safety commissioner, whose duty it is to look after possible hazards, especially during equipment alterations. The unceasing activity of the official inspectors of the Red Cedar Shingle Bureau (which includes 90% of the industry), in seeing that the product of various mills is up to specifications set by U. S. Bureau of Standards, also has a favorable influence on safety. This for the reason that machines which are properly set and operated will turn out standard shingles and vice versa.



PLYWOOD OCCUPATIONS

The plywood industry is notable for its research work, not only in glues, but in other phases of production such as strength-testing, increasing water-resistance, finding and testing new materials to improve the durability and quality of its product. To this end, it has established the Douglas Fir Plywood Association which maintains a research laboratory with a trained technical research staff. The Association also gathers and publishes statistics and deals with common problems involved in production, such as standardization of specifications, grade inspection and certification. The majority of Washington and Oregon plywood mills also maintain separate laboratories, or at least carry on independent research, for the purpose of controlling the uniformity of their products and for general investigating work. It is impossible to lay down a hard and fast combination of jobs in the industry, as some occupations overlap according to the size of the mills and the size and amount of their machinery.

Management

The supervisory personnel of a plywood mill is like that of most other factories. As a rule, a president and vice-president are the active managers. But the functions of these officers vary with different mills and the active management may or may not rest with the ranking officers. Some times the president also serves as general manager. As a rule, but not invariably, the vice-president has charge of sales and has under him a varied number of salesmen. Some mills have a secretary-treasurer whose assistants may include, besides stenographers, a purchasing agent, one or more bookkeepers, one or two timekeepers, a draftsman, and possibly an engineer. The typical office set-up is a conventional one consisting of a switch-board operator, stenographers, shipping clerks, bookkeepers, and occasionally a statistician or two, and here and there a traffic expert.

Production

In the mill proper, the general factory superintendent (or general foreman) is the man who supervises manufacturing operations. Directly under him come the foremen in charge of various departments. The duties of these foremen vary in scope with different mills. Sometimes, for instance, the patching as well as the drying is under the Drying Foreman; and sometimes one man has charge of all departments from the veneer department to saws, and another from saws to freight cars.

HE MUST KNOW LOGS

The log buyer serves an important function in a plywood mill. He must first have had experience as a log scaler (or measurer). As a rule, he must work as an assistant log buyer before he can assume command. He must be thoroughly capable of grading logs (or blocks) correctly. The requirements of the veneer industry are such that many logs which might be graded No. 1 for or by a saw mill will not be useful to a plywood mill. "Peelers", for example, must have a solid heart. This so they can be gripped by the lathe, after they are cut into blocks, and rotated for peeling. They must be as free as possible from knots and pitch pockets. They must be of economical size, although minimum diameter is controlled by what the factory wants to produce at the time. To be really good, they must be soft grained. In sum, the log buyer must know logs inside and out. Generally, he has a log buyer's assistant who is being trained to succeed him.

Maintenance Crew

Consists of the necessary electricians (sometimes 3 in number), and 1 or 2 pipe fitters, a welder, a machinist, and a mill wright, who is apt to be foreman of this crew. They are all skilled and their job is to handle the necessary repair work and also the new construction and installation work incidental to running a good sized factory.

Pond Crew

Generally, the Pond Crew consists of a group of 4 to 8 men whose job is to cut the peeler logs into veneer blocks (from 6, 8, 10, to 12 feet in length, dependent upon the length of the panel desired) and sluice them to a point where the crane can pick them up. The cutting is done with a Drag Saw, whose operator has to be of reasonably high skill. The Foreman of this crew is apt to be a worker-foreman; he may be the Sawyer. He gets his orders from the General Foreman, but in some plants the lathe foreman is the only foreman over the Pond Crew.

Cranes

What the Crane men do, besides lifting blocks into the mill and setting them on barkers and lathes, depends on the mill. As a rule, there are 2, both skilled. They are responsible for crane operation and one may help the log barker, or lathe operator. Another may move finished loads.

Barkers, Lathe Crew & Clipper Crew

1 Foreman, generally.

1 Barker, a skilled man who runs the barking machine and removes bark from veneer blocks. He frequently has an assistant who helps put blocks on the barker.

Lathe Crew: Usually 3 men, including a skilled lathe operator, general assistant, and a table man. The latter controls the conveyor trays. Among other duties, such as cleaning up around lathe and barker machines, the Assistant sees that sheets travel down the table without bunching up. There may be another laborer who saws the blocks that are left (centers of logs remaining after peeling has proceeded as far as practicable) up into chunks for fuel wood.

Clipper Crew: 1 Clipper Operator, skilled, for each Clipping machine (and some mills have 3) operates "guillotine-like" cutter which clips veneer sheets into desired lengths, cuts out pitch pockets and other defects. Must be able to judge quickly the best way to cut out these defects with the greatest efficiency. 1 Spotter, grades veneer into clipper. Common laborer, but must be active and alert.

5 to 10 Clipper Off-bearers pull clipped veneer off tables onto trucks segregated according to size. Women are sometimes used in this operation.

Dryer Crew

Drying is an exacting operation as the moisture content in veneer must be reduced to a definite percentage and the uniformity of drying has a positive relation to quality and success in gluing. The average dryer crew consists of a Foreman, 2 or 3 Dryers, 2 or 3 Dryer Feeders, depending upon the size of the dryer, who must be laborers of exceptional manual dexterity, to keep the dryer sections filled. May be women.

1 Grader who marks grades on veneer sheets as they come down conveyor belts on to table.

3 or 4 Dryer Off-bearers take veneer from discharge end of Dryer, sort, and pile on trucks. Men or women.

Patching Crew

Sometimes this work is done under the Dryer Foreman; sometimes gluing foreman. In the largest of mills there are 2 patching tables. But the average mill has 1 skilled patcher, operating machine which cuts out defects, with 2 workers setting the patching; and in another place a man operating a machine which makes the patches.

Dry Clipper

For odd clipping jobs where it is desired to change the size of a bundle of veneer sheets or where, as a routine matter, some sheets need to be straightened or re-clipped. There may be a skilled clipper operator in charge. There is usually a dry clipper off-bearer (man or woman) but not always.

Some plants have a skilled man in the mill whose job it is to see the dryers run the veneer required for the orders he receives from the office. He may have an assistant or two to figure footage and put up orders. In one place, they are called the "write-up" staff.

Taping Department

The average mill has 1 or 2 taping machines. (The narrow strips, obtained in the process of cutting lower grades or sheets of veneer for use as cores or cross bands, are fastened together by strips of paper or cloth, usually by machine. The operator of such a machine is generally a common laborer.) There may be a skilled grader, who sees that grains match so that strips of veneer when taped together make a perfect sheet, and an off-bearer (man or woman) who sorts taped veneer and piles it into the different grades. Common labor. In finishing, the tape is removed.

Glue-spreader Crew

Consists of a glue foreman who will take care of orders, see that machines are in good working order, etc.

1 Core Feeder who feeds the cores (center sheets of plywood panel) through the glue spreader rolls;

1 Core Layer, who takes the core after it comes through the rolls and lays it carefully in place. Skilled man and apt to be in direct charge of glue machine.

1 Core Sawyer cuts core to desired length.

1 Core Rustler, as a rule. He sees that machine feeder is supplied with core. And may rustle other stock.

1 Press Man who controls the press. May have an assistant who sets retaining boards on top of panel piles, sets cauls to insure uniformity of pressure and to adjust clamps. Pushes loads into press.

1 Crane Man. At this point there is a crane man who carries loads to storage where they are stacked and dried 8 hours or more. He may have 2 assistants who are called "crane monkeys", who climb up and down stacks and hitch and unhitch crane hooks to loads.

Finishing Department

1 Foreman

2 Break-down Laborers who take the irons off packages. Glue seeps out of edges of panels while in press and almost invariably causes them to stick together. These men break them apart and must keep up with saws.

1 Rip Sawyer -- "skins" or trims the panels on the long edges to size. Must be skilled operator who can set up saws and change set-up accurately for different sizes.

1 Cut-Off Sawyer -- trims or straight-edges ends of panels to size. Must be skilled operator who can set up saws and change settings accurately for different sizes.

3 -- 4 Patchers who patch and shim or fill seams and checks. In some cases, there is a hand patcher (called chisel patcher) who uses chisel to cut patches.

Sander Crew

1 Foreman

1 Sander to each machine. Average plant has 3 machines.

1 -- 3 Sander Feeders

1 -- 3 Sander Off-bearers and Graders

1 -- 2 Belt Sander Men. Runs belt sander, which has sandpaper on endless belt and whose purpose is to touch up and sand any points which do not look good enough as panel comes from Main Sander. Usually lifts and piles himself.

Filing and Grinding

Usually 1 Head Filer, skilled.

1 Head Grinderman, skilled. Though Filer may have charge of grinding. In the average factory, they do not have assistants.

Warehouse

1 Foreman, though not in all factories.

Number in Warehouse crew varies.

Shipping

Approximately 6 car or truck loaders, some of whom also do blocking -- lock loads in place in box cars. All workers in this crew are as a rule familiar with grading all types of panels. But there is

1 Plywood Association Grader, who is independent of the mill management, at this point.

4 Bundlers, 1 in charge of other 3, to bundle a large percentage of plywood for protection in transit.

PLYWOOD MILL QUALIFICATIONS

EDUCATION:

The average worker does not have, and in a general sense does not need, anything beyond Grade School education. It can be seen from the foregoing that skilled and semi-skilled workers tend to far outnumber common laborers in a plywood factory. However, only in exceptional cases, such as laboratory work, is a college education required.

TRAINING:

The need for in-the-mill training, in various instances requiring rather extended apprenticeship, is another outstanding characteristic of plywood mill employment. Too, application and cooperation are cardinal virtues in manufacturing such a carefully fabricated wood product.

