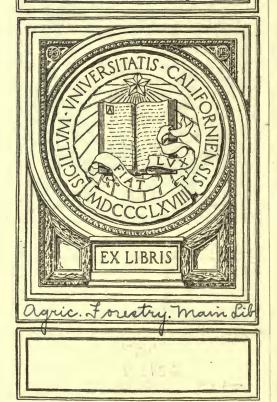
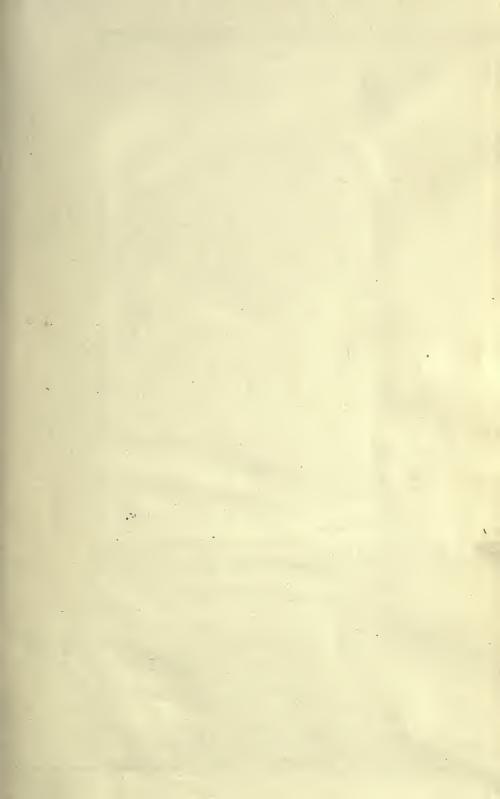


- Walter mulford





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OHIO FORESTRY PAMPHLETS

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EVERGREENS: THEIR USES AND CULTURE.

OHIO Agricultural Experiment Station.

WOOSTER, OHIO, U. S. A., FEBRUARY, 1908.
BULLETIN 190.



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The sulletins of this Station are is shed at irregular intervals. They are paged consecutively and an index is included with the Annual Report, which constitutes the final number of each yearly volume.

INTRODUCTION.

The law establishing a department of forestry at this Station, passed March 17, 1906, makes it the duty of the Station, in addition to conducting inquiries into the forest conditions of the state and publishing the results of such inquiries, "to determine by experiment and investigation the kinds of trees and shrubs best suited to the various situations for windbreaks and shelter, for beautifying grounds, and the best methods of planting and managing the same." The present bulletin has been prepared in obedience to this section of the law.



BULLETIN

OF THE

Ohio Agricultural Experiment Station

NUMBER 190.

FEBRUARY, 1908.

EVERGREENS: THEIR USES AND CULTURE.

BY W. J. GREEN AND W. EMERSON BONTRAGER.

Evergreens are of peculiar value both for shelter and ornament. At all times they furnish a barrier to wind and cold, and the remarkably picturesque forms assumed by the adult specimens of many species add much to the attractiveness of a country home, especially when their boughs gracefully bend beneath a load of snow. In winter, when other trees are destitute of foliage, these majestic trees lend to the scene an air of animation which mitigates in a large measure the severity and desolation of the season. If tastefully intermingled with other trees and shrubs about the home they give a warmth of verdure and variety of outline unattainable without their use. That many of the evergreens can be successfully grown upon thin sandy soils is an additional argument in their favor.

Where grown to show the characteristic beauty of individual trees, evergreens should be grouped naturally and not so closely as to crowd upon each other, usually along the sides or at the rear of the lawn. Planting in straight lines should be avoided, and, in small groups, the disposition of trees in odd numbers is to be preferred. Immediate effects may be secured by planting thickly, but thinning should not be so long deferred as to work injury to the lower branches of those trees which it is intended to grow to maturity. The individual who expects to begin the planting of evergreens should not underestimate the importance of ascertaining what species and varieties have been found vigorous and hardy after being tested over a wide range of country under dissimilar conditions. After a beginning has been made, specimens may be added from time to time as the planter determines what kinds are best suited to his needs and locality.

Probably the most valuable of all the evergreens in produc landscape pictures is the silver or white fir. Somewhat similar color, although of a distinctly different habit of growth, is the Co T rado blue spruce, which should be found in every collection. superb tree is of iron-clad hardiness and the foliage is of a p nounced shade of blue which renders it very effective when gro in proximity to darker-colored kinds. The retinosporas, or Jap cypresses, are an extensive group of elegant small trees especia adapted to massing and also to use upon small lawns, while dwarf Mugho pine will be found serviceable where one of low spre ing habit is desired. At times in grouping trees a specimen of right, columnar habit will be admissable, when the pyramidal arb vitae or Irish Juniper may be appropriately introduced; but a p ponderance of such trees should be avoided, as it conduces to as thing but a natural, graceful landscape composition. Who has witnessed, in some rural cemetery, the spectacle of numero stiff, erect Irish junipers which served only to deepen rather th dispel the depressing effect that is often felt in many of the smal resting places for the dead? Likewise, an occasional specimen the grotesque weeping spruce will add variety, but all trees of su abnormal type would best be used sparingly.



FIG. I—A good group of evergreens. At the rear are shown White, Austrian and Scotch Pinwith a Cut-leaf Weeping Birch to the right. In the foreground appear Colorado Blue Spruce, Arborvitaes and Red-twigged Dogwood.

The dismal funereal sensation sometimes experienced uponent ing grounds where somber, suggestive trees, like the Norway spri and Irish juniper, have been planted too profusely may be avoid by the use of such light, cheerful trees as the silver firs, Colora

blue spruce, hemlock and retinosporas. A mingling of deciduous trees will also be helpful in counteracting any tendency to dull or gloomy effects. The white birch is admirably suited to this style of planting, and, when interspersed among evergreens, its snowy bark gleaming against a background of green boughs becomes a charming part of the Winter scene. The beauty of home grounds would be greatly augmented by the more general use of this handsome, hardy and easily-grown tree, which is so attractive a feature in much of Nature's grouping. Excellent enlivening effects may also be secured by using the red-twigged dogwood, a shrub some five feet high, whose numerous, wine-colored branches contrast finely with evergreens or snow. Owing to its small size this must be grown in front of taller trees, or in nooks such as frequently occur along the edges of an evergreen group. As a companion plant to the dwarf dogwood the golden willow is sometimes used, thereby throwing golden twigs into contrast with those of a crimson hue.



FIG. II-Hollyhocks and White Pine. Photo by Ballou.

The foliage of the golden elder, a hardy, rugged shrub of the very easiest culture, will be of material value during the summer months. This must be planted in full exposure to the sunlight, as the rich yellow foliage becomes greenish in color when grown in partial shade. The coloring of this shrub is finest on young growth, hence it is well to cut back the plant severely in spring. Still another shrub useful

for such purposes is the red-bud or Judas tree, whose flowers, in a cheery shade of pink, cover the branches before the leaves appear.

At the base of evergreens occasional touches of color, such as are afforded by beds of petunia, canna, salvia or other bedding plants, are highly effective and satisfactory. Owing to their vigor of growth and ease of culture clumps of many of the perennial plants are exceedingly valuable adjuncts used in this way, and, if left undisturbed, they will increase in size and beauty from year to year. Foxglove, platycodon, hardy phlox, larkspur and a host of others, from which selection may be made according to the planter's fancy, are available for the purpose. In fact, evergreens form a most excellent background for a great variety of charming hues in flower, fruit and foliage. During the entire cycle of the seasons they may be made to accentuate and brighten an infinite variety of colors in plants, from the humblest flowers to the gorgeous maples.



Photo by Waid.

FIG. III—Arborvitaes, Japan Cypress and Irish Juniper grouped against deciduous shrubs and trees.

WINDBREAKS, SHELTER BELTS AND SCREENS.

Every country home should have its shelter belt of evergreens. Windbreaks are not meant for the sole use of extensive orchardists, as was once thought, but should be so commonly planted as to protect every home exposed in the least to the ravages of wind and storm. The saving in fuel alone will defray the cost of planting material in a few years' time. Nor need one wait a dozen years or even half so long for evergreens to grow large enough to afford a protection against piercing winds. Results may be secured in a comparatively short time by planting quite thickly, the superfluous trees to be removed from time to time as they encroach upon those

which it is designed to leave for the permanent shelter. Many an exposed barnyard or poultry run might be transformed into a place of genuine comfort for its inmates on wintry days, by planting along its northern and western sides a row of white pine, Norway spruce or arborvitae. Frequently, a barn which has been located too near the dwelling, a number of outbuildings or an unsightly view, may be concealed by the suitable location of a group of evergreens, and in many instances this bit of planting will perform the double function of screen and windbreak. A strip approximately ten times its height is protected by a windbreak, as is shown by the snow lying smooth on the ground for this distance beyond it after a storm.



FIG. IV-A White Pine Windbreak. Trees are fifteen years old. Photo by Waid

Often a windbreak can be worked into the general landscape effect to break up the monotony. This is done by informal grouping and combining different shades of color. Thus an irregular shelter belt of evergreens becomes, with maples, birches and other trees, a charming addition to the landscape. Its graceful outlines are far more charming than the formal and stiff appearance of the straightrow windbreak of a single species,

Since evergreens are a favorite place for the nesting of birds, an increase in the number of our little feathered friends will be observed wherever windbreaks are established. This is no small incentive for planting, whether viewed from the aspect of sentiment or that of economic advantage. The birds will many times compensate for the consumption of fruit and grain by the destruction of pernicious insects which are becoming more and more a menance to the farmer and fruit-grower.

For screens, to hide unsightly objects, or to secure a degree of privacy to the home, evergreens, because of persistent foliage, serve the purpose at all seasons. Used for this purpose they may be planted in straight or curved rows, to suit the boundaries, or in almost any manner, so that the purpose sought is realized. Very often, where a row of trees may be essential, in order to make a serviceable screen, the object can be quite as well attained by grouping and by mingling harmonious deciduous trees with evergreens. For a formal screen a dwarf or half-dwarf species is best, but by shearing, or close clipping, even such tall growing trees as Norway spruce can be used. The hemlock is admirable for the purpose and there are a number of species and varieties of arborvitae, retinospora and juniper which are good.

An evergreen hedge is but a closely clipped screen and the same species can be used for both. A screen needs some pruning to prevent openings and to keep the trees in somewhat symmetrical form, but a hedge should be clipped once or twice each year, the first early and the second time in midseason. Arborvitae, retinosporas and junipers bear clipping or shearing best of all, but spruces, firs and even pines are quite tractable under the knife early in summer before the new buds are fully formed, provided the young growth only is cut.

An evergreen hedge should always be kept wider at the base than at the top, otherwise those portions of the foliage which receive insufficient light perish and unsightly dead spots appear. It is useless to attempt to start an evergreen hedge in the shade of trees. If one is in doubt as to the propriety of planting an evergreen hedge, a safe rule is not to locate one where it is not actually needed.

PLANTING AND CULTURE.

Probably best results will be secured by transplanting evergreens in May, just as the buds are beginning to swell. A rainy time in September is also good. The size of holes will depend upon the size of the tree to be planted, and they should be large enough to hold the clump of roots without crowding. If it occur in digging that the surface soil is of better quality than that found further down, as frequently happens, put a small quantity of this to one side and replace it in the hole before the tree is inserted. After adjusting the roots in the hole as nearly as possible in the position which they formerly occupied, fill the earth in gently and thoroughly about them, finally firming it well. When the hole has been half filled a thorough watering will make success doubly certain. As a finishing process, after filling the hole and firming the soil well about the tree, apply as a mulch six or eight inches of straw, coarse manure or grass. Too much emphasis can scarcely be placed upon the importance of this last step. In digging evergreens take special care to avoid injury to the roots. With deciduous trees it is possible to preserve a balance between top and roots by cutting back the former if the latter be injured, but this is not practicable in dealing with evergreens. To protect the roots against drying by exposure to sun and wind they must be carefully wrapped in a wet sack, piece of burlap or old cloth, even if being moved for only a short distance. If the soil be markedly deficient in fertility the trees will be benefitted by having thoroughly rotted manure spaded into the earth about them, but this must not come into direct contact with the roots and fresh manure ought never to be used. If evergreens are transplanted several times in the nursery, as they should be, most kinds, except pines and some of the firs, will form a mass of roots to which the soil will adhere in digging. If a ball of earth is carried along in the final transplanting, and other precautions taken, not a single tree will be lost.

AUGUST PLANTING.

It is possible to transplant evergreens successfully during a wet spell in August and up to the middle of September. However, this period is suited only to the shifting of trees from one part of the home grounds to another or to the planting of those secured in the vicinity, as evergreens cannot safely be shipped long distances at this time of the year, owing to danger from heating in the packages. Spring seems to be the natural and logical time for the removal of such trees, hence it is likely that the average planter will only resort to summer and autumn planting in exceptional cases.

PRUNING.

The pruning of evergreens is not often required, being necessary only to preserve the symmetrical shape of the tree or for the removal of diseased, dead or dying branches. Dead limbs may be cut at any time, but pruning of pines, spruces and firs should be done during the growing season, when the young wood is still soft,

as a number of new buds will then be formed at the end of the branch. Arborvitaes, Japan cypress and junipers may be shorn in spring and summer. No evergreens should be pruned in autumn. As most evergreen's naturally assume a conical form, the encouragement of this by pinching back any branches inclined to make an over-vigorous growth is advisable and necessary. Such branches should be cut back to a strong bud, thus leaving a chance for the limb to begin growth again. It is gratifying to note that the once prevalent fashion of pruning evergreens into urns, fowls and other fantastic shapes seems to be dying out. Evergreens are often planted where they are to serve as partial, or open screens, the object being to afford some seclusion to a dwelling or building in a somewhat public place. In cases of this kind it is desirable to have a thick mass of foliage near the center of the tree while the outer portions are more open. This is accomplished by very close clipping when the trees are young and afterward allowing a natural growth. While this form of a tree is less picturesque than one where the pruning has been more moderate, it is allowable because it serves a definite purpose. With some species this treatment makes more lasting specimens than where no pruning is done.



FIG. V-White Pine. Pinus strobus Linn.

The Pine. Pinus Linn. The pines are found in most of the colder parts of the world, where they cover immense areas. Few trees will endure greater extremes of cold and the region of their natural habitat extends north to Greenland. They are so constituted as to flourish upon poor, gravelly or sandy soils, while their abundant and enduring foliage, in its various shades of green renders them of signal value in ornamental planting, whether used as shelter or screen, or as a background against which to group deciduous trees and shrubs.

White Pine. Pinus strobus Linn. As an ornamental tree the white pine is probably the most valuable of the group, since its color is more cheerful and its foliage more pliant and graceful than that of any other species. Unlike some of the other pines, the shape of the tree does not become rounding at the top with increasing years, but it permanently retains the form of atapering shaft. Making a dense growth, it is of great value in the formation of plantings for shelter and protection. It is perhaps most graceful and beautiful when grown on thin, sandy soil, as the tree then assumes a dignified, stately, spire-like form sometimes 150 feet tall, while if reared on land abounding in fertility the head is much more dense. In rate of growth it is very rapid, hence of unusual value where speedy results are wanted, as in the case of windbreaks and open screens. The great white pine forests of North America are found in a belt extending across the northern part of the United States and southern Canada.

The Red Pine, sometimes called Norway pine (Pinus resinosa Ait.), so named on account of its attractive, bright red bark, is found native in New England and the region extending northward through Canada and westward to Wisconsin. The trees vary from 50 to 75 feet in height and the wood is very rich in resinous matter, being only excelled in this regard by that of the pitch pine. Its habit of growth is peculiar in that the needles are borne in thick tufts on the ends of the branches. These needles are long and of a dark green color and, as they contrast well with the reddish bark, the tree is not an unattractive one. While not of as great value from the ornamental standpoint as some of the other pines, its distinctive habitof growth and hardiness entitle it to a place in collections.

Western Yellow Pine. Pinus ponderosa Dougl. This species is found in river valleys and on the lower mountain slopes along the Pacific coast, being common in Oregon, where it often attains a height of one hundred feet with a greater part of the trunk free from branches. It resembles the Austrian pine in form, but is of a darker green and has long, glossy needles, which are borne in plume-like clusters, While the appearance of the young tree is quite attractive, the yellow pine will probably not be much used as an ornamental, on account of the coarse and open appearance presented by the mature specimen, although its vigor of growth and hardiness commend it for use in certain positions.

Austrian or Black Pine. Pinus Austriaca Link. This large speading species is found native in Austria and adjacent countries. It is one of the most widely planted kinds and its merits have made it a general favorite. It has a massive appearance and a symmetrical outline, due to its branches being placed equally distant apart around the trunk, and as it is of a rich, dark green color, it is very handsome as seen from a distance and harmonizes well with both white and Scotch pines. However, an intimate examination will disclose a coarseness which renders it unsuitable for planting near residences, although it makes a satisfactory specimen when located in some remote site upon the lawn. For use where an evergreen of strong, rapid growth, hardiness and adaptability to a great diversity of soils is desired, the Austrian pine is one of the best trees to be had. It is of exceptional value when used in shelter strips for protecting orchards and buildings. While it does not grow so rapidly when young as the Scotch pine, it lives to a greater age, and will succeed in a moister soil than is suited to most of the pines.

Scotch Pine. Pinus sylvestris Linn. The name of this species would indicate that it is of Scotch origin, but in reality it is found covering large areas in central Europe, where it is held in about the same esteem as the white pine here. It is much inferior to the white pine in all respects. The mature trees sometimes reach a height of 80 feet and are four or five feet in diameter. Its foliage is of a bluish color and the size of the tree precludes its use in small grounds, but in parks and upon extensive lawns it can be used to considerable advantage. Its rate of growth is exceedingly rapid, and this fact, together with its hardiness and the ease with which it can be grown upon many kinds of soil, make it of great service in the formation of windbreaks. It is handsome when young and often assumes picturesque forms in old age.

Swiss Stone Pine. Pinus cembra Linn. This one inhabits the higher regions of the Alps, specimens fifty feet tall being frequently found. It also abounds in Austria, where it forms vast forests of the darkest shade of green. In form the tree is conical, with branches borne well to the ground; while the foliage, which is very dense, has a peculiar tufted appearance. It produces attractive purple cones which are born at or near the apex of the tree. Unfortunately of very slow growth, the Swiss stone pine has great value in ornamental planting, as it is capable of producing effects not to be secured by the use of any other species. It will flourish upon thin, stony soil in exposed situations such as few other evergreens can endure, while its dark foliage contrasts well with that of lighter-colored species. A well-grown tree of Swiss stone pine is a fitting subject for any lawn, whether it be in the home grounds, cemetery or park.

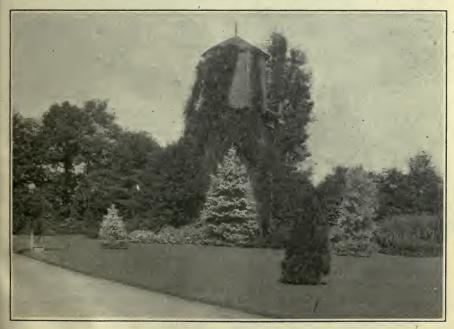


FIG. VI-Colorado Blue Spruce in center, Umbrella Pine in foreground

Umbrella Pine. Sciadopitys verticellata Sieb. & Zucc. This unique conifer, so-called from the fact that its leaves are arranged about the twig somewhat like the ribs of an umbrella, is a native of Japan. The foliage is dark-colored and rich looking. This tree seems to be of undoubted hardiness, and, while it

grows somewhat slowly when young, the rate of growth is more rapid in later years, so that trees twenty-five years old ought to be fifteen to twenty feet high. In Japan umbrella pines one hundred feet high are by no means uncommon, but trees of this size are undoubtedly very old Where one wishes to cultivate on his lawn a rare evergreen of peculiar, yet attractive and satisfactory, habit of growth, no mistake will be made in securing a specimen of the umbrella pine.

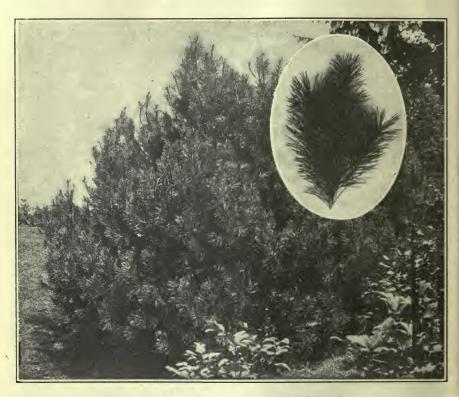


FIG. VII-Dwarf Mugho Pine." Pinus pumilio Haenke.

Dwarf Mugho Pine. Pinus pumilio Haenke. The Mugho pine is a low-growing species originally found upon the mountains of Central Europe. Specimens occasionally attain a height of twenty-five feet, but as generally seen it is a tree of low, sprawling character seldom more than five or six feet tall. Its peculiar spreading habit, together with dense, dark green foliage and assured hardiness, make it of great service in ornamental planting. It shows especially well when planted near to rocks or upon a rocky ledge, and individual trees are attractive on the lawn, if located well in the foreground or planted in front of taller evergreens.

Norway Spruce. Picea excelsa Link. In discussing the Norway spruce, which has been so abundantly and widely planted through the northern half of the United States, the authors feel that they are dealing with a tree already thoroughly well known to most readers. Owing to its rapidity of growth and

cheapness, consequent upon the ease with which it can be propagated from seed, together with the fact that it readily adapts itself to almost any soil, this species has been widely disseminated; and there is scarcely a park, cemetery or rural community where specimens of it cannot be found—many of them being in an advanced stage of dilapidation.

Weeping Norway Spruce. Picea excelsa pendula Loud. In this variety we have a unique member in the family of spruces, which embraces most of the characteristics of the Norway in addition to a strikingly peculiar habit of growth. Differing from the Norway, its limbs grow in a decidedly weeping fashion, while occasional branches turn up in a most eccentric manner. Being slender and much smaller than the Norway, it is one of the finest specimen trees. It should be located at a somewhat conspicuous spot on the lawn and is excellent for use in small grounds. While its growth is made rather slowly, the weeping spruce is entirely hardy and not in the least fastidious as to soil.



FIG. VIII-Weeping Norway Spruce. Picea excelsa pendula Loud.

The Norway spruce comes from central and northern Europe, where dense forests of it cover immense tracts of country and the old trees vary in height from eighty to one hundred and fifty feet. A natural forest of Norway, grown under favorable conditions, presents a sight long to be treasured in one's memory, since their long, pendulous, gracefully-curving branches, festooned with dark green, shining foliage, sweep the ground.

The Norway is of great value in ornamental planting, when used judiciously, but it is not suited to use on extremely small lawns nor to any situation where space cannot be afforded for it to develop normally. It is valuable for planting

in parks, cemeteries and upon spacious lawns, while its vigorous, rapid habit of growth specially commends it for any position were speedy results are wanted. It is also one of the good trees for making windbreaks, since its dense growth forms an almost impenetrable barrier to chilling winds and frosts that often destroy fruit and ornamental trees of doubtful hardiness. The Norway spruce stands shearing well and has been much used in the form of close hedges, for which purpose it has given good service.

Like many general favorites, the Norway spruce has its faults and there is no doubt that it has been planted too freely, to the exclusion of more valuable, though less generally known, species. At thirty-five years the Norway begins to get thin and ragged in the top, and a perfect tree more than fifty years old is seldom seen. It is one of the darkest-colored evergreens, and, when used in the formation of large belts or long avenues, if not brightened by the occasional use of some more cheerful tree, the general effect is monotonous and at times even exceedingly oppressive.



FIG. IX-Oriental Spruce. Picea orientalis Carr.

Oriental Spruce. Picca Orientalis Carr. A native of the regions surrounding the Black Sea and other parts of southwestern Asia, where it is abundant, the oriental spruce is one of the finest foreign evergreens that has ever been introduced into America. It is of slender, elegant and remarkably refined habit, its growth being made less rapidly than that of the Norway, which it resembles in color. The species is etirely hardy and produces a tree one hundred and twenty-

five feet tall, which retains the lower limbs for many years. As it makes its growth slowly it is well suited while young for use upon small lawns. The oriental spruce is one of the very best evergreens for any situation where a fine specimen is wanted and, with the exception of its slower habit of growth, is in every way superior to the popular Norway for ornamental purposes.

White Spruce. Picea Canadensis B. S. P. Of the spruces native to America one of the most pleasing, on account of its conical shape and compact habit of growth, is the white spruce. Variously estimated at from fifty to one hundred and fifty feet in height, the white spruce bears foliage of a bluish-green color, which is unpleasantly aromatic when crushed. It has been much used as an ornamental, and when grown in a group with Norway spruce or other dark-colored trees the contrast formed is a lively and agreeable one, although the white spruce is longer lived and of slower growth than the Norway. It is a native of the north, as its natural range extends from northern New England through Canada to the Arctic Circle and westward through northern United States to Montana, and it is therefore well suited to cold regions. The white spruce does not stand heat well and in central United States the foliage is liable to be attacked in summer by the red spider, which soon causes it to look discolored and thin. For the construction of windbreaks in the extreme northern states no tree is superior to the white spruce.



FIG. X-Colorado Blue Spruce. Picea parryanna glauca. Photo by Waid.

Colorado Blue Spruce. Picea parryana glauca. Too many good things can scarcely be said of this rarely beautiful conifer from the mountains of Colorado. While trees grown from seed vary greatly in shades of color, the finest have foliage of rich steel blue which is handsomest in summer and fall, becoming somewhat dimmer in winter. Nothing more attractive in the evergreen line can be easily imagined than the young growth on a well-colored Colorado blue

spruce, and a place should be found for at least one specimen on every lawn in Ohio. A tree of so unusual and striking a color as this should never be planted in masses, but instead used as a solitary specimen or in very small groups. When associated with other evergreens it would best be used sparingly, serving for accent as it were. The habit of this tree is to put out its branches, which are covered with erect, sharp-pointed needles, in a somewhat stiff, horizontal manner. Even in its native home the blue spruce does not retain the characteristic shade of blueness after it is forty years old, but that period of daily satisfaction and enjoyment will abundantly justify any one for planting it.

Koster's Blue Spruce. Picca parryana glanca (forma) Kosteriana. This is but the Colorado blue spruce grafted with wood from trees of the finest color, hence a prospective planter can make no mistake in purchasing the grafted sort,

although they are slightly more expensive.

Weeping Blue Spruce. Picea parryana glauca-pendula (forma) Kosteriana. In this variety we have combined the gracefully pendulous habit of the weeping Norway spruce and the highly colored foliage of the colorado blue, the result

being a weeping tree of even greater worth than the weeping Norway.

Engelmann's Spruce. Picea Engelmanni Engelm. Engelmann's spruce is another good tree which has come to us from the Rocky Mountains. The foliage of this species is ill-smelling and has some of the blue tints of the Colorado blue, but the needles are softer and much more pliant, the sharp, piercing character being wholly lacking. It is entirely hardy and attains a height at maturity ranging from one hundred to one hundred and fifty feet. While it has not been extensively planted in Ohio it seems to be a desirable and promising species and worthy of much more general use. Engelmann's spruce is not a rapid grower.

American Hemlock (Tsuga Canadensis Carr), considered by many to be one of " the most beautiful evergreens, is native to a region extending from Nova Scotia to Wisconsin and along the Appalachian mountains from North Carolina northward through Canada. In Canada and northern United States vast forests of hemlock are found, the trees seeming to stand the conditions of a northern region better than the heat and drought of a more southerly locality. It often becomes a tree 70 to 80 feet in height and solitary specimens hold their branches well to the ground, but as often found in forests a large portion of the trunk is bare For ornamental and decorative purposes the hemlock has been much used and the grace with which it carries its light, feathery, drooping branches makes it indispensable. The tree is a symmetrical one, without rigid formality, clad in foliage of dark, yet lively and cheerful, shade of green. While seen at its best when grown as an individual specimen, the hemlock also harmonizes well with other trees. It bears shearing well and has been much used in the formation of hedges, a good hemlock hedge being unsurpassed in beauty by that of any other evergreen.

Douglas Fir. Pseudotsuga taxifolia (Lamb.) Britt. By some this is also called Douglas spruce. This important timber tree grows along the Pacific coast from Mexico through the Rocky Mountain Region to southern Canada, being found at its greatest perfection in the territory around Puget Sound, where trees three hundred feet in diameter are not uncommon. As an ornamental it is a dark-colored, very rich looking tree of graceful habit, and it is being used extensively in forestry on account of its rapid rate of growth and hardiness. Owing to its extremely large size it should be planted where it may ultimately have unrestricted space in which to grow.



FIG. XI-Douglas Fir. Pseudotsuga taxifolia (Lamb) Britt.

Photo by Waid



FIG. XII-White or Silver Fir. Abies concolor Lindl. & Gord. Photo by Waid

White or Silver Fir. Abies concolor Lindl. & Gord. In this excellent conifer from the Rocky mountains it is believed we have the ornamental evergreen of the future. In every way a fitting companion for the Colorado blue spruce, it is superior in that the tree retains the distinctive, silvery hue of the foliage to a very great age. Of undoubted hardiness and adaptability to a wide variety of soils, the enduring qualities of this tree commend it for very general planting. Unexcelled as a specimen tree, it may also be used in small groups or in conjunction with other species, notably pines and spruces, when it should be used occasionally in the foreground. As the silver fir finally becomes a towering monarch one hundred and fifty feet tall, ample space for development should be apportioned to it.

Nordmann's Fir. Abies Nordmanniana Spach. From southwestern Asia, Nordmann's fir has been more generally planted through the eastern states than any other foreign species. While it has given satisfaction in many localities in the east, on the grounds of the Experiment Station it seems to be of doubtful hardiness and is therefore not recommended for general planting, unless in well-sheltered situations. Its foliage is of a dark, shining green above and a silvery shade below. Trees one hundred and twenty-five to one hundred and fifty feet tall are frequently found in the regions of which it is a native.

American Arborvitae, also called White Cedar. Thuya occidentalis Linn. The flat compressed foliage of the American arborvitae, which consists of numerous scales overlapping each other, effectually distinguishes the tree from any other conifer. It is found in that portion of the North American continent extending from the latitude of Pennsylvania northward, where it often grows in swamps, near the base of mountains, or in moist valleys between them. At maturity it becomes a neat-looking slender cone, ranging from twenty-five to fifty feet in height, with branches well retained to the ground. It is one of the very best evergreens for use on lawns and lots of small size, although its extremely formal, artificial shape militates against its being associated promiscuously with other evergreens. The dull, brownish, unattractive color assumed by the foliage in winter is the chief objection to the arborvitae, although its color is remarkably bright and fresh-looking during the summer and fall months. There is no evergreen, either native or introduced, which will endure as much hardship and grow on as great a variety of soils, under even adverse conditions, as the arborvitae.

Owing to its regular habit of growth and the impunity with which it stands the pruning shears, the arborvitae has become the most popular from its extensive use in hedges and screens for which purpose it has no superior. When it is intended to make a hedge the ground should be thoroughly dug up or cultivated and the trees planted two or three feet apart. After planting a mulch will aid greatly in retaining a moisture in the soil and is essential, for the first season at least.

The marked proclivity of the arborvitae to sport has resulted in the production of many named varieties, one of the very best of which is the Siberian Arborvitae (*Thuya Sibirica Hort.*), a variety superior, indeed, to the species itself. The Siberian has dense foliage of a darker shade of green than that of the American and in form the tree is also conical but wider at the base and sloping less steeply to the apex. It retains its color ln winter much better than the American, and is an elegant specimen tree of the greatest hardiness for any situation where a very formal tree is appropriate. While it has not been so

much used in the formation of hedges as has the American, it is excellent for the purpose and a smoothly shorn hedge of Siberian arborvitae is a satisfying sight. The popularity of this variety is growing and no mistake will be made in planting it freely.

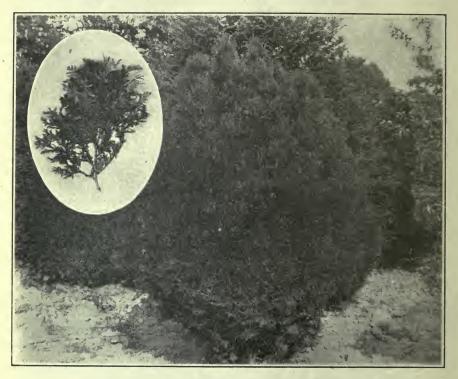


FIG. XIII-Siberian Arborvitae. Thuya Siberica Hort.

Geo. Peabody Arborvitae. Thuya occidentalis var. Geo. Peabody. In this variety we have a tree similar in form and general character to the American arborvitae, clad in foliage of clerr and enduring golden yellow. As with all trees of striking and unusual shades of color, this variety should be used with discretion and only as a sort of spice to brighten a mass or bed of evergreens in darker colors. It is a handsome specimen tree and of value where space is limited.

Globe-Headed Arborvitae. Thuya occidentalis Globosa. A variety of dwarf and very dense growth with spherical or globular form, two or three feet in diameter. As an aid in forming the typical shape, the shears may be applied to this tree two or three times in a season.

Hovey's Golden Arborvitae. Thuya occidentalis Hoveyi. This variety is of very dense and compact, yet not severely formal, habit, the head of the tree being oval-globular in shape, The color of the foliage is a beautiful, freshlooking shade of light golden green. It grows from five to seven feet tall and is one of the very finest of the smaller evergreens; especially good for cemetery use.

Pyramidal Arborvitae. Thuya occidentalis pyramidalis forms an elegant and very slender shaft of dark green—useful for producing columnar effects and superior to the Irish Juniper, familiar from its frequent use in cemeteries. This variety is one of the hardiest and can also be used in the formation of a very handsome ornamental hedge or screen.



FIG. XIV-Pyramidal Arborvitae. Thuya occidentalis peramidatis Photo by Ballou.

Lawson's Cypress. Chamaecyparis Lawsoniana Murr. One of the most pleasing evergreens in habit of growth is Lawson's cypress, a species from the Pacific coast, the lower part of whose branches curve upward like those of the spruce, while the extremities droop with the utmost grace. Of rapid growth, the tree is covered with bluish-green foliage singularly fern-like in character,

and specimens one hundred feet tall are not uncommon in their native home. The Lawson cypress is hardy in Ohio, excepting that the tips of twigs on young trees are occasionally winter-killed. This may be ascribed to their habit of sometimes making a vigorous growth in late summer or early autumn and the use of stimulating manures, or even excessively fertile soil, about them should be avoided. This species is one of the really excellent ornamental evergreens and is too seldom seen.



FIG. XV-Golden Plume-like Japan Cypress, Retinospora plumosa aurea Hort.

Japan Cypress. Retinospora. The Japan cypresses are an important group of elegant, small evergreens, in which are embodied a great diversity of color and texture in foliage as well as variety in type and outline of tree. In their numerous shades of green, blue and gold they afford some of the finest material for the formation of groups and beds of evergreens, and are unexcelled as miniature specimen trees. As grown for a number of years on the grounds of the Experiment Station they have satisfactorily withstood the rigors of our winters and are a source of perennial delight to all beholders. While their hardiness is assured, the age to which they will retain their youthful beauty and vigor is as yet undetermined, although it is claimed that in some localities they are short lived. They revel in a fertile soil, without which it is not easy to secure foliage of the best quality and color. In making a bed or group they may be planted four to six feet apart and will not crowd for a number of years. The botanical classification of the Japan cypresses is as yet considerably involved, but in this connection it will suffice to group them under four or five principal types, most of which have green and golden forms.

Pea-fruited Japan Cypress (Cupressus pisifera Seib. & Zucc,) is a graceful tree from the mountains of Japan. Its branchlets are covered with compressed or flattened foliage slightly resembling that of arborvitae, while the branches have a pendulous, feathery character which gives the tree a charming and desirable aspect. This is one of the largest and hardiest kinds.

Golden Pea-fruited Japan Cypress. Cupressus pisifera aurea. This variety has the form and general characteristics of the preceding one, with the exception that its foliage is of a golden yellow color. It is a popular sort, as the color of the new growth is very bright; one of the very finest and best of the golden evergreens.

Plume-like Japan Cypress. Retinospora plumosa Hort. In this we have one of the most valuable of the entire group. The tree is dense and compact in habit, its smaller branches being covered with a fluffy, plume-like green foliage, and forms a superb small specimen.

Golden Plume-like Japan Cypress. Retinospora plumosa aurea Hort. This variety is a sport from the plume-like Japan cypress and differs from it only in having golden foliage. When planted with the plume-like or other of the green sorts the entire group is lightened and brightened in a remarkable manner.

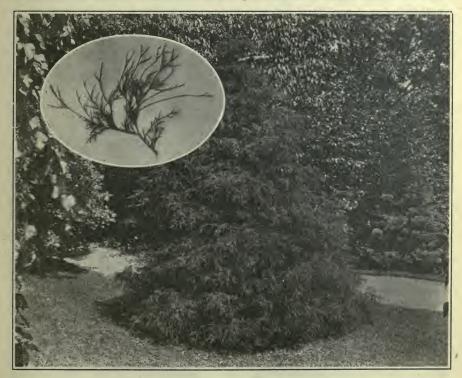


FIG. XVI-Thread-branched Japan Cypress. Retinospora filifera Fowler.

Squarrose-leaved Japan Cypress (*Retinospora squarrosa Hort*.) is a muchbranched, bushy tree seldom more than five or six feet tall whose soft foliage is in color a silvery blue. The foliage is fragile and tender in appearance but is not often injured by cold. To preserve a conical shape it is necessary to shear this variety annually. Thread-branched Japan Cypress (Retinospora filifera Fowler) is a unique form having peculiar, thread-like or whip-like branches, and seems to be one of the most vigorously constituted of the entire group. In time it becomes a bushy shrub or small tree from which stiffness and formality are wholly lacking. It should be used, even in very small collections, on account of its hardiness and vigorous habit of growth.

Golden Thread-branched Japan Cypress. Retinospora filifera aurea. In this we have the showy golden form of thread-branched Japan cypress. Its foliage is abundantly marked with yellow in a glowing tint, which is well retained through summer, even when the tree is grown in partial shade; a peculiar, distinct and valuable variety.

Obtuse-leaved Japan Cypress. Cupressus obtusa Sieb. and Zucc. By some this is regarded as the finest of all the Japan cypresses. In Japan, where it becomes a tree sixty feet tall, it is considered sacred and its wood is used in the construction of temples. The foliage is a clear, brilliant green in color and for ornamental purposes the value of the tree can scarcely be rated too high. As the tree acquires size it is apt to become open and thin, which can be obviated by annual shearing or pruning in its younger years to increase the number of branches.

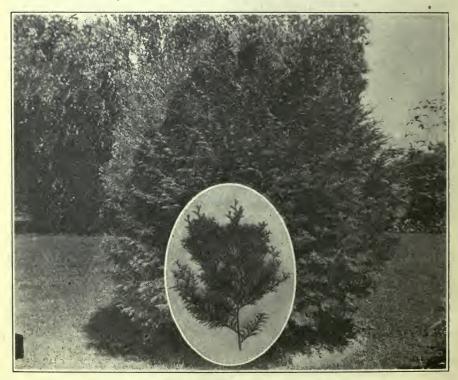


FIG. XVII-Graceful Obtuse-leaved Japan Cypress. Cupressus obtusa gracilis.

Compact obtuse-leaved Japan Cypress (Cupressus obtusa compacta) is a neat, dwarf, compact grower, which has foliage similar to the obtuse-leaved Japan cypress and is one of the very best of the small, low-growing evergreens.

Graceful obtuse-leaved Japan Cypress (Cupressus obtusa gracilis) is a form somewhat larger and taller than the preceding variety, but which makes a compact, symmetrical, small tree. Has the good foliage and color of obtusa and is sure to give satisfaction wherever planted.

Blue-tinted Red Cedar. Juniperus Virginiana var. Glauca. Blue-tinted red cedar is a variety of the red cedar, a native tree of Eastern North America whose habitat extends from southern Canada to Florida. Adult trees are of slim upright habit, ranging from fifty to seventy-five feet in height. Although the shearing and clipping of evergreens into artificial shapes is not encouraged, no tree is better suited to the purpose than is this variety, which is one of the very best kinds for making formal gardens. The red cedar will grow on gravelly upland and is equally at home in the moist, sandy soil of the sea shore.

English Yew. Taxus baccata. The Yew, famous because of its extensive use in English cemeteries, is a handsome, slow-growing tree, often forty feet tall, whose foliage somewhat resembles in color and texture that of the American hemlock. In England it attains an extraordinary age, there being some authenticated instances of trees having lived for a thousand years. Unfortunately, in this country the English Yew lacks vigor, is short-lived and altogether unsuited to extensive planting in Ohio. The very hardiest and best of the yews is the Japanese species (Taxus cuspidata), which is as yet quite rare but worthy of trial.

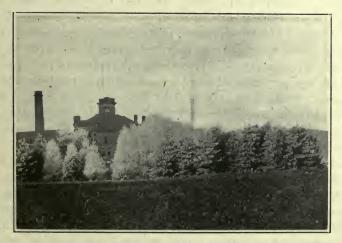


FIG. XVIII--Evergreens laden with frost. Photo by Waid.

SUMMARY.

Because of their enduring foliage, evergreens should be more extensively planted about country homes, whether used in straightrow windbreaks or mingled informally with other trees on the lawn. From the ornamental standpoint, they abound in rich, dark shades of green, equally valuable as a background for deciduous trees or flowering shrubs and plants.

The finest of the larger ornamental evergreens are the White Pine, Colorado Blue Spruce, White or Silver Fir, Oriental Spruce and American Hemlock. Of the smaller ones none is better than Siberian, Hovey's Golden, Pyramidal or Globe Arborvitae, Threadbranched Japan Cypress, Graceful Obtuse-leaved Japan Cypress and Plume-like Japan Cypress.

The best evergreens bearing foliage in shades of yellow are Geo, Peabody Arborvitae, Golden Pea-fruited Japan Cypress and Golden Plume-like Japan Cypress.

In making an evergreen hedge use American Hemlock or Siberian Arborvitae.

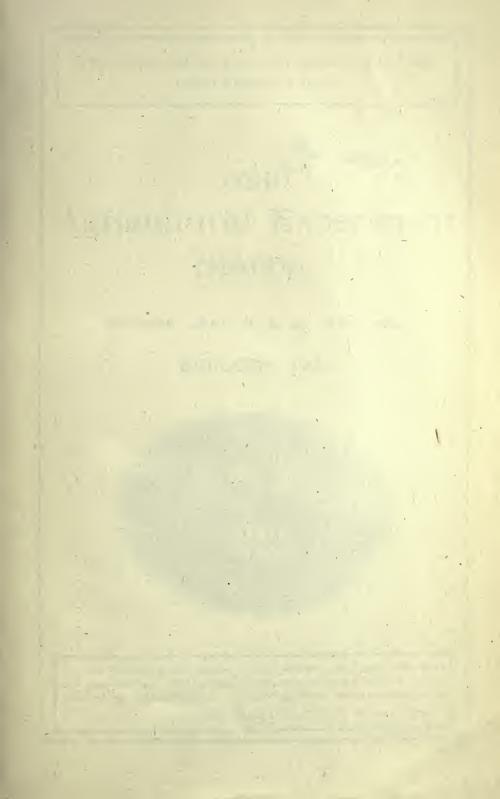
For specimens to be shorn into fanciful shapes, use common Red Cedar, Blue-tinted Cedar or any Arborvitae.

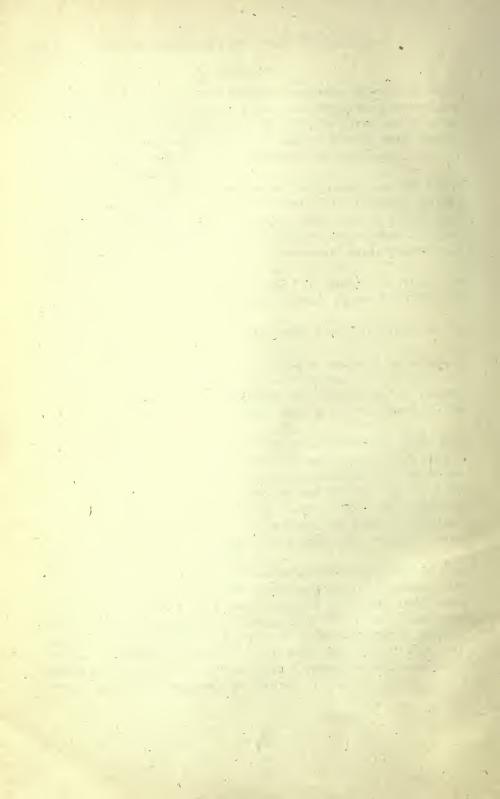
As a protection to farm buildings, the barn-yard, or poultry run, a good windbreak will repay its cost in a few years in the saving of fuel or feed.

The length of time consumed in its growth need not deter anyone from making a windbreak, as results may be secured in half a dozen years by planting thickly, subsequent thinning to be practiced.

For the construction of windbreaks and shelter belts the White Pine, Norway Spruce, Austrian and Scotch Pines and American Arborvitae have no superiors. These kinds all grow rapidly and are not lacking in vigor or adaptability to thin soils, exposed situations and other adverse conditions.

It is hoped that no reader will so misconstrue any part of this publication as to plan evergreens exclusively about the home. Deciduous trees occupy a place in any scheme for beautifying lawns which conifers alone do not and cannot fill. When surrounded and completely enveloped in a dense growth of evergreens, a style of planting somewhat prevalent a few decades ago and of which examples are even now occasionally seen, a residence becomes dark, gloomy, damp and dangerous to health.





THE MORE IMPORTANT INSECTS AFFECTING
OHIO SHADE TREES.

Walter Mulford

Agricultural Experiment Station.

WOOSTER, OHIO, U. S. A., JUNE, 1908.
BULLETIN 194.



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BULLETIN

OF THE

Ohio Agricultural Experiment Station

NUMBER 194.

June, 1908.

THE MORE IMPORTANT INSECTS AFFECTING OHIO SHADE TREES.

BY J. S. HOUSER.

INTRODUCTION.

With the rapid decrease in the forest acreage of the country we are learning to appreciate trees, both for their beauty and for their value as an economic factor in our welfare; hence, the problem of their preservation is coming to mean more and more to us. Generally speaking, this decrease in the number of trees has been accompanied by an increase of the insect foes that prey upon them, both as regards numbers of species and individuals of a given species. Further, this band of depredators seems to be getting in its work more effectively in the city districts than in those more rurally situated. This publication, therefore, from the very nature of things, will be of greatest value to the city householder, but may be applied to the needs of all.

INSECT CONTROL A NECESSITY IN CITIES.

For several reasons the employment of artificial measures against shade tree insects is more nearly a necessity under conditions that exist in the cities and towns than under those found in the rural districts.

Absence of insect-eating birds. partially explains the abundance of insect life in the cities. Since the advent of the English sparrow—a bird which is not a pronounced insect eater—many of the birds that previously nested in the cities have been driven to more remote districts.

The city tree under the most favorable condi-City trees unhealthy. tions must keep up a continual fight for existence. Impure, smoke-laden atmosphere; poorly watered and badly ventilated root system; the careless, thoughtless mutilation by teamsters and passers-by, all tend to weaken it. If in this weakened condition it becomes the subject of attack, it is poorly fitted to withstand the burden and, unless assisted, stands a poor show to win out in its fight for existence.

INSECT CONTROL DIFFICULT IN CITIES.

Individual work of householders impracticable.

The application of insecticidal measures is a difficult task under most city conditions, especially so if the various householders attempt the operation individually. It is usually the

the operation individually. It is usually the case that a few trees only are located in each yard, and frequently these trees are tall, thus requiring a strong, expensive spraying apparatus for treating them properly. Besides the sprayer the service of two men is required, at least one of whom should have a knowledge of machinery and the preparation of insecticides to insure best results. It is only in the case of large lawns that it would be practicable for private individuals to own and operate spraying outfits.

However, in a few instances, designated in the description of the various shade tree pests following, it is possible for the householder to furnish effective assistance, and to do so with small expenditure of time and money.

A municipal tree-treating department desirable.

The more desirable and practicable arrangement is for the city to support a tree spraying department, operated by com-

petent, experienced men, whose business it is to look after the public trees and who are prepared to do spraying on private grounds for a reasonable charge. Such departments are already in existence or are under way of organization in some of our principal cities, the department at Cleveland being the most complete in this state.

CORRECT PLANTING THE FIRST STEP TOWARD INSECT CONTROL.

From the standpoint of the future control of insect pests, two things should be considered in the planting of a shade tree; the species of tree and the location of planting.

Some trees more susceptible to insect attack than others. All kinds of shade trees are not equally susceptible to insect attack, some being almost immune, others so highly susceptible to attack from one or two species

that it is impossible to grow them, while still others are the prey of a whole host of depredators.

Dr. E. P. Felt, in his most excellent work on "The Insects Affecting Park and Woodland Trees," has tabulated the more common trees of New York state with relation to their liability to insect attack. As Ohio conditions do not vary to any great extent from those found in New York state, the classification arranged for New York holds good in the main here. Dr. Felt's rating, with a few alterations that will be designated later, is as follows: "The figure 3 has been placed opposite trees which are practically immune from insect injury; 2.5 indicates some damage. Trees having one somewhat serious enemy are rated at 2 and those having at least one notorious insect pest at 1.5. Greater likelihood of injuries is indicated by 1 and still more by .5. The species are arranged according to the comparative injury as follows:

Tulip tree	3	Catalpa
*Tree of heaven	3	European linden 1.5
Gingko	3	American linden 1.5
Red oak	2.5	Horse chestnut
Scarlet oak	2.5	Soft or silver maple 1.5
Oriental plane tree	2.5	American elm
American plane tree	2.5	*Hackberry 1.5
Sycamore maple		European elm1
Sugar maple		Scotch elm1
White oak		Cottonwood5
Burr oak	2	Balm of Gilead5
Red maple	2	Yellow locust
Honey locust	2	•

*Those that are starred have been seen only in parks or in such small numbers that the rating can be regarded as provisional only."

The above arrangement differs from that of Dr. Felt's list in the position of catalpa, rated by him as 3 and here rated as 2 on account of it's being subject to attack from the catalpa sphinx in the southern sections of the state and rather generally to the action of the catalpa diplosis (or a closely allied species) working in the tender, growing tips. Also the hackberry and elm are rated .5 higher because of the fact that the elm leaf-beetle is not well established in this state.

Plant mixed varieties. Another general principle of correct planting, as brought out by Dr. Felt, is the undesirability of planting clumps or rows of a single species. It may easily be seen that an insect on the hunt for its favorite food plant is much more likely to locate a collection of trees than single individuals scattered here and there. Further, that a pest is more easily disseminated when once it becomes established on one of a number of trees of the same variety growing close together, than if the trees were at least alternated with other kinds.

Avoid poor environment at planting time.

It is an admitted fact that insects prefer the weaker to the stronger plant, and when we consider how much more easily

a healthy, vigorous tree withstands insect attack than does its weaker neighbor, it is self-evident that, if for no reason other than the future control of insects, we should attempt to grow strong trees. Much can be accomplished toward this end by not planting in unfavorable immediate surroundings, such as over or near a gas main, thus running the risk of having the tree poisoned by escaping gas; nor directly under high-tension electric wires, the injurious burning effects of which are well known; nor too near the street, where the trunks are subject to injury; nor in soil deficient in plant food; nor in a half dozen or more additional situations that might be named.

Plant to make insect warfare possible.

Tall growing species subject to insect attack should not be planted close beside buildings, thus making it impossible to

spray them properly without covering the side of the building with the spraying mixture. This is one of the great difficulties experienced by a city spraying department. Householders object seriously—and justly too—to the disagreeable mixtures. To illustrate the necessity for exercising this precaution take, for instance, the applying of the lime-sulfur wash, a mixture used quite extensively as a scale destroyer. This mixture when sprayed upon a painted surface combines chemically with the paint, causing some shades to discolor. It is absolutely impossible to spray a tree located beside a building without some of the mixture being misplaced.

COMMONLY INJURIOUS SPECIES.

It is the author's intention in his treatment of the individual shade tree pests to deal with each species as briefly as possible, but at the same time to afford a working knowledge for operations against it. To this end the description of the various insects will be confined to pointing out the characteristics most useful in differentiation, and only such phases of their life histories will be dwelt upon as bear directly upon our understanding of the methods of control suggested. No attempt is made to list all of the insects that may be found injuring ornamentals or forest plantings within the borders of the state, but only those species are considered which are at present doing damage or those that may likely be introduced within the near future. For more complete information, no better source may be found than Memoir 8, New York State Museum, entitled "Insects Affecting Park and Woodland Trees" by Dr. E. P. Felt.

The observations and practical spraying experience herein recorded, in addition to the information compiled from the writings of others, are mainly the result of work done by the Ohio Experiment Station, in co-operation with the Department of Forestry of the City of Cleveland.

SCALE INSECTS.

Scale insects are among the most formidable of the pests from which the shade trees must be protected. On account of small size and protective coloration they frequently escape detection by the untrained eye until they have secured such a strong foothold that the host is permanently injured. Further, in addition to the advantage they possess by reason of the insidious nature of their attack, some are extremely resistant to remedial measures, among these being some of our most common species, such as oyster shell bark-louse, terrapin scale of the maple, etc.

The majority of the species remain fixed after the scale covering is formed. The spreading is effected by the young as they crawl about seeking a suitable place to begin feeding; as they are carried short distances by spider webs or winds; or possibly longer distances upon the feet and feathers of birds. This motile period in the history is of short duration, usually not longer than two or three days.

Insects of this order obtain their food by inserting their sharp, hair-like beaks into the tissues of the plant and drawing out the sap, hence applications of poisons are ineffective, and for all practical purposes it may be said that control methods are confined to spraying with contact insecticides during one or both of two seasons, the latter depending upon the species. Some scales are more easily destroyed by the action of a strong spray, used during the winter months, while others are susceptible to treatment with a weak spray applied during the summer months when the brood of young is appearing. The last named method, however, is useful only when the entire brood of young appear within a few days, and when the host is foliated sparsely enough to permit the spray to reach all parts of the plant.

The oyster-shell bark louse, Lepidosaphes ulmi. In appearance this scale is dark brown in color, shaped like an oyster shell, and is about one-eighth inch in length.

(Plate 1, Figs. 1, 2 and 3.) The winter is passed in the egg stage under the protection of the covering scale, the large quantity of whitish eggs being quite easily detected if the covering is removed. The eggs hatch during the latter part of May or early June. at which time the tiny, yellowish, mite-like scale insects may be located by the unaided eye, as they crawl about seeking a suitable place to begin feeding.

A number of plants are quite susceptible to this scale, the most common for Ohio being Carolina and Lombardy poplar, willow, horse chestnut, ash, sassafras, and red-twigged dogwood. The poplars are undoubtedly the most susceptible of all, and so injurious in fact is this scale to these trees that the authorities in Cleveland have stopped the planting of them, and wherever practicable are replacing growing trees with more desirable kinds.

Spraying during the early spring with the lime-sulfur wash, or during the hatching period with kerosene emulsion or whale oil soap solution, is the remedy usually employed against this pest. However, for extensive spraying operations, the two latter materials are hardly practicable, as in order to be effective they must be applied during the interval between the hatching of the scale insect and the completion of the first scale covering. This allows a few days only and therefore is prohibitive of work on a large scale.

The lime-sulphur wash is undoubtedly the best of the control methods to be used against this scale, but in the author's experience it has proven somewhat of a disappointment. From observations made upon hundreds of trees and shrubs, sprayed with a mixture made by experienced men and applied thoroughly, it is apparent that only when conditions are the most favorable are the results following its use satisfactory. A slight dampness, such as light fog, at the time of application; a somewhat weakened spraying mixture; an extra case of infection where several scales are piled upon one another; a temperature below 32 degrees; any of these unfavorable conditions is sufficient to give poor results.

In spraying trees that are deeply incrusted with the scale, the mixture cannot be forced to penetrate underneath the outer layers and frequently many escape, to multiply the ensuing year.

Sassafras and soft maple, both well infested with this species, were carefully sprayed under favorable conditions during the spring of 1907, with scalecide and limoid. This scalecide was used in a 5 percent solution, and the limoid was prepared after the following formula: Limoid, 30 lbs., kerosene, 7½ gal., water to make 50 gallons. In every instance the scale increased abundantly 'during the ensuing season, indicating that little benefit had resulted from the treatment.

Because of the power often possessed to withstand the action of the most practicable of the stronger scale insecticides as a winter treatment, and of the the impossibility of doing extensive work during the summer period, the writer is almost ready to place the oyster shell on a par for destructiveness with the San Jose species, when it occurs under city conditions. The San Jose Scale, Aspidiotus perniciosus Comst.