ADVANCEMENT:

Usually, if not invariably, comes from a minor post in one department to a more responsible post in the same department. Superior men, however, can rise to foremanship which may cover more than one department.

SEX:

There are a number of operations which are rather light such as, dry feeding, straightening veneer sheets, off-bearing veneer, helping with patches, and even core feeding, where women can and do find employment in plywood mills. However, a relatively small percentage of women are employed in Washington and Oregon mills. Of the mills reporting the number of their employees to the Washington Manufacturer's Association in 1937, 7 reported a total of 247 women employed. The largest number reported in any one factory was 130, and the next largest was 50.

RACE:

Plywood employees, in general, are Americans of many racial origins, with those of Scandinavian origin perhaps predominating. At one time there were quite a few Japanese, but that is no longer the case.

PHYSICAL & MISCELLANEOUS:

The plywood mill worker does not have to be as robust as the average worker in the lumber mill proper, but various jobs require a considerable degree of manual dexterity; e.g., running a clipper, which involves operating levers accurately, and at the glue spreader, where veneer is put through rapidly but carefully, and laying cores, which has to be done just right and is somewhat of a pace-setting operation.

TO BECOME SKILLED: (Length of Time)

Depends entirely upon the job but the average is from 6 months to a year.

WORKING CONDITIONS IN PLYWOOD MILLS

The president of the Douglas Fir Plywood Association, himself the general manager of 4 mills, is authority for the statement that "from the standpoint of an employee the plywood business is probably the most desirable of any branch of the lumber industry. The work is sheltered because it is all under cover. Opportunities are certainly going to be as great, if not greater, than any other branch of the lumber industry"..... Factories are well-lighted and ventilated. Working conditions are in general healthy and safe.

EARNINGS:

Base pay now 62½¢ an hour. Average wage, 79¢ an hour.

SEASONALITY:

There is one factor affecting steadiness of operation which is unique among all branches of the lumber industry, viz: plywood mills supply so many different kinds of businesses that when it is off-season for one type of user, there is usually another to take his place. Intensive laboratory research and engineering skill are other factors which have contributed not only to a wider but a steadier market.

HAZARDS:

Hazards are relatively few in a plywood mill. The saws and other machines are in general well safeguarded. The tables and benches are well-lighted. As a rule, there is a safety committee which looks out for the interest of the workers; and, in some factories, prizes have been awarded for safety suggestions. The State Department of Labor and Industries, in its Annual Reports, lumps box and furniture manufacturing with veneer making, so an official segregation of accidents is difficult to obtain. However, in the whole group only 4 fatal accidents were reported in 1935; and the total number of claims finally determined was 780.

SALES:

Plywood is sold through distributors -- jobbers, or wholesalers who concentrate stock in marketing centers. Thence it goes to the dealer; from dealer to contractor, and from contractor to builder. Or it may go direct to users from retailers. Within the past 2 years plywood companies on the West Coast formed an export association and now export through one company. This organization also operates warehouses in strategic points like Tacoma, Seattle, Portland, and these warehouses give employment to about 50 more men. The organization exports direct and also through independent operators. Packing for export requires special pains and skill, as sea-going cargoes are subject to rough handling. Also cargoes must be prepared on short notice; so mechanical bundling machines are used. We have seen how inspectors for the Douglas Fir Plywood Association form another, independent, group of specially selected and trained employees.

PULP MILL OCCUPATIONS

Ultra modern pulp mills, such as we have in Washington and Oregon, are not only safe and healthy places in which to work but, on the whole, exceptionally interesting factories. Both the mechanical and chemical processes require a high degree of skill and alertness as well as ability to follow orders. In talking with the technical and managerial experts of the industry -- and in studying trade literature -- one frequently encounters the word "control". And in pulp making control means more than authority; it means superintendence of the keenest order -- keeping a constant check on different steps of the process as well as coordinating the different departments. As one official put it, "one department being off a little can throw the whole mill a mile out of gear." Which explains why the ability to follow orders is one of the main requisites of holding the better class jobs in a pulp mill. This is not to say that working in a pulp mill is a case of making yourself an automaton, without thought or initiative; rather than that, it takes more judgment and more initiative than most manufacturing processes. But it also takes close cooperation and close attention to detail.

Most of the mills have clearly defined employment departments; one or two of the larger mills going so far as to have a highly trained personnel officer in charge of employment.

To give you a clear conception of how modern pulp mills are managed -- controlled for quality as well as for efficiency -- it is believed advisable to make a chart of the different supervisors and technicians. This chart will show you just how the different departments are coordinated, or tied together; and it will also show you to whom the various departmental workers as well as their direct superiors are responsible. This chart -- and the occupational breakdowns which follow it -- may be said to be representative of both sulphite and sulphate pulp mills in Washington and Oregon.

PULP MILL QUALIFICATIONS

EDUCATION:

In general, it can be said that a worker with a high school education can get as far as he wants to in the operating departments of a pulp mill. (Records from various mills show that the average worker has at least gone through grammar school.) In supervisory capacities, a high school education or better is virtually a necessity. The top officials, Managing Director, Technical Director, Chemist, General Superintendent, Resident Engineer and Plant Superintendent, among others, are almost invariably college graduates.

TRAINING:

In a pulp mill all jobs -- save only those in the Bull Gang which are common laborers -- are in the skilled or semi-skilled category and require definite training and experience. According to the best informed and most experienced superintendents in the trade, it takes at least a year for workers to become really expert. They advise that 96% of all jobs are skilled or technical.

ADVANCEMENT:

Comes in two ways: (1) from the common labor and odd jobs of the Bull Gang to different positions involving more responsibility and skill in the mill proper. Progress in the different mill departments is usually from the least particular or difficult jobs to the more skilled and particular and on to foreman or supervisor. Unless a man has exceptional ability or a particular desire to broaden his knowledge or skill, he is not apt to progress from one department to another.

SEX:

With the exception of stenographic and clerical positions in the office, pulp mill occupations are all filled by men. Some mills, making both pulp and paper, do employ women, however. In one of the largest Washington mills, the machines which turn out paper bags are all operated by women. A total in excess of 500 women employees was reported in the latest (1937) Directory of Washington State Products and Manufacturers. They were mainly paper workers.

AGE:

The average age in typical mills is around 38. Frequently men as old as 60 are employed because of the high value placed on experience.

PHYSICAL & MISCELLANEOUS:

With the exception of the wood breakdown department where the manual labor is as strenuous as that in a typical sawmill, and where strength as well as manual dexterity is required, physical requirements are not exceptionally high. When you recall, however, that a pulp mill is one of the most closely coordinated of industrial institutions, you understand the emphasis that is placed on the alertness which usually goes with good health and a first-class physique.

TO BECOME SKILLED:

Generally speaking, it takes six months to a year to "get over making mistakes" in the pulp business. That is, ordinary, routine mistakes. Inside of a year a man is expected to carry his job without regular instruction or close supervision.

WORKING CONDITIONS IN PULP MILLS

HOURS:

8 - hour shift, 40-hour week. There may be 3 shifts a day in a pulp mill.

EARNINGS:

62½¢ an hour minimum to $1.12 an hour for machine tenders. The head sawyer and filer, again among the highest paid workers, get around $1.25 an hour and up.

SEASONALITY:

Having a demand that is growing and which is not apt to vary greatly with different times of the year, pulp mills are very little given to seasonal fluctuations when business in general is good. In fact, many of the leading Northwest mills, which produce some of the finest pulp in the world, operate the year 'round when business warrants.

HAZARDS:

We have already seen that pulp mills are clean, well-lighted, healthful places in which to work. And, save in the wood-preparation department, there are few accidents and fatalities are rare. There is generally an employee's safety committee and safety work is carried on vigorously and consistently. It is rather general practice to give cash rewards each month for practical safety suggestions. Such rewards may run from $1 to $2.50 and $5. Some mills use a symbol, such as a white elephant, which is given to the department that has the highest accident record for that month. It is fair to say that most pulp mill accidents are caused by carelessness. Machines involving hazards are almost entirely safeguarded and everything is covered where practicable. The most accidents occur in the wood-preparation department where conditions change, of necessity, with the sizes of pieces. 1938 statistics covering pulp and paper mills together show that, while the industry is 35 to 40% larger in Washington than it was 3 years ago, accidents have been lowered 50% and the industry's state insurance rate has been cut in half in the same period. This is due to an organized and comprehensive safety campaign.

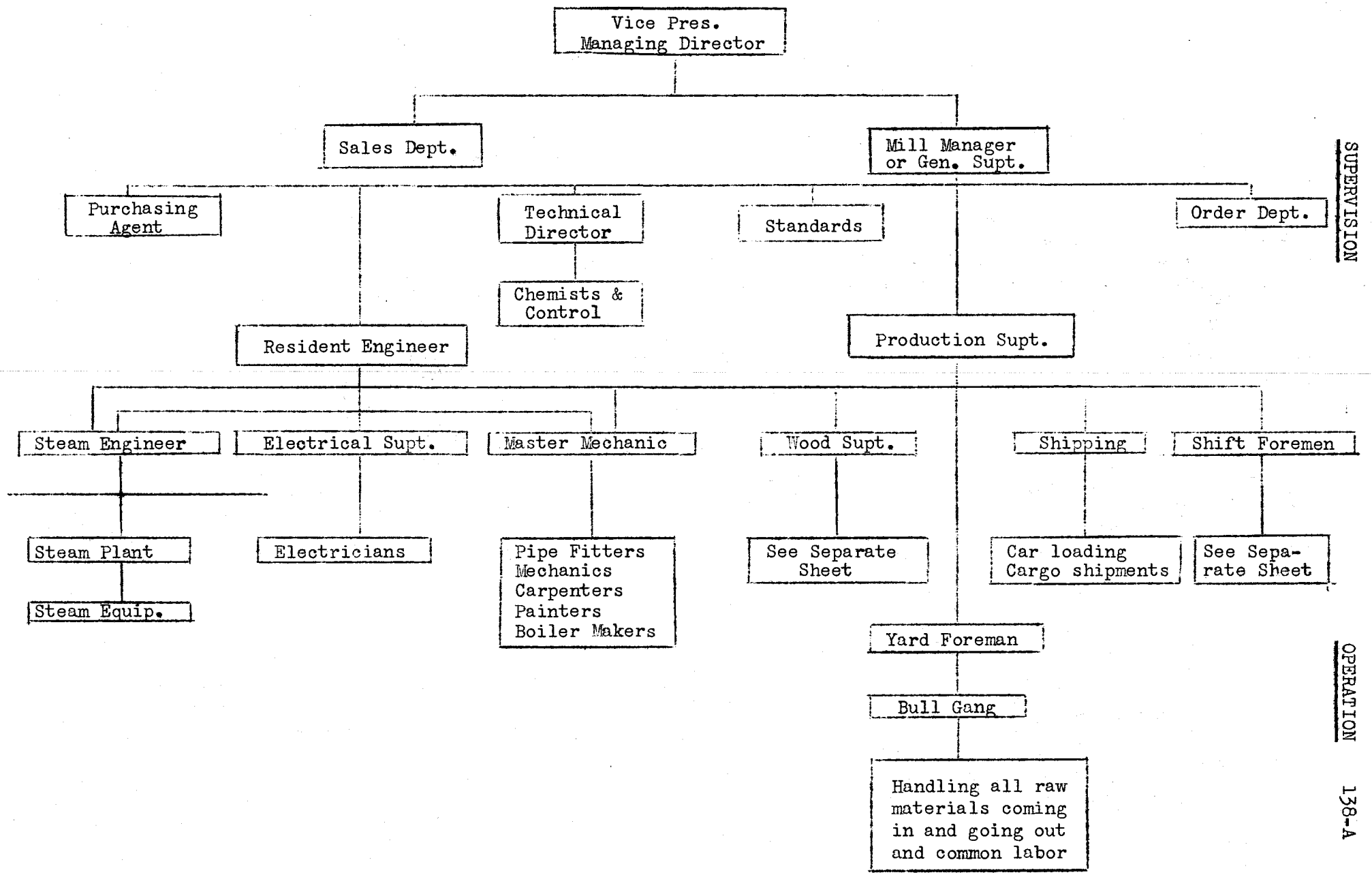
. . . . . .

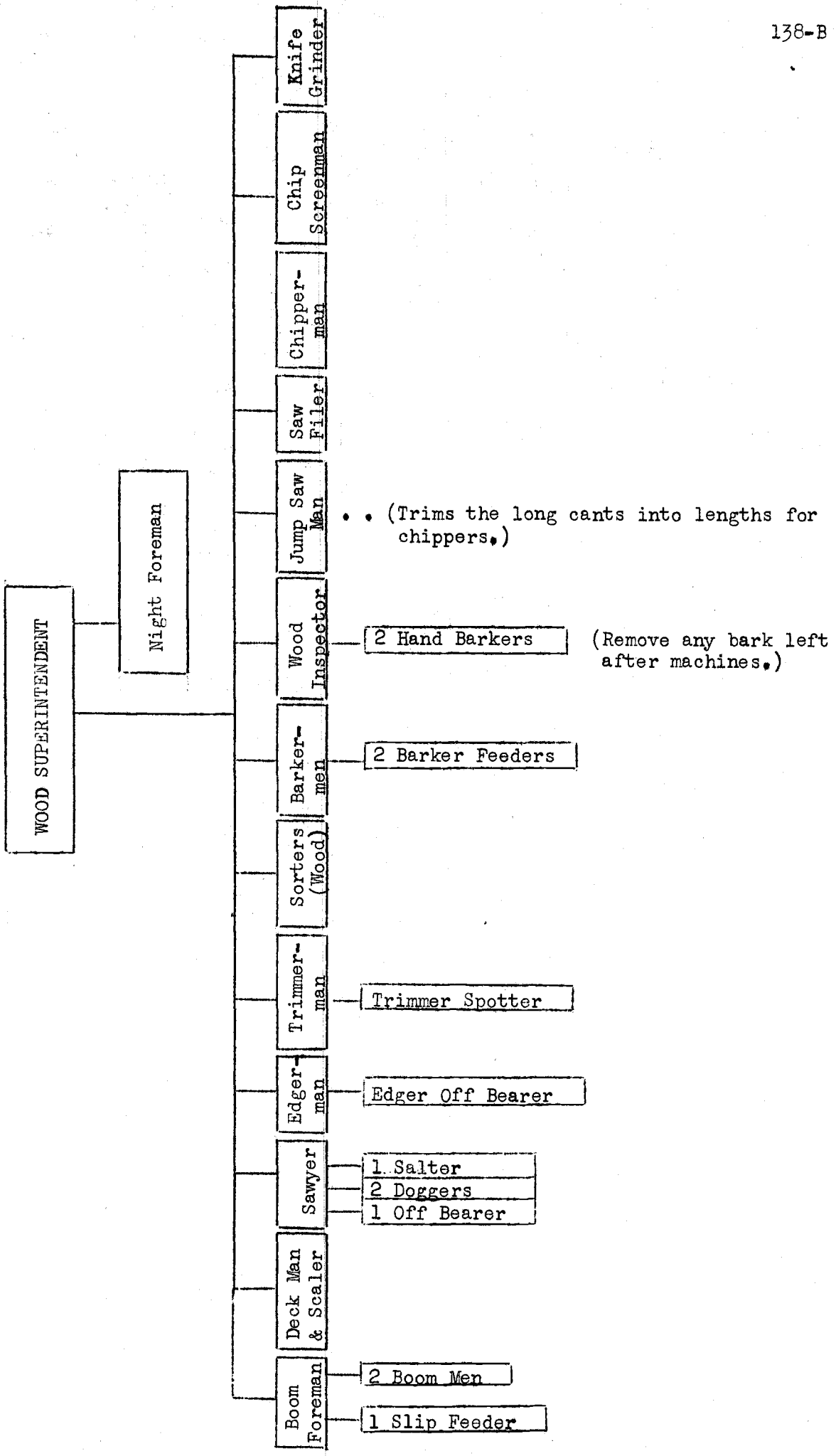
REGIONAL PERCENTAGES OF UNITED STATES WOOD PULP PRODUCTION *
Total and by Grades in 1934, 1935 and 1936

	SULPHITE			SULPHATE			GROUNDWOOD		
REGION	1934	1935	1936	1934	1935	1936	1934	1935	1936
New England	23%	24%	23.3%	0%			42%	41%	42.5%
Middle Atlantic	12%	13%	12.8%	0%	0%	4.5 %	18%	18%	21.5%
Lake States	25%	23%	23.3%	13%	17%	19.25%	20%	19½%	18.0%
South	4%	4%	2.6%	73½%	70%	66.25%	1%	2%	
West Coast	36%	36%	38.0%	13½%	13%	10.0 %	19%	19½%	18.0%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%

	TOTAL		
REGION	1934	1935	1936
New England	22%	21%	21.5%
Middle Atlantic	10%	10%	13.5%
Lake States	20%	20%	19.0%
South	25%	26%	24.5%
West Coast	23%	23%	22.0%
Total	100%	100%	100%

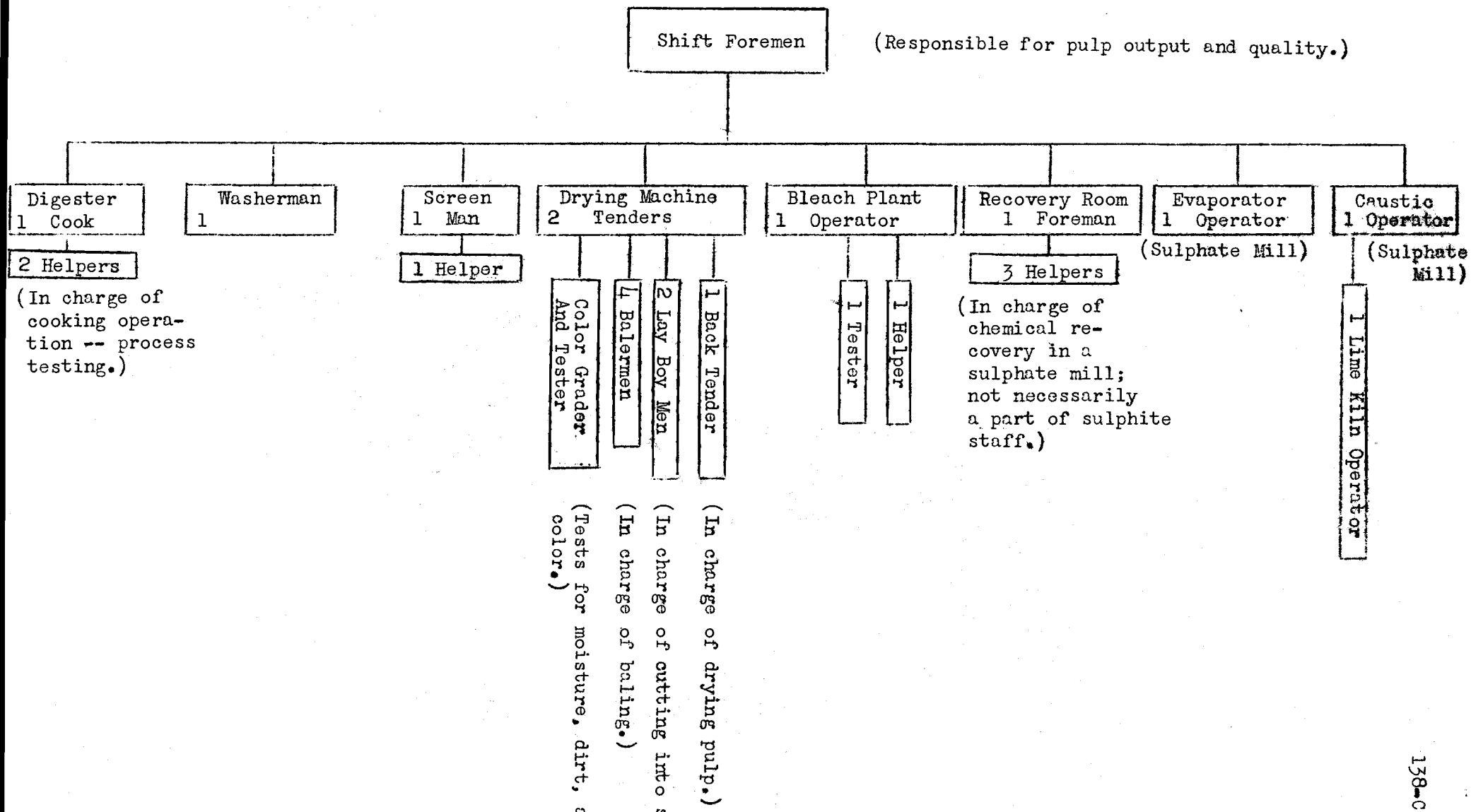
* ---from "Pacific Pulp & Paper Industry Annual", May, 1937.