This species is almost well enough distributed and well enough known to render a description unneces-

sary. However, it may be stated briefly that the individual scales are very flatly conelike, with a whitish nipple at the apex; the remainder of the scale is gray or blackish and the whole is about the size of a pinhead. When occurring in large numbers on a branch it gives it a gray ashy, flaky appearance. Additional distinguishing features are that when a tree becomes badly infested. pressure upon the limbs with a knife blade or similar flat instrument causes a yellowish oily liquid to appear. Following infestation the tree assumes a sickly appearance and ultimately dies if uncared for. The length of the period between infestation and fatality depends of course upon the natural hardiness and the resources of the host. Some trees and shrubs may withstand the burden of attack a considerable number of years while others, less hardy, as the peach, may succumb in as few as three years. According to Dr. W. E. Britton, State Entomologist of Connecticut, a little over one-third of the trees, shrubs, and vines grown for fruit and ornamental purposes are subject to serious attack from this species, while an additional third are occasionally or rarely infested. The more common of the plants suffering seriously are as follows: juneberry, hawthorn, privet, poplar, Prunus spp., currant, apple, rose, willow, ash, lilac, osage orange and elm.

The scale is well distributed throughout the State, there being very few counties only from which it is not reported. It is rapidly gaining headway each year, notably in the cities and towns, where as yet comparatively little systematic work has been attempted to hold it in check.

In many parts of the country and particularly in the orcharding districts annual spraying is being performed. Where such is the case and thorough work is done the advance of the pest is being checked and the damage reduced to a scarcely perceptible amount.

A winter application of the lime-sulfur wash is the safest, most effective and cheapest remedy for this pest. However, by way of modification of the statement concerning the cost of the spray, it should be said that this holds true only where the wash may be purchased at a rate affording no more than a reasonable profit to the maker, or where the area to be treated is sufficiently large to warrant the expense of setting up the boiling plant. Where it is impossible to purchase the wash or where it is impracticable to arrange a private plant for preparing it, then some of the commercial insecticides may be resorted to. Among washes of this class

the Experiment Station has tried during the past two or three years, the one known as Scalecide has given the best results. This material is a patent so-called soluble oil, in other words an oil emulsified so that when water is added the two combine, resulting in a milk-white, oily spray. This material is not excessively expensive and serves most excellently the purposes of the householder who has a small area to be treated, and who has not access to the public sprayer or cannot hire the work done.

The Scurfy Bark Louse, Chionaspis furfura Fitch.

This insect appears in the adult stage as flat white specks upon the bark or fruit of the host. The female is about

1-10 inch in diameter and shaped after the outline of a pear, while the male is about one-third as large and more elongated. (Plate 1, Figs. 4 and 5.) With both sexes there is a yellow pellicle at the tip end of the scale. The winter is passed in the egg stage under the protecting mother scale, hatching occurring during the latter part of May or in early June.

Some closely allied species occur in great numbers at times on park trees and shrubs, but for the most part they have life histories that are similar to the common species and in general the same remedies will apply. The red-twig dogwood, willows and some of the rosaceae are particularly subject to such infestation.

The lime-sulfur wash applied during the winter is effective, as are also contact sprays applied at hatching time. However the same difficulty arises here that is encountered in connection with summer applications against the oyster shell bark louse, i. e.: the brood appears en masse and the time for effective work is as a result very brief.

The Putnam Scale, Aspidiotus ancylus Putnam. On account of similarity in general form this species is frequently mistaken for the San Jose Scale, especially

when the infestation is slight and the scales immature. The superficial distinguishing features however are as follows: the scale is slightly darker in coloration; the nipple reddish; the spread less rapid; the injury less severe, and lastly the young exhibit a stronger tendency to settle about the mother, resulting in a somewhat irregular infestation.

This insect occurs more commonly in the towns than in the country, and the trees most generally attacked are hard maple and linden. The maples in the parks and upon the streets in Cleveland suffer severely from this pest.

The lime-sulfur is effective against this pest. Applications of limoid and scalecide gave fair returns.

The Rose Scale.
Aulacaspis rosae Bouche

This species resembles the scurfy bark louse, though the general appearance of the infestation as a rule is of a whiter,

fluffier nature. (Plate 2, Fig. 1.) The life history is practically the same as that of the scurfy scale, and the winter applications of the lime-sulfur wash are effective. Scalecide in 5 percent solution was not successful.

Roses, blackberries and raspberries are most commonly attacked. Rosa rugosa is more severely attacked than other roses, but even with this variety, the writer has observed very few instances where the plants were killed.

The Elm Scurfy Scale. Chionaspis Americana Johns.

This species occurs upon the elms and the lindens. It resembles very closely the scurfy bark louse, in fact

it is quite likely that for many years it was confused with this insect. The life history is the same. In the writer's observation, however, the elm scurfy scale is not so evenly distributed over the host plant as is the scurfy, the lower side of the branches being more subject to infestation.

Lindens moderately infested with this scale were sprayed with lime-sulfur, April, 1907. Observations made during the ensuing season indicated that the results of the application were all that could be desired. In the vicinity of the lime-sulfur sprayed trees, other lindens were sprayed with 5 percent scalecide. Little good seemed to result from this treatment, as the scale developed in abundant quantities during the following season.

Contact sprays applied at hatching time are effective against this species, but as has been indicated in the case of other scales with a similar life history, they are hardly practicable.

The Cottony Maple Scale, Pulvinaria innumerabilis Rathv.

During the early summer months this scale is easily detected by the presence of a white, cottony mass

which the insect exudes from beneath the covering scale. (Plate 2, Fig. 2.) Within this mass may be found the eggs, the number varying from a few hundred to two thousand. Hatching occurs during the early summer and the young migrate to the leaves or to the tender young growth, where they settle and begin feeding upon the sap of the tree. Meanwhile a thin scale covering forms over each individual, which with the growth of the insect enlarges and in time turns brown. Before the leaves fall most of the insects migrate to the branches and trunk, where they settle preparatory to passing the winter in their partially grown condition. With the coming of spring maturity is soon reached and the cottony mass already described appears.

The species prefers soft maple, though a number of other trees are subject to slight attack, among the more common being hard maple, honey locust, elm and grapevine.

Two species very closely resembling the one just described attack the hard maple: the maple leaf scale, *Pulvinaria acericola* Walsh and Riley, and the maple *Phenacoccus*, *Phenacoccus acericola* King. The former is found upon the leaves and the latter upon either the leaves or branches.

Natural parasites play an important part in the economy of this insect, in most seasons being sufficiently numerous to prevent serious damage. However, for some reason the natural enemies are not always successful in developing and considerable harm is done by the scale. When the insect becomes sufficiently troublesome to require attention, winter spraying with kerosene emulsion, containing from 12½ to 25 percent kerosene, is the remedy most commonly recommended.

The tests of the value of different spraying materials that have been performed by this department against the insect under consideration have been conducted upon trees only slightly infested, so that the results were not as conclusive as they might have been. A clump of soft maples was divided into plots and sprayed during the latter part of March and early in April, 1907. The following were the mixtures applied: Scalecide, 5 percent solution; Scalecide, 3 percent solution; Limoid, 15 percent kerosene; Limoid, 7½ percent kerosene; Kerosene emulsion, 12½ percent kerosene.

The kerosene-limoid, containing 15 percent kerosene, killed practically all of the scales; the kerosene emulsion sprayed plot came next in order of cleanness and the value of the remaining materials is indicated in the following order: Kerosene-limoid, 7½ percent, scalecide 5 percent and scalecide 3 percent. The weaker solution of scalecide was of little value.

In another section the merits of the lime-sulfur wash and of 17 percent limoid were compared, resulting favorably toward the limoid and in practical failure for the lime-sulfur solution.

The Maple Terrapin or Black Banded Scale, Eulecanium nigrofasciatum Perg. This insect is sharply hemispherical in form, the adult female is about one-sixteenth of an inch in diameter and the color, though variable, is of

a general reddish tone with a more or less distinct blackish band near the border. One of the most distinctive characteristics, however, is the peculiar sickening odor that is especially noticeable when the well grown scales are crushed.

Soft and hard maples suffer most commonly from this pest.

The winter is passed in a partially grown condition, maturity being reached and egg development completed early in June. Usually about the middle of June the young appear.

In the author's experience winter applications of the stronger insecticides commonly used against scale insects have proved unsuccessful in furnishing a control, in fact the insects seemed to be little harmed by the applications. It may be found, however, that kerosene emulsion containing 20 to 22 percent kerosene will bring about the desired results. This, however, cannot be given as an authoritative statement. The emulsion used in the experiments against the pest was only 14 percent kerosene, as it was not deemed safe to use a stronger mixture. Subsequent trials have demonstrated, however, that a hard maple will stand, during the dormant period, applications of an emulsion containing 20 percent kerosene and in some instances will recover from the effect of applications containing 40 percent kerosene. See Plate 4, Fig 2. The hard maple is more liable to injury from the application of strong emulsion than is the soft maple.

The Elm Bark Louse, Gossyparia spuria Modeer. The adult females of this insect are the most conspicious forms. (Plate 3, Fig. 2.) The following description

is taken from Memoir 8, N. Y. State Museum. "They may be seen clustered along the under side of the smaller limbs, usually beside a crack or crevice in the bark, and presenting a general resemblance to a growth of lichens. The full grown viviparous females are about 1-10 inch long just before giving birth to their young, oval in outline and with slightly pointed extremities. Each is surrounded with a white, woolly secretion, which also extends partly over the insect and thus renders its segmentation more apparent." The females become full grown in early spring and the young appear during the month of June.

This insect occurs upon the elms in Marietta and according to Burgess in Columbus is not known to occur in any other portions of the state. According to Dr. Felt it is present in the following parts of the Union: Vermont, Massachusetts, District of Columbia, Michigan, Nevada, Colorado and New York.

In June, 1906, the writer made a careful study of the condition of the city of Marietta. The insect was found to occur in various parts of the city, the vicinity of the chair factory being seemingly the center of infestation. It is not known definitely when it was first introduced, nor is there any plausible theory as to how the introduction was made. The trees were not in a serious condition,

though some of the limbs were dying. The majority of the scales were upon the lower limbs, though many specimens were found as high as 46 feet from the ground.

What is known as the bitter elm is most subject to attack. The water elm is rarely attacked and, if so, very slightly, even when growing beside infested specimens of the former species.

The progress of the insect will be watched with considerable interest as it is considered a serious pest in some of the localities before mentioned.

June 28, 1906, while the young scales were emerging, an application of kerosene emulsion containing 7 percent kerosene was made to a small elm badly infested. The tree was very thoroughly sprayed, special care being taken to follow out the under side of the limbs. The treatment was successful in destroying the young insects already emerged, but did not seem to affect the females nor the young beneath the mother scale, as the young were noticed emerging in considerable quantity an hour after the conclusion of the treatment.

Prof. R. H. Pettit, of the Michigan Agricultural College, reports success from the use of the lime-sulfur wash upon the elms located upon the college grounds. It is quite likely that this is the most practicable and satisfactory spray to be used.

Tulip Tree Lecanium, Eulecanium tulipiferae Cook.

The tulip tree lecanium is one of the scales quite frequently received by the entomological department, not

that it is especially common, but because it is easily detected. In cases of severe infestation the branches on which it occurs appear irregularly knotted.

Occasionally, fatal results are reported to follow its attack, but in the writer's experience he has never seen a tree killed or severely injured by it. However, the large fleshy scales surely consume considerable of the tree's sap and thus harm it to a certain extent. Applications of control methods are in no wise misplaced. As the scales are so large and so easily detected, probably removing them with a stiff wire brush is the most practicable remedy.

The Pine Leaf Scale, Chionaspis pinifolae Fitch. Scale, at the narrow end of which is attached a small yellow pellicle. It is

found attached to the leaves of the pine. (Plate 3, Fig. 1.)

The winter is passed in the egg stage. Two broods occur annually, one in early summer and the other during the fall.

During the spring of 1903 the pines on the Experiment Station grounds were badly infested by this insect, some of the trees being

in a dying condition. A weak kerosene emulsion was applied at the time the first brood was emerging and a very dilute solution of whale oil soap at the time the smaller fall brood appeared. As a result the trees were almost completely cleared of the pest, and additional treatments have not been found necessary thus far. However, the scale is again obtaining a rather strong foothold and will soon need attention. The insect is illustrated, natural size, in Plate 3, Fig. 1. There is also shown in the illustration an adult of the twice-stabded ladybird *Chilocorus bivulnerus* Muls., a natural enemy of the scale which does considerable towards holding it in check.

The Golden Oak Scale,
Asterolecanium variolosum Ratz.

This scale was recorded at Mentor by Newell in 1900 and was also received from Glendale in 1907. An infested tree stood in a lawn adjoining Edgewater Park, Cleveland, in 1906, and on it, July 19, the young were appearing in immense quantities. The scale is easily determined on account of a yellowish-green golden color and because it causes a slight abnormal growth upon the twig, thus presenting the appearance of being partially imbedded in the bark. Although alive, the trees infested were not healthy, the bark being very rough and uneven and seemingly only partially able to fulfill its duties.

Kerosene emulsion is an effective remedy when applied during the hatching period.

The Fine Bark Aphid, Chermes pinicorticis Fitch. Though not a scale, this insect may logically be considered here, as it's appearance is much the same as that of some of the scales and the control methods are similar. The adults are illustrated in Plate 3, Fig. 3, where they may be seen as collected

are illustrated in Plate 3, Fig. 3, where they may be seen as collected in thick, white, floculent masses upon the base of the pines. The pest has been noticed for the past two seasons upon certain trees in the Experiment Station gardens, and the writer has observed it in lesser quantities than those shown in the illustration upon pines in the Cleveland parks.

The foliage of the trees that are worst infested upon the Experiment Station grounds is beginning to loose color, indicating the vitality of the trees is becoming weakened.

The pest is subject to the action of contact sprays, according to Dr. E. B. Southwick, Entomologist of the New York parks, the stiff sprays being effectual.

THE LEAF EATING INSECTS.

The White Marked Tussock Moth, Hemerocampa leucostigma Sm. & Abb. This insect undoubtedly heads the list of leaf-eating pests found in Ohio. It is easily distinguished during all stages of it's life history. See Plate 5.

Two broods occur each season, the young larvae of the first appearing soon after the leaves are well out upon the majority of the shade trees. The winter is passed in the egg stage.

The eggs are deposited upon the discarded cocoon of the female moth, in a white frothy mass from $\frac{1}{2}$ to 1 inch in length and varies from 200 to 400 in number. The frothy aspect results from the brittle material that binds the mass together.

The larva upon first hatching is a hairy caterpillar about ½ inch in length and, while young, has the power of spinning a silken thread with which it lowers itself if the tree is jarred or suddenly shaken by wind. Currents of air, swinging it, may deposit it upon the nearby trees and this is one of the means by which the spread of the insect is effected.

The newly hatched larva feeds for a time upon the epidermis of the lower side of the leaf but as it grows older and stronger more of the leaf is eaten until by the time it is full grown all but the midrib and larger veins are devoured.

The grown larva is one of the most beautiful caterpillars occuring in Ohio. The head is coral red; extending longitudinally along the back is a broken black line bordered by narrower lines of vellow. The vellow bands are bordered by broader ones of drab. Below, the caterpillar is yellow. Projecting forward like horns just above the head are two black tufts of hair 1/3 or more the length of the body, and extending from the opposite end is a single tuft of the same texture, though not quite so long. On the dorsal side of the 4th, 5th, 6th and 7th segments are compact tussocks of pure white hair and on account of this the insect is called the Tussock Moth. The larval stage is of a little over a month's duration. the completion of larval growth the caterpillars become abnormally active, crawling about, seeking a suitable place to pupate. During their wanderings they may travel considerable distances and it is mainly at this time that the advance from tree to tree is effected.

After a satisfactory place has been found in which to pupate, the larva constructs for itself a cocoon, mainly from the hairs of its own body. About two weeks are spent in the pupal stage at the the termination of which the adults appear. The adult female is

CONTROL INSECTICIDES.

The lime-	Lime 20 lbs.
sulfur wash.	Sulfur
suijui wasn.	Water

The lime is placed in the boiling receptacle and water added. (preferably hot) in small quantity until slacking is well under way. The sulfur is then thrown on either dry or in the form of a paste, and water is added as necessary to keep the mass sloppy. Upon the completion of the slacking process, water to make 15 gals. is added and the whole is boiled for an hour. At the end of the boiling period water, hot or cold, is added to make 50 gals. and application is made as soon as possible. A steam cooker is more satisfactory than a kettle over a fire, as less stirring during the boiling process is necessary and the mixture thus made is more even in quality.

For more detailed instruction concerning the preparation of this wash, the reader is referred to bulletin 169 of this station.

It may be safely said of the lime-sulfur wash that it is the most generally employed of the scale-destroying sprays. In its use, however, care must be taken that the cooking is done thoroughly lest the lime and sulfur fail to combine properly, and conditions must be favorable at the time of application. The spray should not be applied when the temperature is below freezing.

Kerosene Emulsion	SoapWater	3/4 1b.

Heat the water and dissolve the soap in it. While boiling hot, pour into a convenient receptacle into which has previously been placed the kerosene, and agitate thoroughly until a thick creamy mass results from which the oil does not separate. A spray pump serves admirably for this purpose, as the mixture may be pumped back into itself. Where the sprayer is not available an old churn and dasher serve the purpose admirably.

After the emulsion is perfect, it may be diluted with water to the consistency desired which varies with the insect to be combatted.

Whale oil soap solution

This is a very convenient spray to use where it is not convenient to prepare kerosene emulsion. It is made by merely dissolving the soap in hot water in the proportion desired.

Kerosene-Limoid The principle involved in the preparation of this emulsion is practically the same as in kerosene emulsion, the difference being that a very fine lime is used as the emulsifying agent instead of soap. A special kind of lime containing about ½ magnesia is prepared by the Chas. Warner Co., Wilmington, Del., and is called Limoid. Prof. C. P. Close of the Delaware Experiment Station reports that any dry-slacked, finely powdered lime is good for the purpose.

A power sprayer, such as either of the ones illustrated, is capable of supplying three lines of hose, and with the proper attention, of distributing 700 to 1000 gallons of mixture per day.

However, it is not always possible to take a large spraying outfit to the scene of operations, and in such an event a smaller machine is desirable. The outfits illustrated (Plate 19, Figs. 1 and 2) supply such a need very well.

Aside from the difficulty of application in cities, another obstacle is the matter of the preparation of the sprays. Insect outbreaks are liable to occur in widely separated districts, so that it is impossible to have a central spray-house easily accessible from all points. The difficulty is especially emphasized in the work with the lime-sulfur wash, or in fact, in the preparation of any spray requiring considerable apparatus. The problem has been largely solved by the city of Cleveland by mounting a steam boiling plant on wheels. Plate 18, Fig. 2. This rig is taken to the scene of operations and stopped near a water plug. A plant of this kind with its four barrels for boiling the mixture and heating water is easily capable of furnishing material for one power sprayer.

The rig was also used to excellent advantage in the preparation of kerosene emulsion. Plate 18, Fig. 1. The soap and water were placed in a barrel and the steam turned on until the soap was dissolved. The kerosene was then thrown in and the steam, rushing out, formed a perfect emulsion in an exceedingly short time. Such a rig is capable of furnishing emulsion for three or four power sprayers.

SPRAYING FORMULAE.

In the general application of insecticides, the materials divide themselves into two classes according to the manner in which they affect the insect. The first includes the contact sprays which are used against insects possessing mouth parts constructed for piercing the covering tissue and taking out the sap of the plant. Of this class the lime-sulfur wash, kerosene emulsion, etc., are well known illustrations. The idea in their application is to cover the body of the pest with the spraying mixture.

The second class of sprays is used against insects that bite out portions of the plant. The active element in them is some poisonous substance such as arsenate of lead, Paris green, etc. They are applied to the surface upon which the insect feeds.

The newly hatched larva bores through the outer layer of bark and rests in the white layer next the wood through the winter. With the advent of spring feeding is resumed, and the larva eats its way well into the body of the tree. If the tree is small the trunk may be almost severed and a slight wind may blow it over. See Plate 17, Fig. 2.

The full grown larva is a creamy, club-shaped, footless grub, about ¾ inch in length. See Plate 16, Fig. 2.

The pupal stage is passed within the burrow, the adult emerging at the time previously stated. There remains to be found a practicable, effective, combative measure for this pest. Spraying the trunks of the trees with a repellant just previous to the time the females deposit their eggs is of some value, though not wholly effective. Whale oil soap and white-wash were applied to adjoining rows of trees in the Station planting, resulting in a slightly lessened injury during the season following. Injecting carbon bisulphide into the tunnels, by the use of an engineer's oil can, previous to the appearance of the adults and closing the tunnels with grafting wax was also partially successful in controlling the pest.

The Locust Twig Borer, Ecdytolopha insiticiana Zell.

The presence of this insect in yellow locust groves is quite easily detected by its work upon the twigs of the tree.

The smaller twigs become swollen and after a time white, sawdust-like material commences to drop from an opening in the enlarged section (Plate 16, Fig. 1.) The injury is the work of a lepidopterous larva, which, upon the completion of growth, drops to the ground and pupates among the dried leaves. In this position the winter is passed. Although not exceptionally injurious it harms the tree to a certain extent. It is a question, however, whether combative measures are worth while. Should action be considered necessary, the affected twigs may be cut and burned while the larvae are still present in them, or the leaves containing the hibernating pupae may be collected and destroyed during the winter.

SPRAYING APPARATUS.

Power sprayers connected with large mixture tanks are the most practicable for general operations against shade tree pests, as only a strong pump is able to elevate the mixture to the top of tall trees, and the work in doing so is enormous if it is attempted by hand. The city of Cleveland has two of these sprayers, driven by small gasoline engines, which are giving very good satisfaction. See Plate 20, Figs. 1 and 2. One of these sprayers has a platform built above the pump and engine upon which the men stand when spraying the tops of large trees. The sides of the platform are closed, thus protecting the machinery from the spraying mixtures.

Spraying with arsenate of lead, used at the rate of 5 pounds to 50 gallons of water, as soon as the young leaves are well developed is the most satisfactory remedy for combatting this pest. If the application be made at that time, many of the adult beetles will be destroyed and egg-laying prevented.

The banding process undoubtedly does considerable good, but the labor involved in watching the bands renders the cost out of proportion to the good accomplished. See Plate 15, Fig. 2.

The Locust Leaf Miner, Odontota dorsalis Thumb.

This insect has occurred in destructive numbers for several years, in Ohio, the most severe attacks being upon yellow

locust, both in plantings and in the wild hillside growth along the southern border of the state. It may be found in the vicinity of Wooster, but very scatteringly. Along the section bordering the Ohio River, the locusts suffer so severely as to cause the browning and shedding of the leaves, large areas appearing as if scorched by fire.

The adult is a firthened beetle about 1/4 inch in length. The general color is red, broken by a medial line, with head, appendages and under surface black. The wings are deeply dotted with fine punctures.

The winter is passed in the adult stage under trash in the vicinity of the feeding ground. In the spring the beetles emerge soon after the leaves of the locust are well grown. Eggs are deposited upon the surface of the leaves, and the young larva makes its way out through the under side of the egg-shell into the tissue of the leaf. feeding until grown and pupating between the two layers of epidermis. The adults feed upon the leaves and may be found in the groves throughout the summer. The most satisfactory method of combatting the pest is spraying thoroughly with arsenicals as soon as the locust leaves are out, that the beetles may be killed before egg laying is accomplished. This of course is impracticable for forest plantings.

The Locust Borer.

So destructive is the work of this insect The Locust Borer,
Cyllene robiniae Drury.

upon locust trees that in some places the growing of a perfect tree is an im-

possibility. The adult belongs to that class of insects known as the long-horned borers. It is a black beetle, brilliantly marked with yellow lines; the long antennae and the legs are dull vellow and the length varies from 1½ to 1¾ inches.

At the time the golden rod blossoms the adults appear and egglaying commences. The female hurries about over the trunk of the tree, and when a crevice is found which suits her fancy she deposits a single white egg, then continues her search for another place. The eggs are shown much magnified in Plate 17, Fig. 1.

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The Elm Leaf Beetle, Galerucella luteola Mull. This insect was first discovered within the borders of this state by Mr. G. A. Runner of the State Nursery and Or-

chard Inspecting Department. It was found during the summer of 1904 feeding upon the elms located in the grounds of the National Cash Register Co., Dayton, Ohio. Subsequent examinations revealed its presence in a number of parts of the city.

In July, 1907, the writer made a visit to the city, and found the elms in some sections to be in very bad condition. At that time, as far as the writer was able to learn, work of combatting the insect had been commenced in three places only, one being on the grounds of the Cash Register Company, where arsenical sprays had been applied, and the remaining two were near the center of the town, where some work in banding had been executed by Mr. C. F. Harbison in cooperation with the Agricultural Experiment Station.

Because of the absence of the chief gardener, in whose charge the work had been placed, the writer was unable to obtain a very definite idea of what had been accomplished towards controlling the insect on the grounds of the Cash Register Company.

The plan worked upon by Mr. Harbison was to band the trees with tanglefoot and burlap when the larvae first began to descend, and to examine the bands at frequent intervals throughout the season, destroying all larvae or pupae that collected on or under the bands or at the base of the tree. Although most carefully executed, the banding process was only partially successful in controlling the pest.

The elm leaf beetle is well distributed in the eastern states, and now annually ruins great numbers of shade trees. The green and black striped beetles, not over 3/8 inch in length, pass the winter in the adult stage in some sheltered place. With the coming of spring they leave their shelters and begin feeding upon foliage of the elm. Soon the eggs are deposited on the under sides of the leaves and within a few days the larvae appear. They feed upon the undersides of the leaves, leaving the vein work and epidermis above. Soon the injured portions of the leaf die and the leaves appear as illustrated in Plate 15, Fig. 1.

The grubs become full grown in from 2 to 3 weeks, or possibly longer, depending upon the weather conditions. At the conclusion of larval development the insects crawl about and either pupate in the crevices of the bark or in some nearby shelter. Often they may be seen lying helpless in considerable quantities at the base of the tree.

It is quite likely that only two generations occur annually in Ohio. Elms only are attacked.

The Catalpa Bud Gnat. The work of this insect upon the catalpa was first mentioned in Bul. 7, Ohio Department of Agriculture, Division of Nursery and Orchard Inspection.

During the early summer, the tender growing tips of the catalpa become swollen and in time blacken at the point of injury. During the early part of the season the injury is usually found 3 or 4 inches below the tip, and at a lesser distance during late summer when the tree is growing less rapidly. The tip above the injury dies. Following the death of the tip in early summer, the next node below develops one or more branches and frequently a cluster of leaves, giving the tree a bushy growth. Plate 24. The ultimate result after continued topping is a stunted, crooked, forked, growth—Plate 13. Fig. 2.

An examination made last spring of all the twigs upon 15 threeyear-old catalpa trees revealed the fact that 49 percent of the tips of the twigs had been injured by the bud gnat.

If one of the injured twigs is examined by being cut open, small, footless, yellow or white larvae will be found. If one of these is placed on a smooth surface, it has the power to jump several inches in the air. This is accomplished by raising both ends of the body so that they almost meet above, and then with a sudden motion straightening out.

The insect has been under observation on the Experiment Station farm since the summer of 1904. From observations made in the field there appear to be two broods per annum, one in early and another in late summer. The pupal stage is probably passed under the surface of the soil, as the author was unable to secure adults by placing twigs infested with the larva in cages that did not contain moist soil.

With solittle understood concerning the pest it is difficult to plan remedial measures. It has been suggested in Bul. 7, Ohio State Department of Agriculture, Division of Nursery and Orchard Inspection, that cutting the infested twigs and destroying them would be of value during the summer.

The Station plantings at Wooster indicate that the pest is less serious in cultivated groves than in sodded ones. However, this observation can only be considered as an indication, as the cultivated groves are younger than the sodded ones and the insect has thus been unable to become so well established.

e 4.

mass to cast their skins and after the completion of the operation pass back along their well marked trail to their feeding grounds. A considerable quantity of the cast skins remains attached to the tree at the point where the cluster of larvae rested. They again travel en masse when they pass to the ground to pupate.

The insects may be destroyed in great quantity while they are settled upon the trunk of the tree during their molting period, or the crop of insects for the following season may be considerably lessened by thoroughly working the ground beneath the tree during the winter months to destroy the hibernating pupae.

The Catalpa Sphinx, Ceratomia catalpa Bois.

This insect has been known to occur in Ohio for a number of years. It is only since the catalpa has become so popular as a tree for forestry purposes that the catalpa sphinx has attracted yery much attention. Its ravages are confined mainly to the south-

ern part of the state.

The insect, as represented in the different stages of its development by Plate 12, is most easily detected by its work upon the leaves during the larval stage. The tiny worms may be observed feeding in rows or clusters upon the epidermis of the leaf. Later the whole leaf is eaten and in case of bad attacks the entire tree is defoliated, as represented in Plate 13, Fig. 1. The larva is first of a pale yellowish-green color and bears a black horn or spine at the rear of the body. When full grown it resembles the large green tomato or tobacco worm, with the exception that the color, instead of being solid green, is green with broken black bands extending lengthwise of the body. The worms may be observed in Ohio at least twice each season—once in June and again in late summer. Possibly there are more than two broods.

The larva pupate under the surface of the soil, the pupa proper being reddish brown, and somewhat smaller than that of the tobacco sphinx. It also lacks the peculiar "jug handle" common to the other species.

The moth is of the regular sphinx type; pointed body, narrow, strong wings, large eyes, and is of a gray ashy color. The eggs are deposited in pearly masses on the under sides of the leaves. The winter is passed in the pupal stage.

Three methods of control are practicable to be used against the pest. The first is collecting the egg-masses or clusters of newly hatched larvae. The second method is spraying with arsenicals. The third, recommended in Bul. 7, Ohio Department of Agriculture, Division of Nursery and Orchard Inspection, relates to the control of the species in nurseries or plantations and consists in deep plowing at the time the insects are in the pupal stage.

"The caterpillars prefer to hide during the daytime, and advantage may be taken of this habit to tie burlap bands in the middle around the tree trunks and then turn the upper portion of the burlap down over the string. The bands can be lifted daily and the caterpillars beneath killed. This method proved of such great value in the work against the gypsy moth that thousands of trees were banded during the latter part of the caterpillar season."

"The larva is quite resistant to arsenical poisons, and it requires a large dose to kill it, especially when the caterpillar is nearly grown. There is probably no better poison for this pest than arsenate of lead, using at least 5 pounds to every 50 gallons. The application should be made as soon as the leaves are well grown, and then the caterpillars will be poisoned while young and most susceptible to the insecticide."

Spiny Elm Caterpillar or Mourning Cloak Butterfly, Evanessa antiopa Linn. The adult of this species is one of the butterflies quite commonly seen flying about. It is strikingly marked by the gen-

eral dark-brown color of the wings being bordered by a margin of broken yellow, the whole general appearance being that of black bordered with white.

The eggs are deposited in rings around the twigs of the food plant, which for Ohio is usually willow, though elms are sometimes attacked. The full grown larva is black with a row of red spots down the back. It bears numerous long spines which in turn bear shorter branches. It measures about two inches in length. The pupal stage is passed as an unprotected chrysalid attached to some portion of the food plant. The winter is passed in the adult stage in some sheltered nook.

Control methods consist in spraying with poison, or in collecting the larvae and destroying them as they feed in clusters.

Black Walnut Caterpillar, Datana integerrima Grote & Robinson.

The general body color of the larva of this insect varies from dark brown to black, and it is

clothed in long, white hairs. When disturbed it suddenly raises both ends of the body to a vertical position, holding only with the body legs. This peculiarity, in combination with its general color, renders the insect comparatively easy to distinguish. The full grown larva is about 2 inches in length. It has been observed by the writer feeding on black walnut only, though it is reported from other states as feeding upon butternut, hickory and others.

The larvae feed in clusters on the leaves and at certain intervals travel to the trunk or larger branches of the tree for the purpose of molting, leaving a silken path as they go. They settle in a large "The larvae transform to pupae during the month of June, the moths appearing from the latter part of June till the latter part of July. In exceptional cases these dates may be considerably extended. Males emerge in advance of the opposite sex, and shortly afterwards the females appear, pairing takes place and egg deposition begins. The embryos are frequently well developed within the egg in two or three weeks after oviposition, but as a rule the caterpillars do not emerge till the next spring. A case is on record of eggs hatching in early September, 1895, at Woburn, Mass., but the round of life was not completed, and in this northern latitude at least, there need be little fear of two generations annually."*

The insect feeds upon the foliage of practically all of the shrubs and plants grown for economic and ornamental purposes.

Concerning recommendations for combatting this pest, Dr. Felt has the following to say:

"Investigate anything that arouses a suspicion that it may be the gypsy moth, but be in no undue haste to identify the insect. It will be much more satisfactory to submit the specimens to an entomologist than to arouse unnecessary fears. There have already been several false alarms occasioned by persons with more enthusiasm than discretion, who have attempted to identify an insect with which they were unacquainted.

"It would undoubtedly pay to exterminate a small colony, but in the course of time this will be impracticable. We must learn to control it on our own land. The inability of the female to fly and the conspicuousness of the 'egg-masses make this task relatively easy, unless the pest is allowed to escape to the woods. There, a private individual could hardly cope with the insect. The point of establishment in this state is almost bound to be near some dwelling, and therefore the species need not be allowed to establish itself in wild land, at least for some years.

"One of the most effective methods of keeping this pest under control is the careful collection and burning of the conspicuous eggmasses. This can be done most effectually in the fall, during the winter and in early spring. No ordinary fire running over the ground can be relied on to kill the eggs. The only safe way is to put them in a stove or similar fire and burn them. Creosote oil applied to the egg-mass will soak in and kill the eggs. The following preparation was used in the work against the gypsy moth: Creosote oil, 50 percent; carbolic acid, 10 percent; spirts of turpentine, 20 percent, and 10 percent of coal tar. The latter was added to color the compound and thus show at a glance what clusters had been treated."

^{*}Insects Affecting Park and Woodland Trees. N. Y. State Museum Memoir 8. †Ibid.

larly of limbs and fence rails. The nearly globular, pale yellowish or salmon-colored eggs are about one-twentieth of an inch in diameter, and there are usually 400 to 500 eggs in a cluster, though occasionally 1000 may be found in an egg mass.

"The young caterpillar is slightly over one-tenth of an inch long just after it emerges from the egg. It has a black head, the body is brownish yellow and well clothed with long hairs. There is a prominent hairy tubercle on either side of the segment next the head; this gives the caterpillar a peculiar broad-headed appearance, especially in its early stages. The markings become plainer as it increases in size, and when full grown it is from 2 to $2\frac{1}{2}$ inches long. This caterpillar has a double row of conspicuous warts or tubercles down its back, the eight anterior blue, the 12 remaining red, not counting the four blue ones just behind the head. Similar tubercles also occur on the sides.

"The somewhat conical, dark brown pupa ranges from ¾ to 1½ inches long. It is usually found lying among a few threads and securely attached to them by its terminal spine.

"The male and female moths differ markedly. The former, a slender, olive brown, black-marked creature with feather-like antennae and having a wing spread of about 1½ inches, may be seen flying in the late afternoon and early evening in considerable numbers. The female is much heavier and lighter colored. She has a wing spread of about 2 inches and is a white or buff white color with more or less distinct black markings. The abdomen is tipped with buff. The female moth does not fly though she apparently has well developed wings.

"The winter is passed in the egg-mass, which is remarkably resistant to atmospheric and other agencies. Experiments have shown that even when the egg clusters were broken up and freely exposed to the elements, the eggs were apparently not harmed, and a normal proportion of the caterpillars appeared at the usual time. which, in the vicinity of Boston, is from the last of April until the middle of June. The feeding period extends from the first of May to about the middle of July, a caterpillar requiring from about 9 to 11 weeks to complete its growth and enter the pupal stage. The young caterpillars remain on the egg clusters from one to five or more days and then commence feeding on the leaf hairs. Soon they eat out small holes in the leaves and, after the third or fourth molt, about as many feed on the edge of the leaf as eat out holes. The caterpillars are largely nocturnal, remaining in clusters on limbs and trunk, or hiding in some crevice during the day, and beginning between 7 and 8 o'clock in the evening leisurely to ascend the tree, where they feed on the foliage at intervals during the night, descending about 3 o'clock in the morning.

"When full grown the caterpillars are 1½ inches long." They are dark brown with a sprinkling of orange. Long, fine, reddish hairs cover the body, and a row of conspicuous white hairs runs along each side. Like the caterpillars of the tussock and gypsy moths, they bear bright red eversible tubercles on the top of the sixth and seventh abdominal segments."*

Besides doing great injury to the trees in badly infested districts, the caterpillars are equally obnoxious because of the poisoning effect the spines from the hairs of their bodies have upon human flesh. Contact with the insect's body, with cast skins as they are blown about, with the cocoons or with clothing in which the spines have gained access, may cause the characteristic irritating eruptions.

The cocoons are placed upon the leaves or in some sheltered position. They are lightly covered with the brown hairs from the tip of the female abdomen.

As to food plants, according to Dr. Felt, the insect feeds upon such fruit trees as the pear, apple, plum, and cherry, and upon the following forest trees: oak, maple and elm.

The remedial measures are comparatively simple, consisting of the collecting and destroying of the conspicuous winter nests. Spraying with arsenicals is also to be relied upon, but the former is preferable because of the smaller expense involved.

The Gypsy Moth, Porthetria dispar Linn. This, as with the preceding insect, is one that Ohioans may happily say does not occur within the borders of the state.

It was introduced into Medford, Mass., in 1868 or 1869, but did not develop in excessive numbers until 1889, when the attacks became very severe in the locality of its introduction.

At that time the state of Massachusetts began making annual appropriations for the purpose of combatting the pest and during the nine years following over \$1,000,000 was expended. During that time the insect spread slowly, and since 1899, when the appropriations were discontinued, more rapidly, so that at the present time a considerable area of Massachusetts is infested, and the infestation has spread to at least one of the neighboring states (Rhode Island.)

"The eggs of this insect are deposited usually in round or oval patches on a piece of bark and then covered with the buff-colored scales from the underside of the female's abdomen. A completed egg-mass looks very much like a small piece of sponge. The egg-mass may be found on stones, in tin cans, and in fact on almost any fixed object near at hand, preferably on the under surface, particu-

^{*}Bul. 108, Maine Agricultural Experiment Station.

Probably the simplest and most effective of the methods to be used in combatting this pest is the collecting of the conspicuous bags during the winter, thus destroying the eggs; followed by the application of mechanical barriers placed around the trunk of the tree, to prevent it from being reinfested by larvae wandering from other sources.

Another remedy applicable during the summer season when the larvae are feeding is spraying with arsenicals. See Plate, 10 Figs. 1 and 2, and Plate 11, Fig. 1.

The Brown Tail Moth, Euproctis chrysorrhaea Linn. This species occurs only in the New England States at present, but unless something unforeseen

happens it will be only a matter of time until it spreads to this state. The following description is taken largely from Memoir 8, New York State Museum, and is herewith given that the pest may be recognized and prompt measures be taken to stamp it out when it reaches our borders.

The insect has two features peculiar to it which render its separation from other insects comparatively easy. The first is the presence of a tuft of brown hair on the tips of the abdomens of the moths of both sexes, and the second is the position in which the webs are spun, namely, upon the tips of the branches.

The female moth is white in color with the exception of the brown marking already described, and measures 1¾ inches across her spread wings. The male is smaller, having a wing expanse of 1¼ inches, and the general white of the wings is broken with a few black spots. The brown tuft on the abdomen is smaller and darker in color than that of the female.

The moths fly during July, and during this season the eggs are deposited in masses on the under sides of the leaves. From 200 to 300 are clustered together and are then covered with the brown hairs from the tip of the abdomen of the female.

Upon hatching, the young feed gregariously upon the surface of the leaf, spinning a covering web as they go. They soon begin the preparation of their winter nest by drawing a few leaves together and lining them with silk, and binding the whole tightly to the twigs. The winter is passed in the immature larval condition within the protection of the soil.

"Early in the spring the caterpillars emerge and, if the leaves have not started, begin feeding upon the swelling buds. During the spring they continue their work, completely stripping the tree in cases of severe attack. One brood occurs annually. softer portions of the leaves causing the remainder to die. Occasionally, as the larvae approach maturity, the food supply is exhausted within the web and they wander to adjoining twigs. The pupal stage is passed in a thin cocoon, usually located in trash on the surface of the ground or just below the surface.

Both sexes are winged moths, white, or white dotted with black. The eggs are deposited upon the leaves.

Because of the conspicuous web, one of the common methods used in combatting this pest is clipping the twigs from the tree to which the masses are attached and destroying them. This, however, involves a loss of a part of the tree and for this reason it is preferable, where possible, to spray with arsenicals when the young caterpillars are known to be emerging. This occurs during the month of June. See Plate 9, Fig. 2.

The Bag or Basket Worm, Thyridopteryx ephemeraeformis Haworth. Insects of the class to which the one under present consideration belongs, derive their popular name from the curious bag or basket which is con-

structed during the larval stage. Soon after the larva is hatched it contructs for itself a silken sack, smooth inside, while to the outside are attached portions of bark, leaf tissue, leaf petioles, etc. From the open end of the bag the larva protrudes its head and fore legs, and thus walks about at will, dragging its home with it. To one unaccustomed to the sight it is indeed a surprise when the curious semi-shapely bundle of trash that has attracted his attention, suddenly develops life and moves away.

As the enclosed larva grows, the bag is enlarged from time to time by additions to the open end. Upon reaching maturity the larva binds its case to a limb and pupates. At the end of the pupal stage the males emerge and fly about, while the females, being wingless, oviposit within their old cases and afterwards wriggle out to fall upon the ground and die.

The winter is passed in the egg stage.

A number of bag-constructing insects occur in Ohio: one, a small species, and quite common, covers its bag with portions of grass stems, and the empty cases may be found attached to fence posts, etc. The one under discussion is a comparatively large species, the completed bag varying in length from 1½ to 2 inches. It was observed doing considerable damage to shade trees during the past season in the central and south-western portions of the state.

A large number of trees and shrubs serve as food plants, the ones most commonly found during the past season being sycamore, horse chestnut, hard maple and willow. The most severe case of attack coming to the author's attention was upon hard maples in Cincinnati. See Plate 11, Fig 2.

The Forest Tent Caterpillar, Malacosoma disstria Hubn. During the last half century there have been occasional severe outbreaks of this insect in widely separated sec-

tions of the United States, the hard maple being the principal sufferer in the north.

The eggs are deposited in late summer, usually upon the lower branches of the tree, though they sometimes may be found upon the topmost twigs. They are placed in belts of about 150 each surrounding small twigs. After the egg is deposited, the larva develops within the egg-shell, but does not break through until the following spring, about the time the leaves are appearing. As the larvae feed and develop, they do not spin a sheltering web as do some of the other leaf-feeding caterpillars, but, as they pass up and down the limbs of the tree, they spin a silken thread behind them, which after many passages becomes a silken path. When not feeding upon the leaves they rest in clusters upon the limbs and trunk of the tree. They also take this position to shed their skins.

The full grown caterpillar is about two inches in length and is characteristically marked with a blue head and a row of diamond shaped spots down the middle of the back.

The cocoons are spun in any sheltered position, such as among crumpled leaves on or under the tree, in crevices of the bark and of fence-posts, etc. They are composed of the hairs from the insect's body, silken threads, and a liquid which the caterpillar ejects, the latter giving the mass a yellow, powdery appearance.

The adult is a brown moth, bearing a darker colored band across each fore-wing, almost parallel to the outer border. They fly mostly at night.

Concerning remedial measures, as with the tussock moth, much good may be accomplished by collecting and destroying the eggmasses during the winter months. However, this method is not as fully applicable in the present instance as the egg-masses are not so conspicuous. Probably the best method of control is spraying with arsenicals at the time the larvae appear. As with the tussock moth it will probably be of advantage to band to prevent reinfestation.

The Fall Web Worm,
Hyphantria textor Harris.

The distinguishing characteristic of this insect is seen in the large unsightly webs occurring most commonly upon wild cherry during the late summer. Upon critical examination, it is seen that the webs contain a quantity of hairy larvae which feed upon the more or less browned leaves of the twigs enclosed. This discoloration results from the insect's eating the

paper. Ses Plate 7, Fig. 1. At the time of the treatment, the first brood of larva was beginning to give evidence of its presence by its work upon the leaves.

Both sprays killed the feeding larvae and the trees were practically free from the insect during the entire season, whereas, their untreated neighbors were partly defoliated. The sticky materials upon the bands was replenished once during the summer with a coating of Thum's tree tanglefoot.

The third measure looking toward control that was tried experimentally, was the application of strong kerosene emulsion at the time the first brood of larvae was transforming to the pupal stage. Horse chestnuts that had been defoliated by the first brood were heavily sprayed with strong kerosene emulsion July 20. The trees were located in front of 2236 84th St. SE. Directly adjoining these trees were other horse chestnuts that were left unsprayed for comparison. The comparison however was not a fair one as the untreated trees had in no wise suffered as severely as had the others. An idea of the appearance of the tree at that time of treatment may be had from Plate 6, Fig. 1.

August 30, the tree was again photographed as shown in Plate 6, Fig. 2. At the later date scarcely a single larva could be seen upon the treated trees and a small crop of new foliage had grown meantime; while enough larvae had escaped the parasites on the untreated trees to do considerable harm. A comparison between the treated and untreated trees may be drawn from Plate 7, Fig. 2. It may also be seen where some larvae from the untreated tree had gained access by means of the interlocking branches to the treated tree, and had destroyed a portion of the second crop of foliage.

As a general specific measure to be used in combatting this pest, the author believes there is nothing more effective and practical than collecting or treating the egg masses during the winter months and keeping the trees banded with tanglefoot from the middle of June until the first killing frost. This measure is escially commendable for individual operations as the cost would not be excessive to hire nimble workmen to climb the trees and destroy the egg-masses. It would only remain to keep the bands in good working order. If the work of destroying the cocoons is thoroughly done and the trees so treated are not close enough to neighboring trees so that the young caterpillars are able to span the distance with their webs, there is no reason why careful banding alone should not keep the trees free of this pest.

If impossible to collect the egg masses, spraying with arsenicals is next in order but it too should be supplemented with banding and the mixture should be applied while the larvae are young.

wingless and never leaves her cocoon until her eggs are deposited as previously described. With the completion of oviposition she dies and usually falls to the ground.

The male has feathery antennae, hairy legs and a wing expanse of nearly an inch. The wings and body are rather definitely marked with varying shades of gray.

For several seasons previous to that of 1907 the insect appeared to be gradually increasing in numbers and in destructiveness in the city of Cleveland. During the early part of the season of 1907, the first brood, which was an unusually large one, was beset by an army of parasites, resulting in a very small second brood of larvae.

A consignment of larvae and pupae placed in the breeding cages gave forth a large quantity of Hymenopterous and Dipterous parasites. In addition to the parasites just named, Heteropterous nymphs, the adult form of which we were unable to obtain, were observed clustered about the cocoons with their beaks inserted into the chrysalid or larva, as the case might be, that was contained therein.

The principal hosts for this species in Ohio are lindens, horse chestnuts and elms.

During the season of 1907, three methods of combatting this insect were given trial. The first consisted in clearing the eggmasses from small elms on Euclid Ave. See Plate 8, Fig. 2. The collecting was done during the spring months. The trees were in a small park removed some little distance from other trees. As a result of the treatment they were unaffected by the insect during the entire summer following. However, as before stated, the trees were small, and the work of clearing them could be very thoroughly done. This is one of the standard methods to be used against the pest.

When the infested trees are very tall, thus rendering collecting impossible, dampening the masses with creosote is sometimes substituted. The operation is performed with a sponge dipped in creosote tied to the end of a long pole. Where trees that have been cleared of the egg-masses are situated in the vicinity of other plantings it is well to supplement the collecting process by banding the trunks of the trees with mechanical barriers, such as rings of cotton batting or bands of sticky material, such as Thum's tree tanglefoot.

The second method given trial during the summer of 1907 was spraying lindens with kerosene emulsion containing 5 percent kerosene and with arsenate of lead, 3 pounds to 50 gallons of water; supplementing the treatment in each case with bands of tanglefoot fly-

The kerosene and lime are mixed in the proportion of one gal. kerosene to 4 lbs. lime, or in other words, the lime is added to the kerosene until all the kerosene is absorbed. It requires from 3 to 5 minutes to thoroughly mix the mass. When the emulsion is complete, it is diluted with water and applied. For scale insects, upon which the mixture is most commonly used, the following are the proportions: kerosene 12½ gal., lime 50 lb., water 34½ gal.

S alecide and other so-called Soluble Oils

Materials of this class require dilution with water only; usually 5 percent mixtures are recommended by the manufactures for scale applications.

In the experience of Prof. P. J. Parrott of the New York Experiment Station, mixtures containing 7 to 10 percent of oil applied to trees infested with the San Jose scale, gave results slightly inferior to those obtained from the use of boiled lime-sulfur sprays.

POISON SPRAYS.

The poison sprays in most general use at the present time are Arsenate of Lead and Paris Green. Of the two, the lead is the most expensive but the extra expense is usually justified by reason of its superior adhesive qualities and consequently longer period of efficiency after the application. The Paris green is more quickly effective than the lead.

Arsenate of Lead This material is manufactured by a number of companies and is placed on the market under varying trade names. It is paste-like in consistency, requiring only the addition of water before use. Some brands are with difficulty dissolved, and for these the author has found the work of the process of preparation much lessened by placing the paste in a small burlap sack and, with frequent dippings in the spraying mixtures, work the materials through the cloth.

For most leaf-eating insects three pounds of material to 50 gal. is sufficient, while for others 5 to 7 lbs. to the same amount of water is more desirable.

Where it is impossible to obtain the manufactured article or for any reason undesirable to do so, arsenate of lead may be prepared after the following formula:

	ead	
Arsenate of	soda	4 oz.

Dissolve the acetate of lead and arsenate of soda separately in 2 quarts of water each. Pour the two together and add the desired amount of water.

^{*}Bulletin 28, New York Agricultural Experiment Station.

Paris Green is mixed with water at the rate of one pounds of lime are added to prevent burning. The mixture settles readily to the bottom of the sprayer, rendering frequent agitation necessary.

REMARKS.

As stated at the outset, the problem of the control of shade tree pests is one to be encountered to the greatest extent in cities and towns, and is largely a municipal matter. Already steps are being taken in some cities, Cleveland being the most advanced in the matter in this state.

The city of Cleveland has authorized the Department of Forestry to extend its operations to the combatting of the shade tree pests, and to this end has commenced the purchasing of suitable apparatus for the purpose.

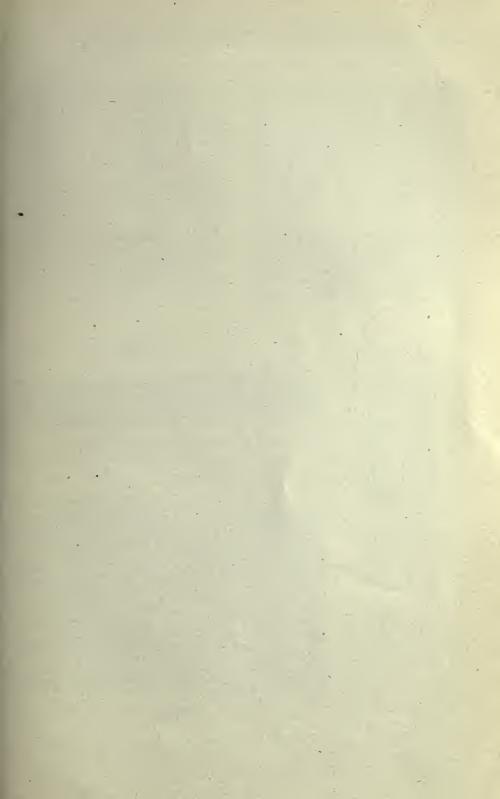
The personnel of the department consists of a Forester, Assistant Forester, clerks, and a number of "tree wardens." To the latter are assigned certain sections of the city. Besides their duties of planting, trimming, etc., as far as possible each is supplied with a spray pump mounted on wheels which he uses to the best of his ability. The two large power sprayers, before mentioned, travel about over the city to the points where the work is most needed.

At present the work of the department is confined to the street and park plantings. It is very necessary, however, that the Department be allowed to expand, until it is able to care for trees on private grounds as well, as it loses much of the good effects that should follow the work, because treated trees are reinfested by adjoining untreated ones. Possibly a fair sum could be charged the property owners for the service rendered.

It is evident that all cities and towns cannot afford such an institution as the Cleveland department, but it is the author's opinion that the public sprayer most nearly approaches the solution of the shade tree insect problem for the cities and towns of our state.

ACKNOWLEDGEMENTS.

The author wishes to express his appreciation to Prof. H. A. Gossard, Entomologist of the Station for his suggestions and approval of plans for work; to Mr. M. H. Horvath, former City Forester of Cleveland, and to Mr. John Boddy, the present Forester, for their cooperation with the Experiment Station in the conducting of experimental work, and to Mr. C. R. Neillie, of the same department, for being accorded the opportunity from time to time to examine the records of the work done by the power sprayers; and to Mr. W. H. Goodwin for preparation of one or two of the illustrations, among them the cover cut.



EXPLANATION OF PLATE I.

- Fig. 1. The oyster shell bark louse much enlarged.
- Fig. 2. The oyster shell bark louse enlarged two diameters.
- Fig. 3. Branch of horse chestnut defoliated by oyster shell bark louse.
- Fig. 4. Scurfy bark louse much enlarged.
- Fig. 5. Scurfy bark louse, enlarged two diameters.

PLATE I.





Fig. 1.

Fig. 4.



Fig. 2.



Fig. 3.

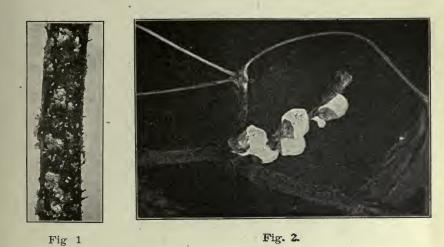


Fig 5.

EXPLANATION OF PLATE II.

- Fig. 1. The rose scale, natural size.
- Fig. 2. The maple cottony scale, natural size.
- Fig. 3. Lombardy poplar on the campus of Buchtel College, Akron, Ohio. This tree is badly infested with oyster shell bark louse. The horse chestnut is badly infested at the base; the next in order a little less so; the next one a little less, etc., down the line. It is a most striking illustration of how scale insects spread from a badly infested center.

PLATE II.



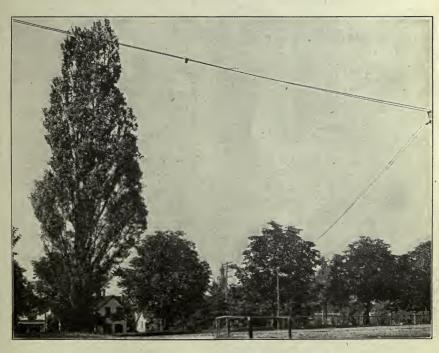


Fig. 3.

EXPLANATION OF PLATE III.

- Fig. 1. The pine leaf scale, natural size, with the twice-stabbed lady bird, Chilocorus bivulnerus Muls., feeding upon the scales.
- Fig. 2. Adult females of the elm bark louse.
- Fig. 3. The pine bark aphid upon the base of a pine.

PLATE III.

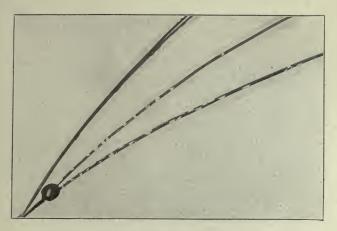


Fig. 1.



Fig. 2.



Fig. 3.

EXPLANATION OF PLATE IV.

- Fig. 1. Hard maple sprayed during the early spring with kerosene emulsion containing 40% kerosene. The tree was severely injured.
- Fig. 2. Hard maple sprayed with kerosene emulsion containing 20% kerosene. Uninjured.

PLATE IV.

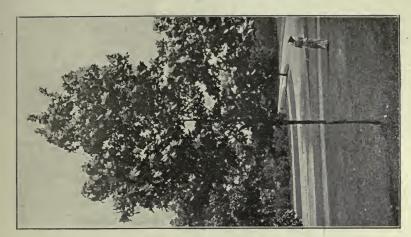


Fig. 2.



Fig. 1.

EXPLANATION OF PLATE V.

- Fig. 1. Egg mass of white marked tussock moth,
- Fig. 2. Adult female moth about to oviposit upon her empty cococa. Slightly reduced.
- Fig. 3. Full grown larva.
- Fig. 4. Mass of cocoons spun in a cavity on the underside of a branch of horse chestnut.

PLATE V.



Fig. 1.



Fig. 2.

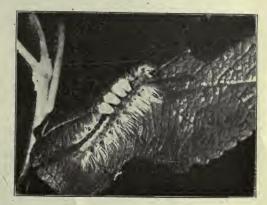


Fig. 3.