Vice Pres.
Managing Director
Sales Dept.
Mill Manager
or Gen. Supt.
Purchasing
Agent
Technical
Director
Standards
Order Dept.
Chemists &
Control
Resident Engineer
Production Supt.
Steam Engineer
Electrical Supt.
Master Mechanic
Wood Supt.
Shipping
Shift Foremen
Steam Plant
Steam Equip.
Electricians
Pipe Fitters
Mechanics
Carpenters
Painters
Boiler Makers
See Separate
Sheet
Car loading
Cargo shipments
See Sepa-
rate Sheet
Yard Foreman
Bull Gang
Handling all raw
materials coming
in and going out
and common labor
SUPERVISION
OPERATION



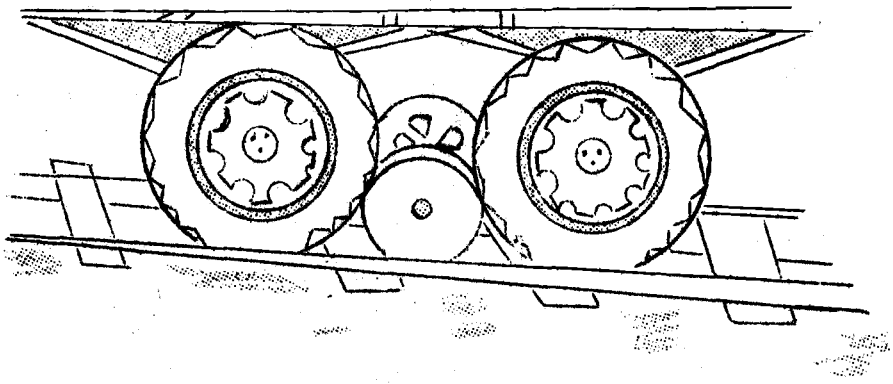
. . (Trims the long cants into lengths for chippers.)

(Remove any bark left after machines.)


Shift Foremen
(Responsible for pulp output and quality.)
Digester
1 Cook
2 Helpers
(In charge of cooking operation -- process testing.)
Washerman
1
Screen
1 Man
1 Helper
Drying Machine
2 Tenders
Color Grader And Tester
(Tests for moisture, dirt, and color.)
4 Balermen
(In charge of baling.)
2 Lay Boy Men
(In charge of cutting into sheets)
1 Back Tender
(In charge of drying pulp.)
Bleach Plant
1 Operator
1 Tester
1 Helper
Recovery Room
1 Foreman
3 Helpers
(In charge of chemical recovery in a sulphate mill; not necessarily a part of sulphite staff.)
Evaporator
1 Operator
(Sulphate Mill)
Caustic
1 Operator
(Sulphate Mill)
1 Lime Kiln Operator

CHAPTER IV

THE FUTURE



WOOD AND THE FUTURE

While the use of wood substitutes, changing styles and customs in industrial and housing standards, the passing of the era of agricultural expansion, trends toward more permanent forms of construction, the general depression in recent years and various other factors have caused changes and decreases in lumber consumption -- the student can find much of encouragement in the future of wood (and particularly Northwest wood) if he will take the trouble to look for it.

"Wood", as J. S. Illick reminds us, " is a material of such wide and universal use, owing to its workability, cheapness, durability, demand for purposes for which it is best suited."

MORE AND MORE TOWARD CONVERSION

What will those purposes be in a decade or a generation from now? In an age of great chemical achievement -- even magic, in some instances -- no man can answer arbitrarily. But, with new uses being constantly found for it, it is patent that wood will become more and more a material for conversion into other substances from which finished goods can be made.

Men like Axel H. Oxholm go as far as to say that the future of the North Pacific forest industries unquestionably lies in the chemical field. To this end, the logical (one might almost say, the inevitable) trend will be toward the uniting of lumber mills, pulp and paper mills, and various mills of secondary manufacture under common ownership.

To this end also, applied research covering the utilization of Northwest timber is bound to be intensified. The time is not far off, many authorities predict, when our forests will be looked upon as producers of cellulose and lignin; and the product in which these materials naturally appear -- WOOD -- will be far less directly used than it is today. When that time comes, forest practices will have been sufficiently improved and coordinated to insure the establishment of successive crops of timber -- several "harvests" to a generation, even.

As we have seen, the plywood, cellulose, paper and plastics industries involve chemical wood uses that hold great possiblities. It has already been demonstrated that such items as rayon, cellophane, linoleum, bakelite, shatter-proof glass, pyrolixin (or imitation ivory), celluloid, "hard rubber", billiard balls, creosote, paint, alcohol, dynamite, and other products may be made profitably of wood. Motor fuels, oils, sugar and cow feed can be made from wood, as Germany has demonstrated. Yeast is a by-product of pulp manufacture.

MANY POSSIBILITIES

"In view of our immense water power possibilities, and our ocean transportation," says George E. Griffith in "Green Gold", the "paper, cellulose and plastics industries hold promise of great development here.

The Pacific Northwest can support a much greater population if the remanufacture of wood products can be located here. Many payroll dollars are lost to this territory through the practice of shipping out raw lumber, logs, and pulp to be manufactured elsewhere."

In the plywood division new ideas, new methods and improvements have so expanded the field for this fabricated wood product that output in 1935 registered a 350% increase over 1925; and the last five years of that period were conspicuous for low-construction activity. In the field of plastics -- molded products made in large part of wood flour and another wood product, resin -- developments are not only rapid but are expected to be of paramount importance in the early future.

HOUSES AND FENDERS OF PLASTICS

Wood flour men are looking forward to the day when whole houses will be built of plastics, with molded art panels in various colors and shingles that will last forever without paint. They even expect to make automobile fenders -- one of the most difficult parts of a car to shape in metal -- of this highly "workable" material.

But, getting back to the lumber business proper, supplying low-cost houses is one of the great economic problems of America which looks to wood for its solution. Architects and other authorities in this field recognize that a good small home, if it is to be a reasonably low-cost home, must be constructed of wood. The wood home is an American tradition.

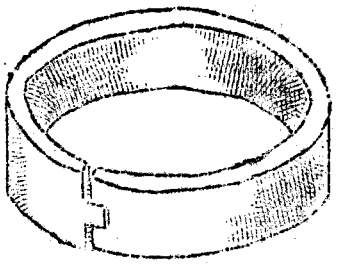
LOW COST HOUSING THE NEXT FRONTIER

So, the next frontier, in the opinion of hard-headed business men as well as economists, is going to be low-cost housing -- housing people who cannot afford the kind of houses it has been our habit to build. President Larsen, of the West Coast Lumbermen's Association, retiring from office early in 1938, said that the previous average cost of a home in America has been around $4500; whereas, there are 25 million families which would like a home of their own but cannot afford over $2500. He added that 80% of the home building in 1937 was of lumber, but that 90% of the homes built in the $1000 to $1800 salary class were of lumber. The average lumber dealer does practically all his business in the $5000 to $6000 house class; and there will be a great deal of business and prosperity for him -- and many other lines of endeavor -- when the low cost housing program gathers the momentum there is every reason to expect of it.

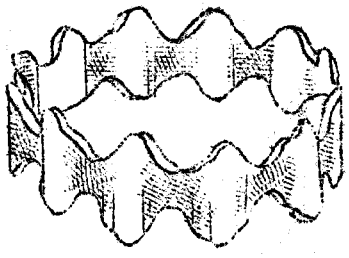
By way of suggestion and in the interests of attractiveness and convenience, as well as serviceableness and economy, the National Lumber Manufacturers' Association is promulgating and demonstrating the feasibility of 8 designs for low-cost houses -- and doing it with the active cooperation of the equipment and material industries.

TREATING TO INCREASE DEMAND

One of the most interesting developments is in the treatment of wood for durability and fire-resistance. A decade ago, experts said that when a satisfactory and inexpensive method of treating wood to make it fire-proof or fire-resistant was found, demand for wood would increase enormously. Now many salts are effective for this purpose, singly or in combination; and, with returning prosperity, that demand should make itself felt in many ways.



Split Ring Connector



Toothed Ring Connector

Shear Plate Connector

Above Left: Split Ring Connector. A split ring connector is a smooth ring of steel with a tongue and grooved break or "split" which increases its load capacity. Split rings transmit loads when placed in pre-cut grooves in the faces of adjoining timbers.

Center: Toothed Ring Connector. A toothed-ring connector is a ring of sixteen gauge hot-rolled steel, ribbed to guard against lateral bending, with sharpened teeth on each edge. These rings, imbedded half their depth in the contacting surfaces of adjacent timbers, transmit loads from member to member.

Right: Shear Plate. Shear-plate connectors are designed to transmit loads from wood to steel, or vice-versa.

Source: "WOOD -- Its Characteristics and Uses", West Coast Lumbermen's Association, Seattle, Washington.

Another interesting and highly important development -- which has already provided an increasing use of wood in highway bridges, roof-trusses, radio towers, oil well derricks and similar structures -- is in the realm of timber engineering. In this connection, timber connectors and other devices, long used successfully and economically in Europe, have recently been introduced in this country with a success that promises much for the future.

WHAT TIMBER CONNECTORS MEAN

Timber connectors are of three kinds: the split ring type, the toothed ring connector, and the shear plate connector. A split ring connector is a smooth ring of steel with a tongue and groove break or "split" which increases the load capacity. Split rings transmit loads when placed in pre-cut grooves in the faces of adjoining timbers. A toothed ring connector is a ring of 60-gauge, hot-rolled steel, ribbed to guard against lateral bending, with sharpened teeth on each edge. These rings imbedded half their depth in the contacting surfaces of adjacent timbers, transmit loads from member to member. Shear plate connectors are designed to transmit loads from wood to steel, or vice-versa.

Devices such as these strengthen wood construction (in highway bridges, roof trusses, radio towers, oil well derricks, etc.) from 200 to 1000% at the joints -- so it is not hard to appreciate why they have enabled wood to replace steel in many important markets.

Using ring connectors, and applying composite wood and concrete slab beams to the deck and stringers, two outstanding bridges have recently been built at Port Angeles, Washington, each 800 feet in length and 100 feet above the ground at the highest point. They are so completely integrated (brought together) that any one member, even to a stringer under the concrete slab, can be removed and replaced without disturbing other members -- structures of durability through any probable useful life, because of the creosote treatment of the timbers, but actually as permanent as ever may be required, because of the replaceability of individual members.

WHEREIN WOOD IS UNIQUE

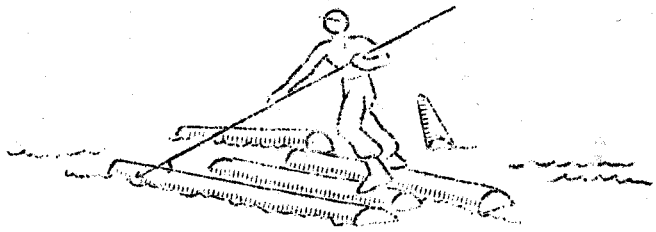
So while the future may see a decline of lumber, as it is now known, the prospect is that forest utilization will actually grow (and grow enormously). Eternally producible wood -- our one basic material which is replaceable (growable) -- so far from giving way to substitutes, may well become the universal substitute to piece out the dwindling supplies of our non-organic materials such as minerals....as we observed at the outset of this study.

THE END

TOPICS FOR DISCUSSION

1. Give some peculiarities, or typical characteristics, of the lumber industry as a field for employment.
2. What job is the most hazardous and among the best paid in a logging crew?
3. Name some of the different kinds of engineers employed in logging.
4. How does a log scaler measure the contents of a log?
5. Where does blasting fit in the logging process?
6. Give some qualifications of work around skidding apparatus.
7. What two abilities are particularly useful in logging?
8. Name two of the best paid and key jobs in sawmills.
9. Why is experience so valuable in certain sawmill operations?
10. Where is the biggest opportunity in shingle manufacture?
11. Why is a log buyer's job so important in plywood manufacture?
12. Why is such a high percentage of labor in plywood mills skilled or semi-skilled?
13. Why does the work in pulp mills have to be so closely coordinated?
14. What do experts believe the next great trend will be in lumber manufacture?
15. What has been called "the next frontier?"
16. What are timber connectors? And why are they important?
17. Wherein is wood unique as regards the future?

CHAPTER V



LABOR ORGANIZATIONS

Workers in all branches of the industry are organized. Non-union camps and mills are rare. Both American Federation of Labor and Congress of Industrial Organizations unions are in the field. To estimate numbers in the two organizations is very difficult, not only because of conflicting claims, but because of shifts, in both directions, of considerable bodies of workers. This process was still going on as of February 1, 1939. The net result to date is uncertain and the final outcome cannot be predicted.

Wage scales and working conditions, which vary greatly with locality and type of operation, are covered in the foregoing sections.

Much valuable information concerning labor relations in the lumber industry is contained in "Trees and Men", Pages 117 to 127, inclusive. This work is a 1938 publication of the Division of Education and Recreation, Works Progress Administration, State of Washington.

APPENDIX

COMPLETE CLASSIFICATION OF LUMBER AND ITS REMANUFACTURES

The following alphabetical breakdown shows all classifications of Lumber and its Remanufactures in the State of Washington. In various instances, one company makes two or more products; as, e. g. of the six companies making barrels, five also make cooperage (or barrel making) stock. Obviously, a detailed analysis of the multitudinous manufacturing processes is out of the question.

However, it can be said that virtually all these concerns use turning, shaping, and finishing machines which are similar in character, while varying in detail, according to requirements. Also, women play a far larger part in remanufacturing -- particularly in box and veneer works -- than they do in lumber proper. The last official state report, made in 1934 when such a record was discontinued, showed 977,474 woman hours in Class 29 (cooperage, sash and door, box and veneer, and furniture manufacturing), 927,700 of which hours were worked in the box and veneer divisions.

WOMEN PLAY LARGER PART

ALPEN-STOCKS
2 Seattle

ARBORS
1 Seattle

ARMS -- CROSS
2 Centralia
2 Tacoma
2 Bellingham
1 Chehalis
1 Doty
1 Fortson
1 Everett
1 Merville

BALUSTERS -- WOOD
2 Tacoma

BARRELS
2 Spokane
2 Seattle
1 Tacoma
1 Everett

BARRELS -- PLYWOOD
1 Olympia

BARS -- CLOTHES DRYING
1 Kent

BASKETS -- APPLE
1 Puyallup

BASKETS -- BERRY -- GRAPE
1 Puyallup

BASKETS -- FLOUR
1 Seattle

BASKETS -- RATTAN
2 Seattle
1 Eatonville

BEARINGS -- WOOD
1 Seattle

BEDS -- WALL
1 Tacoma

BEDS -- WOODEN -- UNFINISHED
1 Seattle

BENCHES -- GARDEN OR LAWN
1 Aberdeen

BLEACHERS -- PORTABLE
1 Seattle

BLOCKS -- MATCH
4 Spokane

BLOCKS -- PAVING -- WOODEN -- CREOSOTED
1 Seattle

BLOCKS -- VENEER
1 South Bend

BOARDS -- AUTO. FLOOR
1 McCleary
1 Shelton
1 Everett
1 Vancouver
1 Sumner

BOARDS -- IRONING
1 Auburn
1 Kent
1 Hoquiam
1 Garfield

BOARDS -- IRONING -- BUILT-IN
1 Seattle
1 Spokane

BOARDS -- ORGAN REED -- PIANO SOUNDING
1 Hoquiam

BOARDS -- PACK
3 Seattle

BOARDS -- SLEEVE
1 Kent

BOATS -- (including plain boats, ferry, fish, knock-down, life, motor and row boats)
17 Seattle
3 Gig Harbor
3 Tacoma
2 Bellingham
2 Spokane

BOATS -- (including plain boats, ferry, fish, knock-down, life, motor and row boats) (cont.)
1 Vancouver
1 Hoquiam
1 Everett
1 Lakeview
1 Lakeside
1 Chelan
1 Houghton
1 Marysville
1 Centralia
1 Spokane
1 Olympia

BOLTS -- SHINGLE
1 Hoquiam
1 Markham

BOOKCASES (under Furniture)

BOOMS -- CARGO
1 Seattle

BOX MATERIAL -- BERRIES (under Veneer)

BOXES -- CIGAR
1 Tacoma
1 Seattle

BOXES -- FLOWER
2 Seattle

BOXES -- FRUIT
1 Brewster
1 Chelan
1 Wenatchee
1 Raymond
1 Tacoma
1 Puyallup
1 Entiat

BOXES -- LEMON (under Wooden Boxes)

BOXES -- ORANGE (under Wooden Boxes)

BOXES -- WOODEN
7 Spokane
5 Seattle
4 Goldendale
4 Wenatchee
3 Tacoma
3 Anacortes
3 Colville

BOXES -- WOODEN (cont.)
2 Bellingham
2 Puyallup
2 Yakima
2 Aberdeen
2 Port Angeles
2 Brewster
2 Lyle
1 Gig Harbor
1 Omak
1 Easton
1 Copalis
1 Deer Park
1 Ellensburg
1 Lincoln
1 Twisp
1 Gilmer
1 Winesap
1 Malott
1 Ardenvoir
1 Everett
1 Illwaco
1 Junction City
1 Dishman
1 Laurier
1 Garfield
1 Cle Elum
1 Gertrude
1 Trout Lake
1 Bordeaux
1 Klickitat
1 White Salmon
1 Raymond
1 Peshastin
1 Carlton
1 Cashmere
1 Tonasket
1 Wahkiacus
1 Clarkston
1 Okanogan
1 Enumclaw
1 Oroville

BOXES -- WOODEN -- REBUILT
1 Seattle

BRACKETS -- CURTAIN POLE
1 Seattle

BRICK -- IMITATION
1 Aberdeen

BRIQUETS -- SAWDUST
1 Longview

BUCKLES -- WOOD
1 Seattle

BUFFETS -- (under Furniture)