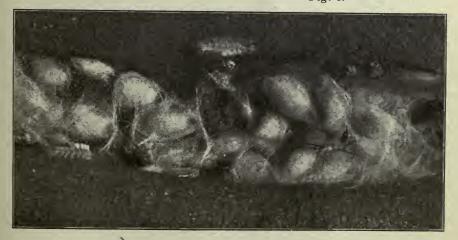


Fig. 4

EXPLANATION OF PLATE VI.

- Fig. 1. Horse chestnut photographed July 20, 1906, after it had been defoliated by the first brood of tussock moth larvae. The larvae, at the time the photograph was taken, were transforming to the pupal stage, many having already completed the operation. The tree was sprayed with strong kerosene emulsion and banded with tanglefoot.
- Fig. 2. The same tree, as above described, 40 days later. Evidently most of the larvae were destroyed by the treatment, as the tree had grown a partial second crop of foliage. Compare with Fig. 2, Plate VII.

PLATE VI.





Fig. 1.

Fig. 2.

EXPLANATION OF PLATE VII.

- Fig. 1. Elms protected from tussock moth by spraying with arsenicals supplemented with banding.
- Fig. 2. Elm growing beside the one represented in Plate IX, Fig. 2. Untreated, Photo Aug. 30, 1906.

PLATE VII.



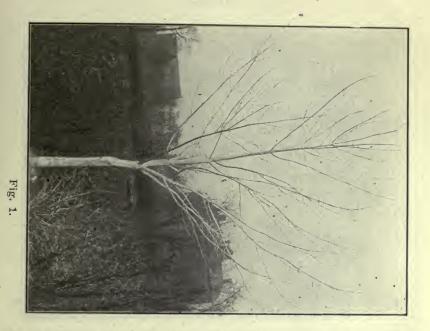


Fig. 2.

EXPLANATION OF PLATE VIII.

- Fig. 1. An ash tree perfectly sprayed with lime-sultur wash.
- Fig. 2. An elm protected from tussock moth by collecting the egg-masses during the winter.

PLATE VIII.



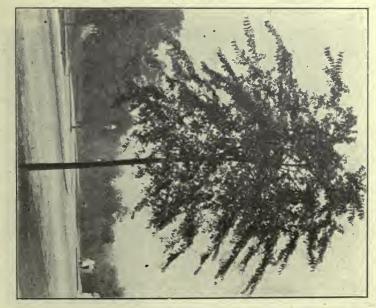


Fig. 2.

EXPLANATION OF PLATE IX.

- Fig. 1. Elms located in Washington Park, Cincinnati, Ohio, defoliated by tussock moth July, 1907.
- Fig. 2. Sycamore near Howard Street Station, Akron, defoliated by fall web worm.

PLATE IX.



Fig. 1.

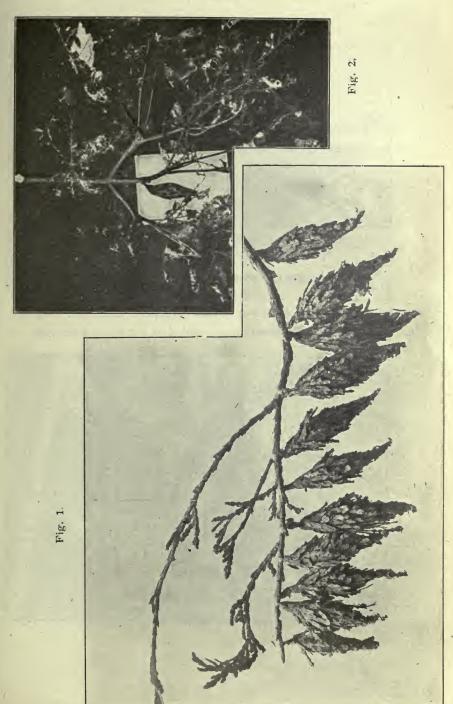


Fig. 2.

EXPLANATION OF PLATE X.

- Fig. 1. Bags of bag worm on arborvitae. Photo by Newell.
- Fig. 2. Branch of hard maple badly injured by bag worm. July, 1907.

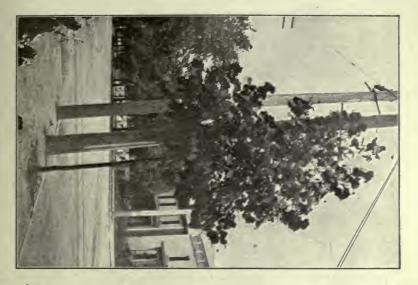
PLATE X.



EXPLANATION OF PLATE XI.

- Fig. 1. Sycamore injured by bag worm. Columbus, Ohio, July. 1907.
- Fig. 2. Hard maple, Cincinnati, Ohio, injured by bag worm, July, 1907.

PLATE XI.





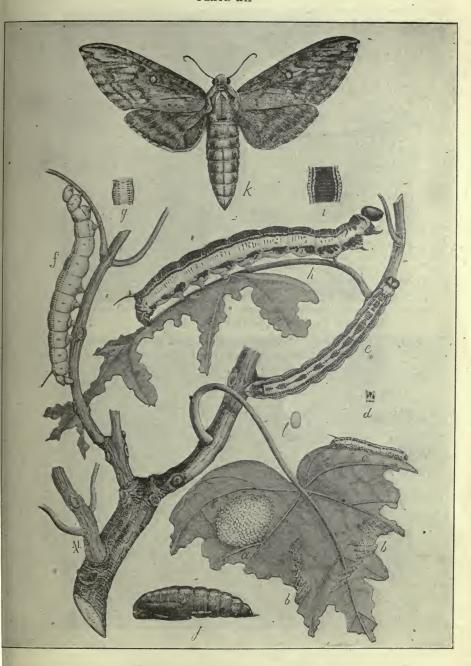
o. 1.

Fig. 2.

EXPLANATION OF PLATE XII.

The Catalpa Sphinx: a, egg-mass; b, newly-hatched larvae; c, a larva one-third grown; d, dorsal view of one its joints; e, f, h, differently marked larvae; g, dorsal view of one of the joints of f; i, do. of h; j, pupa; k, moth, natural saze; l, egg enlarged. (From Riley, Rept. U. S. Commissioner of Agriculture, 1881.)

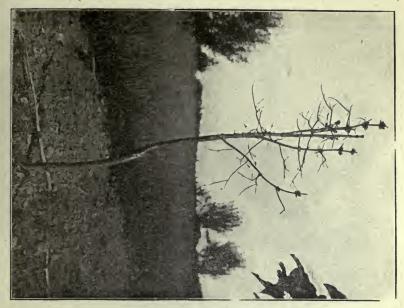
PLATE XII



EXPLANATION OF PLATE XIII.

- Fig. 1. Young catalpa on the farm of Mr. Clymer, Chillicothe, Ohio, defoliated by Catalpa Sphinx July 2, 1906.
- Fig. 2. A catalpa tree illustrating the characteristic stunted growth following the successive injuries to the tips of the twigs by the Catalpa Bud Gnat.

PLATE XIII.



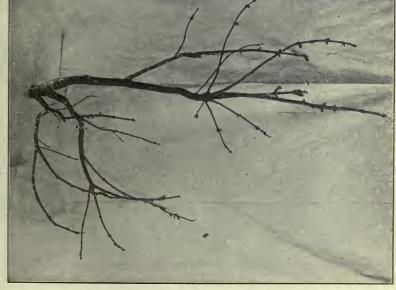


Fig. 1.

Fig. 2.

EXPLANATION OF PLATE XIV.

The top of a young catalpa tree illustrating the characteristic bushy growth which follows injury by the Catalpa Bud Gnat to the growing tip.

PLATE XIV.



EXPLANATION OF PLATE XV.

- Fig. 1. Elm leaves injured by the Elm Leaf Beetle.
- Fig. 2. Elm tree infested with the Elm Leaf Beetle during the season of 1906. The tree was banded with burlap and tanglefoot and the larvae collected and destroyed at frequent intervals. Photographed July, 1907.

PLATE XV.



Fig. 1



Fig. 2.

EXPLANATION OF PLATE XVI.

- Fig. 1. The Locust Twig Borer, showing larvae in boring, and the characteristic swollen twig.
- Fig. 2. Larva of the Locust Borer in the body of a young locust tree.

PLATE XVI.



Fig. 1.

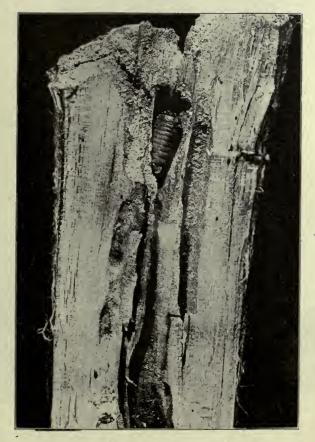


Fig. 2.

EXPLANATION OF PLATE XVII.

- Fig. 1. Eggs of Locust Borer, much enlarged.
- Fig. 2. Young locust tree injured by the Locust Borer, and subsequently broken by the wind.

PLATE XV I.



Fig. 1.



Fig. 2.

EXPLANATION OF PLATE XVIII.

- Fig. 1. Preparing kerosene emulsion by the use of a steam boiling plant, capable of preparing 3000 to 4000 gallons of first-class emulsion per day.
- Fig. 2. Same rig as above, being used for boiling lime sulfur wash.
 Used by the Department of Forestry, Cleveland, Ohio.

PLATE XVIII.

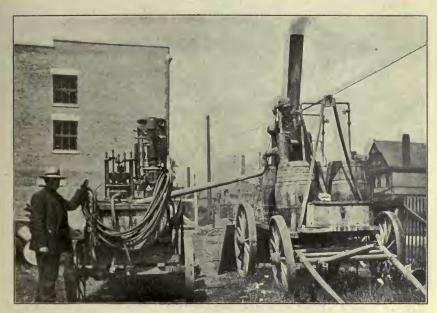


Fig 1.



Fig. 2.

EXPLANATION OF PLATE XIX.

Figs. 1 and 2. Hard sprayers used by the Department of Forestry, Cleveland, Ohio, Fig. 2 represents a most excellent rig, durable, easily portable and capable of furnishing good pressure.

PLATE X.X.

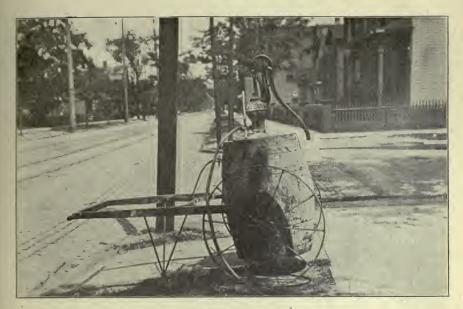
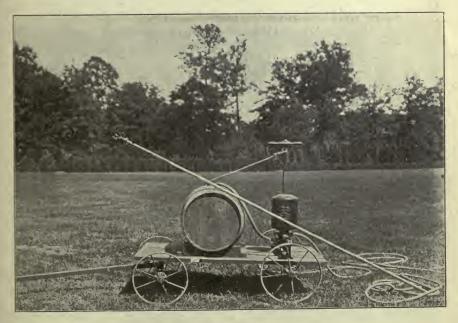


Fig. 1.



Fi 3. 2.

EXPLANATION OF PLATE XX.

Power sprayers used by the Department of Forestry, Cleveland, Ohio. Fig. 2 is the better of the two rigs.

PLATE XX.



Fig. 1.



Fig. 2.

EXPLANATION OF PLATE XXI.

- Fig. 1. An elm tree, C'evelard. Ohio, in bad condition, resulting likely from gas poisoning.
- Fig: 2. An Ailanthus tree, Cincinnati, Ohio. The Ailanthus is a most excellent tree for street planting as it is almost immune from insect attack and thrives even though the roots are completely paved over as was the case of the tree illustrated. Smoke seems to have little effect upon this species.

PLATE XXI



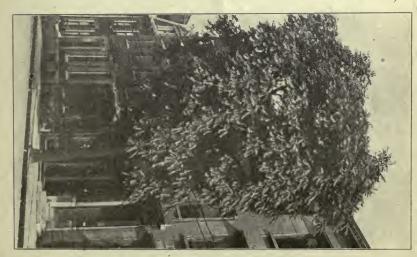
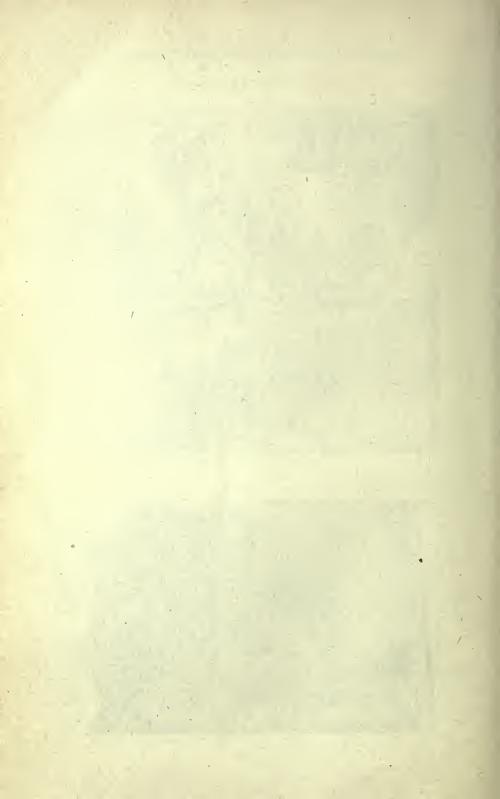


Fig.







Walter Mulford

THE CATALPA MIDGE.

Cecidomyia catalpae Comstock.

Agricultural Experiment Station.

WOOSTER, OHIO, U. S. A., OCTOBER, 1908.

BULLETIN 197.



Photo by Goodwin.

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EXPERIMENT STATION, Wooster, Ohio

ORGANIZATION OF THE

OHIO AGRICULTURAL EXPERIMENT STATION.

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The Bulletins of this Station are issued at irregular intervals. They are paged consecutively and an index is included with the Annual Report, which constitutes the final number of each yearly volume.

BULLETIN

OF THE

Ohio Agricultural Experiment Station

NUMBER 197.

OCTOBER, 1908.

THE CATALPA MIDGE.

Cecidomyia catalpae Comstock.

BY H. A. GOSSARD.

CHARACTER OF DAMAGE AND IMPORTANCE.

Three distinct forms of injury are chargeable to the larvae of the catalpa midge.

- 1. To the leaves, causing a form of leaf spot.
- 2. To the terminal buds and ends of the branches.
- 3. To the seeds in the pods.
- 1. The adult midges must appear in late May and early June in ordinary seasons. About June 22, 1908, my assistants found injury pronounced on many trees and numerous larvae were in the terminal buds. A close examination of the material brought in from the field soon discovered larvae on the leaves as well as in the buds, and a few hours observation of hundreds of larvae on collected leaves, as well as on leaves still on the trees, established their connection with the leaf-spot trouble. In the center of many of the spots could be found a larva with its head end inserted into a small hole in the center of the spot from which it imbibed its nourishment. Apparently the damage was caused by the removal of the plant juices from the spot, as there seemed to be no separation of the upper and lower epidermal surfaces over the injured area, nor did the larva seem to bury the front part of its body between the surfaces after the manner of some leaf-miners. Some spots just commencing to form could be found with young larvae feeding in their centers. Hundreds of these spots could often be found on single leaves, and large fruiting trees are sometimes so badly

attacked that from one-third to one-half the leaves wilt, turn brown and die from this cause. After the larvae disappear from the leaves. the resemblance of these spots to some of the fungous leaf-spot maladies is so great that for one or two seasons our botanists examined the spots very carefully at intervals with the compound microscope, the only result being to strengthen the suspicion that they were in some way caused by insects. The spots are generally about threesixteenths of an inch in diameter, but vary from mere points of brown to more than one-fourth inch in diameter, and sometimes by the coalescence of numerous spots large irregular patches of dead tissue are formed. Late in the season many of the spots break through or fall away, leaving the leaf full of holes and torn and ragged in appearance. That the larvae causing this trouble are identical with those which work in the bud seems quite certain by their similar appearance of form and coincident period of attack, but we have not yet bred leaf larvae from adults known to have developed from bud-inhabiting larvae, or vice versa, so the proof of their supposed identity is not perfect. But few larvae have been found on the leaves of old trees in the fall, the attack being apparently concentrated on the seed pods; but young trees have many larvae on their leaves in mid September, and probably until the leaves fall.

2. The most conspicuous form of injury due to the midge and the one which has been the subject of most inquiry at the Station is that done to the terminal buds. Mr. Cotton writes thus of his observations in 1905: "At several points in southwestern Ohio, injury to the tender tips of vigorously growing two-and three-year-old catalpa trees in nursery rows was observed during August and September, 1905. Usually two or three inches of the tips began to wither and turn brown, finally becoming much shrunken and black. When opened they were found to contain several small, yellow, footless maggots, similar to the catalpa pod Diplosis, and having the same power of leaping. The eggs were apparently deposited in the stem at the base of a leaf petiole or in the petiole base itself, and the stem began to die at this point."

"In one small block of two-year-old catalpas, about twenty-five percent of the trees had been injured. They had been cut back to the ground the previous spring and as a consequence had made a very vigorous growth. Many of them had been injured while still quite small, and in nearly every case all three of the lateral buds, at the last joint below the point of injury, had attempted to produce a



Figs. 1 and 2.

Dead tips due to midge larvae working in buds and tender wood.



In it to have ar



FIG. 2.

Photo by Houser.



FIG. 4. Photo by Hon. er

leader which resulted in a crooked, forked stem. This insect seems likely to assume considerable economic importance to nurserymen and others growing catalpa trees."*

Mr. Houser in Bulletin 194 of this Station says: "During the early summer, the tender growing tips of the catalpa become swollen and in time blacken at the point of injury. During the early part of the season the injury is usually found three or four inches below the tip, and at a lesser distance during late summer when the tree is growing less rapidly. The tip above the injury dies. Following the death of the tip in early summer, the next node below develops one or more branches, and frequently a cluster of leaves, giving the tree a bushy growth. The ultimate result, after continued topping, is a stunted, crooked, forked growth."

"An examination made last spring (1906) of all the twigs upon 15 three-year-old catalpa trees, revealed the fact that 49 percent of the tips had been injured by the bud gnat."

These blackened tips are generally full of larvae, the whole presenting the same general appearance as does the interior of the pods later in the season. It seems probable that injured spots in the skin of the twigs are used as points of entrance, where these are available, but it seems certain that entrance is often gained into uninjured twigs.

In July 1907, a circular letter accompanied by a small folder of illustrations, entitled "Three Catalpa Troubles," was sent out from the Department of Entomology of the Ohio Experiment Station to several hundred catalpa growers in Ohio, requesting reports on the kinds of injury described and illustrated. Two of the forms of injury due to the catalpa midge, viz., terminal bud damage and leaf-spot were among the subjects of inquiry. Of the growers reporting, 119 had not suffered from either form of injury, so far as they were able to discover, while 107 had observed one or both forms. About one-third of these reporters (37) had noticed the terminal injury without finding any leaf-spot; 33 found leaf-spot conspicuous without any injury to the buds, while 37 found both forms of damage occuring conjointly.

3. Professor Comstock's description of the third form of damage is as follows: "In the early part of August the unripe and normally green pods of the Indian bean (Catalpa bignonoides) upon the Department grounds, at Washington, were noticed in many cases to have partly turned brown in a strange manner; one-half or more of the pod remaining green, while the remainder appeared to

^{*} Bulletin 7 of Div. Nursery and Orchard Inspection, Ohio Department of Agriculture.

be dry and of the color which it usually has when ripe. Upon opening one of these abnormal pods, the mass of seeds was found to be fairly filled with active, footless, little yellow maggots, none of them more than 3.25 mm. long. When disturbed they wriggled from the pod and fell to the ground, or bringing the two ends of the body together and suddenly straightening with a jerk, they would jump to a distance of several inches. The seeds themselves and the whole contents of the pod were, in every case, in a decaying condition. The larvae were of very different sizes, some apparently being nearly full grown, while others were evidently very young.

"Some ten days after the pods had been placed in a breeding jar, the adult flies began to appear-minute yellow midges with dusky wings. From that time on through the fall, occasional examination of the pods showed larvae of all sizes still at work, many of the pods becoming entirely brown and dry before the middle of September. It was often a puzzling thing in examining these pods to find the point where the larvae made their exit, for the pupa state is passed underground. Usually one, two or three small orifices would be found through which all the inhabitants of the pod must have issued. The manner in which this hole is made is a mystery. Examined from the inside, it shows marks of gnawings around its edge, and frequently spots are found where attempts to pierce the pod have evidently been made, but unsuccessfully. Yet as cecidomyid larvae have no horny masticating jaws, how have they then made these orifices? In pods which had evidently been attacked earlier in the season, while younger and tenderer, the holes were much larger and more abundant. Occasionally the pod will have become so dry that it will have cracked, and in such cases, of course, no other hole would be neccesary." *

On July 27th, an examination of the seed pods of the hardy catalpa, Catalpa speciosa, was made and injury to them by the midge was just commencing. At intervals on the pods small blackish spots were found which, when examined with a lens, were seen to be minute holes surrounded by a small area from which the skin had been eaten or torn away. Inside the bean, near the opening, a few very young midge larvae were found. Whether the gnawed surface and hole through the wall of the pod were made by the larvae or adults, it is not possible to state with certainty, but in all probability the newly hatched larvae are wholly or chiefly responsible for it. Probably in some cases they take advantage of injured places in the skin and complete openings already started by other agencies.

^{*} Annual Report, U. S. Dept. Agr. 1880, pp. 266-267.

Fig. 5. Eggs of the midge much enlarged. Photomicrograph.



FIG. 5.



Fig. 6. Larvae of the midge much en-larged.



FIG. 6.

Fig. 7. Adult female midge much enlarged. Photomicrograph.

FIG. 7.

DESCRIPTIVE.

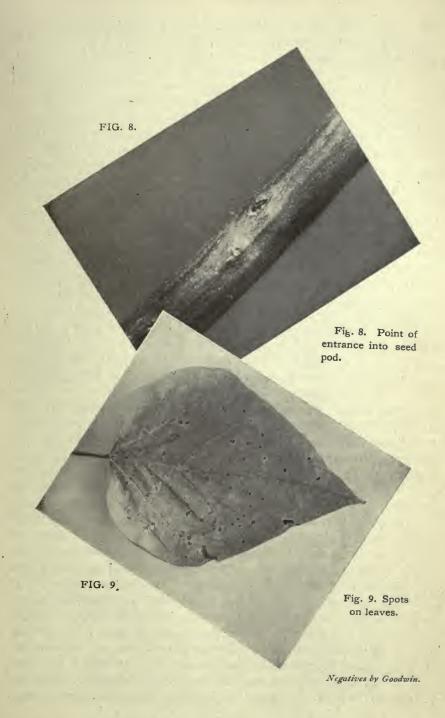
Egg: The egg is elongate with rounded ends, being about .35 mm long and from one-fifth to one-fourth as wide as long. It appears translucent greenish or whitish, probably depending somewhat on the degree of development reached. The eggs are laid in masses, a single mass sometimes containing upwards of 80 eggs. Many of these eggs are curved into a bow shape, and their sides adhere to each other somewhat. The masses found were laid on the inner surfaces of the tiny young leaves just formed in the terminal buds. Whether the larvae found on the older leaves come from eggs scattered promiscuously over them, or if they disperse from egg-clusters, deposited in the manner observed when the leaves are young, we do not yet know; nor do we know where the eggs are laid from which hatch the larvae found in the pods.

Larvae: The full-grown larva is about one-eighth of an inch long and about one-fifth as broad as long. The color varies from pale whitish to orange. Those working most in the open, as upon the leaves, seem, generally speaking, to be the deepest colored; yet deep colored specimens may often be found in buds and also in seed-pods. With a good magnifying glass the body is seen to be segmented transversely, a compound microscope showing fourteen segments. The larva possesses a peculiar habit. It brings the two ends of the body together and by suddenly straightening itself with a jerk, is enabled to jump several inches.

Adult: The female is a minute, two-winged fly, about one-sixteenth of an inch long and has a light yellow body and dusky wings that show a bluish iridescence under a magnifying glass.

SUMMARY OF LIFE HISTORY AND HABITS.

The adult flies must first appear in May, since the spots on the leaves appear in that month or early in June. On June 22, 1908, larvae could be found in abundance on the leaves and also in the terminal buds. Adults could be seen here and there on the leaves and could be captured in abundance by sweeping catalpas with a net. Egg-masses, freshly laid, could be found in the terminal buds. Cuttings of catalpa, containing hundreds of larvae, were sunk into moist sand and placed in breeding cages. Adult flies appeared in these cages July 4th, and for several days thereafter. It was difficult to find a mass of eggs, part of which had not hatched at the time of discovery, thus evidencing the shortness of the incubation period. As nearly as we could determine from eggs laid by midges in our cages, the young larvae begin to emerge within 24 hours or less after the eggs are laid. As nearly as could be judged from our breeding work, the life of a complete generation in mid-summer is



from three to four weeks. While most of the larvae descended into the sand to pupate, some did not, but transformed wherever they happened to be. Some midges were obtained in each of three glass tubes, containing nothing but cuttings harboring the larvae. The pupa, to casual observance, seemed to differ but little from the larva, except that it had become somewhat shorter. The larvae were seen to disengage themselves from the leaves by their jerking habit and drop to the ground. In the latter part of June the upper layer of earth to the depth of one-fourth to one-half inch was removed from beneath an infested catalpa tree and put into a glass covered case in the laboratory. This earth was kept spread out, the depth being not more than one-half inch, and it was moistened as often as necessary. In early July adult midges appeared in the cage, thus proving that the pupal stage is ordinarily passed in the ground. These midges were confined on catalpa slips taken from trees grown in the insectary and which had never shown signs of infestation. July 16th, three or four larvae were found on the leaves of one of these slips. No eggs or larvae could be found in the bud of this slip. A different slip, that was put into a jar containing midges that hatched from buds on July 4th, had new larvae in the bud July 15th. Some adults, that had issued some time after July 4th, were still living in the cage at the time of this observation. The average life of the fly is probably from three or four days to a week or ten days. Sometime in late June both adults and larvae disappeared from the groves outdoors and were not again found until July 16th. In the latter part of summer, the larvae seem chiefly confined to the leaves and seed pods in groves of trees that are of considerable size, but, as before recorded, Mr. Cotton observed them attacking the tender tips of growing nursery stock in August and September. Mr. Houser noted, July 30, 1906, that the "terminal borer" was more abundant than ever at Wooster. dates at which Mr. Houser obtained midges were August 7th and 8th and September 3rd. September 12, 1908, larvae were found on leaves and adults were captured from catalpa by sweeping. Prof. Comstock obtained flies about the middle of August from larvae taken in the seed pods. We found larvae in seed pods as early as July 27th, and they still inhabited these pods in mid-September, showing a much longer life cycle than the earlier generations working in the buds. From all the evidence we possess, we infer that there is an indefinite number of generations, the rate of development probably depending on conditions of heat, moisture and food supply. In the early season the broods are probably distinctly separated, but by the latter part of July all semblance of broods

seems to be lost and after this time every stage of the insect can be found on any date before late autumn if search is made in the right place. So far as known, all varieties of catalpa cultivated in Ohio are attacked.

IDENTITY.

The specimens reared by Mr. Houser were submitted to Mr. Coquillett, of the U.S. Department of Agriculture, and to Dr. E. P. Felt, State Entomologist of New York, both specialists in diptera, and both agreed they were near C. catalpae Comstock, but could not be sure they were identical with it without comparing them with the original types. Abundant material, representing all stages of development, taken from both leaves and buds, was sent to Dr. Felt the past summer and after studying this he provisionally refers the insect to Comstock's species, but has not yet had access to the types for comparison. A close scrutiny of our breeding records and field observations, together with the microscopic examinations made by Messrs. Felt, Coquillett and the writer, leave scarcely a doubt that the different forms of injury herein described are due to the same species of Cecidomvia, though the leaf and bud maggots have not been actually bred from flies hatched from pods and then isolated. From a practical standpoint, the catalpa grower is most interested to know that the maggots causing all three forms of damage are to be dealt with in the same way.

PAST HISTORY AND LITERATURE.

This insect was first described by Prof. J. H. Comstock in the Annual Report of the U.S. Department of Agriculture for 1880. It was called the Catalpa Pod Diplosis, because the maggots were observed working in the seed pods and the adult was referred to the genus Diplosis. In 1890, Packard, in the Fifth Report of the U. S. Entomological Commission, on "Forest Insects," quoted Comstock's article in full, but added nothing thereto. In 1906, Mr. E. C. Cotton referred to it in Bulletin No. 7, of the Division of Nursery and Orchard Inspection, Ohio Department of Agriculture, and expressed the belief that it not only injured the seed of catalpa, but that it also attacked the growing tips of the branches, causing them to blacken and die back for several inches. He only inferred the identity of the insect from an examination of the maggots, being unable to rear the adults. In 1907, a circular, accompanied by a small folder of illustrations, exhibiting different phases of injury caused by the insect, was circulated among the Ohio catalpa growers by the Department of Entomology of the Ohio Experiment Station. A few notes were presented by the author at the twentieth meeting of the Association of Economic Entomologists,

these being published in Vol. I, p. 181, Journal of Economic Entomology. In Bulletin 194, p. 193, Ohio Experiment Station, Mr. J. S. Houser devotes a few paragraphs to it.

NATURAL ENEMIES.

I have observed lacewing larvae feeding with great avidity on the leaf-feeding larvae of the midge. In July, 1905, and also 1906, Mr. Houser so frequently obtained a chalcid from the damaged tips that, for awhile, we were uncertain whether it was not itself responsible for some form of damage to the branches. Subsequent observations led to the conclusion that, in all probability, it subsisted on the midge larvae, but this supposition has never been definitely proved. Mr. J. C. Crawford, of the U. S. Department of Agriculture, has described this chalcid as Zatropis catalpae.* Adults were obtained July 14, 20, 23, 24, 25 and August 14th.

REMEDIES.

Cultivation: Young cultivated groves do not suffer so much as older uncultivated ones. The larvae fling themselves to the ground when full grown and pupate very near to the surface. The fragile adult flies cannot make their way to the surface, if plowing has buried the immature stages under several inches of earth. Plowing in late fall or early spring will accomplish most, but cultivation throughout the summer will help.

Fertilizing: Three or four pounds of kainit scattered under a tree over a circle approximating that of the spread of the limbs will in all probability destroy the larvae in the soil as well as stimulate the tree. Small trees will not need more than half this amount. It may be applied in May to prevent the first brood from issuing and if necessary can be repeated in late June to catch the large July hatching. Stir lightly into the soil with a garden rake. Sulphocarbonate of potash, applied at the rate of thirty kegs per acre, has been found effective against the pear midge in the soil by Dr. Marchal of France.

Drenching ground with insecticides: If, in early spring, the leaves, grass and trash beneath the trees are raked together from a wide circle around the trunks and burned, and these cleared circles are then drenched with kerosene emulsion diluted with eight to ten parts of water, the hibernating stages of the insect will be destroyed.

Close planting: While methods of planting probably have little or no effect on the multiplication of the midge, it seems to have a direct relation to correction of injuries caused by the midge. If the trees are planted not more than four to eight feet apart each

^{*}Proc. Ent. Soc. Wash. Vol. IX Nos. 1-4.

way, a straight skyward growth is forced and, although the young trees start off with crooked trunks due to successive forkings, caused by terminal injury, after a few years the trunks will have become quite straight. After the trees have attained an age of five or six years alternate trees can be cut out, if necessary, and the trees may be trusted after this age to grow fairly straight.

ACKNOWLEDGEMENTS.

I am indebted to Messrs. Howard, Felt, Coquillett and Crawford for examinations and reports on various specimens of insects submitted to them during the progress of the investigation; to Messrs. J. S. Houser, W. H. Goodwin and H. T. Osborn for numerous field observations and laboratory records; to the Department of Cooperative Experiments of this Station for assistance in collecting data from the Ohio growers of catalpa; and to Messrs. Goodwin and Houser for the illustrations given. To all of the foregoing, I express my thanks.



The Agricultural College

EXTENSION BULLETIN

VOLUME VI.

DECEMBER, 1910

No. 4

Our Conebearers and Evergreens

By C. H. GOETZ, Instructor in Forestry.



Spite of winter thou keepest thy green glory .- Lowell,

PUBLISHED MONTHLY BY THE OHIO STATE UNIVERSITY COLUMBUS

LITTLE EVERGREENS, GROW!



Young Spruce.

Up, up so airily
To the blue sky,
Lift up your leafy tips
Stately and high;
Clasp tight your tiny cones,
Tawny and brown;
By and by, buffeting
Rains will pelt down,
By and by, bitterly
Chill winds will blow.
And so,
Little evergreens, grow!
Grow, grow!
Grow, little evergreens, grow

Hey! little evergreens,
Sturdy and strong!
Summer and autumn time,
Hasten along.
Harvest the sunbeams, then,
Bind them in sheaves,
Range them and change them
To tufts of green leaves.
Delve in the mellow mold,
Far, far below,
And so,
Little evergreens, grow!
Grow, grow!
Grow, little evergreens, grow!

Gather all uttermost
Beauty, because—
Hark, till I tell it now—
How Santa Claus,
Out of the northern land,
Over the seas,
Soon shall come seeking you,
Evergreen trees!
Seek you with reindeer, soon,
Over the snow.
And so,
Little evergreen, grow
Grow, grow!
Grow, little evergreens, grow!

What if the maple flare
Flaunting and red,
You will bear waxen-white
Tapers instead.
What if now, otherwhere
Birds are beguiled,
You shall yet nestle
The little Christ-child!
Ah, the strange splendor
The fir trees shall know.
And so,
Little evergreens, grow!
Grow, grow!
Grow, little evergreens, grow!
—St. Nicholas.



Pine tree in winter-robe.

OUR CONEBEARERS AND EVERGREENS

How to Know Them and What Use to Make of Them

By C. H. GOETZ.

INTRODUCTION

Since the coming of man, trees and forests have entered into his life, throughout his rise from the savage state up to the present time.

Without trees and forests, the high state of civilization to which man has attained, and the comforts of life that surround him could not have been possible. The forests were his early home; they furnished him with food and shelter, and though for a period in the history of man the forests, because of their extensiveness, were



A Wind-break of Norway Spruce.

looked upon as hindrances to the advancement of agriculture, the time has come when the true worth of this, the highest expression of our vegetable kingdom, is receiving its due credit and consideration.

Trees are an ever interesting subject for study and wonder to the little child, to the youth, and to the man. He sees so many things around him made of wood, from the cradle to the coffin, that he thinks he never gets out of the woods.

The love of the child for all things pertaining to the vegetable world can readily be seen when one observes children eager for the possession of a flower, a blade of grass, or a leaf of a tree.

The following pages are intended to furnish an opportunity for our boys and girls to get a little better acquainted with some of our conebearers and evergreens.

To many of our young people a needle-leaf tree is simply a pine

or an evergreen, and sometimes it is known only as a Christmas tree. We venture to state that not one out of a hundred of our children know, that, as a rule, the Christmas trees are spruce trees,

Norway Spruce.

or that these trees loose their leaves one by one but never all of them at once.

The conebearers or conifers as botanists call them, and especially our evergreen conebearers, are of great value, not only for ornament, but also for protection. In the winter when the cold winds are blowing and all the other trees have lost their leaves, these evergreens form fine protection and sheltering belts against the cold, biting winds. Who has not seen cattle and horses standing for protection near these trees or hedges? Perhaps we ourselves have found out that it is more comfortable when we have some of these trees between us and the wind.

Let us consider the tree which interests both young and old about the time Santa Claus comes around, namely the Norway spruce. While this spruce is not a native of America or found in over-abundance in this country, yet because it is so extensively planted for Christmas trees and is perhaps the most numerously planted spruce in the State of Ohio, we ought all to be acquainted with it.

The Norway spruce has several American brothers, the red, the white, the blue, and the black spruce. It is, however, easily distinguished from the rest of our spruces, by its slender cones, which are the longest of all spruce cones, sometimes reaching the length of seven inches. There they swing on the ends of the top branches, like the pendulums of clocks, till the wind and the sun dry them

and open the scales to let out the small winged seeds which are then carried away by the wind to find a good place to sprout and bring forth other spruce trees, or until some squirrel comes along and with its sharp teeth cuts off the little branches on which the cones hang, allows them to drop to the ground, and gathers them in its winter storehouse.



From Keeler's "Our Native Trees," published by Charles Scribner's Sons.

Branchlet and Cone of Norway Spruce.

This spruce is one of our most stately trees, very symmetrical in growth, and when loaded down with Christmas presents, burning candles, etc., is the delight of young and old.

To find out that we have a spruce and not a fir tree, which is a cousin to the spruce, we must examine the cones. The cones of the fir stand upright on the branches, and when mature fall to pieces,

while the cones of the spruce are not deciduous and do not come apart on shedding their seeds. If the ends of the needles of the spruce are touched with the bare hands it is found that they are sharp like a



Pitch Pine Needles. Three in a

If Mother Nature patches The leaves of trees and vines, I'm sure she does her darning With needles of the pine.

THE WHITE PINE

This tree ought to be one of our best known trees. When we see it growing in the open we recognize it at once by the cluster of fine, bluish-green leaves situated near the ends of the branches. The leaves are generally from three to four inches in length, five in a sheath, and somewhat grayish on the underside. They are soft, like grass, to the touch and make fine beds for the woodsman and hunter. We see on the very young trees a quite different bark from that Branch of White Pine. Five needles in a sheath. which is found on the old trees.

needle, while those of the fir are blunt and wider. The needles in both are of about the same length but in the spruce they are scattered clear around the branches, while on the fir they are in two rows, one on each side of the little branch. Even on looking at the two trees from a distance one can tell them apart; the spruce is more conical than the fir, which is like a spire pointing skyward.

In the countries where the spruces are plentiful they are extensively used for making paper pulp because the wood is soft and white and has a long fiber.

They are so long and slender, And sometimes, in full view, They have their threads of cobwebs, And thimbles made of dew.

-Wm. H. Hayne



The bark of the former is thin and of grayish green, while that of the latter is divided into large, flat ridges with shallow openings between.



White Pine.

The cones are slender, open, and from four to six inches long. They are matured only after two seasons.

We find the white pine on moderately high places and in moist, sandy but fertile soil. It is a very desirable tree for lawn planting, because it has such a delicate appearance and is, as a rule, a fast grower. "There is a quiet spirit in the woods; with what a tender and impassioned voice it fills the nice and delicate ear of thought."



Scotch Pine.

THE SCOTCH PINE

We might think because of the name that this pine came from Scotland, and that Scotland was its home, while in fact it is found all over Europe. This tree resembles in general appearance our white pine, but upon closer examination we find that the needles are only two in a sheath, are coarse and of a bluish tint, also somewhat shorter than the white pine needles. The cones are very much shorter, and resemble those of the scrub pine, for which it is sometimes mistaken.

We have adopted this European tree because it is very hardy and can stand variations of climatic conditions. It is also a rapid-growing tree, and since it is not particular as to soil and moisture, it can be used almost anywhere both for windbreaks and for ornamentation.

THE PITCH PINE

To this pine the name of pitch pine was given because it has always a large amount of resin upon its buds and branches making them very pitchy. Another peculiar thing about the tree is that it has many short branches on the ends of which the needles, three in a sheath and from three to fine inches long, are arranged in groups, having the appearance of needles growing on the large branches.

The cones, from one to three inches long, and comparatively broad, are often found in clusters, and their sharp spined scales distinguish this pine from the Jack pine and the Scrub pine as well as from the Scotch pine. These cones stay on the trees, as do also the cones of its brothers, the Jack pine and the Scrub pine, for ten or twelve years, even after the seeds have long escaped.

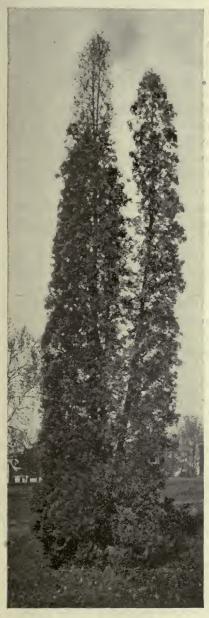
There is not much symmetry or beauty about the tree. It is, however, planted or left standing for the protection of the soil, or for windbreaks. Another reason for allowing it to stand or for planting it is that it occupies ground of a sandy and sterile nature on which hardly any other plant will grow.

Fire may sweep through the forest of pitch pine and destroy the old trees, and yet a new crop will spring up, because many of the cones retain their seeds for a number of years, and open them only by going through extreme heat or on account of old age. The heat of the fire opens the cones and sets free the seeds, which then fall on fertile soil that has been enriched by the ashes from the old trees.



Pitch Pine.

THE ARBORVITÆ



Arborvitae. Leaves are flat as though they had been pressed.

The Indians used to call this tree the feather tree, because it has flattened branches, with flattened leaves. The leaves are very small and look as if they had been pressed; they appear somewhat like a fan or feather. We often hear the arborvitæ spoken of as the cedar or the tree of life, because it looks somewhat like that tree. On close examination, however, we find that the arborvitæ has leaves. larger, flatter and more spreading than the cedar. The cedar has no cone, but a berry-like fruit of a brownish-purple color, which we call cedar berries or Juniper berries. while the arbovitæ has very small, true cones of a light brown color.

We generally see the arbovitæ grown in hedge rows and very often in cemeteries. The name of this tree means the tree of life (arbor, tree; vitæ, of life). The flaky, stringy bark is another good sign for recognition. The leaves and wood have a charactertistic odor which is very pleasing to man, but not to the moth, and so it is used for making chests and closets.

Its native home is in cool, moist areas and it is therefore often found in swamps, but it will do well in drier soils. The arborvitæ can be well recommended as a hedge plant and as an ornamental tree. If properly treated it will grow from cuttings.

THE COMMON JUNIPER THE RED JUNIPER OR RED CEDAR

The common or dwarf juniper and its brother the red juniper, are often called red cedars, because their heartwood is red, and their leaves look somewhat like cedar leaves. The red juniper grows into a tree



Juniper

form, while the dwarf juniper, as its name indicates, is generally a shrub. The leaves of the red juniper are not all of the same kind; some are flat like those of arborvitæ for part of their length, with a point at the end; others are needle shaped and pointed. The needles of the dwarf juniper are shaped more like a shoemaker's awl. This tree has two sets of leaves in its younger shoots, one very much shorter and flatter than the other.

These trees are abundant in regions where limestone is found, which seems most suitable for their growth. In their home climate they appear very much like stately overgrown columns. Every one has heard of the juniperberry and perhaps has seen and tasted it. Many of our birds that stay with us over winter, feast on these berries, and then drop the seeds here and there, in this way distributing the trees over a large area. This is one of Nature's ways of plant distribution. Sometimes we find on these junipers large, fruit-like growths, which are commonly called cedar apples or juniper apples; these,

however, are not fruits with seeds in them, but fungus growths which take unto themselves this form. They are very detrimental to the life of the tree. How many boys and girls know that the wood of their lead pencils is the wood of the juniper?

The wood is very durable and was in times past used by the farmers for fence posts, shingles, and poles, and wherever durability in contact





Spray of Arborvitae. Its leaves are very flat,

Spray of Juniper, which much resembles cedar.

with soil was required, but now the wood has become too valuable for such use and is only employed in the making of lead pencils, cigar boxes, chests and closets; it is used for the latter purposes because the odor of the wood makes it very obnoxious to moths.

The tree and the shrub forms of these junipers are very ornamental. and also make fine windbreaks.



A variety of Juniper used for ornamental planting. It grows much more dense than the one on the opposite page.

13

AMERICAN LARCH OR TAMARACK

The Tamarack or Larch is, as a rule, called by every one an evergreen tree because it looks very much like the other conifers that are ever green, having cones very similar to them. How often, however,



A Tamarack, or Larch. Sheds its leaves in October.

have we noticed some places in the woods, especially the swamps, where there were many of these trees standing throughout the whole winter as if dead, and, perhaps we have counted them with the dead and dying when they were only sleeping and resting, like most of our broad-leaf trees, awaiting the coming of the spring.

The Larch is, then, one of our conifers or needle-leaf trees which shed their leaves in the fall of the year. It is not difficult to recognize this cone bearer from the rest of the needle-leaf trees. In the spring and in the summer the very light pale green leaves, short like the spruces and firs, but borne in clusters of ten or more on the tips of very short branches, give to the foliage and the whole tree an appearance distinct from that of any other conifer; while in the winter its nakedness, with the cones on the limbs, gives it a prominence unlike any other tree.

In the State of Ohio and in the North, the Tamarack is generally found in what are known as Tama-

rack swamps. The long fibrous roots are often seen in the water, great distances from the base of the tree. These roots were used by the Indians to bind their canoes together.

Longfellow mentions this in his "Hiawatha":

"Give me of your roots, O Tamarack! Of your fibrous roots, O Larch tree! My cange to bind together, So to bind the ends together That the waters may not enter, That the river may not wet me."

The Tamarack is a rapid growing tree and on account of its spiral shape and its beauty of foliage during spring and summer, it makes a fine tree for ornamentation.

"The evergreens are of peculiar beauty during the winter season when all things seem desolate and dreary and the ground is covered with a white mantle of snow. Then it is that they remind us not only of the life to come with returning spring, but also of the endless life hereafter."

PLAY AND RECREATION THE SALVATION OF A NATION

Play and recreation are as essential to the proper development of man as is work. Work alone with no allowance for unproductive effort, prevents the normal growth of the body and a sweet-spirited



Game of Fox and Geese. (From "On the Farm." Used by permission D. Appleton Co.)

mental development. Real hard work is absolutely necessary to perform our function in this world, but work alone sours the individual. Proper alternatives of work and play make middle aged people young and old people sympathetic with the children.

A nation's or a community's decay is in part shown by the absence of play at school, and games and pastimes at home. The father who makes cornstalk fiddles, little water wheels, whirligigs, spool tops. and hot-air paper spirals to hang over the old cook stove, is getting pretty close to the "happy corner" in the home; and the mother who plays "I Spy," and "Fly away Jack, Fly away Jill" with spool labels, and who assists with doll dressing and taffy pulling, helps to add to the word "mother" much that will make it a dearer word in the home.

The teacher who enters into the games at school makes his school a more potent factor for good citizenship. Character will be developed in truth telling, a respect for the rights of others, the performance of duty, and an obedience to the will of the many. No new-fangled nor greatly modified games are needed—just common, old fashioned "two

or three cornered cat," "fox and geese," prisoner's or dare base," and others requiring much action, that have been handed down for generations or perhaps for centuries.

Let us help to keep the old young and the young gay by prolonging the pleasures of youth as far as possible. Mind and body will be plastic and "thoughts of youth will be long, long thoughts."

A. B. G.



Gantvort's Music Reader. Used by permission of the American Book Company, Cincinnati, Ohio.

Walter Mulford

PRESS BULLETIN

OF THE

Ohio Agricultural Experiment Station

NUMBER 326

WOOSTER, OHIO

SEPTEMBER 18, 1911

BEWARE OF SPURIOUS CATALPA STOCK

DO NOT PURCHASE SEED OR TREES THIS FALL OR NEXT SPRING
UNLESS YOU ARE SURE YOU ARE GETTING
THE RIGHT KIND

The catalpa speciosa seed crop during the spring of 1910 was almost completely destroyed by late frosts. Very few trees of this species throughout Ohio bore seed, and reports from the sections of Indiana, Illinois and Missouri where these trees are native indicate that the crop there also is very limited. In consequence one-year-old seedlings of the tree will be difficult to obtain next spring.

Unscrupulous individuals purporting to represent reliable nursery firms, or those representing firms of unknown or unstable reputation, have in the past canvassed the state, distributing stock of the spurious or common catalpa, unfit for commercial use, at exorbitant prices. The investigations of the Ohio Experiment Station indicate that a great percentage of catalpa stock distributed in the past has been spurious, and on account of the shortage in seed last year, this practice may be expected to assume much greater proportions.

The common catalpa (bignonioides) bears seed much more prolifically than the commercial speciosa, and the crop of the former was good last year, making this species easy to obtain and substitute for the speciosa.

Prospective planters next spring certainly need every assurance possible before being justified in purchasing seed or trees of the 1910 seed crop.



Walter Mulford

THE AGRICULTURAL COLLEGE

EXTENSION BULLETIN

VOLUME IX

JANUARY, 1914

No. 5

TREES FOR SHADE, SHELTER AND ORNAMENT

By WILLIAM R. LAZENBY
Professor of Forestry



From the blossomy dells
Where the violet dwells,
The cattle came with their clanking bells,
And rested under my shadows sweet.

—FRANK L. STANTON

PUBLISHED MONTHLY BY THE OHIO STATE UNIVERSITY COLUMBUS



"It gave little thought to the future, Just reveled in summer's glad day,



Nor dreamed of the bleak winds of winter When its leaves would be all swept away."

"This publication can be secured by writing A. B. Graham, Superintendent of Agricultural Extension, Columbus."

Trees for Shade, Shelter, and Ornament

WILLIAM R. LAZENBY

Trees are universally desired about the home. They have many and varied uses. By their grateful shade they screen us from the too fervid heat of the sun. They abate the winds and protect us from the chilling blasts of winter. Their leaves prevent the spread of germladen dust and help to purify the air in other ways. They encourage the birds that charm us by their song and save our crops from many an insect injury. They lend a grace and beauty to every homestead and to every roadway that they border. In short, trees around and about the home make for health, comfort, and happiness.

Where shall we plant, what shall we select, and how shall we care for these trees?

Where to plant. Trees should be planted for shade wherever a shield from the hot rays of the summer sun is desired. They should be planted for shelter wherever we wish protection from the wind. They should be planted for ornament wherever we desire to beautify the home and adorn the landscape.

Genuine happiness as well as comfort centers in the home. Trees add to the attractiveness of the home. They should be planted around the house, the barn, and other buildings. They should find an appropriate place in permanent pastures. Nearly all public roads, private drives, lanes, walks, and pathways should be bordered with suitable trees.

Along the banks of streams and open ditches, about the borders of ponds and lakes, upon rough knolls and steep hillsides, trees may be planted for ornament as well as use. We hear much of the beauty of the scenery of our mother country, England. The commanding feature of this scenery is trees. They are the glory of every English landscape. There is scarcely a farm, scarcely a rural or suburban home that is not beautified by them. Grand individual specimens, picturesque groups, sometimes stately rows, and often pretty groves are everywhere visible. These trees are found in cultivated fields and pastures as well as on lawns and in parks and pleasure grounds. They are not the long-trunked, shadeless specimens often seen in this country. They are widespreading and hospitable.

Some of these sturdy oaks, beeches, lindens, and plane trees must have braved the winds and storms of several centuries. They seem to be a permanent part of every outdoor scene, and without them the sullen skies and level lines of much of England would be almost dreary.

A few years ago I visited Salt Lake City and was wonderfully impressed with the beauty, restfulness, and value of trees for shade and ornament. I had spent a month just previous to this on the treeless plains of North Dakota and Montana. To pass from such a region into a city where every street was bordered and every home belted with stately, graceful trees was like coming to an oasis in a desert.

What to plant. When we begin to study a good shade tree we learn that it should meet certain demands, or should have certain





Shade for Man and Beast.

qualities or characteristics. Of these, the following are the most essential:

- (1) An agreeable shade
- (2) A pleasing appearance
- (3) Easy to transplant
- (4) Vigorous and long-lived
- (5) Free from insect enemies, disagreeable odors, and objectionable litter.

Agreeable Shade. Not all shade is agreeable. The shade of some trees is too dense and that of others too light. A heavy woolen blanket properly suspended will make a shade; so will mosquito netting, but we would not care to use either. Trees with a close, compact head, and large heavy leaves may make too dense a shade. On the other hand trees with small leaves and open, spreading branches may make too light a shade. So far as shade alone is concerned, the beech is nearly ideal. Its leaves are about the right size, they are well distributed, and so attached that a slight breeze causes them to rustle, giving a sense of refreshing coolness. The branches of the beech are widespread and

its trunk is neat and graceful. It is comparatively long-lived and free from insect enemies. The bark is more attractive than that of almost any other tree. Unfortunately, it is a more or less exacting tree as to soil and light conditions, and for this and other reasons it is difficult to transplant. The elm and maple are also examples of trees that give an agreeable shade.

Pleasing Appearance. Whether or not a tree is ornamental is largely a matter of individual taste. Every tree may be said to have a beauty of its own. A tree that is ornamental in one place may not be ornamental in another. The surroundings must always be taken into account. A weeping willow may be beautiful along the bank of a stream or the shore of a pond, but out of place and unattractive on a high, dry lawn.

It is a mistake to combine or contrast the strictly useful or economic tree with the purely ornamental tree. Such combination violates the principles of unity and harmony. An apple tree may have all the requisites of an ideal shade tree, but the primary purpose of an apple tree is fruit and we associate this tree with the orchard and garden and not with the lawn. Fruit and nut trees may be planted along certain roadsides, lanes, etc., because here utility and not beauty alone may be the governing feature. In fact this practise has much to commend it and should be more general than it is.

Some Essential Features. A tree may have all other good qualities, and yet if it be difficult to propagate and transplant it will not come into general use for shade and ornament. The beech, as has been said, is one of our most beautiful trees, yet it is seldom used. It is so difficult to propagate and transplant that it is not generally grown by nurseryman, and is rarely taken from the woods.

In a climate like that of Ohio, hardiness should always be taken into account. Some good shade trees are not perfectly hardy when planted in exposed situations. Many fine ornamental trees and shrubs have the same weakness. Only such as will withstand the severities of the climate should be generally planted. Longevity is an important requisite. We value old trees not alone for what they are, but for the associations connected with them.

Freedom from Disease and Insect Injuries. This is an essential that must not be overlooked. Some trees are quite subject to disease, and others are liable to attacks by insects. Other things being equal, it is better to select varieties that are not predisposed to these troubles. It is well to know, however, that diseases and insect attacks are often one of the effects, not a primary cause, of a sickly and enfeebled condition. There can be no doubt that these troubles are largely incited

by the weakness of our trees, caused by bad treatment and unsanitary conditions. The vitality of our trees is lessened by careless transplanting, bad soil, lack of moisture, etc., and thus they become a ready prey to fungi and insect foes. This is especially true in our towns and cities. Here a lack of light, sour and poorly aerated soil, smoke and dust in the air, so weaken many trees that they have little power of existence and are speedily overcome. When these conditions cannot be corrected, the most resistant trees should be selected. Those of vigorous habit, with smooth, shining leaves, are best. The Carolina poplar and the silver maple will often thrive and do well where the white elm and the sugar maple will drag out a feeble, sickly existence.

Neatness in trees. This is a quality of no little importance. We all like a neat tree. There are trees, with large, coarse leaves which begin to drop early in the season and make an annoying litter upon the lawn. The cottonwoods are of this class. They drop their leaves unseasonably and many small self-pruned branches fall from these trees and add to their untidiness.

The male or staminate form of the Ailanthus, often called the "Tree of Heaven", is objectionable on account of the disagreeable odor of its flowers.

Some trees have rather brittle wood so that branches are likely to break off in time of storm. The silver maple and some of the willows may be cited as examples. The persistent pods or beans of the catalpa fall from the trees and disfigure the lawn in early spring.

Other trees have the bad habit of sending up shoots or suckers from the roots. The silver poplar and some forms of the European elm have this disagreeable tendency.

A good habit of foreign trees. Most of the introduced trees and shrubs commonly grown in Ohio hold their foliage longer than native species of the same class. So marked is this peculiarity that late in the fall nearly all foreign trees can be recognized as such. As a rule the European maple, ash, and elm hold their leaves for at least two weeks later than the American species of these respective sorts. The same is true of the horse chestnut when compared with the Ohio buckeye and the oriental plane tree when compared with our sycamore.

How to Plant. Planting a tree is usually regarded as a very simple matter such as building a fire and a few other things every-body knows all about. The fact remains, however, that there is much careless tree planting, and even worse lack of care after planting. Many have told us just how planting should be done. It may be well to know what should not be done.

The following are some of the things to be avoided:

- 1. Do not plant trees that are more than from four to six years old. An older, larger tree may look better at first, but it will soon be overtaken by the younger tree. Large and quite old trees can be moved, but this is an operation that usually costs more than it is worth and, unless done just right, should not be done at all. Planting large trees for "immediate effect" is usually a failure.
- 2. Do not overcrowd your trees. This mistake is frequently made in roadside planting and on small lots. Too many trees should

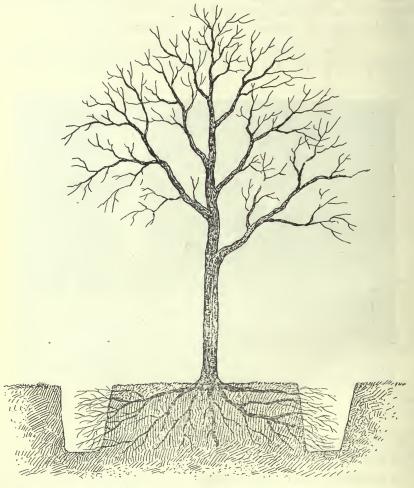


"Too many trees should not be planted close to the house."

not be planted close to the house. This impedes the circulation of air and cuts off sunshine. Dampness in the house "spells doctor bills".