BUILDINGS -- PORTABLE
2 Seattle
1 Hoquiam
1 Chehalis
1 Tumwater

BUILDINGS -- READY CUT
3 Seattle
1 Aberdeen
1 Spokane

BUNGS
1 Seattle

BUTTONS -- WOOD
1 Aberdeen
1 Seattle

BUTTS
1 Bellingham

CABINET WORK
25 Seattle
10 Spokane
7 Tacoma
5 Everett
4 Yakima
2 Okanogan
2 Aberdeen
2 Vancouver
2 Ellensburg
2 Sunnyside
2 Hoquiam
2 Montesano
1 Prosser
1 Rosalia
1 Dayton
1 Edmonds
1 Kelso
1 Pasco
1 Ephrata
1 Wenatchee
1 Colville
1 Puyallup
1 Pullman
1 Olympia
1 Gig Harbor
1 Kirkland
1 Walla Walla
1 Mt. Vernon
1 Marysville
1 Centralia
1 Oakesdale
1 Toppenish
1 Kennewick

CABINET WORK (cont.)
1 Bellingham

CABINETS -- DETAIL
1 Seattle
1 Spokane

CABINETS -- ICE CREAM
1 Seattle
1 Tacoma
1 Spokane

CABINETS -- KITCHEN
1 Marysville

CABINETS -- RADIO
2 Seattle
1 Spokane
1 Tacoma

CABINETS -- SEWING
1 Olympia

CABINETS -- MEDICINE
2 Seattle
1 Spokane

CANOES
1 Seattle
1 Tacoma

CAR MATERIAL -- WOOD
1 Winlock

CARVINGS -- WOODEN
1 Tacoma

CASES -- EGG
1 Everett
1 Seattle

CASES -- MILK BOTTLE --WOODEN
1 Seattle

CASES -- PACKING -- REBUILT
1 Seattle

CASING & BASE
1 Tacoma

CASKETS
3 Everett
2 Tacoma
2 Seattle
1 Spokane

CASTER CUPS
1 Seattle

CHAIRS -- HOUSEHOLD
7 Tacoma
4 Seattle
1 Hoquiam
1 Spokane

CHAIRS -- FOLDING
1 Auburn

CHAIRS -- CANVAS -- FOLDING
1 Auburn

CHAIRS -- KITCHEN
1 Seattle
1 Tacoma

CHAIRS -- SWIVEL
1 Tacoma

CHAIRS -- WHEEL
1 Seattle

CHESTS -- CEDAR
1 Tacoma
1 Vancouver
1 Olympia
1 Spokane

CHESTS -- DRIFTWOOD
1 Seattle

COLUMNS
2 Tacoma
1 Edmonds
1 Everett
1 Seattle

COLUMNS -- PORCH
1 Tacoma

CONDUITS
2 Tacoma

CONDUITS -- WOOD -- CREOSOTE
1 Chehalis
1 Seattle

COOPERAGE
2 Seattle
2 Spokane
1 Everett

CORES -- PAPER
1 Vancouver

COUNTERS
2 Spokane

COVERS -- UNITIZED
1 Raymond

CRATES -- DOG (for Autos)
1 Seattle

CRATES -- REBUILT
1 Seattle

CRATES -- WOODEN
3 Seattle
2 Tacoma
2 Puyallup
2 Goldendale
1 Kent
1 Raymond
1 Kelso
1 Lyle

CRATING
1 Everett
1 Seattle
1 Puyallup

CYLINDERS -- WOOD
1 Seattle

DECOYS -- GAME
1 Tacoma
1 Seattle

DESKS
1 Seattle

DOORS
17 Tacoma
9 Seattle
6 Spokane
4 Hoquiam
4 Everett
3 Bellingham
2 Wenatchee
1 Omak
1 Kelso
1 Vancouver
1 Ellensburg
1 Puyallup
1 Olympia
1 Kirkland
1 McCleary

DOORS (cont.)
1 Port Angeles
1 Montesano
1 Peshastin
1 Marysville
1 Snoqualmie Falls
1 Clarkston

DOORS -- DETAIL
1 Seattle

DOWELS
2 Tacoma
1 Seattle

DRUMS -- COFFEE
1 Seattle

EGG CASE STOCK
(see Veneer)

EQUIPMENT -- PLAYGROUND -- WOOD
1 Seattle

EXCELSIOR
2 Spokane
2 Seattle
1 Tacoma

FENCES -- WOODEN
2 Seattle
1 Vancouver
1 Aberdeen

FIBRE -- FURNITURE MAKING
1 Seattle

FIXTURES -- BANK, STORE & OFFICE
8 Seattle
5 Tacoma
2 Spokane
2 Vancouver
2 Everett
1 Edmonds
1 Cashmere
1 Centralia
1 Pullman
1 Clarkston

FIXTURES -- BUILT-IN
3 Seattle
1 Spokane
1 Vancouver

FIXTURES -- CURTAIN POLE
1 Seattle

FLAGPOLES
1 Seattle
1 Winlock

FLOUR -- WOOD
2 Tacoma

FLUMES -- WOOD
1 Seattle
1 Tacoma

FORKS -- WOODEN
1 Seattle

FRAMES -- DAVENPORT
1 Tacoma
1 Seattle

FRAMES -- DETAIL
1 Seattle

FRAMES -- LUMBER
7 Spokane
4 Seattle
3 Tacoma
2 Everett
2 Bellingham
1 Deer Park
1 Arlington
1 Kennewick
1 Wenatchee

FRAMES -- PICTURE
1 Spokane
1 Vancouver
1 Seattle

FURNITURE
21 Seattle
12 Tacoma
1 Bellingham
1 Bremerton
1 Hoquiam
1 Cashmere
1 Aberdeen

FURNITURE -- BEDROOM
5 Seattle
4 Tacoma
1 Spokane

FURNITURE -- CAMP
2 Seattle

FURNITURE -- CHURCH
1 Seattle

FURNITURE -- DINING ROOM
3 Seattle
2 Tacoma
1 Spokane

FURNITURE -- FIBRE
1 Tacoma

FURNITURE -- GARDEN
2 Seattle
1 Aberdeen

FURNITURE -- JUVENILE
2 Seattle
1 Tacoma
1 Spokane

FURNITURE -- KITCHEN
2 Seattle
2 Spokane
1 Tacoma

FURNITURE -- LIVING ROOM
4 Tacoma
1 Seattle
1 Spokane

FURNITURE -- PERIOD
1 Cashmere

FURNITURE -- PORCH
1 Seattle

FURNITURE -- REED
2 Seattle

FURNITURE -- TOY
(See Toys)

FURNITURE -- UNFINISHED
2 Seattle
1 Bellingham
1 Vancouver

FURNITURE -- UPHOLSTERED
8 Tacoma
7 Seattle
3 Spokane
1 Aberdeen

FURNITURE PADS
1 Seattle

GARAGES -- READY CUT
2 Seattle
1 Aberdeen
1 Auburn

GARDENWARE
1 Aberdeen

GATEWAYS
1 Seattle
1 Aberdeen

GAUGES -- GAS
1 Seattle

GAVELS
1 Tacoma

HANDLES -- BROOM
1 Tacoma
1 Montesano
1 Winlock

HANDLES -- MOP
1 Tacoma

HANGERS -- GARMENT
1 Vancouver

HOUSES -- PORTABLE
(See Buildings--Portable)

HOUSES -- READY-CUT
(See Buildings--Portable)

HUMIDORS
1 Seattle

JAP BOLTS
1 Stearnsville
1 South Bend

JEWELRY -- WOODEN
1 Cosmopolis

KEGS
1 Tacoma
1 Spokane
1 Seattle

KENNELS -- DOG
1 Aberdeen

KITS
1 Aberdeen

KNEES -- SHIP
1 Winlock

LADDERS
1 Yakima
1 Kent

LADDERS (cont.)
1 Kennewick
1 Seattle

LADDERS -- EXTENSION
1 Kent
1 Seattle

LADDERS -- ORCHARD
2 Yakima
1 Kennewick
1 Wenatchee
1 Seattle

LAMPS -- READING
1 Tacoma
1 Seattle

LATH
8 Tacoma
5 Everett
4 Aberdeen
2 Winlock
2 Seattle
1 Bellingham
1 Fairfax
1 Onalaska
1 Yakima
1 Deer Park
1 Hoquiam
1 Yelm
1 Ardenvoir
1 Newport
1 Dishman
1 Longview
1 Spokane
1 McKenna
1 Anacortes
1 Klickitat
1 Oak Harbor
1 Ione
1 Colville
1 Montesano
1 Snoqualmie Falls
1 Kapowsin
1 Okanogan
1 Walla Walla
1 Raymond

LATTICE
1 Seattle

LUMBER -- REMANUFACTURED
1 Spokane

LUMBER -- SHIP & BOAT
1 Everett

MASTS
1 Aberdeen
1 Winlock
1 Seattle

MILL WORK
13 Tacoma
13 Seattle
9 Spokane
4 Hoquiam
3 Vancouver
3 Everett
3 Wenatchee
2 Yakima
2 Olympia
2 Ellensburg
2 Centralia
2 Walla Walla
1 Kelso
1 Longview
1 Port Angeles
1 Enumclaw
1 Chehalis
1 Pullman
1 Garfield
1 Renton
1 Toppenish
1 Dayton
1 College Place

MOLDS -- BUTTER
1 Yakima
1 Kent

MOLDINGS
10 Spokane
5 Seattle
4 Tacoma
3 Aberdeen
3 Everett
2 Bellingham
2 Wenatchee
1 Deer Park
1 Molson
1 Chewelah
1 Peshastin
1 Fairfield
1 Clarkston
1 Olympia

NOVELTIES -- WOOD
3 Seattle
2 Tacoma
1 Hoquiam
1 Marysville
1 Wenatchee

OARS
1 Tacoma

PACKING -- PERFECTED WOOD
1 Spokane

PADDLES
1 Tacoma

PADS -- FRUIT & EGG CASE
1 Seattle

PADS -- PACKING
2 Seattle

PAILS -- WOODEN
1 Tacoma
1 Spokane
1 Aberdeen

PANELS -- FIR
1 Vancouver

PANELS -- PLYWOOD
4 Tacoma
2 Seattle
2 Everett
1 Olympia

PERGOLAS
1 Aberdeen
1 Seattle

PEWS
1 Seattle

PICKETS
1 Tacoma
1 Seattle
1 Everett
1 Aberdeen
1 Ione

PILING
2 Everett
1 Tacoma
1 Spokane
1 Aloha
1 Colville
1 Centralia
1 Seabeck
1 Ione
1 Lyman
1 Cook
1 Yardley

PILING -- CEDAR
1 Tacoma
1 Everett
1 Colville

PILING -- CREOSOTED
1 Seattle

PILING -- FIR
1 Tacoma
1 Everett

PIPE -- CULVERT, WOOD
1 Seattle

PIPE -- DRAINAGE, WOOD
1 Seattle

PIPE -- IRRIGATION, WOOD
1 Seattle

PIPE -- SEWER, WOOD
1 Seattle

PIPE -- WOODEN
1 Tacoma
1 Seattle
1 Bellingham

PIPE -- WOODEN -- CREOSOTED
2 Seattle
1 Tacoma

PLANKS
1 Bremerton
1 Arlington

PLAYHOUSES
1 Arlington
1 Seattle

PLYWOOD
3 Olympia
2 Tacoma
2 Everett
2 Seattle
1 Aberdeen
1 Hoquiam
1 Longview
1 McCleary
1 Shelton
1 Vancouver

PLYWOOD -- MAHOGANY
1 Seattle

POLES
5 Spokane
3 Tacoma
2 Ione
2 Metaline Falls
1 Everett
1 Easton
1 Winlock
1 Lyman
1 Cook

POLES -- CEDAR
1 Tacoma
1 Spokane
1 Aloha
1 Colville
1 Boyds
1 Chewelah
1 Ione
1 Yardley

POLES -- CREOSOTED
2 Seattle
1 Everett
1 Newport

POLES -- CURTAIN
1 Seattle

POLES -- TELEPHONE, TELEGRAPH, ETC.
1 Everett
1 Napavine

POLES -- TENT
1 Bellingham
1 Seattle

POSTS
4 Spokane
1 Kendal
1 Easton
1 Metaline Falls
1 Centralia
1 Aloha
1 Tacoma
1 Ione
1 Everett

POSTS -- CEDAR
1 Colville

POSTS -- FENCE -- WOOD
1 Spokane

POSTS -- NEWEL
2 Tacoma

PULPWOOD
1 Everett

RACKS -- CLOTHES DRYING
1 Auburn
1 Aberdeen
1 Kent
1 Seattle

RAILS -- LADDER
1 Hoquiam

RATTAN GOODS
1 Seattle

REELS -- WIRE ROPE
1 Seattle

ROCKERS
(See Chairs)

RODS -- CLOTHES
1 Aberdeen
1 Kent

ROOFING -- CEDAR
1 Aberdeen

ROSSING (Removes Bark)
1 South Bend

SASH
15 Tacoma
10 Spokane
9 Seattle
4 Everett
3 Bellingham
2 Hoquiam
2 Olympia
2 Wenatchee
1 Yakima
1 Vancouver
1 Ellensburg
1 Kirkland
1 Chelan
1 Port Angeles
1 Molson
1 Chehalis
1 Peshastin
1 Marysville
1 Snoqualmie Falls
1 Fairfield
1 Clarkston
1 Kennewick

SASH -- HOTBED
1 Seattle

SCREENS -- WINDOW & DOOR
3 Seattle
2 Spokane
1 Tacoma
1 Puyallup
1 Yakima
1 College Place

SEATS -- CANE
1 Seattle

SEPARATORS -- BATTERY
2 Seattle
1 Tacoma

SHAKES -- RED CEDAR
1 Everett
1 Seattle
1 Port Angeles

SHELLS -- ROWING
1 Seattle

SHELTERS -- GARDEN
1 Aberdeen

SHELTERS -- GOLF
1 Aberdeen

SHIPLAP
1 Wenatchee
1 Arlington

SHIPS
(See Boats)

SHOWCASES
4 Seattle
2 Tacoma
2 Everett
1 Centralia
1 Kelso

SIDING -- RED CEDAR
2 Tacoma
2 Aberdeen
2 Bellingham
2 Everett
1 Seattle
1 Ridgefield
1 Onalaska
1 Globe
1 McKenna
1 Marysville

SIDING -- RED CEDAR (cont)
1 Bordeaux
1 Snoqualmie Falls
1 Arlington
1 Sultan
1 Walville
1 Enumclaw
1 Hobart

SIDING -- CEDAR LOGS
1 Aberdeen

SILOS -- WOOD
1 Sumner

SKIS
3 Seattle

SOUNDING BOARDS
1 Hoquiam

SPARS
2 Seattle
1 Tacoma
1 Aberdeen
1 Winlock
1 National
1 Hoquiam

SPARS -- AIRPLANE
1 Hoquiam

SPECIALTIES -- LUMBER
1 Aberdeen
1 Sumner

SPOONS -- WOODEN
1 Seattle

SPUDS -- DREDGER
1 Seattle

STAFFS -- FLAG
(See Flagpoles)

STAKES -- TENT
1 Seattle

STANDS -- SMOKING
1 Seattle
1 Olympia

STAVES
(See Barrels, Kegs)

STEPLADDERS
1 Spokane

STEPLADDERS (cont.)
1 Kent
1 Seattle

STOOLS
2 Seattle

STOOLS -- COUNTER
1 Spokane

STOOLS -- RADIO
1 Seattle

STOOLS -- STEPLADDER
1 Auburn
1 Kent

SUPPLIES -- PIANO
1 Hoquiam

TABLES
6 Tacoma
4 Seattle
2 Spokane
1 Hoquiam

TABLES -- BREAKFAST
2 Seattle

TABLES -- CARD
1 Omak

TABLES -- DAVENPORT
2 Tacoma
1 Seattle
1 Spokane

TABLES -- DROPLEAF
1 Tacoma

TABLES -- DINING
1 Tacoma

TABLES -- KITCHEN
2 Tacoma
2 Seattle
1 Spokane

TABLES -- SERVING
1 Spokane

TAGS -- NURSERY
1 Seattle

TANKS -- BREWERY WOOD
1 Seattle

TANKS -- DISTILLERY WOOD
1 Seattle

TANKS -- MINING WOOD
1 Seattle

TANKS -- PULP MILL WOOD
1 Seattle

TANKS -- WATER STORAGE WOOD
1 Seattle

TANKS -- WOODEN
1 Tacoma
1 Seattle
1 Spokane
1 Bellingham

*TIES
2 Vancouver
2 Amboy
1 Alpha
1 Toledo
1 Bremerton
1 Palmer
1 Shelton
1 Lyle
1 Colville
1 Woodland
1 Arlington
1 Yardley
1 Potlatch

TIES -- CREOSOTED
1 Seattle
1 Spokane

TIMBERS
1 Camas
1 Winlock
1 Bremerton
1 Seattle
1 Mead
1 Gilmer
1 Lyle
1 Oak Harbor
1 Arlington
1 Yardley
1 Everett
1 Potlatch

TIMBER -- CREOSOTED
1 Everett
1 Seattle

TIMBER -- LONG
1 Ostrander

TIMBERS -- MINE, CREOSOTED
(See Timber-Creosoted)

TRAYS -- PIE
1 Tacoma

TRELLISES
2 Seattle
1 Aberdeen
1 Vancouver

TUBS -- BUTTER
1 Marysville

TUBS -- ICE CREAM
1 Seattle

TUBS -- WOODEN
1 Tacoma
1 Aberdeen

TUGS
2 Seattle

VENEERS
5 Tacoma
3 Seattle
2 Raymond
2 Puyallup
2 Hoquiam
2 Olympia
2 Everett
1 Aberdeen
1 Kelso
1 Shelton
1 Vancouver

VENEER -- APPLE BOX STOCK
1 Hoquiam
1 Puyallup

VENEER -- BERRY BOX
1 Tacoma
1 Puyallup
1 Hoquiam

VENEER -- CHEESE BOX STOCK
1 Cathlamet

* - Reporting mills. There are many small mills which do not report.

VENEER -- CRATE
1 Tacoma
1 Hoquiam
1 Puyallup

VENEER -- DRUM STOCK
1 Vancouver

VENEER -- EGG CASE STOCK
1 Puyallup
1 Hoquiam

VIOLINS
1 Walla Walla

WASHBOARDS
1 Tacoma
1 Kent

WHEELBARROWS
1 Auburn
1 Aberdeen

WHEELS -- STEERING -- SHIP
1 Tacoma
1 Seattle

WINDOWS
(See Sash)

WOOD -- GROUND
1 Seattle

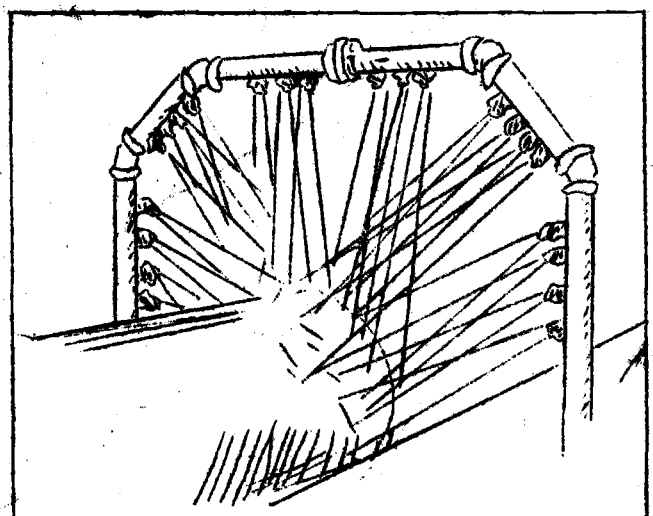
WOOD TURNING
3 Seattle
1 Tacoma
1 Aberdeen
1 Spokane
1 Bellingham

WOODENWARE
1 Tacoma
1 Seattle
1 Kent
1 Aberdeen

WOODWORK
6 Seattle
2 Tacoma
1 Pasco
1 Connell
1 Olympia
1 Ellensburg
1 Winthrop
1 Aberdeen
1 Cashmere
1 Walla Walla
1 Pullman
1 Wenatchee
1 Oakesdale
1 Prosser
1 Kennewick

WOODWORK -- ARCHITECTURAL
1 Spokane

YACHTS
4 Seattle
3 Tacoma



LOG WASHER

Single type log washer -- pressure between 60 and 65 pounds. Such washers are used for removing dirt, stones and grit (which would dull or ruin saws) from the bark on logs, and have largely replaced the work of the old-time "rock sawyer."