- 3. Do not plant trees in straight lines where there is room to plant in groups, or clumps, or in graceful curves. Where straight rows are necessary, plant the trees in perfect lines but remember that the curve is the line of beauty.
- 4. Do not forget that, if you plant a tree for shade you may have some of the disadvantages of shade. The lawn, flower beds, and garden may suffer therefrom unless ample space is reserved for them. Shade-loving plants should be used in the near vicinity of a shade tree.

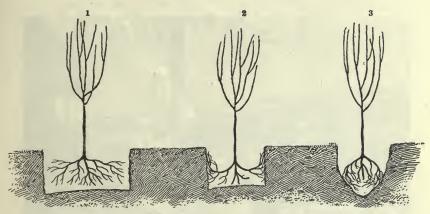
5. Do not defer the planting of trees until spring if you have more time for this work in the fall. Early spring planting may be best, but the time is a matter of small moment. It is many times more important that good trees be selected, the soil properly prepared, the transplanting well done, and the trees carefully cared for.



Showing preparation of large tree for transplanting. The trench should be dug a year before transplanting and filled with rich soil.

6. Do not plant shade or ornamental trees in anything except good soil. If the soil is not good, try to make it so. No soil is good that is habitually soaked with stagnant water. "Wet feet" injure and often kill trees. Large, deep holes in a heavy clay soil are a poor substitute for underdraining.

- 7. Do not plant a tree in a bowl-shaped hole that is deeper in the center than elsewhere. The bottom of the hole should be as wide as the top, and the good soil at the bottom should be in the shape of a flat cone. The tree should be planted only a little lower than it was in the ground from which it was taken, and the earth should be well firmed about the roots.
- 8. Do not forget to cut off all mangled or broken roots. Skilful amputation of an arm or leg will often save life. So the cutting off of broken or diseased roots may save the life of a tree. Likewise all mis-shapen or injured branches should be trimmed or removed. The amount of top pruning will depend upon the condition of the tree



 A good hole. Roots well distributed. 2. Hole to narrow. Roots bent upward. 3. A very poor hole. Roots badly crowded.

and the balance that should be maintained between the roots and the top.

- 9. Do not fail to apply a mulch to a transplanted tree if there is the slightest danger of a drought. Frequent stirring of the soil may be better than any mulch, but this is apt to be neglected. Never forget that a lack of moisture at a critical time or an excess of moisture most of the time destroys many transplanted trees.
- 10. Do not allow your shade trees to be used as hitching posts. If the stupid or thoughtless will permit horses to come within their reach, and vehicles and implements to come in contact with them, you can prevent injury by the use of a wooden or wire guard. Neglect in this matter has caused the disfigurement and even death of numerous shade trees.

- grounds are large enough to permit. They may often serve a useful purpose as a screen, a hedge, or a windbreak. In this way they will conduce to the privacy and comfort of the lawn in summer and mollify and cheer the dreariness of winter.
- 12. Do not forget that hardy, thrifty, vigorous-growing trees, even though less ornamental, are better than feeble growing, diseased specimens of finer varieties. Fine trees are desirable, but healthy, thrifty trees are much better than sickly ones.
- 13. Do not forget that good shade trees are the result of intelligent choice and care. The better the choice and care, the better the tree and the greater the reward for your labor.



A tree should not be used as a hitching post

- 14. Do not forget that a few choice trees old enough to be transplanted cost but a trifle. Whoever plants them judiciously and guards them faithfully has provided a source of healthful pleasure and signal enjoyment for generations yet to be.
- 15. Do not forget that the whole family should be interested in the selection and planting of trees about the home. Each member of the household should do some part of the work. The father can dig the holes, the mother can hold the tree in position, and the boys and girls can assist in covering the roots and replacing the soil. When

planted in this way, trees form a strong bond of attachment to the home and strengthen associations that will become increasingly dear in after years.

Suggestive List of Trees.

1. For dry and thin soils:

Black Locust
The Mulberries
Kentucky Coffee Tree
Box Elder or Ash Leaf-Maple

Red or Common Cedar
Norway Spruce
le Scotch Pine

Chinese Tree of Heaven

2. For rich and moist soils:

American or White Elm Sycamore or Buttonwood Sugar or Hard Maple American Linden Tulip Poplar Northern Magnolia Scarlet Oak White Birch Austrian Pine

3. For wet soils:

The Willows Red or Scarlet Maple The Alders

Red or White Birch

Bald Cypress European Larch Hemlock Spruce

4. For city streets and avenues, where conditions of growth are unfavorable:

Norway Maple Silver Maple Sycamore or Buttonwood Gingko or Maidenhair Tree Chinese Tree of Heaven Carolina Poplar

5. For country or suburban planting:

American Elm Sugar or Hard Maple American Linden Sycamore or Buttonwood Western Catalpa

Scarlet Oak
Pin Oak
Tulip Poplar
Cucumber or Northern Magnolia

6. Trees of rapid growth for quick results:

Carolina Poplar Western Catalpa Silver Maple American White Ash Black Locust Chinese Tree of Heaven Sycamore or Buttonwood European Larch

7. For windbreaks, screens and hedges:

Osage Orange Russian Mulberry Honey Locust Norway Spruce Hemlock Spruce Austrian Pine American Arborvitae

8. Trees with showy flowers:

Horsechestnut Northern Magnolia Black Locust Western Catalpa Empress tree (Paulownia) Tulip Poplar

Flowering Dogwood Crab Apple Hawthorne Yellow Wood June berry or Serviceberry

9. Trees with colored autumn leaves:

Red or Scarlet Maple Flowering Dogwood Scarlet Oak Sweet Gum Black Gum or Tupelo Sassafras



Flowering Dogwood



Juneberry or Serviceberry

TREES IN WINTER

H. E. Eswine

Trees are one of the most interesting objects in Nature, and one of the most valuable too. No treeless country can become great. No man, unless compelled to do so, builds his house far away from them. No artist paints a landscape without them. They are our servants in many ways. At the mention of trees, memory is apt to picture them to us as donning their new dress of leaves in the springtime, or clothed in the leafy fulness of summer, or decked out in autumn in gorgeous apparel. We seldom think of trees in their winter aspect, yet they

may be quite as interesting to us then as at any other season of the year. The reason why they usually are not, however, is because we have been associated with them only during their season of growth. We have observed them leafing out in the spring. We have noted their form and shape. Perhaps we have gathered their leaves or flowers, or plucked their fruit, or maybe we have enjoyed their hospitable shade. All these things have widened our interest in the summer life of trees. Then we learned to recognize them chiefly by some characteristic of shape, or of foliage, or maybe of bark. We may learn to recognize the trees just as accurately in winter as in summer for the unmistakable marks of indentification are there. Even though



Slippery or Red Elm



The American or White Elm

the foliage is gone, the shape remains, and the frame-work is distinct and conspicuous. The method of branching can be plainly observed, and the bark not only on the trunk, but on the limbs as well, is in plain view.

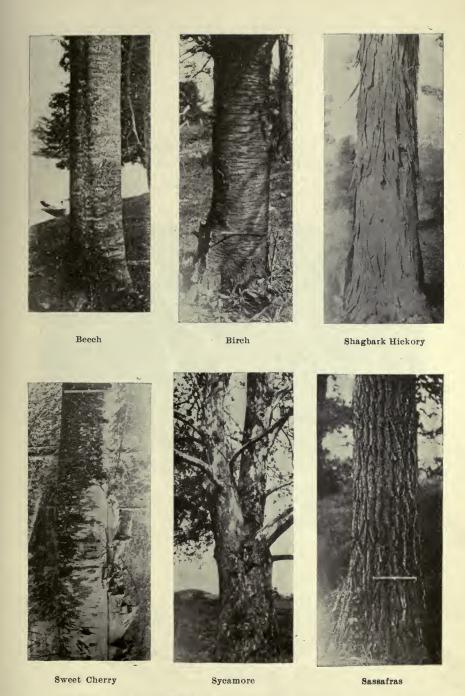
Look at the tree as it prints its outline against the sky. After looking at several kinds of trees, it is apparent that they differ in methods of branching. Some have the trunk continuing almost to the top. Others divide into a few main branches. Some have limbs that are straight; others, long and sweeping. In looking at any one particular tree, we note first, perhaps, its height, then the size and shape of the top, then the number of branches, how they are arranged on the trunk, their direction with reference to the trunk, whether they are set almost at right angles, obliquely, or extend almost parallel with it, and lastly, whether the twigs are few or many, crooked or straight. After observing these points in any one tree, compare one kind of a tree with another. Note how they agree or differ. Observe for in-

stance, how the oak and the elm differ. The oak has short, crooked or gnarled limbs. The limbs of the elm are long, more nearly straight and, in the American elm, inclined to bend toward the ground in graceful curves. Carry the comparison further as between the beech and the walnut, the maple and the hickory, the apple and the peach tree.

After having done this, compare those of the same species, as the different kinds of elms, of oaks, of maples. (Noting the difference between the varieties of the same kind of fruit trees in an orchard is a valuable exercise and will show some interesting contrasts.) For example, note the difference between the American or white-elm, and the slippery or red elm. Which has the straighter limbs? The shorter branches? Note the difference between the shagbark hickory and the pignut hickory, the soft maple and the hard or sugar maple. Fruit trees also often show dissimilarity. What difference in branching have you observed between the sweet and the sour cherry? How does the Keifer pear differ from most other varieties of pears in its shape and method of branching? The Yellow Transparent and the Maiden Blush.

The character of the bark of different trees is worthy of notice. Have you observed that in the same kind of trees, the young ones will have smooth bark, while on the larger and older ones it will be rough and furrowed? Why is this? Only the inner layers of bark are alive and as the tree increases in size by adding new layers of wood on the outside of those already formed, the bark has to split and furrows are formed. This is called bark sculpturing, and it forms one of the most reliable means of tree identification. Some trees have a different method of bark behavior in caring for the annual increase in size. For example, the beech has smooth bark, even though the tree be old. The reason for this is that the bark of this tree is able to expand as the new layer of wood is formed. In some cases the bark comes off in large strips, as with the birch for instance. What pecularity have you noticed regarding the bark of the hickory tree? The cherry tree? The sycamore? Name some trees which have bark that is very deeply furrowed.

Trees have the power of suggesting thoughts and feelings. These thoughts and feelings are attributes of people. In other words, we sometimes think of trees as being possessed of some of the same characteristics that belong to persons. The oak tree because of its size and shape of limbs suggests strength. The elm tree symbolizes grace and beauty. One of our poets called the birch "The Lady of the Forest". What qualities of the birch makes this a fitting nickname? Some trees are weeping, some gay, some quiet and retiring. Some, as the sycamore, are ghostlike. Others such as the honey-locust, because of their great array of thorns appear war-like. The Lombardy poplar, which grows so tall with all its limbs so closely drawn to the trunk, suggests precision. One of these trees standing by itself, like a lone sentinel, is one of Nature's most impressive sights.



From "Handbook of the Trees of the Northern United States and Canada" by Romeyn B. Hough. Courtsey of the author.



And when a snowflake finds a tree, "Good-day," it says; "Good-day to thee, Thou art so bare and lonely, dear, I'll_rest_and call my comrades here."

OHIO AGRICULTURAL EXPERIMENT STATION

AT .

WOOSTER, OHIO

CHAS. E. THORNE, Director EDMUND SECREST, Forester

In Cooperation with the
FOREST SERVICE
U. S. DEPARTMENT OF AGRICULTURE
HENRY S. GRAVES, Forester

WOOD-USING INDUSTRIES OF OHIO



RECEIVED NOV 2 0 1914

Division of Forestry University of California

BY

CARROLL W. DUNNING,

U. S. Forest Service

1912

EXPERIMENT STATION PRESS



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ANNOUNCEMENT

The study upon which this report is based was undertaken by the Ohio Agricultural Experiment Station in cooperation with the Forest Service, the work being done under the direction of Edmund Secrest, Forester of the Experiment Station, and O. T. Swan, In charge Office of Industrial Investigations, Forest Service, United States Department of Agriculture. The Statistics were compiled from data collected in the summer of 1912, covering a period of one year from January 1 to December 31, 1911, inclusive. By the terms of this cooperative agreement, the Ohio Agricultural Experiment Station is authorized to publish the findings of the investigation.

REGEIVED

THood-using Industries of Phio University of California

INTRODUCTION

With her many rail and water transportation facilities, and with her vast resources of soil, forests, coal, oil, gas, iron, stone and clay, Ohio stands high as a manufacturing State. value added to the raw material by the varied manufactures of the State amounted to considerably more than \$600,000,000. For the same period the Bureau of the Census report shows that the sale of farm products reached a value of \$216,000,000, and that the minerals produced, exclusive of clay products, an estimated value \$159,000,000. Manufacturing, therefore, is preeminently Ohio's leading industry. The present report deals with a single class of factories, those manufacturing commodities from wood. They form one of the most important divisions of Ohio's enterprises, and nearly every State in the Union as well as many foreign countries send some portion of their forest material to Ohio for utilization in manu-The commodities turned out by these wood-using factories, together with the value of the rough forest products like lumber, shingles, cross-ties, etc., in 1909, amounted to nearly \$156,000,000. Compared with the value of farm products and the mineral resources, the part the forests and their related industries are taking in the commercial development of Ohio is thus clearly indicated.

In the early days of lumbering the eastern States, closer to the markets, were plentifully supplied with hardwoods similar to those growing in Ohio, and in consequence there was little incentive to ship the rough lumber to outside points. At the same time, in comparison with the softwoods needed by the rapidly growing population for building purposes, there was no demand for hardwoods at home. In order that the magnificent hardwood forests could be profitably exploited, the necessity of developing a home market was soon realized, and resulted in the establishment of industries like those concerned in this investigation.

FOREST CONDITIONS

When the pioneers crossed the Appalachians and began to settle in Ohio, the entire State with the exception of the northwestern corner was covered with a magnificent forest. The

eastern and northeastern part held valuable stands of white pine. Hemlock, too, was scattered on the high hills. The remainder of the State was a forest of deciduous growth. Probably in no section of the United States were there finer hardwoods than in the Ohio valley, particularly in the central and southern portions of this State. Magnificent specimens still to be seen standing here and there confirm this and make one realize the almost inconceivable wealth Ohio had in her timbered lands. For a long time, and even today, manufacturers making high grade products specify woods cut in Ohio and Indiana, considering their quality superior to similar growth in other States. On the uplands forests the principal trees were the oak, hickory, sugar maple, white ash, yellow poplar, black walnut, black cherry, basswood, and beech. In lower areas grew the elm, soft maple, black ash, sycamore, willow, red gum, bur oak, hackberry, cottonwood and red gum.



Fig. 1. A representative of the original forest.

OF OHIO

To the early settlers only the rich soil had a potential value. The vast forests were of no worth. In fact, owing to the expense of clearing, tree growth was a factor to decrease land values. Annually many hundreds of acres of the finest hardwoods in the world were cut and burned, and later, when the early lumbermen started their mills, the farmer, anxious to get the trees out of his way, voluntarily rendered assistance in felling and logging them without thought of remuneration for his labor or timber.

For many years there was no demand for timber products. The first market, it has been stated, was found at New Orleans, and a few rafts were floated down. Before there was any considerable transportation development, Cincinnati became the center for tanbark. To supply the demand gigantic oaks, valuable at that time only for their bark, were cut down and afterwards rolled together and burned.

With the influx of new settlers came the towns. This necessitated the sawmills, and from 1820 until the present time Ohio has held an important place among the States in the production of rough lumber. There were more than 1,900 sawmills operating in Ohio in 1860. This number was steadily maintained for several decades, when the failing timber supply began to be felt and the larger mills were compelled to move to other regions. In 1910, 1,532 mills were still operating in Ohio. These were mostly portable mills of small capacity. Their combined cut in 1910 was 542,000,000 feet as against 990,000,000 feet sawed in 1900, a decrease of more than 45 percent.

The present forest lands of Ohio are found mainly in farm woodlots except in the southern part where there are rough and sterile lands more valuable for growing timber than crops. The woodlots vary in size and condition and only comparatively recently have the farmers begun to show interest in the proper management of them. The northeastern part of the State, as already noted, is where the pine and hemlock now grow; in the north, hard maple, ash, and oak predominate; in the southern portions the woodlots contain mostly oak, beech, elm, sycamore, chestnut and poplar. Those of the greatest commercial importance are the oaks, ashes, beech, maples, yellow poplar, the hickories, chestnut and elms.

PURPOSE OF STUDY

The study of the wood-using industries of Ohio presents data on a subject and along lines not heretofore attempted in the State, although similar studies have been made in other States. Eventually the information from all the States will be correlated in a national study, and a series of publications relating to the wood using industries and the commercial woods of the United States will be issued by the U. S. Forest Service.

The Ohio investigation has been conducted under the same plan followed in other States. Cards indicating the information desired, particularly the amount of each wood employed and the exact use of each wood, were mailed to all the wood-using manufacturers of the State. Inquiries were also included as to the form in which the raw material was desired at the factory and the methods now followed in the utilization of factory waste. To study the processes of manufacturers of certain commodities and special waste problems at close range, agents traveled through the State. They also solicited data from manufacturers who had not sent in reports by mail. The manufacturers cooperated willingly. Both the Ohio Experiment Station and the Forest Service appreciate the aid and consideration given them.

No attempt was made to ascertain the amount of lumber cut by the sawmills of the State or the quantities of wood going into rough products like veneer, lath, shingles, cross-ties, cooperage stock, posts, telegraph and telephone poles, and paper pulp. For a number of years such information has been collected and reported annually by the Bureau of the Census. A copy of a part of the last Census Bulletin, to the extent to which it refers to Ohio, is presented in the appendix of this report.

Apart from the industries making the above-named products, there are scattered through Ohio over 1,600 factories using lumber as their raw material. The question as to what becomes of the lumber produced by the sawmills is answered by this and similar reports. For instance, the amount of white oak demanded for furniture, together with all the other furniture woods, is shown; likewise the amount demanded for making flooring, wagons, farm implements and machinery, automobiles, pianos boxes, railroad cars, sporting goods, matches, etc. The form of the raw material from which to make the many commodities, the prices paid, and the different sources of the material are also given.

The Ohio Experiment Station and the Forest Service are constantly receiving inquiries from points throughout Ohio and nearby States concerning markets for various kinds of timber and lumber, and for advice on profitable utilization of mill and factory waste. This report will answer many of these questions. A directory of the names and addresses of all manufacturers supplying the data

supplements the report. It is classified in the order corresponding to the tabulated information. For example, Table XLIV, gives information on match manufacturers, while under the same heading in the directory appear the names of the firms making matches and buying the various woods listed. Similarly from the "List of Uses of Woods," one can find commodities best suited for the material he has to sell. Information concerning the industry including the selected products can be ascertained from the table of contents and then from the directory the names of the manufacturers making them.

The farmer, the timber owner, and the sawmill man will be instructed by this report in the information it gives of the kinds of wood the manufacturers use, in what form they want it, and approximately the prices paid. It also gives the names and addresses of the consumers. The manufacturers in turn are benefited in the added opportunities for buying raw material and occasionally in finding in the waste of other factories suitable material for making their wares. The report may also suggest to manufacturers substitutes of cheaper woods for the more costly ones they are using, besides pointing out the chief regional sources from which the industries procure their raw materials. Dealers handling wooden commodities in other States can learn what the Ohio manufacturers have to sell, and those outside of Ohio who are in position to furnish raw material can find what the manufacturers demand. bulletin also contains data useful to those concerned in the work of outlining the policies of the State for forest protection and development.

FOREST IMPROVEMENT NECESSARY

From the Census Report we learn that over 63,000 wage earners in Ohio are dependent upon the wood-using industries and the sawmills. These establishments, aside from the sale of the raw material, add to the wealth produced in the State each year \$96,000,000. At present the home-grown timber is far short of the two hundred million feet of lumber required for the maintenance of the wood-working factories. Small tracts of valuable hardwoods are still to be found in the western part of the State, but it will not be many years before these have been consumed. The business men of Ohio should therefore appreciate the economic importance of the forests and lend every aid and encouragement to the work the State is carrying on in protecting and developing them.

Ohio first began to recognize the importance of forestry in 1885, when the Legislature authorized a Bureau of Forestry. This was largely due to the influence and work of the Ohio State Forestry Society together with the assistance of the Ohio Horticultural Society,

which organizations have done much towards promulgating right ideas and fostering a sentiment in favor of conservation. Later on the Bureau of Forestry was made a department under the supervision of the Board of Control of the Ohio Agricultural Experiment Station, and as soon as practicable was placed in charge of the State Forester, technically trained on all subjects pertaining to scientific forestry. A careful survey of the forest conditions of the State is being conducted, the Forester having already finished the field work in thirty counties, and presented the results in annual reports.



Fig. 2. Production of lumber, veneer, cooperage stock, cross-ties, etc., in Ohio that are not included in this study but are referred to in the appendix of the report.

Cooperative work is being carried on with, owners of woodlots throughout the State. In 1911, 50,000 acres of private forest land were being managed by the State Forester under cooperative agreement to improve or conserve the productive capacity. On a number of reservations set aside by the Commonwealth for the use of public institutions, small areas of woods or sections that are untillable have been turned over to the care of the Agricultural Experiment Station for forestry purposes. Eight of these are already under forest management, and upon six others the work has been started or working plans formulated. Several municipalities of the State have set aside areas for park purposes, and have turned them over to the supervision of the Agricultural Experiment Station for forest management. Cincinnati has acquired 600 acres for this purpose,

and Cleveland and Oberlin smaller parks. These areas afford excellent opportunities for demonstration in planting and the practice of forestry.

In addition to the work of woodlot management, considerable progress has been made with planting. Already 3,000 acres of land privately owned and a few small areas of State land have been given over to forest plantations. A large portion of the nursery stock used in this work was taken from the nurseries maintained by the State for the distribution of seedlings, the annual output of which at present amounts to about 375,000, and the capacity of 1,500,000 seedlings and transplants.



Fig. 3. Group of young hickories ready to take the place of old ones recently cut for vehicle stock.

At the recent Constitutional Convention an amendment was adopted empowering the State to purchase lands and likewise to use tax-reverted lands for timber reserves. In various parts of the State there are areas not suitable for farming. Some of these in the southern part, previously referred to are contiguous lands covered with more or less valuable second growth. If these and smaller areas are converted into State forests they will prove to be of considerable economic importance, first, as a factor in forestry education; second, in the advantage of the State having an income from

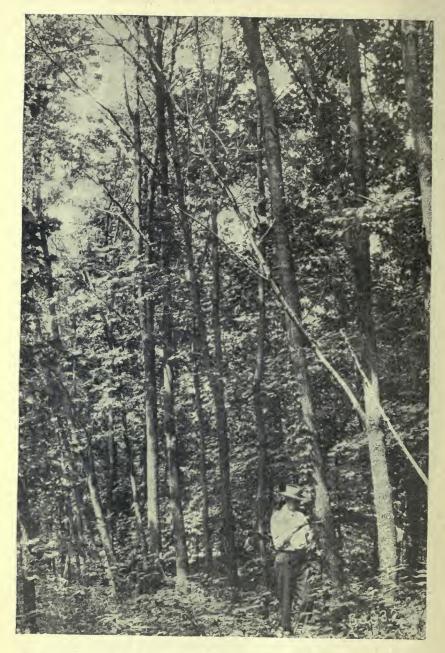


Fig. 4. Showing the development of white ash planted in central Ohio in 1875

lands heretofore non-productive; and third, a constantly growing supply of timber at home would benefit the wood-using factories and other industries of the State.

Equitable taxation of forest lands and fire protection are probably the most important factors in the practice of forestry and in influencing the success of a State wide forest policy. The late Constitutional Convention considered the subject of forest taxation in Ohio and adopted an amendment permitting the enactment of laws separately classifying forest lands for taxable purposes. This will doubtless be followed in the near future by the Legislature establishing a system of timber land assessment based on the income or yield.

Considerable interest has been shown in the subject of the State adopting a policy of fire protection for Ohio timberlands and it is believed that the necessary legislation providing for it will soon follow. It is no less imperative for the woodlot State to control forest fires than for the timbered State. This policy does not entail the provision of sufficient funds for fire fighting, but the maintenance of an organized fire patrol and fire observation stations throughout the danger season. The experience of other States has proved this system more economical not only in fighting fires but in lessening property loss. It was to encourage the States to recognize the importance of such measures that Congress enacted Section 2 of the Weeks Law, providing Federal aid for any State that established and actively maintained a paid forest fire organization. A number of the States have availed themselves of this opportunity with generally gratifying results.

KINDS OF WOOD

Table I brings together all woods purchased by the manufacturers according to species, irrespective of their use, and listed in the order of their amounts. There are sixty of them, all prominent in the lumber market. Eight grew in foreign countries. They are: Mahogany, Spanish cedar, Circassian walnut, padouk, English oak, teak, ebony, and rosewood, and they are all high-priced. It is interesting to note the large amounts of western wood that the Ohio manufacturers demanded. Seven came from forests of the Pacific Coast States, amounting to more than 14,000,000 feet. Douglas fir was the principal one, followed by sugar pine and western white pine, which were imported to compete with Michigan and Minnesota white pine. Others from the same region reported in quantities of less than 1,000,000 feet were: Redwood, western red cedar, western white pine and Sitka spruce. Of the shipped-in material the southern

TABLE I. Summary of kinds of wood used in Ohio

	Grown out	Feet b. m.	129, 785, 937 120, 315, 930 54, 517, 312 73, 432, 252 71, 334, 721	38, 133, 492 38, 038, 570 23, 599, 742 16, 561, 136 27, 342, 740	8,013,505 15,141,290 16,182,675 12,127,302 17,654,417	16,590,424 16,064,964 4,600,365 6,924,615 8,165,665	580,000 1,324,987 5,819,733 5,411,891 4,712,348	3,575,750 2,243,650 2,450,000 1,072,000 137,000
	Grown in	Feet b. m.	9,308,846 25,000 46,374,342	22,962,781 12,021,589 12,438,925 266,919	16 497,876 7 692,077 2 587,708 6,510,581	240,600 100,000 9,302,119 2,403,599 228,898	6,831,570	678,390
	Total cost	f. o. b. factory	\$4,092,344 3,572,169 3,756,033 1,928,610 1,836,638	1,921,936 1,381,758 1,519,840 817,461 626,445	886,705 577,068 369,398 326,519 414,407	497, 559 300, 332 332, 717 165, 863 295, 046	136,891 204,292 201,373 251,399 607,201	79,419 225,838 96,700 50,129 40,015
Martin and an analysis and a second s	A verage cost	per 1,000 ft.	* 883.388 388.385 5.388.385	31.88.38 28.167 28.167 28.19	36.18 25.27 19.68 17.52 23.47	29.56 18.58 23.93 17.78 35.15	18.47 33.37 34.60 46.45 128.85	22.21 39.47 46.76 39.00
	sed annually	Percent ·	15.20 13.15 11.02 8.02 7.79	6.67 33.38 3.17 20.22	22.48 22.05 1.93	1.84 1.52 1.02 .92	8.65.99.95. 12.99.95.	क्षंत्रह <u>ं</u> डां <u>न</u>
	Quantity used annually	Feet b. m.	139,094,784 120,340,930 100,891,654 73,432,252 71,334,721	61,096,273 38,038,570 35,621,331 29,000,061 27,609,659	24,511,381 22,833,367 18,770,383 18,637,884 17,664,417	16,831,024 16,164,964 13,902,484 9,328,214 8,394,563	7,411,570 6,122,309 5,819,733 5,411,891 4,712,348	3,575 750 2,922,040 2,450,000 1,072,000 1,026,000
	Kind of wood	Botanical name	Liriodendron tulipifera Pinus strobus Quercus a lba Pinus gadustris Pinus echinata	Quercus rubra Taxodium distichum Hisoria (sp.) Liquidambar styracifua	Fraxinus americana Tilia americana. Gastana dendada Fagus atropunica. Prins resinosa	Populus deltoides. Tsuga canadensis. Umus americana Acr saccharinum Betula (sp.)	Ulmus racemosa Fraxinus nigra Pseudotsuga taxtfolia Pinus dambertiana Swietenia mahagoni	Picea (sp.) †uginas nigra †uginas nigra Nyssa aquatica Pinus monticola Quercus macrocarpa
	Kin	Common name	Yellow poplar White pine White oak. Longleaf pine.	Red oak. Cypress. Hickory Sugar maple. Red gum	White ash. Basswood. Basswood. Chestnut Beech. Norway pine.	Cottonwood Hemlock White elm Silver maple.	Cork eim. Black ash. Sugar pine. Mahogany,	Spruce. Black wahnut. Cotton gum. Western white pine. Bur oak.

TABLE I.-Continued. Summary of kinds of wood used in Ohio

Kin	Kind of wood	Quantity u	Quantity used annually	Average cost	Total cost	Grown in Ohio	Grown out of Ohio
Common name	Botanical name	Feet b. m.	Percent	per 1,000 it.	r. o. D. lactory	Feet b. m.	Feet b. m.
Red cedar Cherry Northern white cedar Sycamore	funiperus virginiana Prunus serotina Ilmia occidentalis Assculus glabra Platanus occidentalis	953,810 947,881 944,540 930,992 902,250	33333	\$ 28.63 19.16 221.07 23.58	\$27,309 66,048 18,102 19,614 21,276	279,599 533,000 784,250	953, 810 668, 282 944, 540 397, 992 118, 000
Redwood Balm of Gilead Black gum Tamarack Cucumber	Sequoia semperairens. Populus balsamifera. Ayssa septatica. Laria lariaina. Magnoha acuminata.	876,000 688,820 674,500 600,000 521,800	0.007.00.	36.73 17.13 16.51 17.00 16.66	32,174 11,800 11,137 10,200 8,692	314,500	876,000 688,820 360,000 600,000
Western red œdar. Spanish œdar. Pitch pine. Western yellow pine. Loblolly pine.	Thuja plicata Cedrela odorata Pinus rigida. Pinus deda	510,000 478,750 468,000 450,000 449,000	පිපිපිපිපි පි	30.20 124.32 17.03 18.32	15,400 59,517 7,970 20,650 8,225	115,000	510,000 478,750 353,000 450,000 449,000
Western larch. Hackberry Willow. Watternut. Sweet magnolia	Larix occidentalis Celtis occidentalis Salix (sp.) Tuglans cinerea Mappolit glanca	213,000 200,000 170,000 782,500 75,000	9.9.9.9.9.9.	22.50 16.13 27.06 39.26 12.00	4, 7, 225 225, 4, 600 2, 239 900	200,000 157,000 79,500	213,000 13,000 75,000
Circassian walnut	Fugians regia. Picas stichensis. Malus malus. Peterocarpus indicas.	32,470 28,000 24,000 14,500	* * * *	284.39 40.89 20.00 133.16	9,234 1,145 1,930	24,000	32, 470 28, 000 14, 500
Locust English oak Fask Reak Ebony. Rosewood	Robinia pseudacacia Quercus robur Tectonia grandis Dossyrias ebcum Dalbergia (sp.)	12,000 10,000 1,000 500 500	* * * *	35.83 410.00 250.00 350.00	4,100 250 120 175	9,000	6,000 10,000 1,000 500 500
	Total	915,272,369	100.00	\$30 47	\$27,884,839	165,174,792	750,097,577

*Less than I-100 of one percent.

states supply more, both in quantity and kinds, than any other region. Yellow pine—longleaf and shortleaf in nearly equal quantities—heads the list, but the oaks, cypress, red gum, chestnut. cottonwood, hickory and poplar furnished a large percent of the demand. The Lake States region contributed the largest part of the white pine, which, in amount, constituted over 40 percent of all the woods going into further manufacture. Most of the sugar maple reported came from this region, and also the beech and hemlock. Michigan furnished the most and Minnesota next. Only four woods were supplied entirely by Ohio-cut timber. They were: Cucumber, hackberry, applewood and pitch pine. Western larch sent in from Rocky Mountain regions and sweet magnolia from Louisiana are included in the list. The proportion of the total of the different woods listed as grown in or out of the state is also shown. In every instance where a species was reported as partly grown within the state, the average price of the home-grown wood was less than the cost of the material coming from outside.

*TABLE II. Home grown woods used and amount and percent of each shipped in from other States.

	Grown i	n Ohio	Grown ou	t of Ohio
Kind of wood	Feet b. m.	Percent	Feet b. m.	Percent
Applewood sh (black) sh (white) 3asswood Geech	24,000 4,797,322 16,497,876 7,692,077 6,510,582	100.00 78.36 67.31 33.69 34.93	1,324,987 8,013,505 15,141,290 12,127,302	21.64 32.69 66.31 65.07
Birch Buckeye Butternut Cherry Chestnut	228,898 533,000 79,500 279,599 2,587,708	2.73 57.25 96.36 29.50 13.79	8,165,665 397,992 3,000 668,282 16,182,675	97.27 42.75 3.64 70.50 86.21
ottonwood Cucumber Dim (cork)	240,600 521,800 6,831,570 9,302,119 314,500	1.43 100.00 92.17 66.91 46.63	16,590,424 580,000 4,600,365 360,000	98.57 7.83 33.09 53.37
rum (red), Iackberry Iemlock Iickory. ocust.	266,919 200,000 100,000 12,021,589 6,000	.97 100.00 .62 33.75 50.00	27,342,740 16,064,964 23,599,742 6,000	99.03 99.38 66.25 50.00
Iaple (silver)	2,403,599 12,438,925 889,000 22,962,781 46,374,342	25.77 42.89 86.65 37.58 45.96	6,924,615 16,561,136 137,000 38,133,492 54,517,312	74.23 57.11 13.35 62.42 54.04
Pine (pitch) Pine (white) Poplar (yellow) Sycamore Walnut (black) Willow	115,000 25,000 9,308,846 784,250 678,390 157,000	24.57 .02 6.69 86.92 23.22 92.35	353,000 120,315,930 129,785,937 118,000 2,243,650 13,000	75.43 99.98 93.31 13.08 76.78 7.65
rotal	165,172,792	24 . 10	520,272,005	75 90

^{*}Discussion of table on following page.

WOODS GROWN IN OHIO

Table II is a summary of State grown woods, and offers a comparison of the amounts of the same woods shipped in from the producing regions of other States. Different from Table I, this summary groups the species alphabetically as to genus instead of in their numerical order. Sixty woods were reported by the Ohio manufacturers and a part of or all of 31 of them were cut in the State. The oaks were the most important as to quantity demanded, followed by the ashes then the elms, maples and hickories mentioned according to the quantity used. (See Table II on page 18).

To correct any inaccuracies in separating the information according to species as they appear in the summary and the industry compilations, Tables III to XXXIX present the data according to kinds of wood. For example, the white elm and cork elm have been combined and are shown under a single heading—"elm"—likewise the oaks, the gums, the cottonwoods, etc. The principal homegrown woods and a few domestic and foreign woods important as to distribution were the ones so treated and a brief account of them and their apportionment among the industries are as follows:

OAKS

The oak is the most abundant tree growing in Ohio. In trade there are two general classes, white oak and red oak, but botanically they are about equally divided among more than twenty species. The most important are: White oak (Quercus alba) red oak (Quercus rubra), bur oak (Quercus macrocarpa), chestnut oak (Quercus prinus), pin oak (Quercus palustris), black oak (Quercus velutina), and scarlet oak (Quercus coccinea). Among the others are chinquapin oak, post oak, overcup oak and black jack oak. The wood of the white oaks ranks first in general utility and is superior to any of the red oaks. They are, however, slow growing species and on account of the long time rotation will probably not be extensively planted when the present supply is exhausted. Red oaks, on the other hand, are fairly rapid growers. The total amount of oak consumed in Ohio is more than 163,000,000 board feet reported by thirty different industries. They form the largest part of the home-grown woods of any of the species, representing nearly one-half of all the woods that were reported as cut in the State. The industries making planing mill products, flooring, wainscoting and other interior finish, alone required over 37,000,000 feet of oak or 22.7 percent of the total, and furniture makers 14.2 percent of the total. These industries, together with vehicles, car construction, sash, doors, and general mill work, demand a sufficient amount to equal nearly 73 percent of the total consumption of the wood. The remaining 27 percent is divided among 25 other industries in varying small amounts as follows:

TABLE III. Oaks

	Quantity used	1 annually	Average
Industry	Feet b. m.	Percent	cost per 1,0000 ft.
Planing mill products Purniture Vehicles and vehicle parts 2ar construction Jash, doors, blinds and general mill work	37,024,682	22.71	\$39.16
	23,120,041	14.18	40.53
	22,862,012	14.03	37.07
	22,106,292	13.56	26.39
	14,558,697	8.93	41.70
Agricultural implements. Boxes and crates Vixtures Chairs Clumbers' woodwork	11,225,700	6.91	25.64
	6,199,945	3 80	14.93
	5,482,305	3.36	45.37
	3,495,000	2.14	34.26
	3,175,000	1.95	33.15
fiscellaneous. I andles. tefrigerators and kitchen cabinets. hip and boat building. I achine construction.	2,558,000	1.57	30.35
	2,325,372	1 43	29.14
	1,724,056	1.05	29.99
	1,262,000	.78	39.31
	1,207,500	.74	35.93
quipment, playground	1,100,000	.67	14.09
	767,000	.47	13.76
	547,325	.34	49.11
	425,000	.26	28.16
	402,000	.25	54.43
Canks and silos. Voodenware and novelties	400,000	.25	85.00
	280,000	.17	16.79
	210,000	.13	34.29
	165,000	.10	16.55
	116,000	.07	60.23
Pulleys and conveyors. addles and harness Brushes Clevators	100,000	.06	33.00
	87,000	.05	22.86
	75,000	.05	25.00
	29,000	.02	35.86
Potal	163,013,927	100.00	\$35.08



Fig. 5. A white oak and a fine stand of reproduction.

YELLOW POPLAR

According to the quantity used, the manufacturers demand more yellow poplar than any other wood. Nearly 140,000,000 feet were consumed in 1911. Of this amount Ohio furnished nearly 7 percent. Its usefulness can be determined by its distribution among the industries. Thirty out of 35 call for yellow poplar and next to sugar maple it entered into more uses than any other wood purchased by the Ohio manufacturers. Its most exacting use is probably for barrel bungs and for that purpose nearly 7 percent of the total used in Ohio is annually required. The planing mills use the greatest amount of it, followed by the box makers, who, according to the prices shown in the table following, use only the low grades. They paid less than \$16 per thousand feet, which was the lowest average price reported for yellow poplar by any of the industries. The percent going into each class can be noted in the table following.

In Ohio the yellow poplar tree next to oak is probably the most important. It is found in all parts of the State standing on rather moist soils along streams. It grows to very large dimensions and is in no way related to the true poplars, cottonwood, aspen, etc. Yellow poplar is probably the most common name that the wood bears in the market, but in different localities it goes as tulip tree wood, tulip poplar and whitewood.

TABLE IV. Yellow poplar

,	Quantity use	ed annually	Average
Industry .	Feet b. m.	Percent	cost per 1,000 ft.
Planing mill products. Boxes and crates. Sash, doors, blinds and general mill work. Bungs and faucets Vehicles and vehicle parts.	43,394,080 38,779,666 20,324,206 9,620,000 8,918,884	31.20 27.88 14.61 6.92 6.41	\$31.71 15.94 35.66 27.30 52.92
Car construction Furniture Miscellaneous Agricultural implements. Fixtures	4,598,715 3,086,703 2,135,000 1,530,700 1,421,600	3.31 2.22 1.53 1.10 1.02	43.50 30.43 21.53 37.38 37.42
Pumps Refrigerators and kitchen cabinets Instruments, musical Plumbers' woodwork Caskets and coffins	988,000 894,987 823,000 650,000 340,000	.71 .64 .59 .47 .24	48.86 22.41 45.41 17.31 26.76
Pulleys and conveyors Frames and molding Dairymen's, poulterers' and apiarists' supplies. Gigar boxes Machine construction	280,000 271,251 253,000 246,491 175,000	.20 .19 .18 .18	22.71 34.47 30.30 82.85 37.71
Patterns and flasks. Sporting and athletic goods	90,000 80,000 40,000 40,000 50,500	.06 .06 .03 .03	35.00 22.63 25.06 35.50 45.25
Brushes Elevators Frunks and valises Woodenware and novelties	30,000 15,000 10,000 8,000	.02 .01 .01 .01	40.00 32.67 32.00 40.00
Total	139,094,783	100.00	\$29.42

ASHES

Nearly 50 percent of the white ash and more than 60 percent of the black ash is demanded annually in Ohio for handles. It goes into long tool handles such as rakes, hoes, shovels, forks and D handles. The vehicle makers and the car builders come next in demanding this wood, the latter industry uses it for interior finish of cars, especially trolley cars, for which purpose its handsome figure, strength and ability to hold its shape makes it well adapted. Furniture makers use it for cheap grades such as kitchen safes and cabinets, and for butter tubs it is the favorite of all woods because it is considered less liable than any wood to impart a taste to the contents. There are five species of ash growing in Ohio, but it is difficult to distinguish them in the wood. A number of manufacturers use ash indiscriminately, as many of the individual reports indicate, while not a few separate them into two general classes known on the market as white ash and black ash. Twenty-two of the 36 industries in Ohio report using this wood. They are:

TABLE V. Ashes

	Quantity use	d annually	Average
Industry	Feet b. m.	Percent	cost per 1,000 ft.
Handles Vehicles and vehicle parts Car construction Planing mill products. Dairymen's, poulterers' and apiarists' supplies.	16,961,322 .7,786,828 2,579,700 1,049,100 861,000	52.10 25.42 8.42 3.42 2.81	\$31.24 43.81 47.83 33.70 43.40
Woodenware and novelties Agricultural implements Sash, doors, blinds and general mill work Furniture. Miscellaneous	506,000 369,000 289,000 274,640 222,000	1.65 1.20 .94 .90 .72	32.65 34.13 44.89 25.03 14.28
Ship and boat building. Boxes and crates Saddles and harness Instruments, musical. Plumbers' woodwork.	203,000 180,000 110,000 76,000 50,000	.66 .59 .36 .25	35.22 17.20 30.00 50.71 30.00
Trunks and valises Sporting and athletic goods. Machine construction. Pulleys and conveyors. Chairs. Fixtures. Frames and molding.	23,000 20,000 20,000 20,000 12,000 12,000 9,000	.08 .07 .07 .07 .04 .04 .03	34.35 36.00 38.00 30.00 30.00 38.00 47.58
Total	30,633,690	100.00	\$35.61

ELMS

Four elms are found in Ohio, the white or American elm (Ulmus americana), the red or slippery elm (Ulmus pubescens), the rock or cork elm (Ulmus racemosa) and the winged elm (Ulmus alata). The white elm and the slippery elm are more frequent and more widely distributed, the former being the most important commercially but on the market rarely any distinction is made. The trees are usually distinguished by the bark and the leaf; the inner bark of the slippery elm being mucilaginous and nutritious and has a leaf with a very rough upper surface, whereas the white elm leaf has a smooth surface and the outer bark, like all of the other elms, is deeply furrowed. Elm wood has properties which fit it for a number of special uses. In some respects it is one of the best American woods, its elasticity, for instance, is exceeded only by hickory. Bicycle rims have been largely made of it on account of its resiliency and tensile strength. the same qualities that have made it preeminently the best wood for patent barrel hoops. Its scarcity prevents its use for many articles where it would be of exceptional value. Generally a large supply of elm goes into the manufacture of farm implements, slack barrel staves for flour barrels, bent parts of chairs and vehicle bodies, banjo rims, piano case parts, etc. The principal uses in Ohio are indicated by the industries calling for it, which are:

TABLE VI. Elms

	Quantity use	ed annually	A verage.
Industry	Feet b. m.	Percent	cost per 1,000 ft.
Vehicles and vehicle parts	7,284,878	34.18	\$18.40
	7,074,109	33.19	24.35
	1,095,000	5.13	22.73
	3,083,307	5.08	22.06
	870,000	4.08	26.02
Trunks and valises. Planing mill products. Fixtures Chairs. Instruments, musical	760,000	3.57	23.91
	548,260	2.57	22.00
	536,000	2.51	20.99
	510,500	2.40	27.40
	460,000	2.16	23.74
Agricultural implements Equipment, playground. Saddles and harness. Machine construction. Refrigerators and kitchen cabinets	253,000	1.19	26 80
	250,000	1.17	18 80
	172,000	.81	22 47
	140,000	.66	28 25
	70,000	.33	24 00
Brushes Woodenware and novelties Elevators. Patterns and flasks Sash, doors, blinds and general mill work. Car construction	65,000	.30	30.00
	50,000	.23	16.00
	30,000	.14	25.00
	25,000	.12	20.00
	25,000	.12	22.48
	12,000	.06	40.00
Total	21,314,054	100.00	\$22.03

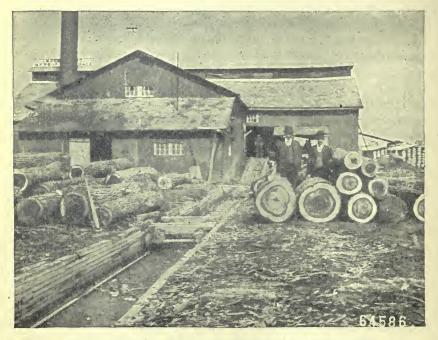


Fig. 6. Elm logs cut in Ohio waiting to be manufactured into barrel hoops.



Fig. 7. Soft maple and white elm logs in the yard of a basket factory. (Statistics included under Box Industry.)

MAPLES

Five maples grow in the State of Ohio. They are the silver maple (Acer saccharinum), the red or scarlet maple (Acer rubrum), the sugar maple (Acer saccharum), the black maple (Acer saccharum nigrum), and the ash-leaf maple or box elder (Acer negundo). The black maple is found only in the southern part of the State. red maple prefers moist soil but it also grows on slopes and ridges, and is found generally throughout the State. The silver maple is usually found following the rivers and streams and on the edges of swamps. The red and silver maples contribute the soft maple lumber, the former being more abundant, and hard maple is from the sugar maple tree. The sugar maple is commercially the most important in the State and grows in all localities except swamps. It supplies practically all of the maple sugar produced in Ohio and its wood next to white oak is called on for by a greater number of users than any lumber the Ohio manufacturers demand. Today, the maples with the oaks lead in the manufacture of hardwood flooring. It goes into various kinds of furniture, especially hidden work of case goods like drawer sides, bottoms, mirror backs, etc., and is used for finish in upholstered furniture where it is stained in imitation of expensive cabinet woods. The occurrence of curly or bird's eye, mostly in the hard maple, makes it extremely valuable in the manufacture of highly artistic furniture usually for bed rooms. Its less

common uses are for machine parts, saddle trees, stirrups, ox-yokes, clothespins, whipstocks, shoe lasts, pegs and lamps. Vehicle makers employ both maples extensively for various purposes and for turnery, the two with beech are the principal woods. They also serve for staves chiefly for sugar barrels and to a large extent for veneers. In the distillation of hardwoods for charcoal, wood alcohol and the acetates the maples are held in high favor. Soft maple is lighter than hard maple, and is nard, strong, brittle, close-grained, compact, easily worked. The color of the wood is light brown tinged with red and has lighter sapwood.

TABLE VII. Maples

***************************************	· wapico		
·	Quantity use	d annually	Average
Industry	Feet b. m.	Percent	cost per 1,000 ft.
Boxes and crates Planing mill products. Furniture Agricultural implements Handles.	*8,007,396 5,814,910 4,526,201 4,270,500 3,835,496	20.39 15.17 11.81 11.14 10.01	\$14.61 27.89 26.85 28.04 22.71
Vehicles and vehicle parts Instruments, musical Fixtures Woodenware and novelties Miscellaneous.	2,536,701 2,369,000 1,849,400 715,000 610,000	6.62 6.18 4.82 1.87 1.59	43.91 28.44 25.62 20.50 41.43
Car construction Machine construction. Chairs. Sash, doors, blinds and general mill work Refrigerators and kitchen cabinets.	517,295 514,000 509,000 493,000 335,209	1.35 1.34 1.33 1.29 .87	34.18 23.13 25.31 32.37 22.21
Plumbers' woodwork. Pulleys and conveyors. Elevators. Laundry appliances Instruments, professional and scientific	320,000 255,000 250,000 220,000 130,000	.83 .67 .65 .57	25.31 23.31 30.00 29.54 27.23
Dairymen's, poulterers' and apiarists' supplies. Brushes. Patterns and flasks. Saddles and harness Ship and boat building. Frames and molding.	97,000 80,417 32,500 30,000 10,000 250	.25 .21 .08 .08 .03	19.37 28.46 25.23 30.00 30.00 36.00
Total.	38,328,275	100.00	\$24.72

^{*}Less than .01 of 1 percent.

HICKORIES

The mockernut (Hicoria alba), the pignut (Hicoria glabra), the bitternut (Hicoria minima), the shagbark (Hicoria ovata), the shell-bark (Hicoria laciniosa), and the small fruited hickory (Hicoria microcarpa) are found in Ohio. The species grow more or less generally throughout the State. The woods of the different hickories are very similar, thus making it difficult to distinguish them. Consequently, the lumber dealers and manufacturers make no attempt to keep the species separate and little information is



Fig. 8. Shagbark hickories growing in Ohio.



Fig. 9. A bitternut hickory growing in southern Ohio.

available as to the quantity of each kind cut within the State. early use was for tool handles and this probably more than any other today distinguishes hickory from other woods. On shipboard and in ship building it is used, but in the latter case only for parts entirely submerged. Belaying pins, oars and pegs are other boat parts usually made of hickory. The hoop pole business has drained the forests of the hickory sapling to a great extent, but in late years sawed hoops made from other woods have begun to replace it to a marked degree. Nearly half of the manufactured hickory goes into the production of spokes and other vehicle parts. Owing largely to variety of special uses to which this wood is put great waste has been occasioned, and it is probable that its waste has exceeded that of any other valuable tree. The wood of hickory is heavy, very hard and strong, tough, close-grained, compact and flexible. The medulary rays are numerous and thin, color brown, sapwood nearly white.

TABLE VIII. Hickory

•	Quantity use	d annually	Average
Industry	Feet b. m.	Percent	cost per 1,000 ft.
Vehicles and vehicle parts	29,324,100 3,435,935 1,691,500 511,000 178,000	82 32 9 65 4 75 1 43 50	\$44.34 24.14 43.87 81.14 25.31
Instruments, professional and scientific. Boxes and crates Furniture Woodenware and novelties Brushes	125,000 105,000 103,000 63,000 30,000	.35 .29 .29 .19 .08	32 80 24.52 24 68 59.28 50.00
Car construction Chairs. Machine construction. Sash, doors, blinds and general mill work. Ship and boat building. Trunks and valises.	18, 296 14, 000 10, 000 10, 000 2, 000 500	.05 .04 .03 .03 .01	36.13 28.57 38.00 40.00 37.50 26.00
Total	35,621,331	100.00	\$42.67

^{*}Less than 1-100 of 1 percent.

BASSWOOD

Two species of basswood grow in Ohio; they are the basswood (Tilia americana) and the white basswood (Tilia heterophylla). The former is the more important, more widely distributed throughout the State and is the wood found in commerce under the name of linn. Practically all makers of wooden wares find use for basswood, and Ohio builders demand it to a limited extent for interior and exterior construction work, and sometimes for siding. Large quantities in the form of thin lumber goes into furniture, for the unexposed parts like drawer bottoms, backs of case goods, etc., while in

the same form it is a favorite for trunk boxes and the best trunks are made from it, usually 3-ply stock. Twenty-three of the 36 industries reported using basswood in large quantities. Among them the vehicle manufacturers use it for bodies, and pyrographers favor it ahead of any wood for their art.

TABLE IX. Basswood

	Quantity use	d annually	Average
Industry	Feet b. m.	Percent	cost per 1,000 ft.
Boxes and crates	4,333,000	18.98	\$20.13
	3,914,000	17.14	22.69
	3,038,340	13.31	24.73
	2,270,000	9.94	26.55
	1,558,500	6.82	27.17
Sash, doors, blinds and general mill work. Planing mill products. Instruments, musical Fixtures. Handles	1,140,000	4.99	27.66
	1,110,660	4.86	26.68
	1,013,000	4.44	38.34
	762,300	3.34	25.53
	708,385	3.10	23.39
Agricultural implements. Miscellaneous. Frames and molding. Vehicles and vehicle parts Car construction	683,000 630,000 572,200 427,000 177,982	2.99 2.76 2.51 1.87	28.15 24.13 35.72 28.53 27.91
Instruments, professional and scientific Refrigerators and kitchen cabinets Laundry appliances Saddles and harness Chairs	150,000	.66	39.00
	134,000	.59	28.29
	70,000	.31	25.86
	41,000	.18	22.80
	40,000	.17	30.00
Caskets and coffins. Machine construction. Patterns and flasks.	25,000	.11	28.00
	25,000	.11	26.00
	10,000	.04	35.00
Total	22,833,367	100.00	\$25.27

BEECH

Beech grows throughout Ohio on well-drained situations, mixed with oak, maple, ash and hickory. This tree seems disposed to decay in its later stages and much of the mature timber in the State is not sound. It is quite tolerant of shade and reproduces readily from seed and by sprouts. This as well as the fact that until within comparatively recent years beech was not valuable as timber and was therefore left standing accounts for its presence in nearly every woodlot in Ohio and often to the exclusion of many other more important hardwoods. Some trees are found having a large percent of sapwood which is whitish in color, hence the name in commerce white beech, while the red heart-wood answers to red beech. On account of its dense shade and freedom from disease and insects, beech is a desirable tree for ornamental purposes. Probably its first commercial use was for charcoal, more on account of its abundance than any special quality that it possesses. Beech furnishes

more material for wood distillation than any species, though birch and maple have been considered equally as suitable. In recent years it has been growing in favor as a flooring wood. It takes a high polish, is very hard, tough, strong close-grained. Since preservative treatment has developed, beech has been found to be an admirable wood for outdoor use when treated. This accounts for its recently going into railroad ties, fence posts, etc. Where toughness is not considered beech is almost equal to hickory. Automobile and vehicle parts, plane stocks, turned chairs, cog wheels, wedges, faucets, veneer, clothespins and broom handles are among the many uses it is called to meet. The wood is fairly difficult to season and if great care is not exercised it is liable to warp and check.

TABLE X. Beech

	Quantity use	d annually	Average
Industry	Feet b. m.	Percent	cost per 1,000 ft.
Boxes and crates	7,338,629	39.37	\$14.24
	2,383,694	12.79	18.02
	2,260,000	12.13	19.70
	2,075,916	11.14	20.43
	1,199,000	6.43	21.67
gricultural implements	833,000	4.47	22.18
	500,000	2.68	19.76
	450,000	2.41	13.34
	402,000	2.16	17.99
	318,350	1.71	19.00
nstruments, musical	144,000	.77	18.50
	130,000	.70	18.92
	100,000	.54	20.00
	100,000	.54	22.00
	100,000	.54	20.00
Purniture Saddles and harness Ship and boat building Saundry appliances Fixtures	95,000	.51	20.79
	90,000	.48	30.00
	51,500	.28	20.29
	40,000	.21	21.00
	20,000	.11	25.00
Car construction Dairymen's, poulterers' and apiarists' supplies Prames and molding	4,200 2,000 595	.02	20.00 10.00 30.25
Cotal	18,637,884	100.00	\$17.52

^{*}Less than 1-100 of 1 percent.

CHESTNUT

The chestnut is found extensively in the woodlots of northeastern, eastern and southern Ohio and is especially common on the glacial drift. Chestnut does not usually occupy the richest soil, but ridges and slopes where soil is thin. It is a fast growing tree, and reproduces exceptionally well and for that reason a few years ago it began receiving attention in woodlot management. Lately, however, the fungus disease (Diapoetha parasitica) has made great inroads on

the standing chestnut of the country, and until the control of the blight is assured, the advisability of using it as a planting tree must be passed over. In the days of wood fences chestnut was used more than any other tree for fencing. It is durable in exposed situations and underground, which accounts for its being a favorite for telephone and telegraph poles, railroad ties, shingles, coffiins and caskets. Chestnut was late coming into general use as lumber, and it might be said that it did not come into commercial prominence long before 1900. Since that time its cut per annum has increased four or five fold. The manufacturers of furniture and pianos had much to do with bringing it into favor, demanding it above any wood for veneer backing or cores. Being cheaper than oak and having an attractive figure, chestnut has become a leading wood for exterior trim and store and office fixtures. It yields more tanning extract than any other wood and with the growing scarcity of tan bark every year more chestnut will go to the extract plants. The wood of the chestnut is light, soft, not strong, coarse-grained and liable to check and warp. The layers of annual growth are marked by many rows of large, open ducts. The color is brown with lighter sapwood.

TABLE XI. Chestnut

TABLE AL	Onestitut		
	Quantity use	d annually	Average
Industry	Feet b. m.	Percent	cost per 1,000 ft.
Boxes and crates	6,343,739	33.80	\$13.85
	3,128,000	16.66	19.55
	2,257,100	12.02	20.92
	1,666,000	8.88	18.19
	1,581,475	8.43	29.51
Planing mill products	1,413,000	7.53	31.37
	968,445	5.16	22.31
	406,000	2.16	18.47
	350,000	1.86	18.00
	240,000	1.28	18.00
Plumbers' woodwork Trunks and valises Sporting and athletic goods. Car construction Vehicles and vehicle parts	110,000	.59	22.64
	100,000	.53	35.00
	80,000	.43	27.75
	52,224	.28	24.09
	25,000	.13	48.00
Refrigerators and kitchen cabinets	24,000	.13	20.71
	23,400	.12	41.03
	2,000	.01	22.00
Total	18,770,383	100.00	\$19.68

WHITE PINES

Though the lumber cut shows that thirteen mills cut white pine in only limited amounts it is not possible to ascertain whether the logs were brought in from other states to the Ohio mills or whether they were cut in the extreme northeastern part of the State where in a limited area white pine appears. The manufacturers report using but 25 M feet of home grown white pine and import more of it than any other wood. Next to yellow poplar more of it goes into manufacturing in Ohio than any of the sixty woods reported.

Table XII following represents three different species because they appear on the market indiscriminately under the name white pine. They are in order of their importance, white pine (Pinns strobus) growing in the Lake states; Norway or red pine (Pinus resinosa) which grows associated with white pine, and usually sold mixed with it, and western white pine (Pinus monticola) that comes from Idaho, Montana and Washington. The last named is similar to the eastern pine but the wood is a little more brittle, harder and heavier. The average cost of the western white pine being \$20 per M feet above the eastern wood can be accounted for in that most of the former was purchased in the upper grades, while a larger part, 24 percent, of the latter was bought at low prices to be used only for packing boxes and crating.

TABLE XII. White pines

	Quantity use	ed annually	
Industry	Feet b. m.	Percent	A verage cost per 1,000 ft.
Planing mill products. Boxes and crates Matches Sash, doors, blinds, and general mill work Car construction	46,357,393	33.23	\$31.97
	35,949,790	25.77	16.59
	24,250,000	17.38	34.75
	18,972,500	13.60	34.99
	4,258,739	3.05	30.98
Caskets and coffins Dairymen's, poulterers' and apiarists' supplies Patterns and flasks Agricultural implements. Machine construction.	3,615,000	2.59	28.82
	2,350,000	1.68	30.00
	1,024,700	.73	56.37
	878,000	.63	30.28
	480,000	.34	33.83
Ship and boat building	344,000	.25	40.06
	262,000	.19	47.08
	202,000	.14	38.12
	199,425	.14	19.60
	147,000	.11	47.45
Fixtures Refrigerators and kitchen cabinets Pumps Bungs and faucets Pulleys and conveyors, Vehicles and vehicle parts	57,000	.04	40.00
	50,000	.04	32.00
	40,000	.03	22.50
	37,000	.03	18.00
	35,000	.02	35.00
	10,800	.01	39.63
Total	139,520,347	100.00	\$28.99

SYCAMORE

Sycamore grows most abundantly in Ohio on the bottom lands of the streams and on areas bordering swamps and marshes. It grows perhaps to be the largest of any of the common

trees in the State. It is easily distinguished by the striking whiteness of its bark and by the fact that it holds its button balls throughout the winter. It is valuable for the protection it affords river banks and islands against washing. The sycamore's ability to grow on wet lands has had a great deal to do with its preservation for the present market supply. It was formerly used almost entirely for butcher blocks and refrigerator linings, but these special uses are not so important as its demand for veneer in built-up lumber. Quarter-sawed sycamore is rapidly growing in popularity. It has a striking grain and goes into sewing machines, furniture, cabinet work and interior finish. Plain sycamore serves for farm implement parts, washing machines, wooden bowls, tool handles and wooden screws and blocks. The uses it serves in Ohio can be discerned from the industries calling for it. The wood is heavy, hard, not strong, very close grained, compact, difficult to split and work. The medullary rays are numerous and conspicuous. Heartwood is brown tinged with red, and sapwood is lighter colored.

TABLE XIII. Sycamore

	Quantity used annually		Average	
Industry	Feet b. m.	Percent	cost per 1,000 ft.	
Planing mill products. Boxes and crates. Miscellaneous. Agricultural implements. Sash, doors, blinds and general mill work. Instruments, musical. Furniture Refrigerators and kitchen cabinets Vehicles and vehicle parts. Brushes. Dairymen's, poulterers' and apiarists' supplies. Handles.	324,750 200,000 150,000 85,000 62,500 40,000 15,000 4,000 3,000 2,000 1,000	36.00 22.17 16.63 7.42 6.93 4.43 1.66 1.66 .44 .33	\$25.72 14.25 18.00 31.76 38.43 32.00 35.00 15.00 35.00 16.00 20.00	
Total	902,250	100.00	\$23.58	

BLACK WALNUT

Ohio is one of the first states in the production of walnut lumber but the fact that the lumber was manufactured there does not necessarily mean it grew in Ohio, though it is found throughout the State. Owing to its value as lumber and its ability to grow fairly rapidly it is a favorite tree for planting. Walnut lumber in earlier days was not appreciated as much at home as in European countries and up to the present time more high grade walnut is sent abroad than is used in America. It has long been used for gunstocks—its most exacting use—because it is strong, handsome, and shows stains less than any

other available wood. It is called on for a great number of uses, but principally for sewing machines, furniture, cabinets, caskets, pews, pulpits and other ecclesiastical furniture. Also for cabinet and pipe organs, parts of automobile bodies, billiard tables, clock cases, etc. In Ohio fourteen industries report buying black walnut. They are listed in the following table:

TABLE XIV. Black Walnut

	Quantity used annually		Average
Industry	Feet b. m.	Percent	cost per 1,000 ft.
Planing mill products	2,103,500	71.99	\$ 69.05
	350,000	11.98	134.29
	167,800	5.74	103.50
	80,850	2.77	50.06
	54,000	1.85	51.57
Bungs and faucets Furniture Caskets and coffins Fixtures. Machine construction.	51,000	1.75	30.15
	50,900	1.74	67.88
	20,000	.68	74.00
	12,600	.43	59.84
	10,000	.34	38.00
Plumbers' woodwork	10,000	.34	80.00
	9,000	.31	90.00
	1,390	.05	38.80
	1,000	.03	70.00
Fotal	2,922,040	100.00	\$ 77.29

BUCKEYE

The horse chestnut (Aesculus hippocastanum), and the buckeye (Aesculus glabra), the former being probably the more common, both grow in Ohio. Lumbermen and manufacturers make no distinction between the wood of the two species. Buckeye, like cucumber, often loses its identity and goes to market mixed with yellow poplar. It is called for separately, however, by the manufacturer of artificial limbs to meet its most exacting use and occasionally by turneries and makers of novelties and athletic goods. Together with yellow poplar it goes for weather boarding, siding and casing and other uses in building for which yellow poplar is required. Buckeye is light, soft, close-grained, compact and difficult to split. The color of the wood is creamy white and quite uniform as the sapwood is hardly distinguishable.

TABLE XV. Buckeye

	Quantity used annually		Average
Industry	Feet b. m.	Percent	cost per 1,000 ft.
Boxes and crates Frames and molding Miscellaneous. Furniture Planing mill products.	561,992 214,000 75,000 60,000 20,000	60.36 22.99 8.06 6.44 2.15	\$14.36 35.61 21.00 35.00 12.50
Total	930,992	100.00	\$21.07

35



Fig. 10. Ohio buckeye tree (Aesculus glabra).

CUCUMBER TREE

The cucumber (Magnolia acuminata) is quite common in Ohio, growing along the banks of rivers and streams. In the extreme southern and southwestern part of the State in timber situations elkwood (Magnolia tripetala), its relative, is found in occasional stands. Cucumber usually passes on the market as yellow poplar or whitewood, and as such enters into manufacture for uses similar to yellow poplar. It is considered the best wood for pump logs and water pipes, and this special use gives it the special recognition it receives in consuming markets. The wood is light, soft, durable, not strong, close-grained, compact, satiny. Color is yellow-brown, sapwood lighter, often nearly white.

TABLE XVI. Cucumber

	Quantity used annually		Average
Industry	Feet b. m.	Percent	cost per 1,000 ft.
Woodenware and novelties	500,000 20,000 1,000 800	95.82 3.83 .19 .16	\$17.00 7.00 20.00 40.00
Potal	521,800	100.00	\$16.66

BIRCHES

Three species of birch grow in Ohio but none very extensively. Sweet or cherry birch (Betula lenta) grows sparingly throughout the State, while yellow birch (Betula lutea) is found only in the extreme northeastern part. Black birch (Betula nigra) of little commercial importance grows scatteringly on the lowlands in the southern part of the State. Considering the importance of birch as a cabinet wood the amount the Ohio manufacturers use is surprisingly small. The largest part is probably sweet birch and goes into commodities where it frequently is stained in imitation of mahogany. So well does it serve for this purpose that the imitation finish is difficult to discern from the real mahogany. Eighteen industries report birch in various amounts, but "sash, doors, blinds and general mill work," "planing mill products," and "store and office fixtures" were the ones which called for the largest quantities and together used 60 percent of all that was reported.

TABLE XVII. Birches

	Quantity use	Quantity used annually	
Industry	Feet b. m.	Percent	cost per 1,000 ft.
Sash, doors, blinds and general millwork	1,918,990 1,717,000 1,443,844 877,996 765,000	22.86 20.45 17.20 10.45 9.11	\$ 43,19 36.79 37.80 30.82 14.10
Vehicles and vehicle parts	350,000	4.27 4.17 3.00 2.80 1.49	43.55 13.00 30.13 28.91 30.48
Frames and molding Handles. Woodenware and novelties Car construction Trunks and valises	105,200 100,000 91,000 54,927 1,500	1.25 1.19 1.08 .66 .02	87.64 26.00 44.95 39.67 114.67
Total	8,394,563	100.00	\$35.15

GUMS

Black gum is a common name given in various localities to the three gum trees, cotton gum or tupelo (Nyssa aquatica), water gum (Nyssa biflora), and black or sour gum (Nyssa sylvatica). Red gum, though it bears the name, botanically is not a relative of these species and therefore has been treated under a separate heading. Two of the above named species, cotton and black gum, are used in Ohio, but only the latter (Nyssa sylvatica) grown within the State. It is found frequently in wet lowlands, but also thrives on slopes. Its bright green foliage attracts attention in the summer and in the fall it yields clusters of two or three oblong berries of black color and sour in taste. The wood of the black or sour gum has an interlaced fibre and is difficult to split and work, which makes it valuable for particular uses, as for vehicle hubs, pulleys, mine rollers, mauls and mallet heads and cogs. In the form of veneer it goes into wooden dishes, berry cups, fruit baskets and veneer boxes. of these uses were shown for it in Ohio, the entire quantity, as lumber, was reported for boxes and crates. Tupelo too was used for boxes and box shooks, but its greatest demand was for cigar boxes in the form of veneer. As lumber it went into cistern pumps, furniture and kitchen cabinets.

TABLE XVIII. Gums (black and cotton)

Industry	Quantity used annually		Average	
	Feet b. m.	Percent	cost per 1,000 ft.	
Cigar boxes Boxes and crates Pumps Furniture Refrigerators and kitchen cabinets.	1,810,000 850,000 300,000 150,000 14,500	57.93 27.20 9.60 4.80 .47	\$43.71 16.96 40.00 16.00 14.97	
Total	3 124,500	100.00	34.51	

CHERRY

Numerous species of cherry are found in Ohio but the black cherry (Prunus serotina) is the only lumber tree and its wood is reported by the Ohio wood-using industries. It is found quite generally throughout the woodlots and forests of the State but is never abundant. The principal demand for cherry has always been for furniture and finish. It goes into expensive furniture mostly as veneer and is seldom seen in any other form. It does not warp readily and the quality gives it a place in the manufacture of electrical appliances, musical instruments, and commends it above any wood electro type backing. The wood is light, hard, strong, close-straight-grained, compact, easily worked. Medullary rays are numerous and thin. Color is red, growing darker with exposure.

TABLE XIX. Cherry

	Quantity used annually		Average
Industry	Feet b. m.	Percent	cost per 1,000 ft.
Car construction	613,581	64.73	\$76.24
	62,000	6.54	58.31
	55,000	5,80	38.00
	47,500	5.01	82.59
	46,500	4.91	50.32
Plumbers' woodwork Ship and boat building. Fixtures. Vehicles and vehicle parts Boxes and crates	41,000	4.33	51.95
	26,000	2.74	88.46
	25,600	2.70	41.17
	12,000	1.27	62.50
	8,000	.84	25.50
Furniture	5,700	.60	89.12
	5,000	.53	74.00
Total	947,881	100.00	\$69.68

RED GUM

Twenty-two industries call for red gum and the quantity demanded equals more than 3 percent of the total of all woods manufactured in Ohio. The several industries and the amount of red gum they consume are listed in the following table, but the specific use for which the wood is demanded and the qualities commending it are referred to later on in the discussion of the individual industry tables. Red gum (Liquidambar styraciflua) is often called sweet gum. In Ohio it grows only in the southern part in the wet soil of bottomlands and is easily identified by its beautiful starshaped leaves and the characteristic wing-like projection of the bark from its smaller branches. Compared with other woods it is not an important lumber tree, though in 1910 the sawmills in the State cut one and one-half million feet.

The wood is fairly soft, straight and close-grained. The sap-wood is light in color, almost white, and the heartwood a light red brown. Users frequently report the sapwood under the name sap gum, and the figured heartwood, which sometimes resembles the color and markings of Circassian walnut, as hazel wood or hazel. In foreign countries the term satin walnut is often given it, believing the name will add to its prestige as a cabinet wood. The growing demand for quarter sawed red gum is meeting the expectations of manufacturers, especially when sawed one inch thick as the grain markings of the transtangential cut is notably effective. Next to oak and maple red gum is demanded in Ohio for more uses than any other wood. It appears in 36 of the 41 industries listed and besides is the leading material for slack staves and for veneer.

TABLE XX. Red gum

	Quantity use	d annually	Average
Industry	Feet b. m.	Percent	cost per 1,000 ft.
Planing mill products. Boxes and crates. Furniture. Cigar boxes Vehicles and vehicle parts.	9,016,000 5,623,025 2,766,300 1,798,270 1,633,064	32.66 20.37 10.02 6.51 5.91	\$22.43 17.06 25.21 17.77 26.09
Refrigerators and kitchen cabinets	1,221,000 1,117,000 1,006,000 1,005,000 960,000	4.42 4.05 3.64 3.64 3.48	23 40 20 60 32 29 40 15 23 67
Instrumental, musical	420,000 265,000 243,000 175,000 145,000	1.52 .96 .88 .63 .53	29.43 20.83 30.06 20.00 26.79
Plumbers' woodwork Casket and coffins. Pulleys and conveyors. Woodenware and novelties. Car construction.	85,000 75,000 22,500 21,000 8,000	.31 .27 .08 .08 .03	24.47 27.49 14.93 25.71 26.00
Trunks and valises	3,500 1,000	- 01	34.86 45.00
Total	27,609,659	100.00	\$22.69

Less than 1-100 of 1 percent.

COTTONWOOD

Cottonwood (*Populus deltoides*) belongs to the willow family and is the species most largely cut into lumber. Its relatives growing in Ohio are the large-tooth aspen (*Populus grandidentata*), and the Balm of Gilead (*Populus balsamifera*). The latter is not frequent and the former does not often grow to a size large enough for lumber. Owing to the difficulty in seasoning cottonwood it is better

adapted for veneer than lumber. It is popular with the manufacturers of built-up lumber and in this form is a favorite with the vehicle makers as a body wood and with the trunk makers for trunk boxes, while in furniture making it serves as mirror backing and drawer bottoms, veneer boxes and other hidden parts of case goods. The implement makers find many places for this wood as lumber but the largest quantities go into boxes and crates and particularly for receptacles for shipping meats and other food stuffs. The wood is very light, soft, not strong, coarse-grained, liable to warp and is dark brown in color except the sapwood, which is nearly white. Like yellow poplar it is easily worked and takes paint well and in many uses, being cheaper, it is often substituted for it.

TABLE XXI. Cottonwood

	Quantity used annually		Average
Industry	Feet b. m.	Percent	cost per 1,000 ft.
Roxes and crates Agricultural implements. Vehicles and vehicle parts. Car construction. Planing mill products. Cash, doors, blinds, and general millwork. Cash, derigerators and kitchen cabinets. Pixtures. Caundry appliances. Cairymen's, poulterer's, and apjarists supplies.	9,851,816 4,805,000 1,297,108 302,000 271,600 130,000 78,500 30,000 25,000	58.53 28.55 7.71 1.79 1.61 .77 47 .18	\$24.04 38.94 36.77 32.55 25.36 28.62 32.11 40.83 24.00
Frunks and valises	10,000	.06	32.00
Total	16 831 024	100.00	\$29.56

HACKBERRY

It is surprising that more hackberry was not reported by the Ohio manufacturers than is shown in this report. The tree ranges from New York to Idaho and from the Great Lakes to the Gulf of Mexico but it reaches its best development and is abundant in the Ohio and Mississippi Valleys. The largest specimens are found growing on the rich bottom lands. The wood is heavy and strong and is generally used for furniture, vehicles and agricultural implements, but in Ohio it was reported for saddle stirrups, boxes and flooring. It is sometimes sold mixed with ash.

TABLE XXII. Hackberry

	Quantity used annually		Average
Industry	Feet b, m.	Percent	cost per 1,000 ft.
Boxes and crates	150,000 25,000 25,000	75.00 12.50 12.50	\$14.00 25.00 20.00
Total.	200 000	100.00	\$16 13

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HEMLOCK

Twelve industries of this report demanded over 16,000,000 feet of hemlock in 1911. Table I shows that all but 100,000 feet came from the producing regions of other states. This is probably true as the hemlock tree grows only in certain restricted areas throughout Ohio, principally in the hilly country. Its principal use is for construction purposes as rough lumber and planing mill products like sheathing and roofing. In the country at large it follows yellow pine and white pine as a valuable wood for boxes and crates.

TABLE XXIII. Hemlock

Industry	Quantity used annually		Average
	Feet b. m.	Percent	cost per 1,000 ft.
Planing mill products Boxes and crates Machine construction. Caskets and coffins Agricultural implements. Furniture Ship and boat building. Car construction Instruments, musical. Patterns and flasks.	13,675,000 1,267,175 260,000 250,000 207,000 207,000 202,000 100,000 65,789 48,000 30,000	84.60 7.84 1.61 1.55 1.28 1.25 62 41 .30	\$18.89 16.22 17.50 11.35 16.22 17.40 30.00 16.66 21.56 22.00
Sash, doors, blinds and general millwork	30,000 30,000	.18 .18	21.67 23.33
Total	16,164,964	100.00	\$18.58

BLACK WILLOW

Black willow is not only abundant in Ohio but it attains large dimensions. It is usually found in wet situations, readily reproduces, and is one of the most rapidly growing of the native trees in the Ohio valley. The wood is light and soft, without figure, checks badly and is not in wide demand. Its chief uses are excelsior, boxes, artificial limbs, charcoal, wooden ware and fuel but in Ohio the makers of artificial limbs and boxes were the only industries reporting this wood.

TABLE XXIV. Black Willow

Industry	Quantity used annually		Average
	Feet b. m.	Percent	cost per 1,000 ft.
Boxes and crates	150,060 20,000	88.24 11.76	\$ 14.00 125.00
Total	170,000	100.00	\$27.06

BUTTERNUT

Butternut is frequently found growing in Ohio usually associated with the beech, elms and maples. It is a species of walnut not infrequently called white walnut. The difference in size and shape of the rough shelled nuts from those of the black walnut easily distinguishes the tree. The butternut is elongated and smaller than the round black walnut. In the wood the color of the heartwood differentiates the two species; the butternut being a light gray-brown. The popularity of Circassian walnut, a foreign wood, for exterior of furniture, piano cases, store and office fixtures; gun stocks, interior finish, vehicle bodies, etc., has recently brought butternut into greater demand as much of the figured wood resembles that of Circassian walnut and therefore can be made to imitate it. The use of this wood in the following table, for patterns in foundry work and for boxes, is worthy of note.

TABLE XXV. Butternut

	Quantity used annually		Average
Industry	Feet b. m.	Percent	cost per 1,000 ft.
Furniture Patterns and flasks Vehicle and vehicle parts Planing mill products Boxes and crates	30,000 16,000 10,000 8,000 7,000	36.36 19.39 12.12 9.70 8.49	\$35.00 49.63 45.00 62.50 16.43
Instruments, musical	6,000 5,000 500	7.27 6.06 .61	22.50 32.00 70.00
Total	82,500	100.00	\$39.26

LOCUST

Stands of honey locust (Gleditsia triacanthos) are occasionally found in Ohio. Black locust (Robinia pseudacacia), which botanically bears no relation to the former, is more important and more widely distributed. It is a rapid grower and therefore desirable and is being largely used in woodlot management. The wood generally is most widely used for fence posts and then for insulator pins and brackets. The vehicle makers call on it for hubs, the ship builders for kevels, bits and treenails, and Maxwell writes that infrequently the manufacturers turn it into police clubs, castor wheels, and parts of farm implements.

TABLE XXVI. Locust

	Quantity used annually		Average
Industry	Feet b. m.	Percent	cost per 1,000 ft.
Vehicles and vehicle parts	10,000 2,000	83.33 16.67	\$35.00 40.00
Total	12 000	100.00	\$35.83



Fig. 11. Black locust development in Ohio nearly three feet in diameter, age about 80 years.

CEDARS

Two of the cedars shown in the report grow in Ohio. They are red cedar (Juniperus virginiana), and the white or arborvitae (Thuja occidentalis). The stand of the latter is limited and mostly to the northeastern part of the State where the growth is small and its occurrence infrequent. The red cedar ranges throughout the State. It too is generally a small tree except in the southern tier of counties where it develops large enough occasionally to be cut into lumber. A small quantity was reported as home grown but with that exception the supply of both of these woods come from other States. The best development and the largest supply of the red cedar is towards the south in Virginia, Tennessee and Missouri, and that of the arborvitae in northern Michigan, Wisconsin, and Canada, From the slim trunks of the arboryitae more than any other wood in the Lake and New England states, are cut fence posts, telephone poles and crossties. Red cedar in the south is the best for fence posts but its most valuable and exacting use is for pencils and to a less extent for caskets and coffins, utility boxes, furniture and wardrobe lining. Western red cedar (Thuja plicata) known as giant arborvitae abounds only in the Pacific northwestern states, and is different from the eastern cedars just described in that the trees grow very large. The wood resembles the southern red cedar and it is that species in the northwest that furnishes the cedar shingles that are marketed throughout all the states even in the east. The principal use of the wood in Ohio was first, ship building and then for cornice and porch work and cases in house construction. The superior durability of western red cedar like that of the other cedars mentioned in damp situations and in contact with the soil are, together with the characteristic cedar fragrance, their distinguishing features.

TABLE XXVII. Cedars

Industry	Quantity used annually		Average
	Feet b. m.	Percent	cost per 1,000 ft.
Sash, doors, blinds and general millwork. Planing mill products Ship and boat building. Boxes and crates Dairymen's poulterer's supplies. Cigar boxes Furniture. Woodenware and novelties Caskets and coffins.	1,046,540 345,000 335,660 199,400 175,000 126,750 105,000 50,000 25,000	43.45 14.32 13.94 8.28 7.27 5.26 4.36 2.08 1.04	\$18.11 20.18 40.09 13.04 35.00 44.77 46.43 18.00 51.60
Total	2,408,350	100.00	\$25.71

SPRUCE

Nine industries show the use of spruce lumber. The eastern wood is listed as spruce because in trade the spruces are not separated. That cut in the Lake states is mostly white spruce as the black spruce in that section is so small that it seldem grows large enough for lumber. The red spruce predominates in the Southern Appalachian region and in the New England states. Sitka spruce is a western tree abounding principally in Washington and Oregon. On account of the growing scarcity of the eastern woods it is finding more and more its way into the eastern markets. The Ohio piano makers use the largest amount of Sitka spruce reported for sounding boards.

TABLE XXVIII. Spruce

Industry	Quantity used annually		Average
	Feet b. m.	Percent	cost per 1,000 ft.
Boxes and crates	1,758,750 750,000 260,000 240,000 210,000	48.80 20.81 7.21 6.66 5.83	\$16.70 20.00 37.58 39.52 16.97
Ship and boat building	166,000 153,000 36,000 30,000	4.61 4 25 1.00 .83	36.02 37.05 28.00 24.00
rotal	3,603,750	100.00	\$22.38

YELLOW PINES

There are four species of yellow pine demanded in large quantities by the wood using industries of Ohio. They are longleaf pine, shortleaf pine, loblolly pine, and pitch pine. Twenty-two different industries consume a total of 145,230 973 board feet. manufacture of planing mill products alone uses over 42 percent of the total; sash, doors, blinds, and general mill work 21 percent; car construction over 13 percent; and boxes and crates over 9 percent. These four industries demand 124,789,000 board feet or 85 percent of the total. The remaining 15 percent is divided among 18 other industries in varied amounts. The average cost for all industries is \$25.99 per thousand feet b. m. Only a very small percentage of the total yellow pine used was grown in the State probably not more than 100,000 board feet and that was all pitch pine. The other three species were shipped into the State from the South. The longleaf pine was used more for construction work while shortleaf pine and loblolly enters into the manufacture of planing mill products.

Loblolly pine probably comprises a larger percentage of the total than the returns show, since it is thrown on the market mixed with shortleaf. It is due to the confusion of the common names of species on the market that the information of the individual woods can not separated except by an arbitrary division.

TABLE XXIX. Yellow pines

	Quantity used annually		Average
Industry	Feet b. m.	Percent	cost per 1,000 ft.
Planing mill products. Sash, doors, blinds and general millwork. Car construction Boxes and crates. Agricultural implements.	61,444,594	42 31	\$26.45
	30,381,903	20.92	28 67
	19,361,640	13.33	27.08
	13,580,713	9.35	15.22
	9,903,500	6.82	28.16
Canks and silos Aachine construction. Vehicles and vehicle parts Vetrigerators and kitchen cabinets Cixtures.	5,994,000	4.13	24.70
	1,064,351	.73	21.93
	819,000	.56	28.59
	409,542	.28	30.18
	407,000	.28	21.29
Pumps Laundry appliances. Lelundry appliances. Lelu	323,230	.22	23.72
	275,000	.19	30.00
	264,000	.18	19.68
	247,500	.17	33.95
	210,000	.15	16.25
Crunks and valises. Patterns and flasks Pulleys and conveyors. Prames and molding. Miscellaneous.	200,060	.14	30 00
	130,000	.09	27.12
	80,000	.06	30.00
	50,000	.04	30.00
	50,000	.04	22.50
rurniture	20,000 15,000	.01	35.00 24.00
Pota1	145,230,973	100.00	\$25.99

CYPRESS

The cypress occupies swampy lands. It is found in its greatest abundance in the lowlands of Louisiana where it forms almost exclusive forests. In the other southern Mississippi Valley States and in the southeastern costal regions its frequent occurrence makes it an important lumbering tree, but in nowise as much so as in Louisiana. Wherever it has been planted in Ohio, it has shown remarkable development and is being recommended for planting operations. Large quantities each year are brought from the south to meet the demands of the manufacturers. Sixteen industries purchased this wood for innumerable uses. The available statistics are as follows:

TABLE XXX. Cypress

	Quantity use	d annually	Average
Industry	Feet b. m.	Percent	cost per 1,000 ft.
Planing mill products Sash, doors, blinds and general millwork Laundry appliances. Boxes and crates. Tanks and silos	17,149,966 11,217,796 3,084,000 2,824,308 1,730,000	45.09 29.49 8.10 7.42 4.55	\$37.98 39.30 28.78 19.46 49.70
Dairymen's, poulterer's and apiarists' supplies	1,035,000 342,000 226,000 151,000 80,000	2.73 .90 .59 .40	26.74 32.95 18.12 32.02 32.50
Machine construction. Agricultural implements Ship and boat building Brushes. Pumps. Vehicle and vehicle parts.	70,000 50,500 41,000 30,000 5,000 2,000	.18 .13 .11 .08 .01	47.86 30.30 57.32 60.00 40.00 75.00
Total	38,038,570	100.00	\$36.33



Fig. 12. Cypress (Taxodium distichum) planted in 1860 in Hamilton county.

DOUGLAS FIR

Next to yellow pine more Douglas fir is cut in the United States than other lumber trees. Most of it is sawed in Washington and Oregon but also it abounds in California and the Rocky Mountain states. The tree attains to great size. Comparatively a short time ago it was unknown to the Ohio manufacturers but its low price in the regions where it is produced and the excellent quality of its lumber opened a market for it in this State and in the states further east. In many ways its wood is similar to longleaf pine and in Ohio it competes with it and also with oak being eminently suited for construction purposes, for flooring and for inside finish. Nine industries report Douglas fir, the amounts and percent of each are as follows:

TABLE XXXI. Douglas Fir

	Quantity use	Average		
Industry	Feet b. m.	Percent	cost per 1,000 ft.	
Planing mill products. Sash, doors, blinds and general millwork. Agricultural implements. Ship and boat building. Machine construction	3,170,000 1,021,000 600,000 431,000 413,000	54.47 17.54 10.31 7.41 7.10	\$31.62 35.24 36.00 36.43 50.60	
aundry appliances. Car construction nstruments professional and scientific nstruments, musical	102,000 32,733 30,000 20,000	1.75 .56 .52 .34	35.00 34.98 40.00 45.00	
Potal	5,819,733	100.00	\$34.60	

SUGAR PINE

The sugar pine tree attains fairly large proportions. The height varies from 160 to 180 feet and the diameter from 4 to 7 feet. Like redwood it is found growing in only two states, California and Oregon, the greatest abundance is in the former, extending from the northern to the southern border on the sides of the Sierra Mountains. Botanically it bears no relation to western white pine and for that reason the statistics appear under a separate heading. In the wood sugar pine both as to appearance and qualities resembles the western white pine and the white pine from the Lake states and its uses are about the same. The making of sash, doors, blinds and general mill work demanded the largest amount of this wood in Ohio, equal to over 87 percent of all.

TABLE XXXII. Sugar pine

	Quantity use	Average	
Industry	Feet b. m.	Percent	cost per 1,000 ft.
Sash, doors, blinds and general millwork. Planing mill products. Patterns and flasks Agricultural implements. Instruments, musical Instruments, professional and scientific.	4,726,891 515,000 90,000 50,000 15,000 15,000	87.34 9.52 1.66 .92 .28	\$46.13 46.10 61.64 30.00 90.00 60.00
Total	4 411 891	100.00	\$46.45

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REDWOOD

Redwood lumber is the product of one state, California. Sixty-seven mills reported cutting it and in the lumber cut for 1910 according to quantity produced it stands twelfth in the list. It is often called big tree owing to its great size, the diameter varying from 6 to 12 feet and the height between 180 to 270 feet. The wood is light, soft and fairly strong which with its even straight grain makes it easy to work. The color of the wood is light to dark red except the thin sapwood which is almost white. Its usefulness and popularity of redwood with the Ohio manufacturers is indicated in the following table:

i

TABLE XXXIII. Redwood

•	Quantity use	Average	
Industry	Feet b. m.	Percent	cost per 1,000 ft.
Dairymen's, poulterer's and apiarists' supplies Planing mill products. Sash, doors, blinds and general millwork. Instruments, musical Instrumental, professional and scientific. Tanks and silos. Miscellaneous.	518,000 180,000 75,000 33,000 30,000 24,000 16,000	59.13 20.55 8.56 3.77 3.42 2.74 1.83	\$32.10 41.06 36.00 50.00 38.00 60.00 54.00
Total	876,000	100.00	\$36.73

TAMARACK

Tamarack is occasionally found in Ohio growing in 'swamps. The wood is heavy, hard, very strong, coarse-grained, compact, and very durable. Color is light brown, and nearly white sapwood. It is used to some extent for fence material on account of being fairly durable, which also recommends its use for cross-ties. The box makers use all that was reported for this report.

FOREIGN WOODS

Foreign woods are usually shipped to this country in log form or in flitches and are manufactured here into lumber and veneer. They are high priced woods and serve principally in cabinet and furniture work on account of their handsome and durable finish. Mahogany is the principal one and annually the Ohio manufacturers use almost 5 million feet. This does not, however, include the large amount of mahogany veneer that each year is cut in this State and sold in that form. Like the domestic oaks there are many species of mahogany. The manufacturers usually take no account of the kind they buy nor do they concern themselves from what country the wood comes. In consequence a good deal of African and Philippine material is sold that is not real mahogany nor of the mahogany

family. The true mahoganies shipped to this country come from Mexico, West Indies, Central and South America. Mahogany is not only consumed in large amounts in Ohio but it is quite widely distributed among the industries as is shown in the following table:

TABLE XXXIV. Mahogany

	Ouantity used	Ouantity used annually			
Industry	Feet b. m.	Percent	cost per 1,000 ft.		
Car construction Purniture Planing mill products. Pixtures. Chairs.	1,089,472	23.12	\$109.12		
	1,046,828	22.21	121.82		
	845,000	17.93	143.35		
	643,364	13.65	142.54		
	337,000	7.15	166.45		
oash, doors, blinds and general millwork	296,294	6.29	141.93		
	261,300	5.55	108.30		
	60,000	1.27	83.58		
	49,000	1.04	108.16		
	26,340	.56	138.83		
Plumbers' woodwork Patterns and flasks. Prames and molding Sporting and athletic goods. Prunks and valises.	22,000	.47	143.64		
	15,000	.32	141.34		
	10,250	.22	115.02		
	10,000	.21	100.00		
	500	.01	150.00		
Potal	4,712,348	100.00	\$128.85		

Spanish cedar in quantity, nearly one-half million feet, follows mahogany. Except a small amount reported for boat building all went to the cigar box manufacturers, the supply usually comes from Mexico, Central America, and the West Indies. It is a broad leaf tree in no way resembling our domestic cedars.

Circassian walnut was reported by six industries in varying small quantities. Owing to its high cost it was used principally in veneer. In 1911 more Circassian walnut veneer was cut in this country than ever before. It is a native tree of Russia, growing in the Circassian Mountains and in adjoining countries near the Black Sea.

Padouk is better known as vermillion wood and is so named from its natural bright red color. Like ebony and teakwood it is shipped from Oriental Countries.

English Oak is cut in the territory surrounding the Caspian Sea. It is the highest priced of any of the foreign woods reported by the Ohio manufacturers. Rosewood is a product of the forests of Central America and the northern States of South America.

INDUSTRIES

The various woods demanded by the Ohio manufacturers irrespective of their uses are listed and discussed on the preceding pages. The industries and the extent that they call for these different woods, their uses, and the qualities which make them valuable will next be considered. There are thirty-six industries in Ohio. The following table shows them in the order of the quality of wood they consume.

TABLE XXXV, Summary of woods by industries in Ohio

			- ,			
Industry	Quantity annual Feet b. m.		Av. cost per 1,000 feet	Total cost f. o. b. factory	Grown in Ohio ft. b. m.	Grown out of Ohio ft. b. m.
Boxes and crates Sash, doors, blinds and general millwork. Vehicle and vehicle parts. Car construction. Furniture	56,200,885	27.24 16.76 12.07 9.36 6.14 4.50	\$31.51 16.89 35.32 39.62 31.69 36.90	\$ 7,854,691 2,591,034 3,901,146 3,395,115 1,780,986 1,521,463 1,162,823	22,772,780 15,990,577 7,932,000 32,912,657 17,730,496 7,830,480 7,048,000	226,523,715 137,426,696 102,515,792 52,779,078 ,38,470,389 33,396,429
Agricultural implements Handles. Matches Fixtures.	39,509,200 30,486,733 25,000,000 13,974,448	4.32 3.33 2.73 1.53	34.31	1,162,823 842,991 857,750 576,800	7,048,000 24,838,733 5,186,979	32,461,200 5,648,000 25,000,000 8,787,479
Bungs and faucets	10,084,000 9,771,000 8,583,100 8,440,000 7,940,000	1.10 1.07 .94 .92 .87	25.94	272,062 253,422 292,875 282,293 209,740	161,000 3,338,000 665,500 200,000 460,000	9,623,000 6,433,000 7,917,600 8,240,000 7,480,000
Miscellaneous	7,749,350 7,076,000 5,757,900 5,333,500 4,850,851	.85 .77 .63 .58	$\begin{vmatrix} 27.50 \\ 40.40 \end{vmatrix}$	247,028 161,440 158,321 215,932 145,560	5,170,350 3,276,000 1,009,500 3,122,000 2,106,500	2,579,000 3,800,000 4,748,400 2,211,500 2,744,351
Cigar boxes. Plumbers' woodwork Trunks and valises Laundry appliances. Ship and boat building.	4,733,186 4,698,000 4,187,340 4,001,000 3,322,660	.52 .51 .45 .44 .36	30.56 25.23 29.24	201,034 143,555 104,636 117,000 130,997	630,000 461,500 65,000 317,500	4,733,186 4,068,000 3,685,840 3,936,000 3,005,160
Frames and molding Brushes Pumps. Patterns and flasks Equipment, playground.	2,809,961 2,697,111 1,656,230 1,469,200 1,450,000	.31 .29 .18 .16	41.21 51.47	118,057 53,622 68,256 75,627 22,200	397,740 180,000 10,000 108,000 325,000	2,412,221 2,517,111 1,646,230 1,361,200 1,125,000
Pulleys and conveyors Sporting and athletic goods Instruments, professional and scientific. Elevators. Saddles and harness	892,500 811,000 604,000 588,000 555,000	.10 .09 .07 .06	66.39	53,840 20,010 14,976	242,500 55,000 259,000 114,000 358,000	650,000 756,000 345,000 474,000 297,000
Total	915,272,369	100.00	\$30.47	\$27,884,839	165,174,792	750,097,577

To maintain uniformity in the reports, the same classification is here followed that has been used in preparing similar reports for other States. Whenever more than three manufacturers in the State specialize in the making of a certain commodity, or closely related commodities, their specialty is classed as an industry. For instance, the cigar box manufacturers make one kind of container, the trunk manufacturers another, and the casket manufacturers, in their outer cases or rough boxes, still another. Instead of listing these several products as "Boxes," they are classified under separate titles. The same rule accounts for separating manufacture of chairs from furniture making, but in several cases the classifications run so closely together that a distinction is difficult to make. Because of this fact, an arbitrary division of the data was sometimes unavoidable. These cases will be pointed out later on under the discussion of the individual industry tables. In many cases, the information

given by a single manufacturer relates to the making of products listed under several different industries. This explains the frequent appearance in the directory of this report of the names of the same manufacturer under more than one industry heading. Several small industries, in which no more than two establishments reported, are grouped together under the caption "Miscellaneous."

Over \$124,000,000 a year is paid by the Ohio wood users for their raw material. Less than 15 percent of this is paid for home-grown woods. This leaves more than \$43,000,000 as the sum which Ohio thus pays out each year to other states. In not a few instances this purchase money is expended for material which might be produced in the State and will be if more of the people awake to the importance of a broader and more thorough application of the principles of forestry to the present timber stand in the State.

Ohio stands nineth in the list of States as to the amount of wood going into final form through the processes of manufacture. The following illustration shows the consumption and also production of rough lumber in the States in which studies similar to this have been completed, arranged in the order of the number of industries which indicates the diversity of manufactured wood products.

	Consumption	Production of rough lumber, 1910	
Štates	Number of industries	Feet board measure	Feet board measure
Illinois. New York Pennsylvania Ohio. Michigan. California Indiana Virginia New Hampshire. Connecticut. Missouri. New Jersey North Carolina Wisconsin. Massachusetts. Iowa Minnesota Alabama Kentucky. Oregon. Maine. Tennessee West Virginia Washington. Georgia Arkansas. Texas. Vezmont. Oklaboma Delaware Maryland Rhode Island Louisiana Mississippi Florida Mississippi Florida Montana	522 449 422 339 337 335 229 227 226 225 224 223 222 221 210 119 18 117 117 117 117 117 117 117 117 117	1,782,000,000 1,740,000,000 1,800,000,000 1,800,000,000 1,283,000,000 662,000,000 662,000,000 423,000,000 423,000,000 4343,000,000 676,000,000 676,000,000 676,000,000 676,000,000 676,000,000 677,000,000 677,000,000 678,000,000	114,000,000 506,000,000 1,241,000,000 490,000,000 1,881,000,000 1,255,000,000 1,255,000,000 4423,000,000 1,552,000,000 4444,000,000 1,552,000,000 37,000,000 1,825,000,000 1,825,000,000 1,885,000,000 1,466,000,000 1,466,000,000 1,466,000,000 1,377,000,000 1,377,000,000 1,377,000,000 1,377,000,000 1,377,000,000 1,377,000,000 1,377,000,000 1,344,000,000 1,844,000,000
Kansas Idaho South Dakota	10 8 8	6,000,000 61,000,000 19,000,000 6,000,000	319,000,000 1,000,000 746,000,000 16,000,000

PLANING MILL PRODUCTS

In Ohio, as in other states, the output of the planing mills forms the largest percentage of lumber used by the various industries. Over a quarter of the total consumption in the State can be accounted for in this line, and the average price paid for the various woods ranks high above that of similar industries in other states.

There are but a few large sawmills in Ohio where, as in the southern states, planing mills are operated in connection, making flooring, ceiling, siding, stock, mouldings or finish, etc. A number of portable mills have planers, but as a rule their production is small and only for local consumption. The largest portion of the material represented by the following table has been taken from the reports of planing mills operating in cities and towns to the extent to which they manufacture the above named products, but the material used for general mill work turned out according to specifications or special orders has been listed under the industry called "sash, doors, blinds and general mill work."

The northern counties in Ohio bordering along the lakes, where the excellent water transportation from Canada and Wisconsin plays an important part, do not use southern pine for manufacturing building materials but substitute hemlock, Norway pine and white pine. In Cleveland and Toledo the large planing mills bring in these woods in the rough, put it through the machines and produce planing mill products shipped for sale in central Ohio, Indiana and Pennsylvania.

Further to the south in Ohio yellow pine soon enters into competition, until along the Ohio river very little white pine is used by the planing mills, except the higher grades, which find service for sash and doors. Norway pine was seldom reported in central and southern Ohio as in the market Norway is generally sold mixed with white pine. A large quantity of material, principally yellow pine, such as finish, flooring, siding, ceiling, etc., is manufactured in the south and shipped north ready for use. This stock was not included under this industry in Ohio but was accounted for in the report of the State where it was manufactured.

Owing to its durability cypress forms one of the principal woods used for siding, although white pine, especially in the northern parts of the State, ranks high for this purpose. Yellow poplar finish was formerly used extensively in this State, but the increasing price of this wood renders substitution necessary. Very little hardwood, such as beech, maple and oak, is manufactured into flooring in this State. Small quantities were reported by planing mills operated in connection with small sawmills, but most that is used in Ohio was brought from adjoining states already manufactured.

TABLE XXXVI. Planing mill products

Kind of wood	Quantity annua		A verage cost per	Total cost f. o. b.	Grown in Ohio	Grown our of Ohio
	Feet b. m.	Percent	1,000 ft.	factory	Feet b. m.	Feet b. m
Yellow poplar Longleaf pine White pine Shortleaf pine Red oak.	43,394,080 35,763,000 33,696,393 25,666,594 20,591,856	17.41 14.34 13.52 10.30 8.26	\$ 31.71 25.27 35.53 28.10 37.84	\$1,376,061 903,640 1,197,226 721,161 779,097	2,468,250 	40,925,830 35,763,000 33,696,393 25,666,594 12,863,856
Cypress White oak Hemlock Norway pine Red gum.	17,149,966 16,402,826 13,675,000 12,010,000 9,016,000	6.88 6.58 5.49 4.82 3.62	37.98 40.83 18.89 22.24 22.43	651,290 669,718 258,385 267,160 202,272	6,043,750 5,000	17,149,966 10,359,076 13,675,000 12,010,000 9,011,000
Sugar maple	5,622,910 3,170,000 2,103,500 1,717,000 1,413,000	2.25 1.27 .84 .69 .57	28.00 31.62 69.05 36.79 31.37	157,460 100,250 145,257 63,170 44,327	1,983,910 100,500 26,000 520,000	3,639,000 3,170,000 2,003,000 1,691,000 893,000
Beech Basswood White ash Mahogany White elm	1,199,000 1,110,660 924,100 845,000 548,260	.48 .44 .37 .34 .22	21.67 26.68 33.70 143.35 22.00	25,980 29,630 31,144 121,130 12,059	929,000 719,660 714,100 478,260	270,000 391,000 210,000 845,000 70,000
Sugar pine	400,000 324,750	.21 .16 .13 .11	46.10 17.00 25.72 25.36 16.30	23,740 6,800 8,354 6,888 4,400	100,000 274,750 101,600	515,000 300,000 50,000 170,000 270,000
Western white pine	200,000 192,000	.10 .08 .08 .07 .07	43.06 16.07 24.48 41.06 25.31	10,808 3,213 4,700 7,390 4,506	152,000 148,000	251,000 200,000 40,000 180,000 30,000
Black ash Western yellow pine Western red cedar Cherry Bur oak.	125,000 75,000 62,000	.05 .05 .03 .02 .01	24.20 40.00 34.00 58.31 37.00	3,025 5,000 2,550 3,615 1,110	62,000 25,000	125,000 75,000 5,000
Hackberry. Buckeye	20,000 15,000	.01 .01 .01 *	25.00 12.50 30.00 35.00 62.50	625 .250 450 350 500	25,000 20,000 15,000 8,000	10,000
Total	249,296,495	100.00	\$31.51	\$7,854,691	22,772,780	226,523,715

^{*}Less than 1-100 of one percent.

BOXES AND CRATES

In nearly all other states box making stands near the head of the list of industries in the amount of material consumed. In Ohio, it is second, using over 150 million feet in 1911. It is interesting to note that in different parts of the State various woods predominate. In the northern portion white pine is more largely used, the central part reported cottonwood and shortleaf pine, while through the southern portion yellow poplar and shortleaf were called for in large quantities.

ration con-

It is an admitted fact that there is a surplus of low-grade lumber in all parts of the country, and here is where the box industry plays such an important part in the closer utilization of wood. Grades of lumber that could be used in no other way find their places in boxes and cratings.

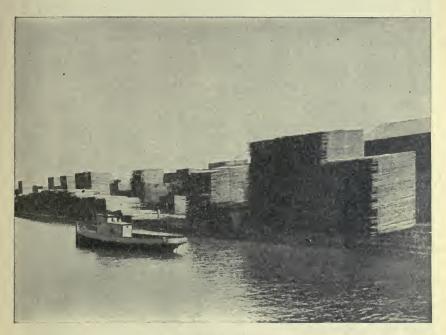


Fig. 13. A lumber wharf on Lake Erie showing the white pine and hardwoods that are shipped from the Lake States and Canada to northern

Ohio to be manufactured into planing mill products.

It should not be understood in reviewing the table that most of the lumber reported under this head enters into box manufacture. An equal amount, if not more, is required for crating purposes. There has been a tendency within the past few years to crate practically everything, whether infrangible or not. Even construction stone, stoves and ranges and some steel girders are frequently crated. The carriage builders require large amounts of lumber annually for this purpose; sheet steel and tin plate are marketed in wood crates, and the furniture factories, even those making a cheap article, have given up the old method of wrapping the furniture in burlap and excelsior pads for the improved system of crating.

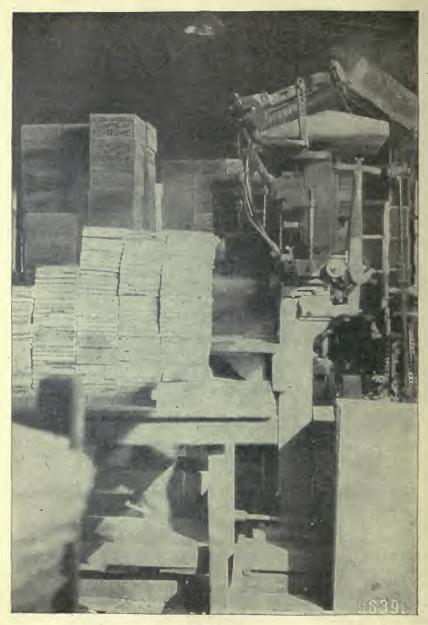


Fig. 14. A nailing machine of an Ohio box maker.

Yellow poplar and white pine surpass all other woods in furnishing a supply for this industry, the two composing 58 percent of the total. The large amount of yellow poplar employed can be accounted for in the fact that the states bordering on the Ohio valley constitute the yellow poplar center of the country. Freight rates prohibit the shipment of this low-grade material to any great distance, hence it must be utilized near the producing markets. While perhaps in some respects not as well suited for certain kinds of boxes as one or two of the other 35 woods reported, yellow poplar can nevertheless be classed generally as an excellent box and crating lumber. It is light in weight and color, and strong, nails well, and is odorless and tasteless if needed for containers requiring those qualities, low grades being used, its price is still within the limit of this class of work.

White pine has long been one of the leading box woods, and owing to Ohio's accessibility by water to the white pine forests it is used in numerous industries that would perhaps employ other woods if the price were higher. This wood enters largely into boxes of all kinds, particularly those intended for food containers like locked cornered starch and confectionary boxes where woods of odorless and tasteless qualities are demanded. White pine is well suited for printed matter since it dresses smooth and white. The entire amount used was obtained without the State.

Shortleaf pine, beech and elm make excellent woods for crating purposes. The two latter are obtained partly in the State, the remainder coming from adjoining states. They answer with the hardwoods, oak, ash, chestnut, etc., for purposes where a strong wood is needed and one difficult to split, like the boxes in which steel plate and tin plate are shipped, and where the weight of the wood is not a considerable factor. Cherry and butternut are employed only in small amounts and for the manufacture of special boxes, such as are required for jewelry and silverware.

Most of the material is obtained in 4-4 inch stock, but some is bought in 1-2, 5-8 and 3-4 inch lumber. For the wire-bound box, which is rapidly coming into use, thin stock is required, ranging from 1-8 inch to 1-2 inch in thickness. Red gum and cottonwood furnishes the bulk of the supply of veneer for veneer boxes. Veneer boxes are made not only with a single layer and wire-bound, but of two and three-ply stock according to the size of the box and the use for which it is intended.

TABLE XXXVII. Boxes and crates

	'Quantity					,
Kind of wood		lly	Average cost per	Total cost f. o. b.	Grown in Ohio	Grown out of Ohio
	Feet b. m.	Percent	1,000 ft.	factory	Feet b. m.	Feet b. m.
Yellow poplar	38,779,666 35,896,790 11,429,613 9,851,816 7,338,629	25.28 23.40 7.45 6.42 4.78	\$15.94 16.60 14.97 24.04 14.24	\$618,100 595,824 171,073 236,880 104,501	2,984,000 25,000 1,622,616	35,795,666 35,896,790 11,429,613 9,826,816 5,716,013
White elm	7,074,109 6,343,739 6,094,795 5,623,025 4,468,945	4.61 4.13 3.97 3.67 2.91	24.35 13.85 13.75 17.06 14.76	172,232 87,834 83,827 95,928 65,978	4,666,552 356,739 1,350,000 165,232 819,837	2,407,557 5,987,000 4,744,795 5,457,793 3,649,108
Basswood Cypress, Sugar maple. Spruce. White oak.	4,333,000 2,824,308 1,912,601 1,758,750 1,731,000	2.82 1.84 1.25 1.15 1.13	20.13 19.46 17.36 16.70 15.35	87,231 54,972° 33,198 29,365 26,567	1,318,000 807,601 336,000	3,015,000 2,824,308 1,105,000 1,758,750 1,395,000
Longleaf pine	1,702,100 1,267,175 765,000 688,820 660,000	1.11 .83 .50 .45 .43	$\begin{array}{c} 16.11 \\ 16.22 \\ 14.10 \\ 17.13 \\ 16.55 \end{array}$	27,418 20,548 10,785 11,800 10,920	100,000 20,000 300,000	1,702,100 1,167,175 745,000 688,820 360,000
Tamarack. Buckeye Loblolly pine Sycamore. Red cedar.	600,000 561,992 449,000 200,000 199,400	.39 .37 .29 .13 .13	17.00 14.36 18.32 14.25 13.04	10,200 8,069 8,225 2,850 2,600	299,000	600,000 262,992 449,000 199,400
Cotton gum Black ash. Hackberry Willow Hickory.	190,000 155,000 150,000 150,000 105,000	.12 .10 .10 .10 .07	18 42 14.35 14.00 14.00 24.52	3,500 2,225 2,100 2,100 2,575	155,000 150,000 150,000 150,000	190,000
Jack pine	53,000 25,000 20,000 8,000 7,000	.03 .02 .01 .01	13 58 17.20 7.00 25.50 16.43	720 430 140 204 115	25,000 20,000 8,000 7,000	53,000
Total	153,417,273	100.00	\$16.89	2,591,034	15,990,577	137,426,696

^{*}Less than 1-100 of 1 percent.

SASH, DOORS AND MILL WORK

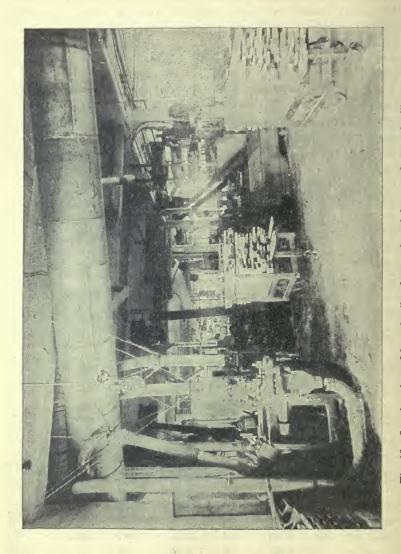
Allied so closely with this industry that it is often difficult to distinguish between them, are the products classified under planing mills and those grouped under fixtures. Planing mill products are the more universal commodities which are kept in stock, such as flooring, siding, ceiling, stock, moulding, etc. Under fixtures higher priced woods including many expensive cabinet woods are utilized for specific purposes like show cases and other movable furnishings not considered furniture, while the sash, door, etc., industry includes sash, doors, frames, blinds, stairwork, built-in cupboards, mantels, colonnades, grills, panels, wainscoting and all exterior and interior finish worked according to special designs. From the average price reported for the wood used it is evident that material required for the products of this industry are the upper grades. Within recent years the establishment of factories specializing in sash and door

manufacture has already induced the general planing mill located, as in Ohio, in nearly every city and town to abandon the making of these products because they can be bought in the open market more advantageously than they can be manufactured in small quantities. Many of the operators grouped under this industry, therefore, make sash, doors and blinds only in special sizes, while most of the material they used went for building purposes, known in trade as general mill work. The tendency to manufacture building materials close to the source of supply of raw material, in other words, close to the sawmills, is largely on the increase and it is well inasmuch as it undoubtedly makes for economy for all concerned, including the consumer. The available statistics showing the kinds of wood used in the order of their importance as to quantity are presented in the following table.

TABLE XXXVIII. Sash, doors, blinds and general mill work

			,			
Kind of wood	Quantit annua		Average cost per	Total cost	Grown in Ohio	Grown out
	Feet b. m.	Percent	1,000 ft.	factory	Feet b. m.	Feet b. m.
Shortleaf pine Yellow poplar White pine. Cypress. White oak.	22,616,217 20,324,206 14,613,500 11,217,796 8,640,697	20.48 18.40 13.23 10.16 7.82	\$29.05 35.36 37.20 39.30 43.48	\$ 656,938 724,781 543,598 440,894 375,980	1,075,000	22,616,217 19,249,206 14,613,500 11,217,796 5,686,197
Longleaf pine	7,765,686 5,918,000 4,726,891 3,950,000 1,918,990	7.03 5.36 4.28 3.58 1.74	27.56 39.05 46.13 25.00 43.19	213,996 231,114 218,359 98,750 82,883	2,496,000	7,765,686 3,422,000 4,726,891 3,950,000 1,826,990
Chestnut	1,581,475 1,140,000 1,021,000 1,006,000 783,540	1.43 1.03 .93 .91 .71	29 51 27.66 35.24 32.29 13.17	46,660 31,536 35,985 31,307 10,317	245,000 521,000	1,336,475 619,000 1,021,000 1,006,000 783 540
Beech Sugar maple, Western white pine. Mahogany, White ash	500,000 460,000 409,000 296,294 289,000	.45 .42 .37 .27 .26	19.76 33.24 52.66 141.93 44.89	9,880 15,292 21,536 42,054 12,972	50,000 174,000 142,000	450,000 286 000 409 000 296,294 147,000
Western yellow pine Spruce	275,000 240,000 200,000 130,000 75,000	.25 .22 .18 .12 .07	46.73 39.52 32.00 28.62 36.00	12,850 9,485 6,400 3,720 2,700	35,000	275,000 240,000 200,000 95,000 75,000
Red cedar Sycamore Black walnut Cherry Silver maple	63,000 62,500 54,000 46,500 33,000	06 .06 .05 .04 .03	35.29 38.43 51.57 50.32 20.15	2,223 2,402 2,785 2,340 665	39,500 44,000 23,500 30,000	63,000 23,000 10,000 23,000 3,000
Hemlock. White elm. Circassian walnut. English oak. Hickory Butternut	30,000 25,000 15,000 10,000 10,000 500	.03	21.67 22.48 333 33 410.00 40.00 70.00	650 562 5,000 4 100 400 35	10,000	30,000 15,000 15,000 10,000 10,000
Total	110 447 792	100.00	\$35.32	\$3 901 149	7,932,000	102 515,792

^{*}Less than 1-100 of one percent.