ACKNOWLEDGEMENTS

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The following persons read the manuscript and offered helpful suggestions for its improvement in arrangment and accuracy of material.

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Bertel J. McCarty,, International Secretary-Treasurer of the International Woodworkers of America, 4134 Arcade Building, Seattle, Washington, made valuable suggestions after the publication of the first edition. Some of them have been incorporated in the text of the second and third editions.

Cover Design*

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*(Done as part of project, participated in by all class members, some of whom -- including Miss Chubb -- are NYA Student Aid workers.)

Acknowledgement is made to Foster Morrison, of the WPA Educational Division, who contributed the chapter on Distribution; and to M. Fay Muridge, also of the College of Puget Sound Art Department, who did the heading-design for Chapter II.

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GLOSSARY

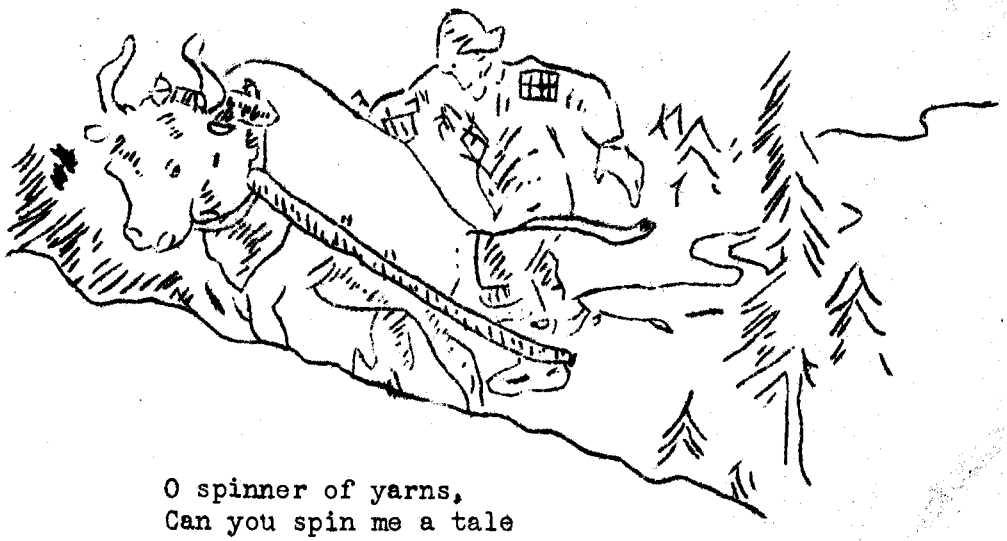
Board Foot	Board measure is the term used to indicate that a board foot is the unit of measurement in lumber. A board foot is the quantity of lumber contained in, or derived from (by drying and/or planing and/or working) from a piece of rough green lumber 1 inch thick, 12 inches wide, and 1 foot long, or the equivalent in thicker, wider, narrower, or longer lumber. This is abbreviated "ft. B.M.". It is common practice to state timber in terms of "thousand board feet", dropping the last three ciphers and using the abbreviation "M ft. B.M.".
Bole	Trunk of tree.
Boom	Logs fastened together end-to-end and forming a floating dam to confine or deflect logs. The term is also used to mean the logs enclosed inside of the floating boom sticks; also the lift part of certain cranes, shovels and log loading derricks.
Bulldozer	A tractor-driven machine which is used in grading and also in fighting forest fires. It has a long curved blade which, set at an angle, pushes dirt to one side.
Bunk	A small 4-wheeled truck used in transporting lumber on rails or on floors of mills. Also a species of truck in the forest. May be a sleeping cot in bunkhouse.
Cant	A large slab cut from a log and sawed to approximate dimensions by having the edges trimmed.
Cant Hook	A stout pole about 5' long fitted at one end with a hinged hook and used as a lever in handling logs.
Choker	A noose of wire rope around a log, by means of which the log can be dragged over or lifted off the ground.
Clear	Clear lumber (free from knots). Always comes from the outside because it grows up around where the limbs used to be on a small tree.
DBH	Diameter Breast High.
Donkey Engine	An engine used to hoist or drag logs. It consists chiefly of a steam or gasoline or electric power unit and one or more drums for winding or unwinding cable.
Flitch	Long slab, with bark still on sides and yet to be edged.

GLOSSARY

Grain	(Often used interchangeably with texture) is the direction or appearance of the fibers in wood. Coarse grained wood results from wide and conspicuous annual rings and woods in which there is considerable difference between spring and summer growth. Fine, (or close), grained wood is the reverse.
Gyypo	Colloquial for small concern engaged in logging operations employing about 4 or 8 men on a piecework basis.
Headrig	The equipment which handles the logs from deck to edger. The carriage is the movable rail unit in a saw-mill by means of which logs are shuttled to and from the head saw and on which they are mechanically turned for further cutting and again clamped to headblock.
Hoot Owl Shift	When -- to help curtail forest fires -- logging operators work during the early morning hours and close down during the dangerous afternoon period.
Jack Ladder	The slip, or inclined trough, up which logs are pulled into sawmill by means of an endless chain conveyor.
Kiln Drying	The process of artificially seasoning lumber by applying steam heat to it in an enclosed space or kiln. (Is widely practiced -- in some plants all grades are kiln dried.)
Landing	Any place where logs are transferred from cables to cars, or from one type of yarding equipment to another.
Log Deck	A platform of timbers upon which logs are piled to await transportation; or, in a sawmill, the sloping platform where they are piled a few at a time to await sawing.
Mop-up Work	A forestry term which consists of falling dangerous snags, cooling down hot spots, rolling and digging out burning logs, digging out smouldering roots, and hastening the burning of material inside the fireline, if any.
Peavey	A wooden handle with a hinged metal hook or tong near the end, and a steel spike or prong at the end, used to roll, move, and lift heavy timbers and logs.

GLOSSARY

Pike Pole	A long pole with a spike at one end, used in guiding floating logs. It may have a hinged hook at the spike end.
Rigging	The cables, pulleys (blocks) and hooks used to drag logs over the ground by a donkey engine.
Scaling Stick	A wooden or metal-shed scale so graduated that the volume of logs in board feet may be read directly from the scale.
Shingle Weaver	Packers, sawyers, knot-sawyers, and knee bolters are called "shingle weaver" in a shingle mill.
Skid	(1) To drag logs over the ground from the forest to a landing place. (2) Poles laid in a road to facilitate movement of logs over a road (skid roads now largely obsolete in the Northwest); or a pole, usually in pairs, to facilitate the loading of logs upon a vehicle.
Skidway	Two skids placed at right angles to a logging road and usually raised at the end nearest the road, used as a platform upon which to pile logs as they are brought from forest and from which the logs are loaded on trucks, etc.
Spar Tree	Tall, straight tree from which the limbs and top have been cut and to which is fastened the cables and pulleys used in dragging logs from forest to the "yard".
Springboard	Short, narrow boards inserted in notches in tree when necessary to cut tree several feet from ground. Springboards are used because of root-swell of big trees, because of pitch deposit at base of bole, and where ground may slope sharply. Working on a hillside obviously the springboard will be farthest from the ground on the downhill side of the tree, and vice versa.
Spud	A short narrow spade.
Straddle Bug	A rubber-tired motor carrier which straddles a load of lumber, raises it with hydraulic lift and deposits it where needed.
Yard	A cleared space in the forest to which logs are dragged preparatory to transportation to the sawmill. An open storage place at mill or retail establishment.
Yarder Tree	A spar tree located in the yard.



O spinner of yarns,
Can you spin me a tale
Of the perilous Long Ago?
Of the braver days and the nobler ways,
And the Winter of Dark Blue Snow?
Of a hero who towered above the trees,
Whose laugh was a hurricane;
Whose favorite food was raw moose meat,
Yet whose brawn was no more than his brain?
Inventor supreme, matchless orator too,
Field marshal of industry;
The father of logging; collossus of dreams,
Whose legend is truer than true.
Tell of Babe the Blue Ox,
Of exuberant might,
Whose speed left the wind far behind,
Who toted whole forests around on his back,
And was humorous, loyal and kind.
Tell of Johnny Inkslinger, titanic wiz
Of figures, and payrolls and facts;
Who was also a doctor of such super skill
He could cure even ducks of their quacks,
Of Sourdough Sam, and Hotbiscuit Slim,
Of the Bull of The Woods, giant Hels;
Of the bunkhouse bards such as Shanty Boy, him
Whose yarns held all men in their spells.....

Call it epic or legend, tall story, or lore,
Nothing equals Paul Bunyan's Romance -- any more.

-- Ray Melton

Wm. Ray Melton

National Youth Administration part-time workers assisted in the illustrating as well as the typing and mimeographing of this study.