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VEHICLES AND PARTS

In contrast with the rapid increase in the automobile industry there has probably been a decline in the consumption of wood for the manufacture of horse-drawn vehicles, and a number of firms priorly specializing in building buggies and wagons have added to their business the making of auto-vehicles, either pleasure cars or commercial trucks. The change has not materially affected the relative standing of the manufacture of horse-drawn vehicles as this industry is still a very important line of manufacturing in the State and in the number of vehicles turned out is one in which Ohio leads all other States.

It was deemed advisable in segregating the industries to include vehicle "parts" under this table, since some firms devote their entire plant and equipment to the manufacture of component parts, such as spokes, rims, hubs and poles. Often carriage manufacturers are practically nothing more than assemblers of parts and enter into production merely as finishers. The southern States, with their comparatively large supplies of hickory and oak, the two important woods of this line of manufacture, are the sources of the main supply. Club turned spokes, rim strips, and gear woods, partly finished, are shipped into Ohio in large quantities from this section. semi-finished products were not taken into account when collecting information for this report since the wood used has already been or will be credited to the States producing them. Likewise it was impractical in collecting statistics for this report to include materials used by the small wheelwright or country blacksmith, who in the aggregate would not consume a great amount and generally buys what he does use in a partly finished condition.

The large amount of hickory consumed, mainly, 29,324,100 feet, indicates that it is the premier wood in vehicle making. Its use is confined mainly to the production of spokes and bent rims for buggy wheels, and to a large extent for gear parts. In the manufacture of heavy wagons white and red oak, the latter to a much less extent, have been the favorite woods. They answer for felloes, hubs, spokes, axles, hounds, bolsters, poles, etc., and are the standard wagon-woods of the country. Mortised wagon hubs are largely made of elm, both white and rock, and woods for gear parts other than the hickories and oaks are sugar maple, white ash, beech, black locust, etc.

Yellow poplar, which comes third in the list, indicates the high grades of this class of manufacture, since only the best carriages, delivery wagons and automobiles could afford this wood, on account of the high prices demanded. Formerly yellow poplar was used for

wagon boards, but of late years it has been replaced with cotton-wood, red gum and yellow pine. It is the principal paint wood for fine vehicle bodies and in the early stages of automobile manufacture was almost entirely the only material used for limousine and other style motor car bodies. Its affinity for paint and capacity for taking a high polish, together with its width and clear grades gave it the preference over other woods. Manufacturers of bodies, which is practically a distinct industry, now report that metal has almost entirely supplanted wood in this respect, being more satisfactory because the hidden defects of the former are apt to show with each change of temperature. Ash and maple are generally used for body frames, where great strength is required. All of the richer cabinet woods reported were employed by the automobile maker, the windshield and steering wheel especially requiring woods of beautiful grain and capable of high finish.

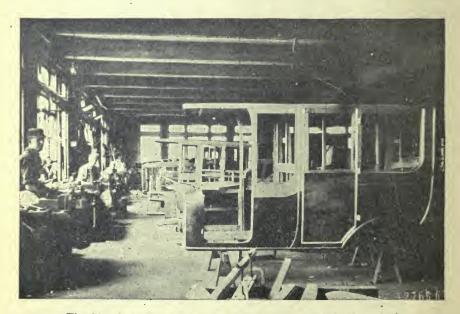


Fig. 16. A small carriage maker who has converted his business to making automobile bodies.

Beech is largely used for the felloes of heavy vehicles, and a considerable amount is noted; but all of this wood does not enter into felloes; indeed the larger part of it is converted into wheelbarrows. Although beech is a strong and stiff wood and wears well and long, it is more likely to break under a sudden jar or strain than white oak. White oak is preferred for skeined axles. Red oak and sugar

maple are also used but some object to maple because it is said that where the iron skein is clamped to maple the axle will not last as long as with the oaks, owing to dry rot caused by contact with the metal. In many parts of the country steel axles are replacing oak, this being especially true in the Mississippi valley and eastern states. Statistics show that this change has been very rapid, having reached an average of about seventy-five percent during the past decade. The average cost of the steel axle is about \$10 per set more than wood.

Besides wagons, carriages and automobiles, there are included under this industry such vehicles as warehouse trucks, push carts, sleighs and cutters; but it is unnecessary to mention in detail the woods that enter into their manufacture, because the requirements are the same as for other vehicles. No doubt not a little of the hard maple reported is utilized for bobsleds and cutter sleighs, owing to its strength and rigidity, as well as its lower price.

TABLE XXXIX, Vehicles and vehicle parts

Kind of wood		Quantity used annually		Total cost	Grown in	Grown out
	Feet b. m.	Percent	cost per 1,000 ft.	factory	Feet b. m.	Feet b. m.
Hickory White oak Yellow poplar. White ash Cork elm.	29,324,100 19,701,012 8,918,884 6,182,841 6,083,570	34.22 22.99 10.41 7.22 7.10	\$ 44.34 37.07 52.92 43.81 17.55	\$1,300,352 730,335 471,987 270,847 106,791	8,271,400 9,925,000 414,000 2,367,000 5,668,570	21,052,700 9,776,012 8,504,884 3,815,841 415,000
Red oak. Sugar maple. Beech. Red gum. Black ash.	2,556,000 2,518,081 2,260,000 1,633,064 1,603,987	2.98 2.94 2.64 1.91 1.87	35.33 44.00 19.70 26.09 39.08	90,315 110,801 44,530 42,612 62,682	1,678,000 939,500 755,000 14,187 992,000	878,000 1,578,581 1,505,000 1 618,877 611,987
Cottonwood	1,297,108 1,201,308 605,000 587,000 427,000	1.51 1.40 .71 .69 .50	36.77 22.66 41.94 28.46 28.53	47,700 27,218 25,375 16,704 12,183	22,000 1,090,000 573,000 159,000	1,275,108 111,308 32,000 587,000 268,000
Birch Shortleaf pine. Black walnut Mahogany Chestnut	358,000 232, 0 00 80,850 26,340 25,000	.42 .27 .10 .03 .03	43.55 28.92 50.06 138.83 48.00	15,591 6,710 4,047 3,657 1,200	13,000	358,000 232,000 67,850 26,340 25,000
Silver maple. Cherry. White pine. Locust. Butternut.	18,620 12,000 10,800 10,000 10,000	.02 .01 .01 .01	30.93 62.50 39.63 35.00 45.00	576 750 428 350 450	12,000 5,000 10,000	18 620 10,800 5,000
Sycamore	4,000 3,170 2,000	* *	35.00 200 00 75.00	140 634 150	4,000	3,170 2,000
Total	85,691,735	100.00	\$39.62	\$3,395,115	32,912,657	52,779,078

^{*}Less than 1-100 of one percent.

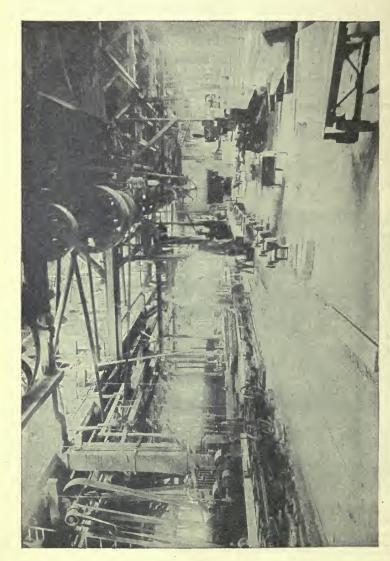


Fig. 17. Showing the importance of wood-working machinery in building freight cars.

OF OHIO . 65

CAR CONSTRUCTION

Ohio, with its vast network of railroads and trolley lines, is an advantageous location for car building industries. As indicated, however, in table following, the manufacture of high-class cars, such as parlor, sleeping, diners and observation cars, which require expensive cabinet woods, is not a factor of this industry. To the contrary, the material reported goes largely into building and repairing freight cars, locomotive cabs and pilots, passenger coaches and the building of electric cars for street railway and interurban service. Grain door material is included in this table and lumber demanded for the construction of mine cars and contractors' dump cars.

In Ohio as in most of the other States already studied for wood consumption, longleaf pine heads the list of woods in quantity for car building. It meets many uses but principally for structural parts where great strength is required like sills, brake beams, body posts, dead blocks, bolsters, plates, draft timbers, etc., and in this respect is a competitor of red and white oak and Douglas fir. Douglas fir, possessing qualities similar in strength, durability and adaptability, to the other woods for car building, is consumed only to a limited extent, owing to its relatively higher price delivered to Ohio points. If there is a reduction in the rate of transportation possible after the opening of the Panama Canal, it may lessen the price and bring Douglas fir, which is already held in high favor, into greater prominence in Ohio and other eastern markets. This wood is not only suitable for framing and other parts of freight cars but for interior finish of passenger and trolley cars where the high polish it takes and its conspicuous figure make it sufficiently ornamental to be used for this purpose. The finish woods reported by Ohio car builders are white ash, red oak, white oak, red gum, mahogany, birch and cherry, also padouk and black walnut in small quantities. Shortleaf pine, longleaf, Norway pine and cypress were used mainly in the superstructure of box cars. They supplied the material for carline, ridge poles, roof ribs, belt rails, outer sheathing or siding, lining, inside roof, roof boards and many other parts of both passenger and freight cars. Yellow poplar meets many uses for interior work of passenger cars but its chiefest use, with limited quantities of cottonwood and basswood, is for outside panel work.

TABLE XL. Car construction

Kind of wood	Quantity annu Feet b. m.		Average cost per 1,000 ft.	Total cost f. o. b. factory	Grown in Ohio Feet b. m.	Grown out of Ohio Feet b. m
Longleaf pine	16,599,615 13,404,535 8,481,757 4,598,715 3,629,322	29.54 23.85 15.09 8.18 6.46	\$ 27.33 28.31 23.25 43.50 32.29	\$453,710 379,459 197,193 200,030 117,206	10,312,705 6,114,344 5,496	16,599,615 3,091,830 2,367,413 4,593,219 3,629,322
Shortleaf pine	2,762,025 2,450,700 1,089,472 629,417 613,581	4.91 4.36 1.94 1.12 1.09	25.35 47.83 109.12 23.42 76.24	70,028 117,219 118,887 14,742 46,782	725,676 56,799	2,762,025 1,725,024 1,089,472 629,417 556,782
Sugar maple Cottonwood Bur oak. Western larch Basswood	517,295 302,000 220,000 213,000 177,982	.92 54 .39 .38 .32	34.18 32.55 30.73 22.50 27.91	17,679 9,830 6,760 4,792 4,968	120,766 2,000 220,000 132,232	396,529 300,000 213,000 45,750
Black ash Cypress, Hemlock Birch Chestnut	129,000 80,000 65,789 54,927 52,224	.23 .14 .12 .10 .09	65.00 32.50 16.66 39.67 24.09	8,385 2,600 1,096 2,179 1,258	12,024	129,000 80,000 65,789 54,927 40,200
Douglas fir SpruceHickoryPadouk White elm	32,733 30,000 18,296 14,000 12,000	.06 .05 .03 .02 .02	34.98 24.00 36.13 125.00 40.00	1,145 720 661 1,750 480	10,254 5,000	32,733 30,000 8,042 14,000 7,000
Black walnut	9,000 8,000 4,200 1,300	.02 .01 .01	90.00 26.00 20.00 250.00	810 208 84 325	9,000	8,000 1,300
Total	56,200,885	100.00	\$ 31.69	\$1,780,986	17,730,496	38,470,389

^{*}Less than 1-100 of one percent.

FURNITURE

The manufacture of furniture is one of the oldest industries in the State, and at the same time one of the most important, twentyseven woods being required to meet the demand. Chairs and kitchen cabinets are not a part of this industry, but have been considered under separate classifications. Commodities grouped in the following table are bedroom furnishings, chiffoniers and bureaus, dining tables and buffets, parlor outfits, including frames for upholstered furniture, hall racks, desks, china closets and bookcases. Many of the woods reported are used only in parts that are not visible, such as cores for veneering, frames, and brackets and table slides. such places beauty of finish is not required, and the cheaper woods are employed. The other woods are selected for show and must be of high grade without defect, having a pleasing figure and capable of polish. The use of veneer in this line of manufacture and the artful staining of inferior woods enable the furniture makers to turn out the attractive products at much lower prices than they could otherwise afford. Indeed it is a rare occasion when the expensive woods,

such as mahogany, Circassian walnut and black walnut are used in solid pieces. Veneer is bought from the veneer mills in surface measure, the sheets ranging from 1-24 inch to 1-8 inch in thickness. As a rule, the expensive foreign woods are obtained in the former thickness. Cores, or the backing to which veneer is glued, are made of solid lumber or built-up lumber. The latter is purchased already made built of several layers of cheap veneers glued with the grains transversing. Built-up lumber is rapidly growing in favor everywhere with furniture makers. It has the qualities of not warping and being light with exceptional strength.

In Ohio white oak is the principal furniture wood and next to it red oak, which furnishes about one-half as much as white oak. With these two, over 52 percent of the total of the furniture material can be accounted for. A large amount of the oak reported is quartered oak, for this industry absorbs the largest amount of quartered stock reported by any other class of manufacture in Ohio. It costs considerably more than the plain sawed oak, owing to the fact that only prime logs are used, the waste in quarter sawing is greater, and more skilled labor and time are required in producing it. The enhanced beauty of quarter-sawed wood is due to figures and waves of the grain caused by sawing tangentially across the medullary rays.

Sugar maple and yellow poplar are employed in about equal amounts. Part of the maple is required for the outside or finish, especially the bird's-eye or mottled wood, but the main portion is made into drawer sides and bottoms, couch frames, table slides, tops, legs, etc. Yellow poplar, although greatly in demand for backing, the bottoms of drawers and coring, is used also for the exterior of furniture in painted or enameled work.

Red gum is of great service in two ways, now that the difficulties of seasoning the wood have been fairly well overcome, which heretofore prevented its extensive use. It goes, like yellow poplar, into
hidden work and besides is a favorite wood for finish, either in natural
color, where sometimes its richly mottled wood resembles Circassian
walnut, or it can be stained so as to be a close imitation of mahogany
and other cabinet woods. It is not uncommon for furniture makers
to call products made from red gum resembling Circassian walnut
hazel wood. The idea of giving new names to this wood likely
originated abroad, where it is called satin walnut and where it was
used for cabinet work before its adaptability was considered in this
country.

Hemlock and buckeye went for backs of case goods and drawer sides, but were reported only in small quantities. Basswood was the favorite for interior work, especially shelving, and it also served

for matress frames, bed slats and table rails. Chestnut was the chief wood for veneer backing, serving for tops of tables and case goods, drawer fronts and other panel work. Parlor furniture frames were made from sugar maple, birch, ash and mahogany, while davenport and couch frames were of yellow pine, maple, red gum, yellow poplar and oak. Black walnut answered for wardrobes and bedsteads. The large amount of mahogany indicates the popularity of this finish. It was reported to a large extent as veneer.

TABLE XLI. Furniture

Kind of wood	Quantity used annually		Average cost per	Total	Grown in Ohio	Grown out
	Feet b. m.	Percent	1,000 ft.	factory	Feet b. m.	Feet b. m.
White oak. Red oak. Sugar maple Yellow poplar Red gum	15,704,982 7,415,059 3,603,400 3,086,703 2,766,300	38.09 17.99 8.74 7.49 6.71	\$ 40.84 39.86 26.72 30.43 25.21	\$ 641,452 295,550 96,298 93,930 69,751	4,084,381 1,311,000 1,000,900 202,000	11,620,601 6,104,059 2,603,400 2,884,703 2,766,300
Chestnut	2,257,100 1,558,500 1,046,828 922,801 876,996	5.48 3.78 2.54 2.24 2.13	20.92 27.13 121.82 27.35 30,82	47,219 42,285 127,524 25,239 27,032	201,500 663,500 172,101 30,898	2,055,600 895,000 1,046,828 750,700 846,098
White elm	870,000 274,640 202,000 150,000 105,000	2.11 .67 .49 .36 .25	26.02 25.03 17.40 16.00 46.43	22,640 6,874 3,514 2,400 4,875	85,000	785,000 274,640 202,000 150,000 105,000
Hickory. Beech Buckeye Black walnut Butternut.	103,000 95,000 60,000 50,900 30,000	.25 .23 .15 .12 .07	24.68 20.79 35.00 67.88 35.00	2,542 1,975 2,100 3,455 1,050	1,000 20,000 23,400 30,000	102,000 75,000 60,000 27,500
Shortleaf pine	20,000 15,000 5,700 5,500 5,500	.05 .04 .01 .01	35.00 35.00 89.12 281.82 240.00	700 . 525 . 508 . 1,550 . 120	5,700	20,000 15,000 5,500 500
Rosewood	500 500	*	350 00 360.00	175 180		500 500
Total	41,226,909	100.00	\$ 36.90	\$1,521,463	7,830,480	33,396,429

^{*}Less than 1-100 of one percent.

AGRICULTURAL IMPLEMENTS

Ohio is one of the leading agricultural states, and with the propaganda of scientific farming gaining converts each year the use of agricultural implements in place of the old makeshift methods of farming has greatly advanced. The growing cost and scarcity of farm labor has aided in this industry. Ohio is now among the foremost in this manufacture, consuming 38,659,200 board feet annually. All kinds of farm machinery are produced, from a threshing machine to a hand hay rake. Such implements as hoes, pitchforks, garden rakes, etc., have been excluded because they consume wood only for handles and this material has been considered under Table XXVI.

Twenty-seven woods were employed for implements, of which more than four-fifths were shipped into the State, the home market supplying only 6,488,000 board feet. The tendency to substitute metal for wood in this line of manufacture is growing rapidly. Some implements are entirely of steel where formerly they were mostly of wood. Plows, whiffle and singletrees, horse rakes and eveners are examples. Shortleaf and longleaf pine, red and white oak, cottonwood, maple, hickory, yellow poplar and basswood are the main woods employed, and the average cost, \$29.30, signifies that a fairly high grade of lumber is used. This is the only industry in which red oak is employed in greater amounts than white oak. These two woods are used in larger quantities than any other two, furnishing over one-fourth of the total. The strength and hardness of these woods render them most important and they enter into a variety of uses.

Shortleaf and longleaf pine, which comprise nearly one-quarter of the total, are almost ideal material for farm implement manufacture. They are lacking in toughness, which unfits them for certain purposes, but next to the oaks they are demanded ahead of any other woods.

Cottonwood, basswood, red gum and yellow poplar are well suited, like the pines and maples, for certain parts. Their weight in proportion to strength, ease of working, and the fact that they take paint readily, make them well liked. The use of yellow poplar is decreasing, however, because the manufacturers cannot afford to pay the price for the grades desired. Red gum and cottonwood are the principal substitutes.

Where hardness or the quality to wear smooth is desired, maple and beech are used. Ash was employed largely in competition with oak, while hickory entered into parts where elasticity with shock resisting and strength tendencies were demanded. Six hundred thousand feet of Douglas fir were used by the implement makers. This wood has all the desirable qualities of longleaf pine and is a strong competitor of it in every way except price, which, on account of the freight rates, is much higher. The uses of the various woods reported by the implement makers are as follows:

ASH

Animal pokes
Cider mill cylinders
Cultivator beams
Hand corn planters
Handles (drill plow)
Handles (cultivator)
Handles (scraper)
Rake heads

Separator parts
Threshing machine parts

BASSWOOD

Fans (bodies)
Frames (fan screen and hopper)
Seed huller parts
Slats (fan mills)
Threshing machine parts

BEECH

Braces (wheelbarrow) Ensilage cutters

Frames (sheller)

Handles (wheelbarrow) Handles (scraper)

Neck yokes

Posts (cider mill, corn sheller, feed cutter)

Sills (fan mills)

Wheelbarrow sides

CHESTNUT Levers (feed grinder)

Posts (cider mill, corn sheller, feed cutter)

Tables (feed cutter)

COTTONWOOD

Ensilage cutters Fan mill boxes Feed boxes Grain drill hoppers

Swath boards

Wheelbarrow sides

CUCUMBER

Hay rack beams

CYPRESS Separator (interior parts)

Threshing machine (interior parts)

ELM

Feed cutters

Frames (wheelbarrow) Handles (scraper)

Platforms (reaper and mower)

Rollers for mowers

Separator or threshing machinery parts

RED GUM

Beater bars

Divider boards

Paddles (manure spreader)

Tables (manure spreader)

Rye dividers

HEMLOCK

Potato sorter parts

HICKORY

Doubletrees

Eveners

Hitches

Huller parts

Levers

Pitman's mowers

Pitman's threshers

Revolving horse rakes

Shaft bars

Separator parts

Silage cutter parts

Singletrees

Teeth (hand rake)

Tongues

Wagon jacks

MAPLE

Beds (manure spreader)

Doubletrees

Eveners (harrow)

Feeder cutters

Frames (cleaner)

Frames (ensilage cutter)

Frames (manure spreader)

Frames (pulley) Frames (sheller)

Frames (wheelbarrow)

Hand corn planters

Corn huller boxes Legs (fan mills)

Neck vokes

Poles (mower, reaper, binder)

Poles (cultivator) Posts (cider mill)

Posts (corn sheller)

Rakes

Rakes (revolving hay)

Separators (interior parts)

Frames Singletrees

Sling sticks Stubs

Swath boards (binders and mowers)

Threshing machines (interior parts)

Wheelbarrows

Pulley frames (hay loader)

OAK, WHITE AND RED

Animal pokes

Belt slats Bobsleds

Bottoms (manure spreader)

Brake beams

Cider mills Corn shellers

Cross bars (hay loaders)

Cross pieces (manure spreaders)

Doubletrees

Ensilage cutters

Eveners

Feed cutters

Frames (drag harrow)

Frames (corn sheller) Handles (cultivator)

Handles (plow)

Harrows

Harrow bars Hullers

Levers

Neck yokes

Plow beams

Rakes

Reel arms (binders)

Rims (clover huller and motor truck)

Scraper parts Separator parts

Sills (corn grinder)

Singletrees

Sling hay carriers

Stanchions

Stoneboats

Thresher parts

Tongues

Potato sorter frames and legs

Trucks (silage cutter)

Wagon jacks

Wheelbarrows

Whiffle trees

YELLOW PINE, LONGLEAF AND SHORTLEAF

Beds (wagon) Boxes (feed mill)

Crushers Cultivators

Drags for handling grain

Draw bars (harrow)

Elevator heads

Frames (wagon)

Lids (grain drill hopper)

Pole stock

Poles (potato digger)

Poles (sled and roller)

Poles (cultivator, disc harrow, land roller)

Rakes (side delivery)

Seed boxes (grain drill)

Separator parts

Sides and side sills (manure spreaders)

Spreader boxes

Sweeps (feed mill)

Thills (manure spreader)
Threshing machine parts

Tongues (rollers)

SUGAR PINE

Separator (interior parts)
Threshing machine (interior parts)

YELLOW POPLAR

Bodies (fan mills)

Cider mill parts

Corn sheller sides

Feed cutter tables Frames (hopper)

Hopper boxes (grain drill)

Separator parts

Panels (boxes)

Sled cultivators

Potato sorter parts

Compartments (drill hopper)

SYCAMORE

Threshing machine parts

TABLE XLII. Agricultural implements

Kind of wood	Quantity annua Feet b. m.		A verage cost per 1,000 ft.	Total cost f. o. b. factory	Grown in Ohio Feet b. m.	Grown out of Ohio Feet b. m.
Shortleaf pine	6,370,500 6,362,100 4,822,600 4,805,000 4,187,000	16.12 16.10 12.21 12.16 10.60	\$24.51 16 50 37.36 38.94 27.98	\$156,147 105,004 180,166 187,130 117,138	455,100 2,339,600 2,032,000	6,370,500 5,907,000 2,483,000 4,805,000 2,155,000
Longleaf pine	3,533,000 1,691,500 1,530,700 1,117,000 883,000	8.94 4.28 3.87 2.83 2.23	34.88 43.87 37.38 20.60 29.70	123,242 74,205 57,214 23,007 26,224	506,500 96,000 212,000	3,533,000 1,185,000 1,434,700 1,117,000 671,000
Beech Douglas fir Norway pine White pine Chestnut	833,000 600,000 465,000 413,000 406,000	2.11 1.52 1.18 1.05 1.03	22.18 36.00 33.11 27.10 18.47	18,473 21,600 15,395 11,191 7,500	358,000 276,000	475,000 600,000 465,000 413,000 130,000
Birch Black ash Hemlock Cork elm White ash	350,000 243,000 207,000 148,000 126,000	.89 .61 .52 .37 .32	13.00 31.17 16.22 28.04 44.21	4,550 7,575 3,357 4,150 5,570	222,000 148,000 126,000	350,000 21,000 207,000
White elm. Sycamore. Silver maple. Cypress. Sugar pine	105,000 85,000 83,500 50,500 50,000	.27 .22 .21 .13 .13	24.62 31.76 30.99 30.30 30.00	2,585 2,700 2,588 1,530 1,500	85,000 85,000 65,000	20,000 18,500 50,500 50,000
Bur oak	41,000	.10	74.39 40.00	3,050 32	41,000	
Total	39,509,200	100.00	\$29.43	\$1,162,823	7,048,000	32,461,200

^{*}Less than 1-100 percent.

HANDLES

Handles manufactured in Ohio can properly be divided into four classes: First, garden tool and fork handles, like hoe, rake, spade and D shovel, long handle shovels, pitch and hay fork handles, etc. In the quantity of wood consumed the making of this class in Ohio is far more important than the others. Ash is the principal wood, white ash being preferred, but black or gray ash is quite suitable and largely demanded. Stiffness and strength without weight are qualities of ash which fit it preeminently for this line of manufacture. Other woods serve with ash, but according to quantity they are relatively unimportant. They included sugar maple, beech and elm, for garden tools, and the two first named with basswood for fork and shovel handles.



Fig. 18. Mop handle and chair dowels and mill waste from which they are manufactured.

Second are track tool, sledge and axe handles. Besides exceptional strength these tools require handles with the important quality of stiffness and shock resisting ability, which is found in hickory in a greater degree than any other wood. A small quantity of young second growth white oak is reported for pick handles but aside from that hickory alone in Ohio is used for making commodities of this class.

The third class are broom, mop and miscellaneous handles. Large quantities of sugar or hard maple squares are required each year in Ohio for brooms and according to amounts this wood is the

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most important. It is not, however, the only suitable broom, handle wood and does not hold relatively the important position in this as ash does in the first and hickory in the second class described above. Beech, basswood, ash and sycamore were the other broom handle woods, hickory being called on for street and stable broom handles and sugar maple for handles of carpet sweepers. Mop handles are made of the same woods only of little lower grades. In Illinois red gum is extensively used for them.

A variety of handles not yet mentioned and belonging to each of the three classes have been listed together with the woods from which they are made. They are:

CLASS	KINDS	WOODS
(1)	Cant hook handles	Hickory Sugar maple
(2)		Hard maple
(2)	Mine handles.	Ash
(3)	Tinware handles.	Sugar maple Beech Soft maple
(3)	Spoon, dipper and other utensil holders and handles	Red gum Basswood
(1)	Pump handles	Sugar manle
(2)	Fence wire stretcher handles	Hickory elm Rock elm
(3)	Brush poles for long handle brushes	Basswood Oak

TABLE XLIII. Handles

Wind of word	Quantity used annually		Average cost per	Total cost f. o. b.	Grown in	Grown out
Kind of wood	Feet b. m.	Percent	1,000 ft.	factory	Ohio Feet b. m.	of Ohio Feet b. m.
White ash Sugar maple Black ash Hickory. White oak	12,195,000 3,811,998 3,766,322 3,435,935 2,255,372	40.00 12.50 12.35 11.27 7.40	\$31.24 22.76 30.81 24.14 29.37	\$380,974 86,773 116,040 82,931 66,232	11,415,000 3,206,998 3,263,322 2,710,935 2,240,372	780,000 1,605,000 503,000 725,000 15,000
Beech. Cork elm. Red gum. Basswood. Birch.	2,075,916 1,020,000 960,000 708,385 100,000	6.81 3.34 3.15 2.32 .33	20.43 21.91 23.67 23.39 26.00	42,410 22,350 22,725 16,566 2,600	1,295,916 1,015,000 553,385	780,000 5,000 960,000 155,000 100,000
White elm. Red oak. Bur oak. Silver maple. Sycamore.	63,307 40,000 30,000 23,498 1,000	.21 .13 .10 .08	24.39 20.00 24.00 13.36 12.00	1,544 800 720 314 12	63,307 20,000 30,000 23,498 1,000	20,000
Total	30,486,733	100.00	\$27.65	\$842,991	24,838,733	5,648,000

^{*}Less than 1-100 of one percent.

MATCHES

The manufacture of matches is not a common industry in Ohio, although a considerable amount of wood is utilized for this purpose. White pine, the principal wood employed, constitutes 97 percent of the total. Not a single foot of this wood was obtained in the State. Within recent years Canada has supplied a large amount, and the remainder is brought from California, Oregon and the Rocky Mountain States.

It will be noticed that spruce is another wood appearing in the table following. It was not used for matches but was converted into match cases. The Virginia report shows that yellow poplar, basswood and soft maple supplied the match stick material. New York, Pennsylvania, Maine, and Wisconsin factories consume white pine and some of them a little basswood, while lawson cypress, usually called Port Orford cedar, and sugar pine in large quantities are the woods out of which the California-made matches are manufactured. In Europe poplar, more often called cottonwood in this country, is extensively used, and it makes an excellent match, many of them being shipped to this country.

Wood for match making should be straight-grained, easily worked, and readily ignited and inflammable. A very important consideration is to get a wood that will not retain the glowing ember after the flame has been extinguished. A white, soft and long fibre is also desirable. All match stock is obtained either in 2 inch or 3 inch plank, or in blocks averaging 2×23 -8 inches and any length. An exceptionally good grade of stock is demanded. The veneer match is growing in popularity but none of them were reported as being made in Ohio. They are cut from thin sheets and made into match books used mainly as an advertising novelty. Soft maple is the principal wood used.

TABLE XLIV. Matches

Kind of wood	Quantity used annually		Average	Total cost	Grown in	Grown out
Kilid of wood	Feet b. m.	Percent	cost per f. o. b. factory		Ohio Feet b. m.	of Ohio Feet b. m.
White pine	24,000,000 750,000 250,000	96.00 3.00 1.00	\$34.74 20.00 35.50	\$833,875 15,000 8 875	•••••	24,000,000 750 000 250,000
Total	25,000,000	100.00	\$34.31	\$857 750		25,000,000

FIXTURES

The classified products under furniture, sash, doors and general millwork and fixtures are closely related and so often overlap that the lines separating the industries are difficult to define. Fixtures

properly include equipment for offices, stores, lodge rooms, saloons, banks, hotel lobbies, court houses, churches and cabinets for dentists and surgeons, account registers, cash registers and index files, besides other special work of similar character too varied to mention. are distinguished from the class of material going into high grade inside finish, mantels, and house cabinet work, included in general millwork by the fact that when in place the latter are stationary, while fixtures are movable. They are separated from furniture according to the uses of the finished products. Office and store desks, tables and book cases belong under the heading fixtures, while similar commodities for the residence are put in the furniture class. Practically the same woods and grades are employed for fixtures as for furniture, and they are generally speaking of two classes, one for outside work, the other for interior parts not intended to show. For the former veneer stock is largely used and rapidly growing in favor, chestnut being the favorite wood supplying the backing or core material. Solid woods for finish are probably given preference over veneer work, which largely accounts for the high average price as shown in the table.

White oak furnishes 30.30 percent of the total fixture woods and about one-third of the supply is obtained in the State. In every state oak is a great favorite in this line and will always be one of the principal woods for exterior work. Included with the amounts of this wood is a large quantity of quartered oak. For high-grade fixtures quartered material is preferred to plain wood, since the beauty of the grain can be shown to a better advantage. In price, however, quartered oak averages about \$12 to \$20 per thousand feet higher.

Birch is ahead of any wood for imitating mahogany, which accounts for its use among the finishing woods. While yellow poplar in considerable quantity is made into panels for painted and enameled work, the greater part, with basswood and maple, is utilized for backing, shelving and hidden work. The average cost of red oak is lower than white and a notable difference is found in the quantity used. It being more porous, requires a greater amount of filler in the finishing, which, in part, tends to offset the variation in price. Three foreign woods are included in the requisition of the fixture makers. They are mahogany, Circassian walnut, and teakwood. Practically all the Circassian walnut is used in veneer form, and is lower in average price than that shown in the other industries reporting it. The small amount of teak used comprises the entire amount returned for the State. It is a very hard wood

and a large portion of the supply shipped to this country comes from India. This is one of the industries that calls on the State for a good portion of its raw material, about three-eighths of the total amount being grown in Ohio.

TABLE XLV. Fixtures

Kind of wood	Quantity annua Feet b. m.		A verage cost per 1,000 ft.	Total cost f. o. b. factory	Grown in Ohio Feet b. m.	Grown out of Ohio Feet b. m.
White oak	4,234,305 1,829,400 1,443,844 1,421,600 1,248,000	30.30 13.09 10.33 10.17 8.93	\$ 46.97 25.65 37.80 37.42 39.96	\$198,872 46,933 54,573 53,199 49,876	1,515,534 1,759,400 10,000 297,100 578,000	2,718,771 70,000 1,433,844 1,124,500 670,000
Chestnut Basswood. Mahogany White elm Shortleaf pine.	968,445 762,300 643,364 536,000 322,000	6.93 5.46 4.60 3.84 2.30	22.31 25.53 . 142.54 20.99 30.23	21,605 19,464 91,702 11,253 9,734	118,445 347,300 500,000	850,000 415,000 643,364 36,000 322,000
Cypress Red gum. Longleaf pine. White pine. Cottonwood.	151,000 145,000 85,000 57,000 30,000	1.08 1.04 .61 .41 .22	32.02 26.79 30.00 40.00 40.83	4,835 3,885 2,550 2,280 1,225	5,000	151,000 145,000 85,000 57,000 25,000
Cherry. Beech. Silver maple. Black walnut. White ash.	25,600 20,000 20,000 12,600 12,000	.18 .14 .14 .09 .09	41.17 25.00 22.50 59.84 38.00	1,054 500 450 754 456	23,600 20,000 12,600	2,000 20,000 12,000
Circassian walnut	6,000 1,000	.04	225.00 250.00	1,350 250		6,000 1,000
Total	13,974,458	100.00	\$ 41.28	\$576,800	1,186,979	8,787,479

BUNGS

The Forest Service has made studies similar to this in thirty states. So far Ohio leads in the production of bungs and their manufacture is centered in the city of Cincinnati. When this industry started probably the raw material was obtained within a radius of twenty-five miles. At present nearly the entire amount of material needed is obtained without the State, mainly in Tennessee, Kentucky, and West Virginia, and the manufacturers are searching over a wider extent of territory each year to satisfy their demands.

These commodities are essentially products of but one wood, yellow poplar. The table shows it furnished over 95 percent of the total, which indicates that its suitability for this line of manufacture is superior to any other wood that has been tried up to date. Yellow poplar is straight-grained, soft, easily worked, strong, and it does not shear easily and contracts evenly, having a very uniform structure, all important considerations in driving the bung. Furthermore, its tendency to swell on coming in contact with liquids

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makes the bung fit tightly, which is also a valuable characteristic. The pines can not be utilized as well for this purpose, because of the alternating hard and soft structure of the wood. Other woods for bungs, reported only in small quantities, are white oak, walnut and red gum. Cotton gum or tupelo has not been given an opportunity to demonstrate its suitability for this service, but as its qualities become better understood it doubtless will be called on to substitute for yellow poplar especially as it is lower in cost and more easily obtained. The red gum is comparatively a new wood in this industry which from the amount consumed indicates that it measures up to requirements fairly successfully. A good grade of material is required for bungs, being obtained in the form of rough lumber or planks, full 4-4 inch in thickness. Spilers or vent plugs were principally made from yellow poplar, but also from white pine and spruce.

TABLE XLVI. Bungs and faucets

	Quantity used annually		Average	Total	Grown in	Grown out		
Kind of wood	Feet b. m.	Percent		cost f. o. b. factory	Ohio Feet b. m.	of Ohio Feet b. m.		
Yellow poplar	9,620,000 175,000 165,000 51,000 37,000	95.40 1.73 1.64 :50 .37	\$27.30 20.00 16.55 30.15 18.00	\$262,620 3,500 2,730 1,538 666	140,000	9,629,000 1 5,000 25,000 30,000 37,000		
Spruce	36,000	36	28.00	1,008	******	36,000		
Total	10,084,000	100.00	\$26.98	\$272,062	161,000	9,923,000		

DAIRYMEN'S, POULTERERS' AND APIARISTS' SUPPLIES

Advance toward more scientific management in the occupations of dairymen, poulterers, and apiarists has created a wide demand for special equipments of the new methods involved and in consequence factories manufacturing these commodities have sprung up in several states. These establishments and their products are distinct industries and have been combined statistically in this report under one heading for convenience, because it was not possible to present them in individual tables. In dairymen's supplies Ohio manufacturers report making churns of various sizes and kinds from the small domestic churn propelled by hand to the large barrel churns used in creameries and also dash churns. In all the States in which studies similar to this have been made, white ash is preeminently the leading wood for churns. In Ohio close to half a

million feet a year is used for this purpose and this wood is chosen not only for the staves but also for the paddles because more than any other wood it is considered less liable to affect the taste of the contents. For the same reason ash is the leading wood for butter tubs. Cheese boxes are the only other dairy products made in Ohio. The raw material is purchased in the log and cut into veneer for the sides and the rims of lids, while the head and the bottom of these boxes are made of a little thicker material, about quarter-inch lumber. A number of woods answer for making cheese boxes; maple leads all others followed by basswood, soft elm, and yellow poplar; the others were cottonwood, beech, ash, and cucumber, reported in only nominal quantities.



Fig. 19. Lumber yard of a manufacturer of bee keepers' supplies.

The manufacturers of poulterers' equipment require over a million feet of lumber annually. Redwood is the principal species which with cypress goes mainly into incubator cases. For egg trays and other inside work yellow poplar is used and yellow pine, ash, and shortleaf pine for the tops and bottoms of the incubators. Brooder cases are made from yellow poplar and basswood with the bottoms and platforms of shortleaf pine and chestnut, the latter being preferable. In making portable poultry houses the roof is frequently of chestnut and yellow pine with the sides and frame parts of pine, shortleaf being the species reported.

Beehives are made of three kinds of wood in Ohio. White pine answers for the sides and tops, cypress for the bottoms and frames, and basswood for honey boxes, with a small amount of sycamore for other interior parts.

TABLE XLVII. Dairymen's, poulterers', and apiarists' supplies

Kind of wood	Quantit; annu		Average cost per 1,000 f.t	Total	Grown in Ohio Feet b. m.	Grown out
Killt of wood	Feet b. m.	Percent		factory		Feet b. m.
White pine. Basswood. White elm. Cypress. White ash.	2,350,000 2,120,000 1,095,000 1,035,000 861,000	24.05 21.70 11.21 10.59 8.81	\$30.00 25.71 22.73 26.74 28.05	\$ 70,500 54,510 24,890 27,680 24,147	1,090,000 1,095,000 456,000	2,350,000 1,030,000 1,035,000 405,000
Redwood White oak Redoak Yellow poplar Chestnut.	518,000 480,000 287,000 253,000 240,000	5.30 4.91 2.94 2.59 2.46	32.10 15.92 10.16 30.30 18.00	16,630 7,640 2,917 7,667 4,320	250,000 286,000 34,000	518,000 230,000 1,000 219,000 240,000
Shortleaf pine. Western red cedar. Silver maple. Sugar maple. Cottonwood.	210,000 175,000 52,000 45,000 25,000	2.15 1.79 • .53 .46 .26	16.25 35.00 10.27 29.89 25.00	3,412 6,125 534 1,345 625	52,000 25,000 25,000	210,000 175,000 20,000
Beech	22,000 2,000 1,000	.22	19.09 20.00 20.00	420 40 20	22,000 2,000 1,000	
Total	9,771,000	100.00	\$25.94	\$253 422	3 338,000	6,433,000

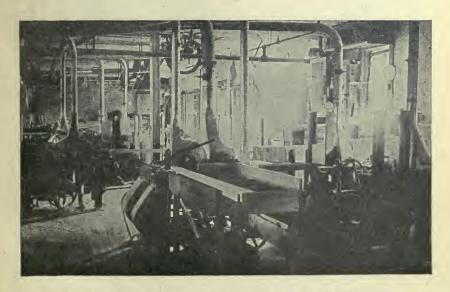


Fig. 20. Machinery setting for making brooders and incubators.

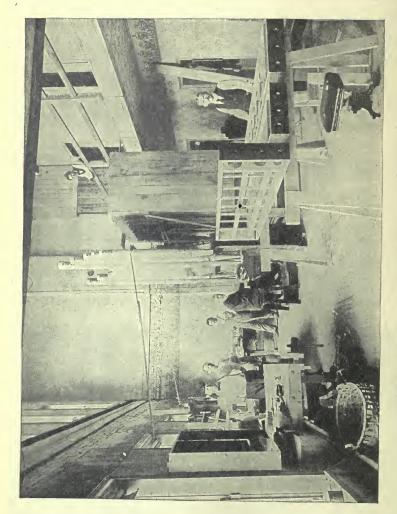


Fig. 21. Assembling room of a pipe organ manufacturer.

MUSICAL INSTRUMENTS

Pianos and organs are the only products reported under this heading, but the industry is an important one in Ohio and the aggregate quantity of wood used is quite large. A large majority of the manufacturers make only certain parts and purchase a portion of their material already to put in place from factories specialing in these lines. Only a few makers today manufacture the piano or organ complete. Spruce is the essential wood for piano sounding boards. It must be carefully seasoned and manufactured, and since they are made from wide stock, trees that are suitable are sought after over great distances, until now many are shipped from the northern Pacific Coast states and British Columbia, where Sitka spruce meets the demand. Trees obtained from high altitudes, where the rate of growth is slow and the annual rings closer together, are preferred for sounding boards and ribs, and bring higher prices.

Chestnut is the first wood on the list for piano shells or cases, to which is glued an overlay of veneer of some expensive cabinet wood which gives the finish. The light weight, combined with strength, durability and gluing properties put chestnut ahead of any wood for this purpose. White ash being stronger and less liable to warp than chestnut probably accounts for the tops of grand pianos being made from it. Sugar and silver maple, elm, ash and sycamore, are the woods going into posts and back casing. Owing to its hardness and strength, sugar maple also finds service for wrists, pin blocks, action parts and other mechanical pieces in the piano. It is almost an exception when other woods than this are used for action parts. Piano legs are of a variety of woods, red oak probably being the foremost, because of its great strength and being porous it holds veneer well. It is interesting to note that neither ebony nor white pine, the principal key woods, were reported, which indicates that piano keys are manufactured elsewhere and shipped to the Ohio manufacturers. Basswood to a limited extent was used in other states for piano keys but in Ohio with sugar maple and black walnut it serves for organ keys.

Action chests in organs are of a strong wood, usually red oak or some other species of oak, white pine, sugar pine, redwood and cherry all answer for organ pipes, while for organ bellows, windchests and swell boxes white pine, basswood, Sitka spruce, and red spruce were the ones reported. These woods are employed owing to their being fairly strong, light in weight, free from pitch, and holding their shape well. Redwood has begun to be used by the eastern manufacturers for parts of organ framework, and being a suitable wood and in high favor with the manufacturers for that purpose, will probably be used more extensively in the future.

White and red quartered oak, mahogany, black walnut, red gum, cherry, and Circassian walnut, are employed chiefly as veneer for exterior finish of pianos and organ cases.

TABLE XLVIII. Instruments, musical

	Quantity used annually		Average	Total	Grown in	Grown out
Kind of wood	Feet b. m.	Percent	cost per 1,000 ft.	cost i. o. b. factory	Ohio Feet b. m.	of Ohio Feet b. m.
Chestnut Sugar maple. Silver maple. Basswood. Yellow poplar.	1,666,000 1,307,000 1,062,000 1,013,000 823,000	19.41 15.23 12.37 11.80 9.59	\$ 18.19 27.33 29.79 38.34 45.41	\$ 30,310 35,723 31,640 38,835 37,372	30,000 24,500 7,000 40,000 5,000	1,636,000 1,282,500 1,055,000 973,000 818,000
White elm	460,000 420,000 271,000 261,300 245,000	5.36 4.89 3.16 3.04 2.86	23.74 29.43 33.25 108.30 37.13	10,920 12,360 9,012 28,298 9,098	300,000 134,500	160,000 420,000 136,500 261,300 245,000
Black walnut Red oak. Beech Birch White pine	167,800 154,000 144,000 125,000 117,000	1.96 1.80 1.68 1.46 1.36	103.50 19.19 18.50 30.48 50.90	17,365 2,956 2,664 3,810 5,955	72,500	95 300 152,000 144,000 125,000 117,000
White ash	76,000 48,000 47,500 40,000 33,000	.89 .56 .55 .47 .38	50.71 21.56 82.59 32.00 50.00	3,854 1,035 3,923 1,280 1,650	34,000	76,000 48,000 13,500 30,000 33,000
Norway pine	30,000 20,000 15,000 15,000 15,000	.35 .23 .17 .17	34.00 45.00 24.00 45.00 90.00	1,020 900 360 675 1,350		30,000 20,000 15,060 15,000 15,000
Butternut	6,000 1,500	.07 .02	22.50 250 00	135 375	6,000	1,500
Total	8,583,100	100.00	\$ 34.12	\$292,875	665,500	7,917,600

TANKS, VATS AND SILOS

Although within the past ten years metal tanks have for a number of purposes replaced the wooden ones such as those on windmills and elevated by factories for storage of water, it is generally conceded that the demand for wooden tanks has greatly increased. The brewery and distilling vats of necessity have to be of wood, while silos, which the farmer finds almost indispensible, with the exception of a small percent built of concrete and brick, are entirely made of lumber.

Longleaf yellow pine, cypress, white pine, and redwood from the Pacific Coast region, are the principal silo regions. Vat staves are made from cypress and white pine as these woods are less liable to affect the taste of food stuff contained in them from which the beverages are being made.

Water tanks and also cisterns which are placed in attics of suburban and rural residences, were made from cypress, yellow pine, and white pine, the last being the western white pine cut

largely in the Rocky Mountain, and also in the Pacific Coast states. Experiments have been tried within the past year to substitute cheaper and less durable woods in tank-making by means of preservative treatment, but it has been found that the oils and salts used for impregnating the wood imparted a taste to the water. It was successful, however, in tanks for water storage for mechanical purposes as along railroads and for factory consumption, and along these lines the demand for treated staves will probably increase. The manufacture of silos, vats and tanks, requires the best grades, usually clear stock, which accounts for the average price of the tank woods being nearly at par with the furniture and implement materials.

TABLE XLIX. Tanks and silos

Kind of wood	Quantity used annually		Average	Total	Grown in	Grown out
A find of wood	Feet b. m.	Percent	cost per 1,000 ft.	cost f. o. b.	Ohio Feet b. m.	of Ohio Feet b. m.
Longleaf pine	5,984,000 1,730,000 400,000 162,000 100,000	70.90 20.50 4.74 1.92 1.18	\$24.71 49.70 85.00 55.00 34.25	\$147,888 85,990 34,000 8,910 3,425	200,000	5,984,000 1,730,000 200,000 162,000 100,000
Hemlock	30,000 24,000 10,000	.36 .28 .12	23.33 60.00 18.00	700 1,200 180		30,000 24,000 10,000
Total	8,440,000	100.00	\$33.45	\$282,293	200,000	8,240,000

CASKETS, COFFINS AND OUTER CASES

Table L following, concerns the woods used in making caskets, coffins and burial or outer cases and shipping cases sometimes called rough boxes. The last named are usually made of softwoods and in Ohio white pine was practically the only wood used, though a small amount of hemlock was reported. Some of the lumber is obtained dressed and matched, but the most of it is ordered in the rough and preferably in a medium grade, as rough boxes require considerably better stock than that employed in the manufacture of boxes and shipping cases. Chestnut was called on in greater amounts than all other casket and coffin woods combined and only for cloth covered caskets. Long ago this wood was found especially durable underground, and this together with its quality of lightness, strength and its susceptibility for holding glue that fastens the cloth accounts for its being the principal wood for this purpose. Disinter ments after 30 years have been made and the chestnut caskets found sufficiently sound for reburial. Inasmuch as black broadcloth is used for the outside finish the sound wormy grade has proved thoroughly practical and is the one usually employed. The other woods

competing with chestnut are yellow poplar, white oak, red oak, mahogany, basswood and red cedar. The last named wood comes from the Pacific Coast and is gaining in popularity with eastern casket makers. It resembles and is quite similar to the southern red cedars which years ago were extensively employed for making coffins on account of their excellent durability. The absence of cypress is somewhat surprising, as this wood in a number of states is quite prominent in this line of manufacture. The higher price caskets are not cloth covered but are finished naturally with a high polish like that used for pianos and in cabinet work and some are richly carved. Red and white quartered oak, mahogany and black walnut were the woods used.

Only two factories in Ohio reported the manufacture of coffins. They do not make all of the coffins used in Ohio, because many are made by hand by the cabinet makers throughout the State, statistics of which are not included because it was impracticable to gather them. Yellow poplar is the principal coffin wood throughout all the states. It takes stain readily and is finished in imitation of more expensive woods, principally mahogany. Walnut and mahogany are sometimes used for higher grade coffins, while perhaps the cheapest coffin is made from chestnut with only a varnish finish.

TABLE L. Caskets and coffins

Kind of wood	Quantity used annually		Average cost per	Total	Grown in	Grown out		
	Feet b. m.	Percent	1,000 ft.	oost f. o. b. factory	Ohio Feet b. m.	of Ohio Feet b. m.		
White pine	3,615,000 3,128,000 340,000 250,000 232,000	45.53 39.40 4.28 3.15 2.92	\$28.82 19.55 26.76 11.35 55.22	\$104,220 61,154 9,100 2,837 12,812	258,000 70,000 112,000	3,615,000 2,870,000 270,000 250,000 120,000		
Red oak Red gum. Mahogany. Basswood Red cedar.	170,000 75,000 60,000 25,000 25,000	2 14 .95 .76 .31 .31	53.35 27.49 83.58 28.00 51.60	9,070 2,062 5,015 700 1,290	10,000	160,000 75,000 60,000 25,000 25,000		
Black walnut	20,000	.25	74.00	1,480	10,000	10,000		
Total	7,940,000	100.00	\$26.42	\$209,740	460,000	7,480,000		

WOODENWARE AND NOVELTIES

Woodenware is the caption selected to cover articles useful to the household, such as chopping bowls, biscuit boards, potato stompers, pails and buckets, ice cream freezers, step ladders, rolling pins, ironing boards, etc. The Ohio manufacturers report making only pails and buckets, ice cream freezers, mop wringers and wringer tubs, hose reels and ladders. A portion of the pails

made in Ohio are used as packages for the shipment of candy and tobacco, and for their manufacture cypress and white cedar or juniper shipped from the South Atlantic States were the woods used. Pails and buckets for miscellaneous purposes were made from basswood and white pine, and to a less extent from beech and soft maple. The two latter woods answered as the chief material for freezers and pails. Cypress shipped from Louisiana was imported in large quantities to be converted into ice cream freezers. The manufacturer buys his material for these and also for pails, in the form of bolts of the required length ready to go directly to the stave saws. In New England and the Lake States white pine alone answers as the wood for ice cream freezers, while in Virginia and North Carolina southern white cedar, locally called juniper, served with cypress in almost equal quantities in meeting the demand. Only recently in Ohio has cypress answered as a substitute for white pine as a freezer wood due perhaps not so much to the superior durable quality of cypress, a white wood being preferred, as to the poor grades of the northern white pine now available at a price which justifies its use. The dasher scraper in freezer cans when of wood is made from sugar maple and the handle of the crank used in revolving the can is made of beech or maple.



Fig. 22. Piling staves in Ohio.

The only wooden parts of mop wringers are the rollers. They are made mainly of sugar maple, and some of beech, purchased in the form of squares 17-16 x 8 inches long. The buckets and tubs to which the wringers are attached are sometimes of metal, but mostly of wood and cypress is the wood most often demanded.

Reels for garden hose are extensively manufactured in Ohio and each year large quantities of lumber are called for in this line of manufacture. Oak, both red and white, purchased in log-run grades, furnished the principal material. Ladders, especially the sides or uprights, were made of various woods, both hard woods and soft woods. The rungs were entirely of hickory purchased in the form of squares 11-4 x 11-4, 16 to 22 inches long.

Novelties include so many different kinds of articles that it is difficult to define, and especially to draw the line separating them from woodenware. The general distinction may be made by stating that commodities entitled woodenware are strictly useful and handy around households, while novelties are more or less ornamental including advertising specialties and products turned out by variety works. Spheres made from basswood and used for geographers globes are among the products of this class in Ohio, likewise coat hangers, necktie rings, carvings, batons, gavels, flag pole tops and emblems, pen racks, etc. Usually hardwoods in expensive grades were required for this line of manufacture.

TABLE LI. Woodenware and novelties

Kind of wood	Quantit annu		Average cost per	Total cost f. o. b.	Grown in Ohio	Grown out
Kind of wood	Feet b. m.	Percent	1,000 ft.	factory	Feet b. m.	Feet b. m.
Basswood	3,914,000 506,000 500,000 450,000 370,000	55.24 7.28 7.06 6.35 5.22	\$22.69 32.65 17.00 13.34 12.38	\$ 88,810 16,595 8,500 6,000 4,580	1,454,000 256,000 500,000 450,000 350,000	2,460,000 250,000 20,000
Sugar maple	345,000 275,000 226,000 200,000 91,000	4,87 3.88 3.19 2.82 1.28	29.20 16.45 18.12 38.00 44.95	10,075 4,525 4,095 7,600 4,090	115,000 25,000	230,000 250,000 226,000 200,000 91,000
Hickory. White elm Southern white cedar. Red gum. Yellow poplar.	63,000 50,000 50,000 21,000 8,000	.89 .71 .71 .29	59.28 16.00 18 00 25.71 40.00	3,735 800 900 540 320	63,000 50,000 8,000	50,000 21,000
White oakWhite pine	5,000 2,000	.07	35.00 50.00	175 100	5,000	2,000
Total	7,076,000	100.00	\$22.82	\$161,440	3,276,000	3,800,000

REFRIGERATORS AND KITCHEN CABINETS

The products represented by Table LII include the manufacture of kitchen cabinets and cupboards and refrigerators for home use and built-in refrigerators or coolers used by butchers and others doing business requiring cold storage equipment. The combination kitchen cabinet having compartments providing a handy place for all the accessories for cooking necessary to be kept in the kitchen has in late years come into popular demand and many factories specialize in making them. Because they are sold at a low price cabinets and cupboards are made of lower grades of woods than furniture. The outside work is largely made of plain oak both white and red and to a limited extent from chestnut and hard maple. Soft maple, yellow birch and red gum enter into backs, while the shelving and drawer sides and bottoms and compartments are made from yellow poplar, basswood, sycamore, and red gum. Soft elm and cypress went into frame work.

In the manufacture of refrigerators cypress is the leading wood selected because of its durability where it is damp, and is employed for ice pans and inside lining. White pine and spruce are also used but in less quantities. Pan joists, framing, and reinforcements are of yellow poplar and white pine, while yellow poplar with shortleaf pine answers for door parts. The built-in refrigerators and cooling rooms used in hotels and business houses are made of a number of woods which accounts for the long list, shown in the following table.

TABLE LII. Refrigerators and kitchen cabinets

The both the second and method and method							
Kind of wood	Quantit		A verage cost per	Total cost f. o. b.	Grown in Ohio	Grown out	
	Feet b. m.	Percent	1,000 ft.	factory	Feet b. m.	Feet b. m.	
Red gum	1,221,000 903,000 894,987	21.21 15.68	\$23.40 27.69	\$ 28,574 25,001	435,000	1,221,000 468,000	
Yellow poplar Red oak Shortleaf pine	811,056 389,542	15.54 14.09 6.76	22.41 32.54 32.31	20,059 26,395 12,587	30,000 290,000	864,987 521,056 *389,542	
Cypress	342,000 311,209	5.94 5.40	32.93 22.22	11,262 6,916	70,000	342,000 241,209	
Birch	252,106 150,000 134,000	4.38 2.60 2.33	30.13 37.00 28.29	6,916 7,596 5,550 3,791	45,000	252 106 150 000 89,000	
Cottonwood	78,500 70,000	$\frac{1.36}{1.22}$	32.11 24.00	2,521 1,680	70,000	78,500	
Norway pine	50,000 50,000 24,000	.87 .87 .42	32.00 56.00 20.71	1,680 1,600 2,800 479	20,000	50,000 50,000 4,000	
Silver mapleLongleaf pine	24,000 20,000	.42	22.08 20.00	530 400	20,000	4,000 20,000	
Sycamore	15,000 14,500 3,000	.26 .25 .05	15.00 14.97 40.00	225 217 120	14,500	3,000	
Total	5,757,900	100.00	\$27.50	\$158,321	1,009,500	4,748,400	

CHAIRS

In Table LIII, fourteen woods are reported as entering into the production of chairs, and a total of 5,333,500 board feet is required for this purpose. Possibly it is the opinion of some that this industry should be consolidated with furniture, but in Ohio, as in other States, the manufacture of chairs is essentially a industry. The average price paid for the raw material indicates that a fairly good grade of chairs is turned out, but the products made include every kind from a cheap office stool or a kitchen chair to highly carved ecclesiastical and lodge room chairs. In comparison with the price for wood shown in the furniture table, chair makers pay \$10.74 per thousand feet more. This does not indicate, however, that better grades of lumber, comparing species with species, is used, but that the large proportion of furniture materials are cheaper woods, employed for veneer backings and other hidden work, while the expensive exterior woods being mostly thin sheets of veneer make up only a small percentage of the total and therefore do not tend to aid much in raising the average price.

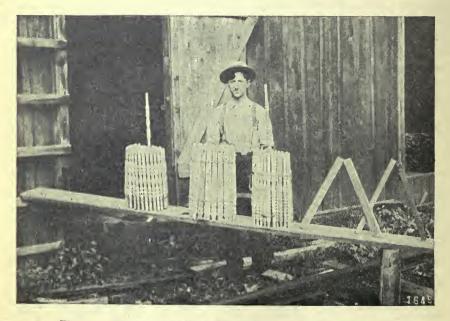


Fig. 23. Chair stock and the squares from which they are turned.

The squares were bolted from slabs.

Dimension stock is utilized in the chair industry to a greater extent than any other. A number of both the large and small sawmills and a few factories throughout the State as a side

line turn and rip thin low grades and culls into rough turned and dimension stock. Frequently small, crooked logs, tops, wind shakes, cut offs, etc., which could be worked in no other way are thus disposed of. It is interesting to notice that the chair makers report obtaining two-thirds of their stock in the State and that the waste is relatively quite small.

Chair dimensions include principally sizes for all parts of many kinds of chairs and nearly every wood is included. The sizes of the dimensions vary from seat stock and backs 4 to 61-4 inches wide down to the dowel 7-8 x 7-8 and 14 inches long. The above dimensions are seasoned before used, so the producer must take care that allowance is made for shrinkage and checking when cutting from green stock. Chair makers desire material to be straight grained, free from defects and cut accurately to the dimension, and that the squares be bundled.

Oak both red and white together are according to quantities the most important woods. The large amount of mahogany reported in comparison with the other woods indicates that it is a popular wood with the Ohio chair makers. Unlike other industries, this wood is largely bought in the form of lumber instead of veneer, and the price paid, 166.45, signifies a good grade. The red gum, which will undoubtedly come more into use, is employed in the cheaper chairs, either as imitations of the more expensive woods notably oak and mahogany, with which it can be used until it is difficult to tell the difference, or finished in its natural color to resemble Circassian walnut. The other woods listed in the table are used for various designs, basswood and yellow poplar going as seats and backs of cheap chairs or as cores for veneer work.

TABLE LIII. Chairs

Kind of wood	Quantity used annually		Average cost per	Total cost f. o, b.	Grown in Ohio	Grown out
	Feet b. m.	Percent	1,000 ft.	factory	Feet b. m.	Feet b. m.
White oak	3,180,000 510,500 339,000 337,000 315,000	59.62 9.57 6.36 6.31 5.91	\$ 34.37 27.40 26.35 166.45 33.31	\$109,223 13,976 8,932 56,100 10,492	2,180,000 162,000 238,000 170,000	1 000,000 348,500 101,000 337,000 145,000
Red gum		4.56 3.19 2.44 .75	33.06 23.24 18.92 30.00 35.50	7,305 3,950 2,460 1,200 1,420	160,000 130,000 40,000 15,000	243,000 10,000 25,000
Hickory White ash Chestnut Black walnut	14,000 12,000 2,000 1,000	.26 .22 .04 .02	28.57 30.00 22.00 70.00	400 360 44 70	14,000 12,000 1,000	2,000
Total	5 333,500	100.00	\$ 40.49	\$215,932	3,122,000	2 211,500

MACHINE CONSTRUCTION

All machinery that does not belong to electrical equipment or agricultural machinery and that requires wood for making some of its parts is grouped under a separate classification. Table LIV therefore represents parts of sawmills, steam shovels, cranes, hoists, well machinery, folding machines, dredges, attrition mills and crushers, brick presses, engine skids, etc. Nineteen species are reported and the total amount gives this industry a standing next to the groups of chair makers and ahead of ship builders and trunk manufacturers.

White oak takes the lead, furnishing 23.38 percent of the total of the woods called for. Red oak in the other industries can compare favorably with white oak as to the amount used, but here it is reported in only a minor amount. A large part of the material listed goes for construction of frames, braces, platforms, skids, etc., where great strength, toughness and durability are the important factors, and which accounts for white oak being the leading wood. The other species are listed in the table in the smaller amounts but for a variety of uses in connection with machinery of all kinds.

The available statistics are as follows:

TABLE LIV. Machine construction

Kind of wood	Quantit		A verage cost per	Total	Grown in Ohio	Grown out
	Feet b. m.	Percent	1,000 ft.	factory	Feet b. m.	Feet b. m.
White oak	1,134,000 575,000	23.38 11.85	\$36.70 16.33	\$ 41,616 9,390	874,000	260,000 575,000
Sugar maple	514,000 489,351 413,000	10.60 10.09 8.51	23.13 28.51 50.60	11,890 13,950 21,020	447,000	67,000 489,351 413,000
Beech. Norway pine	402,000 320,000	8.29 6.60	17.99 25.44	7,230 8,140	402,000	320,000
Hemlock. Yellow poplar White pine	260,000 175,000 160,000	5.36 3.61 3.30	17.50 37.71 50.63	8,140 4,550 6,600 8,100	60,000	260,000 115,000 160,000
White elm	140,000 73,500	2.89 1.51	25.28 24.01	3,539 1,765 3,350	140,000 73,500	******
Cypress Cherry Basswood	70,000 55,000 25,000	1.44 1.13 .51	47.86 38.00 26.00	2,090 650	40,000 25,000	70,000 15,000
Black ash	20,000 10,000	.41	38.00 38.00	760 380	20,000 10,000 10,000	
Hickory Butternut	10,000 5,000	.21 .10	38.00 32.00	380 160	10,000 5,000	
Total	4,850,851	100.00	\$30.01	\$145,560	2,106,500	2,744,351

CIGAR BOXES AND TOBACCO CASES

Distinct from the firms manufacturing crates and boxes, as noted under that heading, are those engaged in the cigar box industry. Ohio stands well up in the list of states engaged in this

line, consuming 4,733,186 board feet annually and requiring eight separate woods for the purpose. Florida, with Tampa and Key West as its leading cities, has long been noted for its fine cigaas, and the advantages of being near the source of supply and requiring the best wood for that class of products, enables the manufacturers to use Spanish cedar entirely. But it is radically different in Ohio and neighboring states. Here the cigar makers are satisfied with a cheaper box, because their grade of product as an average cannot afford a more expensive one. Practically all the cigar boxes made in the State are constructed of two-ply stock, a cheaper wood overlaid with Spanish cedar veneer.. Cotton gum, red gum, and yellow poplar are the principal low-priced domestic woods used for this purpose, preference being given to the gums, because the increasing high price of old yellow poplar is likely taking it out of reach. It is difficult now to find even a few mills that are turning out thin vellow poplar for cigar box material, and no doubt within the next few years this wood will practically cease to be a factor in this line of manufacture.

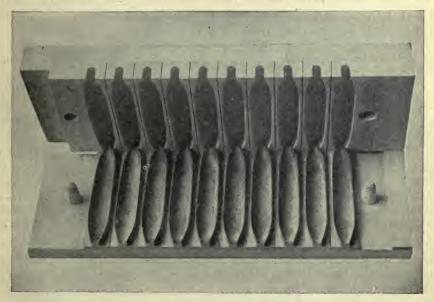


Fig. 24. Cigar mold made of poplar, beech and maple. (Statistics included under Miscellaneous.)

Tupelo or cotton gum and red gum are both admirable woods for this purpose, they work easily and with the improved methods of kiln-drying veneer there is little difficulty in their twisting and warping after manufacture. The custom of stamping these woods, so as to imitate Spanish cedar is quite prevalent and of late the improvement in this line often makes it difficult without close inspection to separate the imitation from the cedar. Care must be taken in selecting the proper wood for cigar boxes, because when the cigars are packed in tight and moist, some woods are apt to impart a taste or odor. Spanish cedar, it is claimed, gives a delicate odor to the cigar which is found in no other wood. This accounts for the fact that sometimes when other woods are employed as in two-ply stock, with Spanish cedar, the latter is put on the inside in contact with the contents.

Where the domestic woods are independently used, most often the inside of the box is covered with lithe paper advertising the name of the cigar and the maker. There is little waste in cigar box manufacture, as the ends can be made from what is left after tops, bottoms and sides are made.

For tobacco boxes like containers for plug, smoking, and chewing tobacco, sycamore and red gum are the favorites. Both of these woods are eminently suited for the purpose and in order to prevent the liquor and moisture on the inside causing them to warp, they are usually used in the form of three-ply veneer. The entire supply of these woods comes from outside the State.

Quantity used Total annually Average Grown in Grown out. cost f. o. b. Kind of wood cost per of Ohio Ohio 1,000 ft. Feet b. m. factory Feet b. m. Feet b. m. Percent \$ 78,800 31,956 59,374 20,420 3,909 1,810,000 1,798,270 477,250 246,491 199,425 1,810,000 1 798,270 477,250 246,491 199,425 38.25 37.99 10.08 \$ 43.71 17.77 124.41 82.85 Cotton gum.... Red gum..... Spanish cedar.... 5.21 4.21 Yellow poplar 19.60 White pine 1.58 1.41 1.2775,000 66,750 60,000 75,000 66,750 60,000 Sweet magnolia..... 58.05 30.00 3,875 1,800 Red cedar... Northern white cedar..... 4.733.186 100.00 \$ 42.47 \$201 034 4,733,186 Total....

TABLE LV. Cigar boxes

All cigar box lumber is bought by the superficial foot. In order to conform to the other tables of this report, it was necessary to reduce the surface feet to board measure; and by the same factor to change the price. This will perhaps make the price of the material appear somewhat high, since the cost of manufacture has not been eliminated nor any allowance made for waste. The following list will give the reader some idea of the average prices paid by cigar box manufacturers according to surface measure:

Spanish cedar	30.00
Cotton or tupelo gum	17.00
Red gum	18.00
Yellow poplar	20.00

PLUMBERS' WOODWORK

The manufacturers of plumbers' supplies report the use of 4,691,000 feet of wood for their product. White oak easily heads the list, furnishing over sixty-seven percent of the total amount. In Ohio this industry is confined entirely to the manufacture of water closet seats and tanks, and woods with considerable figure and susceptible of taking a fine finish, like those used for fixtures and furniture, are the ones reported. Naturally plain and quartered white and red oak lead the lists and are followed by others for exterior work such as ash, sweet birch, cherry, mahogany, sugar maple and black walnut. Quantities of sweet birch were demanded because better than any other wood it can be finished to imitate mahogany, while soft maple and yellow poplar answered for painted or enameled work. Chestnut and yellow poplar and red gum, principally yellow poplar, served as tank backing. Only fifteen percent of the wood used in this industry was home-grown. The greater part of the incoming lumber was shipped from the south.

TABLE LVI. Plumbers' woodwork

	IABLE L	VI. Flui	inders woo	DUWOIK		
Kind of wood	Quantity used annually		A verage cost per	Total cost f. o. b.	Grown in Ohio	Grown out
	Feet b. m.	Percent	1,000 ft.	factory	Feet b. m.	Feet b. m.
White oak. Yellow poplar. Silver maple. Birch.	3,175,000 650,000 260,000 235,000	67.58 13.84 5.53 5.00	\$ 33.15 17.31 23.46 28.91	\$105,250 11,250 6,100 6,795 2,490	350,000	2,825, 0 00 650,000 260,000 185,000
Chestnut	110,000 85,000	2.34 1.81 1.28	22.64 24.47 33.33		100,000	10,000 25,000
Sugar maple	60,000 50,000 41,000 22,000	1.07 .87 .47	30.00 51.95 143.64	2,080 2,000 1,500 2,130 3,160	50,000	10,000 50,000 31,000 22,000
Black walnut	10,000	.21	80.00	800	10,000	
Total	4,698,000	100.00	\$ 30.56	\$143,555	630,000	4,068,000

TRUNKS AND VALISES

The manufacture of trunks is one of the less important industries in this State. The trunk makers are located in the large cities, so as to be in touch with the greatest demand. Basswood, the favorite wood for trunk boxes, furnishes about three-fourths of all the material the Ohio trunk makers use. It works easily, holds its shape well, and the fact that it is quite strong for its weight more than any other quality enhances its value for this line of manufacture. It is very white but inasmuch as little, if any, of the wood is visible in the finished product, being covered with leather, cloth or metal, the figure or color of it is not essential. Veneers are now

largely employed in this industry for the better grades of trunks and are growing in favor. They are used three or four ply, securing strength in many cases great enough to do away with slats and at the same time reducing the weight below that of solid lumber. The trunk manufacturer does not buy veneer and make the panels. He buys them already glued together and when lumber is used it is purchased already resawed to proper thickness.

White elm and white and black ash are utilized for slats because they are strong, will resist abrasion and add stiffness and protection to the box so that it will stand hard knocks. For the trays and inside compartments a light wood is required, and basswood, cottonwood, and yellow poplar were the ones called for. Birch and mahogany in small quantities only find service for the exposed parts of wardrobe trunks which are used as an article of furniture when not in transit.

	TABLE	LVII. IT	unks and	valises		
Kind of wood	Quantity used annually		A verage cost per	Total cost f. o. b.	Grown in Ohio	Grown out
Kind of wood	Feet b. m.	Percent	1,000 ft.	factory	Feet b. m.	Feet b. m.
Basswood. White elm. Shortleaf pine. Chestnut. White ash.	3,038,340 760,000 200,000 100,000 23,000	73.26 18.33 4.82 2.41 .56	\$ 24.73 23.91 30.00 35.00 34.35	\$ 75,149 18,175 6,000 3,500 790	18,000 310,000 100,000 23,000	3,020,340 450,000 200,000
Cottonwood. Yellow poplar. Red gum. Birch. Hickory	10,000 10,000 3,500 1,500 500	.24 .24 .08 .04	32.00 32.00 34.86 114.67 26.00	320 320 122 172 13	10,000	10,000 3,500 1,500
Mahogany	500	.01	150.00	75		•••••
Total	4,147,340	100.00	\$ 25.23	\$104,636	461,500	3,685,840

TABLE LVII. Trunks and valises

LAUNDRY APPLIANCES

Ten woods, aggregating 6,271,000 feet are reported for the manufacture of washing machines and washboards. None of the other laundry accessories were found being made in Ohio. The largest portion of the material required was for washing machines going into both the kinds used for domestic purposes and those forming the important part of steam laundry equipment. The most modern domestic machines are propelled by electric power, purchasable with a small motor attached and ready to connect with any electric light socket convenient. But those propelled by hand costing less are manufactured in the greatest numbers. Washing machines are of various designs and shapes, some in box form, some are made with staves like a wash tub and conical shape, and others are cylindrical. The last named are the design of those

used in laundries, and of late in their manufacture metal has begun to replace wood. All washers are lined with a corrugated surface called rubs. Though these are often made of wood, glass and metal are sometimes used. Cypress and cottonwood are considered best adapted for this purpose. More than any other wood cypress answers for the washing machine bodies because it is less liable to warp in situations of alternating moisture and dryness, Clothes are turned over in the washers by beaters or agitators that are made of some strong hardwood, usually beech or maple. For the supports or legs, cottonwood, cypress and longleaf pine served.

For washboards the manufacturers require woods that are white or light in color suitable for stenciling the upper part called print boards. Basswood, cottonwood and yellow poplar met this use in Ohio, and went also for the top pieces. The sides or posts and backs were made from beech and cottonwood. The rubbing surface was at one time made of wood, but now metal or glass has entirely taken its place. For the grooved pieces holding the rubs, beech supplied the demand.

TABLE LVIII. Laundry appliances

Kind of wood	Quantity used annually		Average cost per	Total cost f. o. b.	Grown in	Grown out
	Feet b. m.	Percent	1,000 ft.	factory	Ohio Feet b. m.	Feet b. m.
Cypress. Longleaf pine. Sugar maple. White oak. Douglas fir.	3,084,000 275,000 220,000 135,000 102,000	77.08 6.87 5.50 3.37 2.55	\$28.78 30.00 29.54 36.67 35.00	\$ 88,760 8,250 6,500 4,950 3,570	10,000	3,084,000 275,000 210,000 135,000 102,000
Red oak	75,000 40,000 30,000 20,000 20,000	1.88 1.00 .75 .50	30 00 25.00 24.00 28.00 22.00	2,250 1,000 720 560 440	20,000 15,000 10,000 10,000	75,000 20,000 15,000 10,000 10,000
rotal	4,001,000	100.00	\$29.24	\$117,000	65,000	3,936,000

SHIP AND BOAT BUILDING

Ohio, with its many miles of lake frontage on the north, and along the Ohio River on the south, strange to say requires relatively little lumber for boat building. Although there are large ship yards at the main harbors on the lake, very little wood enters into the construction of lake steamers, steel having almost entirely replaced wood. The boats along the Ohio River are largely built of wood, but the demand for lumber in Ohio, except for repair work, is very light. It can well be said that with the exception of a small amount of material for canvass skiffs, launches and sail boats, the principal wood consumption is for cabin and deck work on the lake boats, and for tugs, barges and scows for river transportation.

At one time Ohio relied mainly on its waterways for transportation. Before the railroads traversed the State north and south, which was long after lines running east and west had been in operation, there were two canals, one running from Toledo to Cincinnati in the western part of the State, and the other connecting the river and lake in the eastern part. These two canals established direct water transportation from the Great Lakes to all points on the Ohio and Mississippi Rivers. During that period the occupation of boat building in the number of establishments and the amount of wood used was one of the important enterprises in the State; and although navigation is not so active now as formerly a few establishments remain along the Ohio River that are still important industries and are in active operation.

Table LIX shows 22 woods were employed to meet the demands of the boat builders. The long list is due to the large number of uses they serve, which often requires wood of special qualities and and in some cases of extra long dimensions. White oak leads the list and furnished over one-quarter of the total. A major portion of the boat material went for building steam packets, barges and other river crafts. For the framework of hulls, such as keelsons, keels, keel blocks, rails and head logs, besides guards, carlings, and bulkheads, white oak, yellow pine and Douglas fir furnished the material. The latter was employed principally for keelsons in large boats where long lengths were necessary, combined with strength and stiffness and for which longleaf yellow pine and white oak in sufficient lengths were difficult and probably too expensive to secure. For certain barges the keelsons are ordered unspliced and as much as 60-foot timbers were required.

Sugar maple is employed for deck flooring because it is hard and close-grained and also it can be holly-stoned and made to appear whiter than almost any other domestic wood. White pine was the principal siding wood for large boats and it also served with yellow pine, Douglas fir, white oak, and yellow poplar for parts of the superstructure and decking. Yellow poplar and oak were the principal woods for the interior finish of cabins, the former for painted work and the latter in the natural finish. Cypress is not as important a species for ship building in Ohio as in other states. It went principally for boat boards in motor boats and skiffs. Hickory's only demand was for fenders and spuds, while locust was called on owing to its strengh and durable qualities for kevels, bits, tree nails and tillers of sail boats. Red cedar, southern white cedar from Virginia commonly known as juniper, and white cedar or arborvitae from Wisconsin, were purchased for canoe and skiff siding and in this

respect served with spruce. Oak and mahogany met the demand for trim, guards and rails of canoes. In canvas folding boats the framework was of white ash, the floors of cypress and spruce. Cherry and mahogany were reported for pilot wheels and white ash and spruce were used for boat oars and canoe paddles.

TABLE LIX. Ship and boat building

Kind of wood	Quantity used annually		A verage cost per	Total cost f. o. b.	Grown in Ohio	Grown out
Itilia of wood	Feet b. m.	Percent	1,000 ft.	factory	Feet b. m.	Feet b. m.
White oak Douglas fir. White pine. Western red cedar. Longleaf pine.	1 012,000 431,000 344,000 235,000 229,500	30.46 12.97 10.35 7.07 6.91	\$ 40.10 36.43 40.06 27.45 34.49	\$ 40,648 15,703 13,780 6,450 7,916	88,000	924,000 431,000 344,000 235,000 229,500
White ash	203,000 166,000 150,000 100,000 100,000	6.11 5.00 4.51 3.01 3.01	35.22 36.02 40.00 30.00 30.00	7,150 5,980 6,000 3,000 3,000	203,000 2,000	164,000 150,000 100,000 100,000
Beech	51,500 51,000 50,500 49,660 49,000	1.55 1.54 1.52 1.49 1.48	20.29 99.71 45.25 38.68 108.16	1,045 5,085 2,285 1,921 5,300	1,500	50,000 51,000 40,500 49,660 49,000
Cypress. Cherry. Shortleaf pine. Sugar maple. Locust.	41,000 26,000 18,000 10,000 2,000	1.23 .78 .54 .30 .06	57.32 88.46 27.00 30.00 40.00	2,350 2 300 486 300 80	1,000 10,000 1,000	41,000 25,000 18,000
Hickory Spanish cedar	2,000 ° 1,500 °	.06	37.50 95.33	75 143	1,000	1,000 1,500
Total	3,322,660	100.00	\$ 39.43	\$130,997	317,500	3 005,160

FRAMES AND MOLDINGS

In segregating the industries care was taken not to include under this table the woods employed in the manufacture of house moldings as turned out by planing mills, so this industry deals entirely with the manufacture of moldings for picture frames, highly carved moldings for high grade cabinet work, show cases, etc. The fourteen woods included in the list in the following table, representing a total of 2,809,961 board feet, were carefully selected by the manufacturer for special purposes, depending upon the desirability of the wood; and the average price paid per thousand feet, \$42.01, indicates that the best grades of lumber are desired and that cheapness is not one of the prime considerations. The lowest average price paid was for yellow poplar and chestnut, and the highest, \$115.02, for mahogany strips, which, strange to say, is the only foreign wood reported. With the advanced methods of kiln drving lumber, red gum formerly unheard of in this line of manufacture is now a satisfactory material and leads the list according to amounts.

When finished in its natural color red gum has a beautiful appearance, but it also takes stain well and a large part of it is finished to imitate mahogany, oak or walnut. For gilt and burnished gold finish and other enameled moldings yellow poplar and basswood are employed because of their quality to hold paint and retain their shape. Buckeye also was used for this purpose. White and red oak, ash and chestnut were as a rule finished in the natural color with oils and varnish. Birch, like red gum, goes into imitation mahogany unless it has a burly or mottled figure, when it goes into the natural finish.

TABLE LX. Frames and molding

	Quantity		Average	Total	Grown in	Grown out
Kind of wood	Feet b. m.	Percent	cost per 1,000 ft.	cost f. o. b.	Ohio Feet b. m.	of Ohio Feet b. m.
Red gumBasswood. White oak. Yellow poplar. Buckeye.	1,005,000 572,200 389,325 271,251 214,000	35.77 20.36 13.86 9.65 7.62	\$40.15 35.72 49.05 34.47 35.61	\$ 40,350 20,441 19,098 9,350 7,620	50,000 131,000 214,000	1,005,000 . 522,200 258,325 271,251
Red oak. Birch Shortleaf pine Chestnut Mahogany.	158,000 105,200 50,000 23,400 10,250	5.62 3.74 1.78 .83 .36	49.25 87.64 30.00 41.03 115.02	7,782 9,220 1,500 960 1,179	•••••	158,000 105,200 50,000 23,400 10,250
White ash Black walnut Beech. Sugar maple	9,100 1,390 595 250	.33 .05 .02 .01	47.58 38.80 30.25 36.00	433 97 18 9	1,100 1,390 250	8,000 595
Total	2,809,961	100.00	\$42.01	\$118,057	397,740	2,412,221

BRUSHES

Of the 2,383,694 feet of wood utilized for brush blocks, beech constitutes much the larger part, the percentage being 88.38 of the whole. Being perhaps the cheapest hardwood, it is admirably suited for this purpose because it bores well without splitting, is strong, and does not check or warp easily, besides, being light in color, it bears a pleasing appearance. Maple is equally as suitable and in quantity follows beech but it is higher priced. Very little of the woods reported were obtained in Ohio. The principal supplies came from Michigan and Pennsylvania. This industry is confined mainly to the production of cheap brush blocks, such as are used for making scrubbing, dustpan, feather dusters, stable and street brushes, also whitewash or kalsomining, and small brushes for cleansing the hands and nails. No high priced woods were reported, such as holly, ebony, mahogany or dogwood, which are used elsewhere

for hair brushes, hat and jewelry brushes, but those demanded other than beech and maple were white oak, yellow poplar, cypress, sycamore, hickory and elm used as follows:

TABLE LXI. Brushes

Wind of wood	Quantity used annually		Average cost per	Total cost f. o. b.	Grown in	Grown out
Kind of wood	Feet b. m.	Percent	1,000 ft.	factory	Ohio Feet b. m.	Feet b. m.
Beech Sugar maple White oak White elm Cypress.	2,383,694 80,417 75,000 65,000 30,000	88.38 2.99 2.78 2.41 1.11	\$18.02 28.46 25.00 30.00 60.00	\$42,960 2,289 1,875 1,950 1,800	12,000 75,000 75,000	2,371,694 5,417 65,000 30,000
Hickory Yellow poplar Sycamore	30,000 30,000 3,000	1.11 1.11 .11	50.00 40.00 16.00	1,500 1,200 48	15,000 30,000	15,000 30,000
Total	2,697,111	100.00	\$19.88	\$53,622	180,000	2,517,111

PUMPS

The substitution of galvanized and metal pumps for wooden ones has reduced the demand for wood to only a small portion of what formerly was used in this line of manufacturing. The kinds of pumps manufactured are well, cistern and barrel pumps. woods were called for in their making, yellow poplar supplying more than one-half or 59.65 percent. This is one of the few woods that is suitable for the liquor logs. Cucumber, similar to it, is probably most largely used, but not reported in Ohio. The compact fibre of these woods, the straight grain, and their quality of softness enable them to be bored easily, and not being as heavy as other woods are more desirable when hung in place in the well. For barrel pumps poplar was the only material reported, but its exact use was not mentioned. Shortleaf pine, cypress and white pine were made into pump boxes for chain and bucket pumps. For well pump stocks, cotton gum or tupelo was the principal wood and for pump poles, longleaf pine. Pump handles made from hickory, ash and maple have been referred to under the handle industry.

TABLE LXII. Pumps

Kind of wood	Quantity used annually		Average	Total cost	Grown in	Grown out
Yellow poplar	988,000 323,230 300,000 40,000 5,600	59.65 19.52 18.11 2.42 .30	\$48.86 21.29 40.00 22.50 40.00 \$41.21	\$48,274 6,882 12,000 200 \$68,256	Ohio Feet b. m. 10,000	978,000 323,230 300,000 40,000 5,000

PLAYGROUND EQUIPMENT

Lawn and porch swings are the only products listed under this heading. Four woods are reported at an average cost lower than in any industry table of this report. The oaks, both red and white, furnish over three-fourths of the wood because their inherent qualities of strength, hardness and durability when exposed fit them for this line of manufacture. White elm is usually used for the bent parts and beech in small amounts for the bottoms or platforms of lawn swings.

TABLE LXIII. Equipment, playground

			1 / 1	7.0		
Kind of wood	Quantity used annually		Average cost per	Total cost	Grown in Ohio	Grown out
Kind of wood	Feet b. m.	Percent	1,000 ft.	factory	Feet b. m.	Feet b. m.
White oak	600,000 500,000 250,000 100,000	41.38 34.48 17.24 6.90	\$15.00 13.00 18.80 20.00	\$9,000 6,500 4,700 2,000	100,000 125,000 100,000	500,000 500,000 125,000
Total	1,450 000	100.00	\$15.31	\$22,200	325,000	1,125,000

PATTERNS AND FLASKS

Table LXIV represents the lumber required by foundries for castings. Flasks, templets and patterns indicate the uses to which this material is put. Foundry flasks are rough boxes or frames holding the molded sand into which the hot liquid metal is poured. It would be naturally expected that this lumber should be as fire resisting as possible, but in Ohio the foundrymen apparently lay little attention to this detail. The table shows that a variety of woods, usually those to be gotten near at hand are the kinds employed, with the result that the hot metal heats the sand to a temperature where the wood blazes. Notwithstanding the fact that water is dashed on the blaze as soon as it is discovered, owing to frequent firing the flask is soon made unfit for use, thereby requiring the foundrymen to consume quite a large amount of wood for this purpose. If the flask material could be treated or coated with a fire proofing chemical, or if the wood used were redwood, which is the most difficult of all domestic woods to ignite, the additional cost would doubtless prove an economy. White pine is used in larger quantities in Ohio than any other wood for flask material and it serves with shortleaf pine, longleaf pine, hemlock, elm and silver maple.

For patterns white pine is probably superior to any other wood. Its suitability is due to its being more easily worked, close-grained with obscure figure, and not liable to warp or shrink. The increasing cost of this wood, especially in the upper grades and for wide

stock, usually desired for patterns, long ago created a demand for a substitute, but so far none have been found thoroughly practical. It is quite surprising to note the small quantity of western white pine called on for patterns, that is the true white pine cut in the Rocky Mountain states, and the large amount of sugar pine used which in most of its qualities closely resembles the white pine. When durable patterns are required to stand the wear, like those tha tare used over and over again, a harder wood than white pine, not liable to warp or check, is adopted. Mahogany, cherry and butternut are the most widely used. When this kind of pattern is quite large, the entire pattern is not made of the expensive wood, only the outside, the filler being of a cheaper wood like white pine, yellow poplar, basswood or red gum. Sugar maple in many of its qualities is a suitable hardwood, but owing to its tendency to shrink and curl its use is limited to only small quantities.

The material upon which the pattern rests before being removed from the flasks is called templets. Like the flasks, lower grades of lumber are required for these than are used for patterns, and in Ohio white pine and yellow poplar answer for this purpose.

Quantity used annually Average Total cost Grown in Grown out Kind of wood cost per 1,000 ft. f. o. b. Ohio of Ohio Feet b. m. Feet b. m. factory Feet b. m. Percent 1,024,700 90,000 90,000 75,000 55,000 999,700 90,000 90,000 75,000 55,000 69.74 6.13 6.13 5.10 3.74\$ 56.37 61.64 35.00 29.00 \$57,761 5,550 3,150 2,175 25,000 White pine Sugar pine Yellow poplar Shortleaf pine 24.54 Longleaf pine 1,350 30,500 30,000 25,000 16,000 15,000 21.31 22.00 20.002.08 650 30,000 30,000 Sugar maple 2.04 Hemlock.... 660 25,000 13,000 Whiteelm $\frac{1.70}{1.09}$ 500 3,000 15,000 Butternut.... 794 49.63 Mahogany.... 2,120 1.02 141.34 10,000 3,000 2,000 10,000 5,000 2,000 1,000 $\begin{array}{c} 35.00 \\ 74.00 \\ 85.00 \end{array}$ $.68 \\ .34$ $\frac{350}{352}$ Basswood..... 2,000 Cherry..... Silver maple..... 170 1.000 Red gum..... .07 45.00 1,469,200 100.00 .\$51.47 \$75,627 108,000 1,361,200 Total....

TABLE LXIV. Patterns and flasks

PULLEYS AND CONVEYORS

Belt pulleys have a number of parts, but only two woods, yellow poplar and sugar maple, were called on to supply the material. The former answered for the rim pieces and the latter for hubs and braces. The rope pulley is a one-piece product, and hard maple and beech, the first in larger quantities, were the woods reported. In grain and other conveyor apparatus the rollers or pulleys were of red gum and ash and the numerous other parts accounted for the rest of the woods listed in Table LXV.

	Quantity used annually		Average	Total cost	Grown in	Grown out
Kind of wood	Feet b. m.	m. Percent cost per f. o. b. Ohio factory Feet b. n	Feet b. m.	Feet b. m.		
Yellow poplar	255,000 100,000	31.37 28.57 11.21 11.21 8.96	\$22.71 23.31 20.00 33.00 30.00	\$6,360 5,945 2,000 3,300 2,400	100,000	280,000 155,000 100,000 80,000
White pine		3.92 2.52 2.24	35.00 14.93 30.00	1,225 336 600	22,500 20,000	35,000
Total	892,500	100.00	\$24.84	\$22,166	242,500	650,000

TABLE LXV. Pulleys and conveyors

SPORTING GOODS

The shafts of golf sticks and pool and billiard tables are the only commodities made in Ohio that come under the classification of sporting goods. Resiliency, shock resisting quality and strength are the prime considerations for the golf stick material and hickory having them combined to a greater degree than any other wood was the only one demanded by the Ohio manufacturers. Rough squares 1x1 inch x 36 to 44 inch was the form in which the material was purchased. The heads of driving clubs used in playing golf are made of wood, principally persimmon and to a less extent of dogwood. These heads are manufactured at mills in other States who make a specialty of them and brought to Ohio manufactured and ready to be assembled.

Billiard and pool tables are made of a variety of woods. The frames are of yellow poplar and chestnut. The latter is probably more of a favorite in that it combines the qualities of moderate strength, light weight, cheapness and a special affinity for glue. The finish is usually veneer, quarter-sawed oak, birch, mahogany and other expensive cabinet woods. The rail to which the rubber cushions are attached is subjected to great strain and therefore should be a wood that holds its shape well and that has remarkable strength. Ash excellently fulfills these conditions and was the only material called for. The massive legs of billiard tables, like piano legs, are largely red oak, owing to the strength of the wood and its suitability as a backing for veneer.

TABLE LXVI. Sporting and athletic goods

Kind of wood	Quantity annua		A verage cost per	Total cost f. o. b. factory	Grown in Ohio Feet b. m.	Grown out
Kind of wood	Feet b. m.	Percent	1,000 ft.			Feet b. m.
Hickory Chestnut White oak Yellow poplar Red oak.	511,000 80,000 80,000 80,000 30,000	63.01 9.86 9.86 9.86 3.70	\$81.14 27.75 67.81 22.63 40.00	\$41,465 2,220 5,425 1,810 1,200	55,000	456,000 80,000 80,000 80,000 30,000
White ash	20,000 10,000	2.47 1.24	36.00 100.00	720 1,000	•••••	20,000 10,000
Total	811,000	100.00	\$66.39	\$53,840	55,000	756,000

INSTRUMENTS, PROFESSIONAL AND SCIENTIFIC

Besides tables and the straight-edge rulers used by draftsmen the other products manufactured by the factories considered under this heading are confined principally to tools used by carpenters, paper hangers, tinners and foundrymen. Eight woods were reported, totaling 604,000 board feet. Basswood was listed in the greatest amount, and was employed largely for the manufacture of tops of drawing tables, and paste boards for paper hangers. The trestle parts or the collapsible stands upon which these boards rest were made of sugar maple and Douglas fir, the latter shipped from Wyoming. Hickory and applewood were turned into mallets for tinners and foundrymen, including the handles. The mallet material was obtained in rough squares 3x3 inch or 4x4 inch, random lengths. Beech, on account of its close grain and its susceptibility to wear smooth, went into plane stocks. It served with applewood employed only in small amounts. The latter was reported in no other industry of this report. Carpenters' hand screws called for sugar maple and hickory, the former for the jaws and the latter for the screws or spindles, while bench screws for carpenters' vises were made of sugar maple. It will be of interest to notice that two of the eight woods listed in Table LXVII were brought from the Pacific coast, redwood and sugar pine. They were selected and used in this industry for making straight edges, because they do. not warp or twist and are easy to work.

TABLE LXVII. Instruments, professional and scientific

Kind of wood	Quantit annu		Average cost per	Total cost f. o. b. factory	Grown in	Grown out
And of wood	Feet b. m.	Percent	1,000 ft.		Feet b. m.	Feet b. m.
Basswood		24.83 21.52 20.70 16.56 4.97	\$39.00 27.23 32.80 22.00 40.00	\$5,850 3,540 4,100 2,200 1,200	50,000 110,000 75,000	150,000 80,000 15,000 25,000 30,000
RedwoodApplewoodSugar pine	30,000 24,000 15,000	4.97 3.97 2.48	38.00 20.00 60.00	1,740 480 900	24,000	30,000 15,000
Total	604,000	100.00	\$33.14	\$20,010	259,000	345,000

ELEVATORS

Next to the last in the list of industries, from the standpoint of lumber used, are elevators. The manufacturers report 583,000 board feet, six woods representing the amount. Steel to so large an extent has replaced wood in elevator construction that wood is not an important factor compared to what it used to be. It is an exception today to see the old time wooden elevator car in operation. The woods the Ohio manufacturers demand go into dumb waiters, hand elevators and the wooden parts of power elevators, both passenger and freight. Longleaf pine answers principally for guides, hard maple for the platforms and tracks, shortleaf pine for the gates, and white oak and maple for bottoms or flooring. One-fifth of the wood reported was obtained in the State.

TABLE LXVIII. Elevators

Kind of wood	Quantity annua		Average	Total cost	Grown in	Grown out
Kind of wood	Feet b. m. Percent cost per 1,000 ft. facto	factory	Feet b. m.	Feet b. m.		
Longleaf pine. Sugar maple	$\begin{array}{c} 264,000 \\ 250,000 \\ 30,000 \\ 24,000 \\ 15,000 \\ 5,000 \end{array}$	44.90 42.52 5.10 4.08 2.55 .85	\$19.68 30.00 25.00 37.08 32.67 30.00	\$5,196 7,500 750 890 490 150	50,000 30,000 24,000 5,000 5,000	264,000 200,000 10,000
Total	588,000	100.00	\$25.47	\$14,976	114,000	474,000

SADDLES AND HARNESS

Stirrups are the principal commodity included in the table under this heading. Elm, red and white oak, basswood and hackberry were the woods furnishing the raw material, purchased in form of bolts. Elm was the favorite as to quantity, but red, white and bur oak were used for the better grades of stirrups. Basswood served principally for the upper part called the head or neck blocks while hackberry went for stirrups of boys' and for cheaper grades of men's saddles. Hames were the only product reported to be included in this classification. About 350 M feet of material is annually demanded, purchased in squares the size of which were $2\frac{1}{2} \times 2\frac{1}{2} \times 30$ and $2\frac{3}{4} \times 2\frac{3}{4} \times 32$. In Ohio as in other states ash is the most popular hame wood. Other species contributing were beech, sugar maple and white oak.

TA	BLE	LXIX.	Saddles	and	harness
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	Quantit annua		Average	Total cost	Grown in	Grown out
Kind of wood	Feet b. m.	Percent	cost per 1,000 ft.	factory	Ohio Feet b. m.	Feet b. m.
Cork elm Beech. Red oak. Black ash. White ash.	160,000 90,000 61,000 60,000 50,000	28.83 16.22 10.99 10.81 9.01	\$22.50 30.00 18.15 50.00 30.00	\$3,600 2,700 1,107 3,000 1,500	70,000 51,000 30,000	160,000 20,000 10,000 60,000 20,000
Basswood Sugar maple White oak Hackberry White elm	41,000 30,000 26,000 25,000 12,000	7.39 5.41 4.68 4.50 2.16	22.80 30.00 33.92 20.00 22.00	935 900 882 500 264	34,000 20,000 16,000 25,000 12,000	7,000 10,000 10,000
Total	555,000	100.00	\$27.73	\$15,388	258,000	297,000



Fig. 25. Evolution of the shoe last. Rough block partly turned and finished product.

MISCELLANEOUS

When collecting the data for this report the Forest Service assured the Ohio manufacturers that in the compilations, information of individual concerns would not be revealed. To make this rule effective when there were less than three manufacturers making the same or similar commodities, they were not grouped into a separate industry as was the case when there were three or more. Instead of discarding the data in these cases the reports were grouped indiscriminately under a general heading. "Miscellaneous" and Table LXX following presents these statistics.

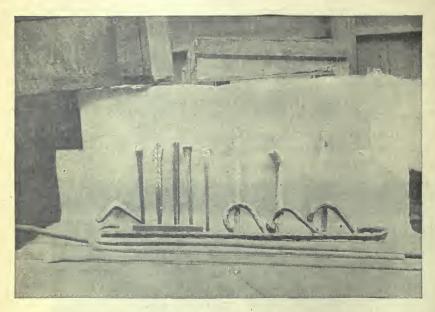


Fig. 26. Showing the raw material and the products of an umbrella handle and cane factory.

Artificial limb manufacturers used only one wood, willow, and the entire supply was cut outside the State. Umbrella racks made mostly of metal have wooden frames; ash and white oak supplied the material. Hard maple answered for looms of silk and textile mills, the sapwood of red gum for curtain poles and black walnut for gun stocks. The making of coffee mills required yellow poplar and red gum, and money drawers, yellow poplar and white oak, the former for the inside compartments, and the latter for the exterior. In the breweries to clarify and filter beer, chips cut from beech are frequently employed and are called brewers' shavings. The manufacture of these in Ohio is not a large industry but is worthy of mention.

On the other hand, the making of cigar molds, cigar makers' boards and presses is quite an extensive line of manufacturing in the quantity of wood reported. The molds are made of yellow poplar, basswood, maple and beech, while for presses and cigar boards, high grade hard maple alone supplied the demand. A large amount of wood in Ohio is converted annually into shoe lasts, trees and forms. The two former were practically all made from sugar maple and high grades were used, for the latter basswood and to a small extent yellow poplar met the demand. The only other product to be mentioned is farm gates made from red and white oak.

TABLE LXX. Miscellaneous.

THE DAM. MISCHAROUS.								
	Quantity annua		Average,	Total cost	Grown in	Grown out		
Kind of wood	Feet b. m.	Percent	1,000 ft.	factory	Ohio Feet b. m.	of Ohio Feet b. m.		
Yellow poplar	2,135,000 1,608,000 950,000 630,000 610,000	27.55 20.75 12.26 8.13 7.87	\$21.53 33.41 25.16 24.13 51.43	\$45,975 53,725 23,900 15,200 31,375	1,500,000 1,508,000 850,000 250,000 100,000	635,000 100,000 100,000 380,000 510,000		
Black walnut	350,000 350,000 318,000 265,000 222,000	4.52 4.52 4.11 3.42 2.86	134.29 18.00, 19.00 20.83 14.28	47,000 6,300 6,049 5,520 3,180	350,000 350,000 103,350 2,000	215,000 265,000 220,000		
Sycamore. BuckeyeShortleaf pine Willow. Redwood.	150,000 75,000 50,000 20,000 16,000	1.93 .97 .64 .26 .21	18.00 21.00 23.50 125.00 54.00	2,700 1,575 1,175 2,500 864	7,000	75,000 50,000 13,000 16,000		
'Total	7,749,350	100.00	\$31.88	\$247,028	5,170,350	2,579,000		

USES OF WOOD IN OHIO

ARBORVITAE (WHITE CEDAR)

Boat parts (row) Boxes Crating

Canoes Oars Pails

Siding (motor boats) Shingles

APPLEWOOD

Mallets

Planes

BALM OF GILEAD

Crating Boxes

BASSWOOD

Agricultural implements (hullers) Desks (school) Drawer bottoms Apparatus parts (electric) Fans (electric) Backings (furniture) Feed mills Backs (organ) File cases Baseboards Baskets (fruit and vegetable)

Bellows (organ) Bookcases (inside work) Boxes

Breadboards Bureaus (inside work) Cabinets (kitchen) Candy pails Car construction Car repairing Casings (building) China closets (interior work) Church pews

Circus seats Cigar boxes Cleats (organ) Clothes bars Commodes Coops (poultry) Cornice Corn shellers Couches (box)

Crating

Cupboards

Fixtures (bar)
Fixtures (barber shop)
Fixtures (store and office) Flag poles Frames (couches)
Frames (davenports)
Frames (hand mirror) Frames (lounges) Furniture (church)
Furniture (interior) Gameboards Games of chance Go-carts

Grain separators (agricultural implements)

Guitars Handles Hayloader parts Hoppers (fruit and vegetable) Incubators (bodies) Ironing boards Interior finish (building)

Ladders (extension) Laundry machinery Lodge furniture Machinery construction Millwork Moldings (casket)

Music cabinets (interior) Organ cases (folding organ) Organ frames Parlor furniture (frames) Patterns Pasteboards

Picture molding Pipe organs (interior parts) Refrigerators Sample cases

Seeder boxes (farm implements) Sheathing (building) Siding (house) Signboards

Staves Stirrups (head blocks) Stirrups (neck blocks) Swing seats

Tables Threshing machines Toys Trunks Vehicle bodies

Veneer cases (piano) Washboards Washing machines

Planing mill products

Rockers (chair) Seeders (farm implements) Sideboards (interior)

Singletrees (farm implements)

Neck yokes (farm implements) Neck yokes (wagon)

Interior finish

Piano chairs Piano stools

Press parts

Rat traps

Sills

Skids

Toys

BEECH

Agricultural implements (parts) Cider mills Backs (washboard) Churns Basket parts Beds (folding) Boats Barges Bookcases (interior) Boxes Box shooks Bottoms (pails) Braces Brush backs Brush blocks Candy pails Car repairing Chairs (rockers) Chair stock

Crating Drills (farm implements) Ensilage cutters Feed cutters Fixtures (office) Furniture (interior work) Frames (grindstone) Hames (wood) Handles Handles (barrow) Handles (broom) Handles (lawn mower) Handles (machinery) Handles (wrench)

BIRD'S EYE MAPLE

Seats (water closets)
Tanks (water closets)

Furniture

Heading

Trunks Fixtures

BLACK ASH

Agricultural implements
Automobile frames Box shooks Car repairing Colonial columns Churns Furniture (interior)
Furniture (exterior)

Handles (garden tools) Handles (small tools) Hayloader parts Mirrors Piano tops Plane bodies Rims (truck) Refrigerators

Sides (washboards) Sills (vehicle) Singletrees Trunk slat Vehicle bodie Wagon cleas Wheelbarrows Wheels

BLACK LOCUST

Boat parts Wagon hubs

BUCKEYE

Crating

Picture molding

BUTTERNUT

Fixtures (store and office)

Fixtures Lodge furniture Machinery construction Patterns Piano cases

Signboards

Altars (church) Cabinet work Church furniture

CHERRY

Brick molds Cabin parts Cabinet work Car repairing Car construction (interior finish) Fixtures (bar)
Fixtures (display windows)
Fixtures (store and office)

Flooring Furniture Furniture (church) Interior finish Lodge furniture Machinery construction Motor boats (deck trimmings) Organs (cabinet)

Organs (pipe) Patterns

Furniture

Piano cases

Piano parts

Trunk trays

Piano veneer

Panels (veneer)

Picture moldings

Sideboards (built in)

Mantels

Piano parts Picture moldings Pilot wheels Planing mill products Seats (water closets) Tanks (water closets)

Panel cores (veneer doors)

Tables (parlor)
Wind shields (automobile)

Agricultural implements (parts) Backs (piano) Barber furniture Bar fixtures Boxes Box shooks Car construction (backing) Car repairing Case recorders (physicians)

Cases (veneer)

Cabinet work Car repairing Furniture

Cornice

Agricultural implements Backs (washboards) Baskets Baskets
Berry boxes
Bevel siding
Bookcases (inside work)
Boxboards (heavy vehicles) Boxes Boxes (manure spreaders) Box shooks Buggy backs Car construction (rafters) Car repairing parts Carts China closets Clothboards Commodes Corn binder parts Corn shellers

Cash registers Casings Caskets Crating Doors Drawer sides Feed cutter tables Fixtures (bank)
Fixtures (barber shop) Frames (upholstered furniture)

CHESTNUT

CIRCASSIAN WALNUT

Fixtures Parlor rockers Piano cases

COTTONWOOD

Cultivator parts Cupboards (kitchen) Crating Drawers Drill boxes (farm implements) Drills (farm implements) Dropsiding Egg cases Egg cases
Ensilage cutters
Eveners (harrow)
Fixtures (bar)
Fixtures (store and office) Fodder shredders Frames (canopy) Furniture (inside work) Interior trimmings Ironing-boards Kitchen cabinets

Music cabinets (inside work)
Packages (fruit and vegetable)
Panels (light vehicle bodies)
Panels (spring wagon bodies) Piano cases (veneer cases) Samples cases Seeders, boxes (farm implements) Self-feeders (threshing machines) Separator sides (threshers) Shelving Shipping cases (butter) Siding (washboards) Stacker parts (farm machinery)

Tables Trunks Vehicle bodies Vehicle seat backs Wheelbarrows

CUCUMBER

Manure spreaders (beds)

Millwork

Agricultural implements (parts) Staves (pail) Crates (fruit and vegetable)

CYPRESS

Altars Baseboards Boat floors Boat parts (sail) Rlinds Cabinet work (unexposed) Carvings Caskets Cisterns Colonades Columns (porches) Cornice Door frames Doors Drawer bottoms

Drawers (ends and sides) Electric cars (interior trimmings) Planing mill products

Finish (boats) Fixtures (banks)
Fixtures (soda fountain)
Fixtures (store and office) Flooring Frames Frames (window tents) Hay baler parts Ice pans Incubator parts Lodge furniture Mantels Millwork Motor boats Pails Panels (delivery wagon)

Exterior trimmings

Doors

Porch work Pumps Refrigerators Sash Siding (heavy vehicle bodies) Silos Skiffs Stairwork Store fronts Tanks Threshing machine parts Turnings Washing machines Window frames Window screens

DONCELLA

Sash frames (automobiles)

DOUGLAS FIR

Agricultural machinery Beats Barges Car construction Collenns (porches) Doc frames Döbrs

Frames (machinery parts)
Frames (outside trimmings;) Interior finish Ladders (extension) Machinery construction Millwork Organ bellows Organ pipes

Proof work Refrigerators Tanks Thestles Seat stringers Silos Washing machines Windmill parts

Musical instruments

EBONY HACKBERRY

Stirrups

Dredge parts

HEMLOCK

Barges Boats (parts) . Boxes Box shooks Building material Car repairing Car construction

Crating Farm implements Flasks Framing Piano cases Refrigerators.

Siding Signboards Skidding Tanks Well machines (frames) Wood conductors

Revolving rakes

HICKORY

Agricultural implements (hullers) Hay baier parts Axles (light vehicles) Binder parts
Bottoms (wagon boxes)
Cabinet work
Calking hammers Car repairing Car construction Carvings Chairs Corn binder parts Crossbars (light vehicles) Cultivator handles Dout letrees Eveners (farm implements) Felloes Freight cars Gear woods (light vehicles) Golf sticks (handles) Hammer handles Handles Handles (broom) Handles (edge tools)

Hay loader parts Header parts Ladders Ladder rungs Machinery handles Mallets Manure spreader parts Maul handles Moulds (brick) Neck yokes (implement) Neck yokes (plows) Neck yokes (vehicles) Patterns Pins Picture moulding Pick handles Pitmans (farm implements) Plow beams Plow handles Poles (light vehicle)

Rims (automobile wheels) Rims (vehicle wheels) Road-scrapers Shafts (vehicle) Singletrees Sledge handles Small tool handles Spokes (automobile)
Spokes (light and heavy vehicles)
Spring bars (light vehicles) Threshing machines
Tongues (light vehicles)
Tongues (wagon)
Tongues (wheel scrapers) Trapeze (gymnasium) Trucks Trunk slats Turnings Wagon stock Wagon jacks Whiffletrees (vehicles)

JACK PINE

Sheathing

LOBLOLLY PINE

Boxes Cases Crating Doors

Columns (porch)

Corn pickers

Corn husker parts

Rake teeth

Window frames

LONGLEAF YELLOW PINE

Agricultural implements (parts)
Balusters Barges Baseboards Beef hoist beams Boats Bottoms (vehicles) Boxes (tool) Box shooks Brackets (cornice)
Brackets (interior trimmings) Cabinet work Car construction (decking) Car construction (flooring) Car construction (framing) Car repairing Carriage timber Ceiling Colonades

Cotton pickers Cranes (flooring) Crating Cultivator parts Derrick beams Disc harrow parts Door frames Doors Doors (railway box cars) Drill boxes (farm implements) Elevator guide posts Elevators Eveners (harrows) Feed mills Fixtures (laboratory) Fixtures (offlice, cafe)

Flasks Flooring Flooring (scale platforms) Frames (box cars) Frames (saw mill) Gears (heavy wagons) Grain elevators Hayloader parts Hayracks Hayrake parts Heads (washing machines) Hydaulic jacks (parts) Inside finish Ladders (extension) Machinery construction Millwork Manure spreaders Neck yokes Panels (veneered)

Platforms (tank towers) Planing mill products Planing mili products
Plow parts (gang)
Poles (farm implements)
Poles (wagon)
Posts (stairwork) Press parts Refrigerators Screen doors Seed-corn driers Seeder boxes (farm implements) Shoveling boards (farm wagons) Sideboards (built in) Side delving rakes Signboards Signs (advertising) Silos Stairwork Staves (washing machines) Sweeps (feed mills) Tanks (acids)

Threshing machines
Tongues (binders)
Tongues (cotton planters)
Tongues (manure spreaders) Tongue (plows and cultivators) Tongues (wagon) Wagon dumps Washing machines (hand) Washing machines (hydraulic) Well machinery Window frames

MAHOGANY

Automobiles Boats Boats (row)
Bookcases (exterior work)
Bureaus (exterior work) Cabinets Cabinet work Cabin parts Cash registers Car construction (finish) Car repairing Case recorders (physicians) Caskets Chair frames (upolstered) Chairs (dining room) Chairs (office) Chairs, official (lodge room) Chairs (rockers) Coffins Consoles

Desks Doors Finish (automobiles)
Finish (boats)
Finish (furniture bodies) Fintures (bank)
Fixtures (bar)
Fixtures (laboratory)
Fixtures (soda fountain)
Fixtures (store and office) Furniture Guitar bodies Hallracks Interior finish Leaves, (table) Mirror cases Organ cases Patterns (machine parts) Piano cases

Tank coverings

Piano parts Piano veneer Picture mouldings Plate racks Pool tables Rocker frames (upholstered furniture) Seats (water closet) Shells (drums) Showcases Stands Tables (card)
Tables (dining)
Tables (extension)
Tables (ibrary)
Tables (parlor)
Tanks (water closets) Trunks

Piano chairs

Furniture

Cabinet work Canoes Cigar boxes Chests (clothes) Coffins Cornice Decking

Agricultural implements Automobiles Bentwood (vehicles) Crating Boxes Doubletrees (plow and harrows) Eveners (plow and harrow) Feed cutters

Bottom boards (piano) Boxboards (dump carts) Boxes Box shooks Bottoms (vehicles) Cabinet backs Cabinets Car construction (gear cases) Car construction (finish) Caskets Carvings Chairs Cigar boxes Corn graders Crating Cultivator handles Dining tables Drawer bottoms Ensilage cutter tables

Agricultural implements (parts) Beams (ple Barber furniture Barrow boxes Baskets

PADOUK (VERMILLION)

RED CEDAR

Interior finish

Flasks Frames Furniture (exterior) Interior trimming Mop wringers Organs Patterns

CORK ELM

Handles Hay loader parts Hounds (vehicles) Hoppers Hubs (light vehicle wheels) Interior finish Machine handles Platforms

RED GUM

Farm implements Fixtures (bank) Fixtures (soda fountain) Fixtures (store and office) Furniture (church)
Furniture (exposed)
Furniture (interior work) Guitar bodies Handles Hay-baler parts Interior finish Kitchen cabinets Kitchen cabinets (backing) Manure spreaders Neck yokes (cultivator) Pianos Piano benches Panels (veneered)

RED OAK

Beds Bent wood Billiard tables Car construction

Planing mill work Planking (boat) Pianos Siding Sheathing Shingles Washing machines

Posts (seat) Rims (trucks) Rockers (chairs) Singletres Stirrups Trunks Trunk slats Wheelbarrows

Picture mouldings . Planing mill work Organs Seats (water closets) Self feeders (threshing machines) Sewing machines parts Singletrees (cultivators) Tables Trunk bodies Trunk trays
Tanks (water closets)
Thresher parts Turnings Vehicle bodies Wardrobes (exterior work) Wardrobes (interior work) Wheelbarrows Window screens

Bob sleds Bottoms (wagon) Boxes Bucket staves

Buggy bows Cabinets Cabin parts Car construction Cars (mine) Car repairing Casing (building) Caskets

Chair frames (upholstered furniture)

Chairs Chairs (office) Chair stock China closets Church pews Clothes props Corn shellers Cornices Crating Cultivator handles Decking

Disc harrow parts

Double doors (farm implements) Drags (farm implements) Dresseirs

Dressang tables Elevtor flooring Eveners (farm implements) File cases

Fixtures (bank)
Fixtures (barber shop)

Fixtures (display window) Fixtures (soda fountain) Flooring (hardwood) Flag staffs Folding beds

Folding machines
Frames (couches)
Frames (davenport)
Frames (light and heavy vehicle bod ies

Frames (upholstered parlor furniture)

Furniture Hallracks Hay-loader parts Interior finish Kitchen cabinets (exterior)

Lodge furniture Mantels Manure spreaders Mission furniture Moulding (stairwork) Organ (pipe) cases Organ actions

Organs Parquetry flooring Piano bencnes Piano cases Piano parts Piano stools Piano tops

Picture moulding Planing mill products Platforms (stairwork) Plow beams Plow handles Plow parts (gang) Plow rounds Pokes (animal) Porch work Refrigerators

Rocker frames (upholstered furniture) Sash Sheathing

Showcases Sideboards (built in) Sideboards (exterior work) Sling crossbars Stirrups Sulky plow parts Table legs Tables (extension) Tables (library) Tables (writing) Tabourets Tanks (water closets) .

Trucks Toys Veneer Wainscoting Washstands

RED SPRUCE

Car construction

Piano boxing

Piano parts

NORWAY PINE

Agricultural implements (hullers) Framing Bu ilding material Car construction Ceiling Derricks Doors

Frames (carriage) Floorings Handrails Ladders (extension)
Ladders (fire department) Machinery construction Pedal pipes Patterns Siding (railway cattle cars) Threshers

REDWOOD

Columns (porch) Cornice Frames

Framework (organs) Incubators Porch work

Siding Tanks

ROSEWOOD

Furniture (exterior)

Musical instruments

SHORTLEAF YELLOW PINE

Agricultural implements (hullers) Columns (porch) Agricultural implement parts Barges Baseboards Beef hoist beams Boats Bottoms (heavy vehicle bodies) Bottoms (light vehicle bodies) Blinds Boxes Boxes (cern planters) Boxes (fed mills) Box shooks Casing Car construction Car repairing Ceiling

Cornices Corn husker parts Corn sheller parts Corn shredder parts Corn planter parts Crating Door frames Doors Fixtures (bank) Fixtures (store and office) Flasks Flooring

Flooring (scale platform) Furniture Interior finish (building)

Millwork Mouldings Newels (stairwork) Pump boxes Planing mill products Sash Sheathing Showcases Sills Stairwork Sweeps (feed mills)
Tanks (water closets) Threshing machines Vehicles Wagon boxes

Ladders (step)

SITKA SPRUCE

Fixtures Frame work Furniture Grand pianos Keyboards (pianos) Organ parts

Organ pipes Refrigerators Sash Store fronts Window frames

Boat floors Braces Canoes Crating Door frames Doors

SOFT MAPLE (SILVER MAPLE)

Action parts (pianos) Backing (veneer) Boxes Cabinets (kitchen)
Candy pails
Crating Egg cases

Fixtures Flasks Furniture Kitchen chairs Packages (fruit and vegetable) Patterns

Pulley frames Planing mill products Seats (water closet) Tables (kitchen) Tanks (water closet) Toys

SPANISH CEDAR

Boats

Cigar boxes

SUGAR MAPLE (HARD MAPLE)

Agricultural implements (hullers) Elevator platforms Agricultural implement parts Ensilage cutter fram Automobiles Backs (washboard)
Bearing boxes (farm implements)
Bobsleds
Bolsters (wagon)
Flooring (heavy trucks)
Floors (platform trucks) trucks) Bottoms (heavy vehicle bodies) Box boards (wagons) Boxes Brush rolls Brush blocks Cabinets (kitchen) Carvings Car construction Car repairing Chairs Chairs (folding) Chairs (opera) Chair legs Chair parts Cider mills Controller boards (motor cars) Church furniture Corn binder parts Corn grinder parts Corn husker parts Corn sheller parts Crating Drags (farm implements) Dredge parts
Electric car (matting)
Electric construction

Ensilage cutter frames Eveners (farm implements) Floor mats Fodder shredder parts Frames (grindstone) Frames (light vehicle) Frames (spring beds) Framing (sawmill) Furniture Go-carts Grain separators (agricultural) Guns Games of chance Hand cars Hand corn planters Handles Handles (broom)
Handles (duster)
Handles (lawn mower)
Hangers (garment) Hayloader parts Hay rakes Hoops (embroidery) Ladders Lasts

Looms Machinery construction Match boards Motor car parts (railway) Neck yokes (cultivator)

Organ cases (reed) Organ cases (pipe) Organ keys Planing mill products Piano actions Piano benches Piano cases (finish) Piano cases (unexposed) Piano parts Piano stools Picture molding Poles (farm implements) Press racks Posts (seat) Pulleys Pulleys (hay) Ribs (washing machines) Rims (trucks) Rollers Self-feeders (threshing machines Sheathing Sheaves Sill sides (washboards) Singletrees (cultivator) Sleds (farm implements) Stanchions (cow ties) Tables Threshers Trestles Trucks (warehouse) Turnings Vehicle bodies Vehicle gears Wardrobes (extension) Washing machines

SUGAR PINE

Doors Millwork

Automobiles

Brush blocks Buffets (bar fixtures) Bureaus (exterior)

Cabinet work

Caskets

Car construction

Car repairing Cases (medicine)

Ba, by perambulators Ba seboards Biliard tables

Bookcases (interior)

Balusters

Boats

Boxes

Elevator flights

Elevator guides

Farm machinery parts Fixtures (bank) Fixtures (bar) Fixtures (laboratory)
Fixtures (soda fountain)
Fixtures (store and office)

Flooring Furniture Frames (couches)
Frames (davenports)
Furniture (church) Handles

Organ pipes

Patterns

Hall racks Headlining Hoops (embroidery) Interior fininsh Mantels

Mill work Moulding Novelties Organ cases (part.) Parlor rockers

Sash Threshing machine parts

Wheelbarrows

BIRCH

Pedestals Piano benches Piano chairs Pianos Picture mouldings Planing mill products Pulley stiles Refrigerators
Sample cases
Sash (window)
Seats (water closets) Sewing machines Show cases Sideboards (exterior) Sofa frames (parlor furniture) Stair work Tables

Tanks (water closets) Trunks Turnings Vehicles Wainscoting

Carvings (coffins) Crating Doors Dressers Dressing tables

Farm implement parts



Fig. 27. Tapping hard maples for making sugar.

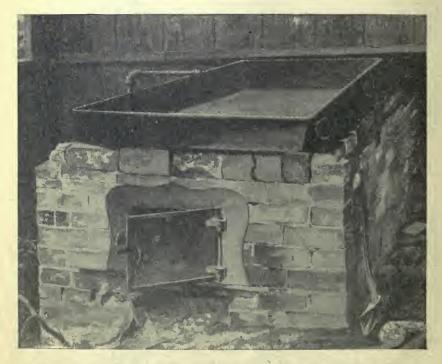


Fig. 28. An old time evaporizer for making maple sugar still in use in Ohio.

SYCAMORE

Boxes Boxes (cigar) Brush blocks Cabinet work Crating

Doors Handles Handles (broom) Interior finish Planing mill products Sides (vehicle) Sash Threshing machinery Piano backs Tobacco boxes

TAMARACK

Crating

₩oxes Cigar boxes

Car construction

COTTON GUM

Crating

Furniture

WALNUT (BLACK)

Altar (church) Barber chairs Car repairing Caskets Chairs (ecclesiastical) Fixtures (store and office) Furniture (church) Furniture Gun butts

Gun forearms Lodge furniture Machinery construction Mill work Organ actions
Organ (reed) cases
Organs (interior work)
Panels (veneered) Patterns Piano benches

Piano cases Piano veneer Piano parts Picture mouldings Sash Showcases Tables (dining)
Tables (parlor) Wind shields (automobile)

WESTERN WHITE PINE

Columns (porch) Door frames

Millwork

Tanks

WHITE ASH

Automobiles (rim boards) Bars (vehicle) Baseball bats Bent panels (light vehicle bodies) Beam (cultivators) Baby perambulators Bobsleds Bows Butter tubs (heading) Boxes Butter tubs (staves) Cabinet work
Car construction (framing) Car repairing Chairs Church pews Churns Churn li-ls Corn planters Cylinders (cider mill)

Flooring Frames (automobile bodies)
Frames (buggy and carriage bodies) Frames (light vehicle seats) Frames (wagon boxes) Furniture (interior) Gears (coach) Handles Handles (edge tool) Hames (wood) Harrows Hoe handles Hose truck bodies Hounds (vehicles) Interior finish (house) Machinery (construction)
Kitchen cabinets Mouldings Piano parts

Planing mill products Plow beams Pokes (animal)
Poles (heavy vehicles)
Posts (vehicles) Rails Rake heads Rake (garden) handles Rims (vehicle) Refrigerators Rosts Sash Shovel handles Staves Tools Vehicle bodies and parts Yokes Wagon parts Well-digging machines

WHITE ELM

Automobile parts Boxes Cabinets (kitchen) Car repairing Chair frames (upholstered furniture) Chairs (kitchen) Chair stock Crating

Electric cars Elevators Flasks Folding machines Furniture Interior finish Machinery construction Piano benches Piano backs

Pillars Press racks Refrigerators Rockers Toys Trunk slats Trunk boxes Wheelbarrows

WHITE OAK

Agricultural implements (hullers) Bob-sleds Agricultural implements (parts) Bolsters (heavy vehicles) Ax handles Backs (brushes) Barber chairs Barber furniture Bar fixtures Barrow boxes Barges Baskets Beams (plow) Beds Bentwood Billiard (tables) Boats

Boat parts (row)

Booms Bottoms (baggage trucks) Bottoms (delivery wagon) Brake beams (heavy articles) Bucket staves Buffers Cabinet finish Cabinets (kitchen) Cabinet work Cabins (boats) Car repairing Cars (mine) Car construction (framing) Car construction (decking)

Carvings Case recorders (physicians) Cash registers Casing Caskets Casks Ceiling Chairs (opera) Chair stock Chiffoniers Churns Church pews Circus seats Cleats (wagon boxes) Coffins Columns (porch)

Cooperage Corn binders Corn grinders Corn shellers Counters (bar) Counters (store) Crating Cultivator handles Desks (house) Desks (office) Disc drill parts Disc harrow parts Doubletrees (farm implements)
Doubletrees (vehicle) Drags (farm implements) Dredges Dressers Dressing tables Drill parts (farm implements) Edge-tool handles Elevator cages Ensilage cutters Eveners (farm implements) Feed cutters Felloes File cases Finish (inside) Finish (inside)
Fixtures (bar)
Fixtures (bank)
Fixtures (barbershop)
Fixtures (display window)
Fixtures (laboratory)
Fixtures (soda fountain)
Fixtures (store and office)
Flooring (hardwood)
Floors (tipple)
Framing Framing
Frames (auto)
Frames (light vehicle bodies)
Frames (machinery)
Frames (window) Furniture Furniture (church) Gear woods (light vehicle) Guitar bodies Hammer handles Handles Handles (broom) Harrow bars

Hay baler parts Hay rake parts Hounds Hubs Hubs (heavy vehicle wheel) Interior finish Kitchen cabinets (exterior) Kitchen cupboards Kitchen safes Lawn swings Ladders Lodge furniture Machinery construction Mantels Manure spreaders Mill work Mine car bodies Mission furniture
Moulding (house trimming)
Music cabinets Neck yokes Organ bellows Organ cases Organ pipes
Panels (veneered)
Parlor cabinets (exterior) Parlor rockers Piano benches Piano cases Piano chairs Piano finish Piano parts Piano players (exterior) Piano stools Piano tops Picture mouldings Planing mill products Platforms Plate racks Plow beams Plow handles Plow rounds Plow parts (gang) Plows Pokes (animal)
Pokes (vehicle)
Poles (agricultural implements)

Registers (cold air) Reels (electric light wire) Refrigerators Rims (heavy vehicle wheels) Rocker frames (upholstered furniture) Sash Seats (water closet)
Sections (wheel-scrapers)
Seeder parts (farm implements) Serving tables Settees Sideboards (exterior) Sills Singletrees (cultivators) Singletrees (vehicles) Skids Sling cross bars Spokes (heavy vehicles) Stacker parts (farm machinery) Stairwork Staves (water tanks) Stirrups Stirtups
Sulky plow parts
Sweeps (farm machinery)
Tables (extension)
Tables (library)
Tables (parlor)
Tables (typewriter)
Tables (writing)
Tanks (water closets)
Threshing machines Threshing machines Tongues (wheel scrapers) Trucks Truck bodies Trunks Turnings Vehicle bodies Veneer Wagon boxes Wagon reaches Wagon tongues Wall cases Wardrobes (exterior) Washing machines Weather boarding Well-digging machinery Wheelbarrows Window screens

WHITE PINE

Agricultural machinery Actions (piano, organ) Beehives Blinds Bookcases (inside) Bottoms (wagon boxes) Boxes Box shooks Cabin parts (boats)
Car construction Car construction (patterns) Car repairing Carvings Caskets Casting patterns Ceiling Coffins Cornices Crating Door frames Doors

Flooring
Fixtures
Foundry flasks
Furniture
Keys (piano)
Incubators
Machinery construction
Matches
Mess tables
Mill work
Organ pipes
Packing tubs
Patterns (cars)
Patterns (machine parts)
Patterns
Planking (boats)
Planking mill work

Pool tables Posts (stairwork) Posts (wagon)

Press parts

Porch work

Rolling globes

Pumps

Shelving
Shipping cases
Siding (barn)
Siding
Signboards
Silos
Storm sash
Tanks (water closet)
Tank bottoms
Trunks
Templets
Tobacco boxes
Vehicles
Wainscoting
Window frames
Window sash
Window screens

Sash Sash (storm)

Screen doors

WHITE SPRUCE

Sounding boards

Harrows

WILLOW

Artificial limbs

YELLOW POPLAR

Actions (piano players)
Agricultural implements (parts)
Automobiles
Backs (washboards)
Barber chairs
Baseboards
Baskets (fruit)
Bevel sidings
Blinds
Bookcases
Boxboards (heavy vehicles)

Bookcases
Boxboards (heavy v
Boxes (veneer)
Box shooks
Brush blocks
Carvings
Cabinets
Car repairing
Car construction
Cart beds
Cases (medicine)
Casing
Caskets

Ceiling
Church furniture
China closets (inside)
Cider mills
Cigar boxes
Churns
Coffins

Courns
Coffins
Cornice
Corn shellers
Crates (fruit and vegetable
Crating

Desks (inside)
Drawer bottoms (furniture)

Doors
Elevators (corn)
Exterior finish
Facia
Evaporator pan sides
Feedcutter tables
Filler pieces
Fixtures (bank)
Fixtures (bar)

Fixtures (bank)
Fixtures (bar)
Fixtures (display windows)
Fixtures (laboratory)
Fixtures (store and office)
Flooring

Flooring Frames (windows) Furniture Handles Hoppers Interior finish Ironing-boards Ladders Laths

Machinery construction Moulding (piano oases) Mill work

Organ chests
Organ parts (interior)
Organ pipes
Panels (automobile bodies)
Panels (vehicle bodies)
Panels (veneered)
Piano finish
Piano parts

Piano parts
Picture mouldings
Planing mill products

Pipe organs (interior parts)
Pool tables

Pipe organs (
Pool tables
Pumps
Refrigerators
Roofing
Sash
Screen doors

Screen doors
Scats (automobile)
Scats (buggy)
Scats (carriages)
Scats (water closets)
Sewing machine parts
Sideboards (built in)
Sidings

Sidings (grain grinders)
Sidings (Ry. refrigerator cars)
Sidings (washboards)
Sidings (wagon beds)
Signboards
Sheathing
Sled cultivators

Sled cultivators
Swing seats
Table (cafe)
Tables (dining)
Tanks (water closet)
Trunks
Turnings
Vehicle bodies

Vehicle bodies
Veneer cores (organ cases)
Veneer cores (piano)
Washing machines
Wardrobes (inside)
Window screens
Wood pumps

DIRECTORY OF MANUFACTURERS

A CONTRACT OF THE PARTITION OF THE	NAME	TOWN
AGRICULTURAL IMPLEMENTS		
NAME TOWN	Atwater Basket & Veneering C The B. L. Marble Chair Co.* Taylor Chair Co.* Buckeye Carriage Body Co.* Cleveland Stone Co. Berlin Fruit Box Co.	CoAtwater
Whitman & Rarnes Mtg. Co	Taylor Chair Co.*	Bedford
Hoover Mfg. Co	Buckeye Carriage Body Co.*	Bellefontaine
Akron Cultivator Co	Cleveland Stone Co	Berea
Thornburg Mfg. CoBowling Green Bryan Plow CoBryan	Berlin Fruit Box Co. Scott & Ewing Co.* Thornburg Mig. Co.* Bryan Show Case Co.* The Richland Handle Works* Adams Carriage Co.* American Sheet Metal Co.* Canfield Mig. Co.* Berger Mig. Co. Canton Box & Crate Co. Canton Buggy Co.* The John Danner Mig. Co.* Joseph Dick*. Gibbs Mig. Co. Havard Co. Knight Mig. Co. F. E. Kohler Co.	Berlin Heights
Bryan Plow Co	Thornburg Mfg. Co.*	Bowling Green
Byckeye Handle Wooks. Canfield V. L. Ney Co. Canton The Ney Mig. Co. Canton Bucher & Gibbs Plow Co. Canton	Bryan Show Case Co.*	Bryan
The Ney Mfg. CoCanton	The Richland Handle Works*	Butler
Bucher & Gibbs Plow CoCanton	Adams Carriage Co.*	Canal Dover
Stark Lumber Co. Canton Joseph Dick . Canton The Decrlick Oil Stove Co. Chagrin Falls Empire Plow Co. Cleveland New Idea Spreader Co. Cold Water	Canfield Mfg. Co*	Canai Dover
The Deerlick Oil Stove Co Chagrin Falls	Berger Mfg. Co	Canton
Empire Plow CoCleveland	Canton Box & Crate Co	Canton
New Idea Spreader CoCold Water	Canton Buggy Co.*	·Canton
Ohio Rake Co Dayton	Joseph Dick*	Canton
Sieberling & Miller CoDoylestown	Gibbs Mfg. Co	Canton
Lehr Agricultural CoFremont	Havard Co	Canton
Hughes & SmytheGalena	Knight Mfg. Co	Canton
Panning Brothers Hamler	The Nev Mfg. Co	Canton
Campbell Corn Drill Co	Ames Bending Co*	Celina
Empire Plow Co. Celeviana New Idea Spreader Co. Cold Water International Mig. Co. Crestline Ohio Rake Co. Dayton Sieberling & Miller Co. Doylestown Lehr Agricultural Co. Fremont Hughes & Smythe. Galena Long & Alistatter Co. Hamilton Panning Brothers. Hamler Campbell Corn Drill Co. Harrison C. S. Bell Co. Hillsboro Eagle Machine Co. Lancaster Hocking Valley Mig. Lancaster Brown-Manley Plow Co. Matta Aultman-Taylor Machinery Co. Mansfield Roderick Lean Mig. Co. Marion Ohio Tractor Mig. Co. Marion W. R. Harrison & Co. Massillon Russell & Co. Newark	Knight Mig. Co. F. E. Kohler Co. The Ney Mig. Co. Ames Bending Co* Wm. Cron Sons Co. Mersman Bros. Brandts Co.* The Deerlick Oil Stone Co.* Aman & Sandman. The Acorn Buggy Co.* American Carriage Co. American Laundry Machine Mi	Celina
Eagle Machine CoLancaster	Mersman Bros. Brandts Co.*	Charrin Falla
Brown-Manley Plow Co	Aman & Sandman	Cincinnati
Aultman-Taylor Machinery CoMansfield	The Acorn Buggy Co.*	Cincinnati
Roderick Lean Mfg. Co Mansfield	American Carriage Co	Cincinnati
Huber Mfg. Co	American Laundry Machine Mi	g. Co Cincinnati
W. R. Harrison & Co Massillon	The A. Armstrong Co	Cincinnati
Russell & CoMassillon	Anchor Box Co	Cincinnati
Blair Mfg. CoNewark	P. T. Baker & Son	Cincinnati
N. I. Shoup New Springfield	Fugene Reminghause Co	Cincinnati
The Silver Mfg. CoSalem	Betts-Street Furniture Co	Cincinnati
Russell & Co. Massillon Blair Mig, Co. Newark The Star Mig, Co. New Lexington N, L, Shoup. New Springfield The Silver Mig, Co. Salem A merican Steel Scraper Co. Sidney Sidney Sidney	Beck & Mueller* Eugene Berninghause Co Betts-Street Furniture Co Chas. Bolt Co. Brumwell Brush & Wire Goods C	Cincinnati
	Brumwell Brush & Wire Goods	CoCincinnati
The Phillip Smith Mfg. Co	Allie Chalmers Co*	Cincinnati
Buckeye Div. American Seeding Mch. Co.	Champion Tool Works*	Cincinnati
International Harvester CoSpringfield	Brumwell Brush & Wire Goods C Case Crane Co Allis Chalmers Co. * Champion Tool Works* Eincinnati Wire Bound Box Co C. A. Conkling Box Co Columbia Show Case Co. * E. Crane & Co Crooks Pattern Works* Dana Mfg. Co	Cincinnati
International Harvester CoSpringfield	C. A. Conkling Box Co	Cincinnati
Mast Foos & Co. Springfield The E. W. Ross Co. Springfield Superior Drill Co. Springfield American Seeding Mch. Co. Springfield	E. Crane & Co	Cincinnati
Superior Drill CoSpringfield	Crooks Pattern Works*	Cincinnati
American Seeding Mch. CoSpringfield	Dana Mfg. Co	Cincinnati
Thomas Mig. Co. Springfield The A. D. Baker Co. Swanton The Toledo Plow Co. Toledo Brown Mig Co. Zanesville	J. F. Deitz Co	Cincinnati
The Toledo Plow Co Toledo	John Douglass*	Cincinnati
Brown Mfg CoZanesville	Enger Motor Car Co.*	Cincinnati
BOAT AND SHIP BUILDING	J. F. Deitz Co. J. Dornette & Bro. Co*. John Douglass* Enger Motor Car Co.* Flcks Reed Co. Globe Wernicke Co.* Hickory Carriage Co. Fred Kenker & Sons Lion Buggy Co. Lobnitz Co. Louis Lipp Co.	Cincinnati
DON' WHO GILL DOLLDING	Hickory Carriage Co	Cincinnati
Riverside Mill Co Antiquity	Fred Kenker & Sons	Cincinnati
Barrett Mill & Lumber Co Cincinnati American Ship Bldg. Co Cleveland	Lion Buggy Co	Cincinnati
John E. Lyon	Louis Linn Co	Cincinnati
J. M. HammittMarietta	A. Lukenheimer & Co.*	Cincinnati
American Ship Bidg. Co. Cleveland John E. Lyon. Higginsport J. M. Hammitt Marietta Acme Folding Boat Co. Miamisburg S. L. Malin & Son. Painsville Mathews Boat Co. Port Clinton	McWilliams & Schulte	Cincinnati
Mathews Roat Co Port Clinton	Miller, Dubrul & Peters Mig. Co	Cincinnati
	Ohio Pattern Works*	Cincinnati
Davis Boat WorksSandusky	Queen City Box Co	Cincinnati
Lake Erie Dry Dock & Mill Co Sandusky	Ratterman & Luth	Cincinnati
Davis Boat Works Sandusky Lake Erie Dry Dock & Mill Co. Sandusky Stryker Boat Oar & Lumber Co. Stryker West Unity Mfg. Co. West Unity	Reuhl Moulding Mfg, Co.*	Cincinnati
	Sagers & Scoville	Cincinnati
BOXES AND CRATES	Lobnitz Co. Louis Lipp Co. A. Lukenheimer & Co.* McWilliams & Schulte. Miller, DuBrul & Peters Mfg. C. National Billiard Mfg. Co.* Ohio Pattern Works* Queen City Box Co. Ratterman & Luth A. Renesch & Co. Reuhl Moulding Mfg. Co.* Sagers & Scoville. Schirmer Furniture Co. Sechler & Co. Sextro Mfg. Co.	Cincinnati
American Sewer Pine Co	Sextro Mfg. Co	Cincinnati
Diamond Rubber Co.* Akron	Sextro Mfg. Co. Steinman & Meyer Furniture Co. The S. F. Street Mfg. Co.* I. Stroble Co.*.	o.*Cincinnati
Firestone Rubber Co.*Akron	The S. F. Street Mfg. Co.*	Cincinnati
Goehring Mfg. Co Akror	I. Stroble Co.*	Cincinnati
Hillgreen Lane Co.* Alliance	Superior Box Co Frank Unnewehr Co Ward-Brook Sash & Door Co.*	Cincinnati
American Sewer Pipe Co. Akron Diamond Rubber Co.* Akron Firestone Rubber Co.* Akron Goehring Mig. Co. Akror Goodrich Rubber Co.* Akror Hillgreen Lane Co.* Alliance McCaskey Register Co.* Alliance	Ward-Brook Sash & Door Co.*	Cincinnati

TOWN

NAME

Wildberg Lumber Co. Cincinnati Withrow Míg. Co. Cincinnati Acme Box & Lumber Co. Cleveland American Box Co. Cleveland Buckeye Stereopticon Co. Cleveland Buckeye Box Co. Cleveland Buckeye Box Co. Cleveland Cleveland Box Co. Cleveland Cleveland Box Co. Cleveland The Co. Cleveland Forest City Box Co. Cleveland The Gebs Mou'ding & Mfg. Co. Cleveland J. N. Hahn Co. Cleveland Theo. Kundts* Cleveland Theo. Kundts* Cleveland D. T. Owen Co.* Cleveland D. T. Owen Co.* Cleveland D. T. Owen Co.* Cleveland Forest Shotor Car Co. Cleveland Fred Pollard Cleveland Fred Pollard Cleveland Saginaw Bay Box Co. Cleveland Saginaw Bay Box Co. Cleveland	** * * * * * * * * * * * * * * * * * * *
Wildberg Lumber CoCincinnati	Marietta Fruit Package CoMarietta
Withrow Mig. Co	Marietta Mantel CoMarietta
Acme Box & Lumber CoCleveland	Stevens Organ Works*
American Box Co Cleveland	Marion Steam Shovel Co.*Marion
Buckeye Stereopticon CoCleveland	McMurry Sulky Co.*Marion
Buckeye Box Co Cleveland	LaBelle Box CoMartin's Ferry
Cleveland Box CoCleveland	The Martin's Ferry Box & Barrel Co.,
James Dunn Co Cleveland	Martin's Ferry
Forest City Box Co Cleveland	Davis Chair Co.*
The Gebs Moulding & Mfg. CoCleveland	The A. I. Root CoMedina
J. N. Hahn Co Cleveland	Enterprise Carriage Mfg. CoMiamisburg
Theo. Kundts*Cleveland	Middlefield Basket CoMiddlefield
National Fixture Co.*Cleveland	Middletown Buggy CoMiddletown
D. T. Owen Co.*	Philps Sheet & Tin Plate CoSteubenville
Peerless Motor Car Co	C. T. DanielsMinerva
Fred PollardCleveland	W. C. Heller Co.*Montpelier
Saginaw Bay Box CoCleveland	Hydraulic Press Mfg. CoMt. Gilead
Smeed Box Co Cleveland	Barnard BrosMt. Vernon
Standard Sewing Machine Co.*Cleveland	The Heller-Aller Co.*Napoleon
Star Box CoCleveland	Newark Ohio Furniture Co.*Newark
C. E. Taft*Cleveland	The Ward Stilson Co New London
The Zimmerman CoCleveland	Enterprise Planing Mill Co New Waterford
Buckeye Steel Casting Co.*Columbus	The Koch Bros. Co.*New Waterford
Case Crane CoColumbus	Deforest Sheet & Tinplate Co.*Niles
The Columbus Buggy Co Columbus	A. B. Chase Co.*Norwark
The Henry Holtzman & Sons*Columbus	Gordon Lumber, Basket & Mfg. CoOakharbor
The Jeffrey Mfg. CoColumbus	S. L. Malin & Son*Painesville
Ohio Carriage Mfg. CoColumbus	Marietta Fruit Package Co. Marietta Marietta Mantel Co*. Marietta Stevens Organ Works* Marietta Marion Steam Shovel Co.* Marion McMurry Sulky Co.* Marion McMurry Sulky Co.* Martin's Ferry The Martin's Ferry Box & Barrel Co., "Martin's Ferry Box & Barrel Co., "Martin's Ferry Davis Chair Co.* Marysville The A. I. Root Co. Medina Enterprise Carriage Mig. Co. Miamisburg Middlefield Basket Co. Middlefield Middlefield Basket Co. Middlefield Middlefown Buggy Co. Middlefield Middlefown Buggy Co. Middlefield W. C. T. DanielsMinerva W. C. Heller Co.* Steubenville C. T. DanielsMinerva W. C. Heller Co.* Montpelier Hydraulic Press Mig. Co. Mt. Gilead Barnard Bros. Mt. Vernon The Heller-Aller Co.* Napoleon Newark Ohio Furniture Co.* Newark The Ward Stilson Co. New London Enterprise Planing Mill Co. New Waterford Deforest Sheet & Tinplate Co.* New Waterford Deforest Sheet & Tinplate Co.* New Waterford Deforest Sheet & Tinplate Co.* Now Waterford Deforest Sheet & Mig. Co. Oakharbor S. L. Malin & Son* Norwark Gordon Lumber, Basket & Mig. Co. Oakharbor S. L. Malin & Son* Painesville The Harrison Basket Co. Painesville The King Mig. Co.* Piqua
Peters Buggy Co Columbus	F. A. WitzlerPerrysburg
R. A. Rood	The King Mfg. Co.*Piqua
Scioto Box CoColumbus	The Piqua Furniture Co.*Piqua
The Seagrove Co Columbus	Sprague Smith Co.*Piqua
Wm. Sebold Columbus	Port Clinton Lumber & Coal CoPort Clinton
Sun Mfg. Co.*Columbus	Portsmouth Steel Co.*Portsmouth
Wildermuth Bending Co.*Columbus	Buckeye Chair Co.*Ravenna
Columbiana Mfg. CoCelumbiana	Oscar Chase & Sen Rutland
H. O. Beech Co Coshocton	Crane & McMahon*St. Mary's
Coshocton Glass Co Coshocton	Clinton Mfg. Co.*Sabina
Holcher Bros. Buggy Co.* Crestline	American Case & Register Co.*Salem
C. E. Cottrell	Buckeye Engine CoSalem
Falls Clutch & Machinery Co Cuyahoga Falls	The Deming CoSalem
Walsh Milling Co Cuyahoga Falls	The Silver Mfg. Co.*Salem
Crawford, McGregor & Canby Co Dayton	The W. H. Mullins CoSalem
Buckhardt Furniture Co.*	American Crayen CoSandusky
Davis Sewing Machine Co.* Dayton	Germania Basket CoSandusky
Gondert & Lienesch	One Minute Washer Co.*Sandusky
L. W. Keyer	The Sandusky Lumber & Bex Co Sandusky
Mutual Mfg. Co Dayton	The Sebring Cooperage CoSebring
National Cash Register Co.* Dayton	Alderfer Crate CoSharon Center
National Sign Co.*Dayton	The Bimel Buggy Co.*Sidney
Ohio Rake Co Dayton	Sidney Mfg. Co.*Sidney
M. Ohmer's Sons Co Dayton	Sidney Tool CoSidney
The Shieble Toy & Novelty Co Dayton	Wagner Mig. Co.*Sidney
P. T. Coffield & Son* Dayton	The Henry Prasse CoSouth Euclid
Defiance Box Co	The Hardman-Potters Crate & Box Co.,
Sun Ray Stove Co Delaware	Zanesville
Oak Mig. CoEdgerton	Buckeye Division (American Seeding Machine
J. G. Haury Bending Works* Erkhart	Co.)*Springheid
Findley Corriege Co Findley	The Payor Prog. Co.*
Cunningham Min Ca*	International Harvester Co.*
Peabody Carriage Co Fostoria	The F. W. Poor Co.*
Frament Furniture Co.*	The E. W. Ross Co
Callia Eurniture Co.** Fremont	There Mer Co
Ohio Valley Fuggiture Co Gallipolis	Ford Class Co *
The Petter Mig. Co.*	Condens Wheel Co *
Clorford May Co	Milliam Waren Co.*
Hoo Hoo Kitchen Cabinat Ca *	Phonix Por Factory Toledo
Com Incubator Co.*	Cohauca Darlar Frama Co
The Anderson Tool Co * Hamilton	I M Skinner Bending Co.* Toledo
The H P Deugcher Co * Hamilton	The Teledo Screen Co*
The Long & Allstatter Co Hamilton	Cao Wilson & Sons Co Toledo
Sanitary Mfg. Co*	The Veshera Mfg. Co.* Toledo
Campbell Corn Drill Co.*	The Troy Carriage Sunshade Co.* Troy
The C. S. Bell Co.*	The Star Storm Front Co.*
L. B. Miller Hillsboro	The Central Ohio Buggy Co.* Upper Sandusky
Jackson Mfg. Co. Lackson	The Advance Glass Co.*
The Lima Locomotive and Machine Co. Tima	The Licking Window Glass Co.* Utica
Philip Carey Mfg. Co*: Lockland	The Utica Glass Co.*
Snider Mfg, Co.*	The New Wassissness Wheel Co * Wassissness
Baxter Stove Co.* Manefold	
	The Western Reserve Furniture Co.* Warren
John A. Halter Mansfield	The Western Reserve Furniture Co Warren Geo. W. Hoffman Wellington
John A. Halter	The Western Reserve Furniture Co.*Warren Geo. W. Hoffman
John A. Halter	The Western Reserve Furniture Co.* Warren Geo. W. Hoffman Wellington Rippe Mfg. Co West Lafayette Carnegie Steel Company* Youngstown
D. T. Owen Co.* Cleveland Peerless Motor Car Co Cleveland Pred Pollard Cleveland Saginaw Bay Box Co Cleveland Saginaw Bay Box Co Cleveland Saginaw Bay Box Co Cleveland Star Box Co Cleveland Star Box Co Cleveland Star Box Co Cleveland Star Box Co Cleveland Ctar Box Co Cleveland Ctar Evantament Co Cleveland Ctar Evantament Co Cleveland The Zimmerman Co Cleveland The Zimmerman Co Cleveland The Zimmerman Co Columbus Case Crane Co Columbus The Columbus Buggy Co Columbus The Henry Holtzman & Sons* Columbus The Jeffrey Mfg. Co Columbus The Seagrove Co Columbus	A. B. Chase Co.* Norwark Gordon Lumber, Basket & Míg. Co. Oakharbor S. L. Malin & Son* Painesville The Harrison Basket Co. Painesville The Harrison Basket Co. Painesville The Harrison Basket Co. Painesville The High Míg. Co.* Piqua The Piqua Furniture Co.* Piqua Sprague Smith Co.* Piqua Sprague Smith Co.* Piqua Sprague Smith Co.* Port Clinton Portsmouth Steel Co.* Port Clinton Portsmouth Steel Co.* Port Smouth Buckeye Chair Co.* Ravenna Oscar Chase & Scn. Rutland Crane & McMahon* St. Mary's Clinton Míg. Co.* Sabina American Case & Register Co.* Salem The Deming Co. Salem The Deming Co. Salem The Silver Míg. Co.* Salem The W. Mullins Co. Salem The W. Mullins Co. Salem The W. Mullins Co. Sandusky One Minute Washer Co.* Sandusky One Minute Washer Co.* Sandusky The Sandusky Lumber & Bex Co. Sandusky The Sandusky Lumber & Bex Co. Schring Alderfer Crate Co. Schring Co.* Sidney Sidney Míg. Co.* Sidney Sidney Míg. Co.* Sidney Sidney Míg. Co.* Sidney Sidney Míg. Co.* Sidney The Henry Prasse Co. South Euclid The Hardman-Potters Crate & Box Co. Zanesville Buckeye Division (American Seeding Machine Co.)* Springfield American Seeding Machine Co.* Springfield The Eauer Ercs. Co.* Springfield The Trojedo Gendron Wheel Co.* Toledo Gendron Wheel Co.* Toledo The Trojedo Gendron Wagon Co.* Toledo The Trojedo Schauss Parlor Frame Co. Toledo Gendron Wheel Co.* Toledo The Trojedo Schauss Parlor Frame Co. Toledo The Trojedo Gendron Wagon Co.* Toledo The Trojedo Screen Co.* Toledo The Trojedo Screen Co.* Toledo The Trojedo Screen Co.* Utica The Utica Glass Co.* Utica The Licking Window Glass Co.* Utica The Licking Window Glass Co.* Utica Th

NAME TOWN	NAME TOWN
W. H. TaylorZanesville	Marietta Chair CoMarietta
	Marietta Chair Co
BRUSHES	Shilling & SonTiro
The Whitman & Barnes Mfg. Co Akron	Williams & CoToledo
Bromwell Brush & Wire Goods CoCincinnati The Mercer Brush Co	T. J. Collins & Co
Geo. Keyer Co	Waldcutter & KahlenburgToledo
Geo. Keyer Co Cincinnati Osborn Mfg. Co Cleveland The Ames Bonner Co Toledo	Glendron Wheel Co. Toledo Waldcutter & Kahlenburg. Toledo Warren Mfg. Co. Warren The Washington Mfg. Co. Washington C. H. J. H. White. Williamsburg Williamsburg Furniture Co. Williamsburg Warren Lumber & Mfg. Co. Wooster
	J. H. White
BUNGS AND FAUCETS	Williamsburg Furniture CoWilliamsburg Wayne Lumber & Mfg. CoWooster
The American Bung Mfg. CoCincinnati National Bung Mfg. CoCincinnati	wayne Lumber & Mig. Co wooster
Queen City Bung Mfg. Co	CIGAR BOXES
Oueen City Bung Mfg. Co	E. J. HutchisonBarnesville
CAR CONSTRUCTION	Aman and Sandmann
Caldwell Mining Car Mfg. Co	Bastian Cigar Box Co
The Fulton Pit Car Co	R. H. Brenner & Co
Cincinnati Car Co	Geese Cigar Box Co
Cleveland, Cincinnati, Chicago & St. Louis Ry	Frank Unnewehr Co
Interurban Ry. & Terminal CoCincinnati	L. Richensburgs SonsCleveland
Atlas Car Mfg. Co. Cleveland Cleveland Railway Co. Cleveland	Scioto Box Co
G. C. Kuhlman Car Co	L. W. Keyer. Dayton H. B. Tenzer Lumber Co. Defiance
Lake Shore & Michigan Southern Rv., Collinwood	W. H. Potter. Delaware Levi K. Basore. Farmersville
Ralston Steel Car Co	The Benner Lumber CoGreenville
Hocking Valley Ry	John Fluispach BrosGermantown
Tri-State Railway & Electric Co., East Liverpool	Globe Cigar Box Co. Lima Superior Cigar Box Mfg. Co. Minster Standard Box Co. Sandusky Horace P. Keyes. Waynesville
Detroit, Toledo & Ironton RyJackson	Standard Box CoSandusky Horace P. KeyesWaynesville
Lima Locomotive & Machine CoLima	
Cleveland Akron & Columbus RyMt. Vernon	DAIRYMAN'S, POULTERERS' AND APIAR- ISTS' SUPPLIES
Detroit, Toledo & Ironton Ry. Jackson Lima Locomotive & Machine Co. Lima Mineral Ridge Míg Co. Mineral Ridge Cleveland Akron & Columbus Ry. Mt. Vernon Star Míg. Co. New Lexington The Jewett Car Co. New Jexington The Jewett Car Co. Newark Erie R. New York. N. Y. The Niles Car & Míg. Co. Pittsburg, Pa. Wabash R. St. Louis, Mo. Illinois Car Co. Urbana Acme Handle Co. Warren	
Erie R. R	The Cardington Cabinet Co Cardington The Dana Mfg. Co Cincinnati
The Niles Car & Mfg. CoNiles	Defiance Box Co Defiance
Wabash R. R. St. Louis Mo	McKenzie Lumber CoDelaware
Illinois Car Co	The Gem Incubator Co
The Cleveland, Painesville & Eastern	H. J. RyanLagrange
Acme Handle Co. Warren The Cleveland, Painesville & Eastern R. R. Co. Willoughby Youngstown Car Mfg. Co. Youngstown	The Germin Internation of the Control of the Contro
Youngstown Car Mfg. CoYoungstown	
CASKETS AND COFFINS	Fuller & Kirkton. New London A. Cook & Co. New Knoxville G. W. Stafford & Co. Novelty The Easy Washing Machine Co. St. Marys Charles & Co. Novelty
Belmont Casket Mfg. Co	G. W. Stafford & CoNovelty
	The Easy Washing Machine CoSt. Marys The Buckeye Churn CoSidney
Cincinnati Coffin Co	The Buckeye Incubator CoSpringfield
Crane & Breed Mfg. Co	A merican Woodenware Mfg CoToledo The M. Brown Co
The Columbus Coffin Co Columbus	The Buckeye Churn Co. Sidney The Buckeye Incubatòr Co. Springfield A merican Woodenware Mfg Co. Toledo The M. Brown Co. Wapakoneta The Standard Churn Co. Wapakoneta
Ohio Casket Co. Columbus Findlay Casket Co. Findlay B. F. Briggs. Pomeroy The Springfield Coffin & Casket Co. Springfield	ELEVATORS
B. F. BriggsPomeroy	
The Springfield Coffin & Casket CoSpringfield Stoll Casket CoSpringfield	James Curran Elevator Co
Stoll Casket Co	Warner Elevator Mfg. CoCincinnati
CHAIRS	Sidney Elevator CoSidney
	FIXTURES
Baltic Bending CoBaltic The B. L. Marble Chair CoBedford	Ada Coal & Lumber CoAda
Laylor Chair Co Bedford	Star Planing Mill CoAkron
Hardesty Mfg. Co Canal Dover Standard Furniture Co Cincinnati	McCaskev Register CoAlliance
Cincinnati	Ashley Lodge & Church Furniture Co Ashley The Hardwood Finish Co
D. Allnker Co Cincinnati	Harvard Co
H. Closterman. Cincinnati Ficks, Reed Co Cincinnati	The John Danner Mfg. Co
Fred S. Lubke Sons. Cincinnati The Henry Holtzman & Sons Co. Columbus Marble and Shattnek Chein Co.	Scioto Valley Casket Co. & Bonner Bros. Chillicothe
	Cincinnati Butchers Supply CoCincinnati P. T. Baker & Son
Delawate Chair Co	
The Gallipolis Chair Co	The American Rilliard Table & Saloon
Globe Chair Co	Fixture CoCincinnati

NAME

TOWN

Closterman. Cincinnati
Modern Furniture Co. Cincinnati
J. Dornette & Bros. Co. Cincinnati
Oscar Onken Co. Cincinnati
Ficks-Reed Co. Cincinnati
A. Renesch & Co. Cincinnati

Globe Wernicke Co. Fred S. Lubke Sons. Meyer Bros. Furn. Co.	Cincinnati
Fred S. Lubke Sons	Cincinnati
Meyer Bros Furn Co	Cincinnati
Schirmer Furn. Co. Schmit Furniture Co. Sextro Míg. Co. Steinman & Meyer Furn, Co. Stille & Duhlmeier Co.	Cincinnati
Schirmer Furn. Co	Cincinnati
Schmit Furniture Co	Cincinnati
Sextro Mfg. Co	Cincinnati
Steinman & Meyer Furn, Co	Cincinnati
Stille & Duhlmeier Co	Cincinnati
The S. F. Streit Mfg. Co. Withrow Mfg. Co. Beelman Cabinet Co	Cincinnati
With man Men Co	Cincinnati
Withrow Mig. Co	Cincinnati
Beelman Cabinet Co	Cleveland
Champion Bed Spring Co	Cleveland
Theo. Kuntz	Cleveland
D. T. Owen Co	Cleveland
Theo. Kuntz. D. T. Owen Co. E. M. Hulse Co. The Hildreth & Martin Lbr. Co.	Columbus
The Hildreth & Montin I by Co	Columbus
The findreth & Martin Lor. Co	Columbus
Sun Mfg. Co.	Columbus
Burkhardt Furn. Co. F. A. Requarth Co. Mutual Mfg. Co.	Dayton
F. A. Requarth Co	Dayton
Mutual Mfg. Co	Dayton
Delaware Chair Co	Delaware
Edon Francisco Co	Edon
Edon Furniture Co. Findlay Mfg. Co. Freemont Furn. Co.	Tolon
Findlay Mig. Co	Findlay
Freemont Furn. Co	Freemont
J. J. Schellkop The Gallia Furn. Co	Freemont
The Gallia Furn, Co	Gallipolis
Ohio Valley Furn Co	Gallipolie
West End Dianing Mill	Callipolia
West End Planing Will	tallipons
The Geyler Furn. Mig. Co	Hillsboro
Kunkle Mfg. Co	Kunkle
Ohio Valley Furn. Co. West End Planing Mill. The Geyler Furn. Mfg. Co. Kunkle Mfg. Co. The Logan Mfg. Co.	Logan
Snider Mfg. Co	Logan
Snider Mfg. Co	Manchester
Ohio Valley Furn. Co	Manchester
A dame Comment of the	Managali
Adam Gross	Mansheid
Adam GrossRoderick Dean Mfg. Co	Mansfield
A. L. Rhinr	Massillon
Marietta Chair Co	Marietta
A. L. Rhinr. Marietta Chair Co. Marysville Cabinet Co.	Marysville
May sy the Cabhet Co. Newark Ohio Furn. Co. The Ward-Stilson Co. Geo. S. Stewart Co. The Cron, Kills & Co.	Nowastr
The Wark Office Furth Co	Man Tandan
The ward-Stilson Co	. New London
Geo. S. Stewart Co	Norwalk
The Cron, Kills & Co	Piqua
The King Mig. Co. The Piqua Furn. Co. Sprague Smith Co. Breece Mig. Co.	Piqua
The Piqua Furn Co	Piqua
Compound Comith Co	Diana
Day of Mer. O.	Domesmouth
Breece Mig. Co	Portsmouth
Wait Furn, Co	Portsmouth
Wait Furn. Co. The Sutter Mfg. Co. The Reed Mfg. Co. The Tippecanoe Furn. Co.	Shelby
The Reed Mfg, Co	Springfield
The Tinnecance Furn. Co.	Tippecanoe
The Ames Penner Co	Toledo
Cahanaa Danlan France Co	Tolodo
Schauss Parlor Frame Co	Toledo
Hein Furniture Co	Toledo
The Ames Bonner Co	Toledo
The Barlow & Kent Co	Urbana
Groll Bros.	Waldo
The M Brown Co	Wanakoneta
110 111 210WH CO	
	Warren
The King Furn. Co	Warren
The King Furn. Co The Western Reserve Furn. Co	Warren Warren
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The Western Reserve Furn. Co C. L Kraig Mfg. CoWasi The Zanesville Furn. Co	Warren Warren hington C. H. Zanesville
Toledo Desk & Fixture Co. The Barlow & Kent Co. Groll Bros. The M. Brown Co. The King Furn. Co. The Western Reserve Furn. Co. C. L Kraig Mfg. Co. Wasi The Zanesville Furn. Co. Wasi	Warren Warren hington C. H. Zanesville
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The King Furn. Co	Warren Warren hington C. H. Zanesville

Geo. n. Kephart & Soll	
The Baker McMillan Co	Akron
Whitman & Barnes	Akron
Ashland Handle Mfg. Co	Ashland
F. E. Mevers & Bro	Ashland
Winchester "D" Handle Co	Attica
T. & A. Rogers	Barnesville
S. G. Wright	Bergholtz
Hunter Brush Mfg. Co	Blanchester
Ash & Mills	Bryan
The Richland Handle Works	
Buckeye Handle Co	
Canfield Mfg. Co	
F. E. Kohler Co	
The Nev Mfg. Co	
H. C. Long Handle Factory	
Carey Bending Co	
W. H. Snyder.	
The Ober Mfg. Co	

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Valley Mfg Co Chillicothe	The Arnold-Greagor Co. New London Cyclone Drilling Co. Orrville Buckeye Engine Co. Salem The Bauer Bros. Co. Springfield Mentger Folding Machine Co. Sidney Loomis Machine Co. Tiffin McMyler Interstate Co. Tiffin
National Handle Co. Cloveland	Cyclone Drilling Co
National Handle Co Cleveland	Destant Francisco Co.
C. E. TaitCleveland	Buckeye Engine Co Salein
The Kilbourne & Jacobs Mfg. Co Cleveland	The Bauer Bros. Co Springheid
Columbiana Mfg. Co : Columbiana	Mentger Folding Machine CoSidney
Creston Handle Co	Loomis Machine CoTiffin
Dayton "D" Handle Co Dayton	McMyler Interstate Co
M. W T. 1 C Dayton	incluyior interstate committee in in including
McKenzie Lbr. Co Delaware	
John C. Shaffer Delphos	MISCELLANEOUS
Lloyd BrosDoylestown	
National Handle CoFindley	Davis & SiehlCincinnati
Calion Handle & Mfg Co Calion	Devter Lumber Co
The Weener Pending Co. Calion	Allie Chalmere Co Cincinnati
The Weaver Bending Co Ganon	Ams-Chaimers Co Meld Co. Cincinnati
The Potter Mfg. Co Geneva	A merican Cigar Wold Co Cincinnati
Delk Mfg. CoGreenville	Miller, DuBrul & Peters Mfg. Co Cincinnati
F E Schumacher Co Hartville	Rebhun Last Co Cincinnati
Wood Novolty Co Harrod	Cincinnati Artificial Limb Co Cincinnati
Constant Con	Dustrawa Stangantiann Co. Claveland
Crook, Son & Co Hicksville	Buckeye Stereopticon Co Cleverand
Miller Mfg. Co	P. A. McHugh Cleveland
The F. E. Kohler Co Louisville	Cleveland Artificial Limb CoCleveland
Middlefield Basket & Veneer Co Middlefield	Sun Mfg. CoColumbus
Hawking Co. Minerva	The Jeffery Mfg. Co
Vingling Dage & Co. Mongoovilla	Cochocton Class Co. Cochocton
Vingining Bros. & Co	Coshocton Glass Co
Napoleon Lbr. & Handle Co Napoleon	National Sign Co Dayton
Clark, Allen & Co New Bremen	Buckeye Lumber Co East Liverpool
The Bell Handle Co New Bremen	Self-Lifting Piano Truck CoFindlay
The Columbia Mfg. Co New Philadelphia	Geo. J. Mulzer Galena
The Callun Puffin Hall Co Normally	Davis & Siehl
The Gallup Ruinii Hul. Co	The Death Colliciant Co.
The McGrillis Handle Co Norwalk	The Burk Gol: Shart CoNewark
Geo. S. Stewart Co Norwalk	The W. J. Clark CoSalem
J. W. Vickes & SonPiedmont	Sandusky Tool CoSandusky
Piqua Handle & Mfg. Co Piqua	Wagner Mfg. CoSidney
Dalle Bros Prospect	The Reed Mfg Co Springfield
Candualty That Ca	Phoenix Por Factory Toledo
Sandusky Tool CoSandusky	Phoenix Box Pactory
C. R. Benjamin & SonSidney	*** MOTTED
E. E. Gilbert Smithville	MATCHES
F. F. Kohler South Zanesville	
Summerfield Lbr. CoSummerfield	Reliable Match Co Ashland
W. S. Fulton Sugar Creek	Reliable Match Co
A D Cuiddle	The Pan-American Match Co. North Raltimore
(The History its Hall Co.	Ohio Match Co
The Hicksville Hal. Co Toledo	Onio Match Co wadsworth
H. A. Bollz Wapakoneta	
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NAME	TOWN	NAME	TOWN
Motznick Bros	Cuyahoga Falls	Holwick Lbr. Co	
The Barney E. Smith Car Co.	Dayton	W. H. Snyder	Carev
Davis Sewing Machine Co	Dayton	P. Kuntz & Herr Ll	or. Co Celina
Dayton Body Co	Dayton	Chardon Bldg. Sup.	Co Chardon
Gebhart Wuichet Lbr. Co	Dayton	A. J. Rhodes	Sup. Co Chardon Chesterland
The H. P. Deuseher Co		Chesterland Bldrs. 8	Sup. Co Chesterland
The Long & Allstatter Co		Beelman Mfg. & Su	oply Co Chicago
Lima Locomotive & Machine	CoLima	Nolze Lbr. Co	Chillicothe Cincinnati
Humphrey Mfg. Co	Mansfield	Beck & Mueller	
Ohio Tractor Co	Marion	Bentel Bros	Cincinnati
The Fairbanks Steam Shovel		Cincinnati Floor Co	
Marion Steam Shovel Co	Marion	M. B. Farrin	
The Marion Lumber Co	Marion	Chas. Ferris Lbr. Co	Cincinnati
Russell & Co	Massillon	Hyde Park Lbr. Co	Cincinnati
Cyclone Drilling Co	Orrville	Meador Interior Wor	k Co Cincinnati
Portsmouth Steel Co	Portsmouth	Chas. Rosentiel & So	on Cincinnati
Buckeye Engine Co	Salem	Clarington Planing	Mill Co Clarington
The Silver Mfg. Co	· · · · · · Salem	Advance Lbr. Co	Cleveland
Wagner Mfg. Co	Sidney	The Barner-Mead L	br. CoCleveland
Sidney Tool Co	Sidney	The Cleveland Lbr.	Co Cleveland
The Bauer Bros. Co	Springfield	The Cuyohoga Lbr.	CoCleveland
Carnegie Steel Co	Youngstown	Fisher & Wilson Co.	Cleveland
Youngstown Steel Tube Co	Youngstown	Gray Lumber Co	Cleveland
		Lake Erie Lbr. Co	
PLANING MILL PR	RODUCTS	Lake Shore Saw Mil	1 & Lbr. CoCleveland
		Lakewood Lbr. Co	Cleveland
Ada Coal & Lbr. Co	Ada	Mills-Carlton Co	Cleveland
G. V. Kern	Adamsville	Potter, Teare & Co.	Cleveland
Akron Lbr. Co	Akron	Reaugh & Son	Cleveland
Clements & Allen	Akron	Kocky River Lbr. Co	Cleveland
Fisher & Bro	Akron	Saginaw Bay Co	Cleveland
Goehring Mfg. Co	Akron	Otis Still Co	Cleveland
Star Planing Mill Co	A kron	The Willson Ave. Li	or. Co Cleveland
Summit Lumber & Building C	o A kron	Collinwood Lbr. Co.	
The F. H. Weeks Lbr. Co White Lumber Co	Akron	Putting A Ti	Columbus
I. G. Tolerton & Son	Akron	The Deddington Co	CoColumbus Columbus
C C Westween & Son	Alliance	The Boddington Co	CoColumbus
C. S. Westover J. T. Weybrecht's Sons	Alliance	The C T Notes Co	Columbus
The Amherst Supply Co	A mhange	I I Spider I by Co	Columbus
Piverside Mill Co	Antiquity	Pond Lumber Co	Conneaut
Riverside Mill Co	A pplaceast	S W Gran	Contrille
Gatshall Bros	Archhold	Thomas Colony	
S. T. Hoover	A rmetrong Mille	E S Heestand	Damascus
S. T. Hoover J. G. Laird Lbr. Co	A shtabula	Davis Sewing Machin	ne Co Dayton
J. E. Strubbe	Ashtabula	Hiestand & Co	Dayton
Athens Lbr. Co		McKenzie Lbr. Co.	
Rardin Bros. Lbr. Co	Athens		Dellroy
Bemendefer & Co		Herman Ricker & So	nsDelphos
W. R. Lynn	Atwater	H. L. Niles	Delta
A. H. Regula & Co	Baltic	Lytle Lbr. Co	Deshler
J. E. Doudna	Bannock	Dresden Lbr. Co	DresdenEast Liverpool
Etling Lbr. & Mfg. Co Mathie & Lutz	Barberton	Buckeye Lbr. Co	East Liverpool
Mathie & Lutz	Barberton	C. Nease & Co	East Liverpool East Orwell Co. Elyria
T. & A. Rogers.	Barnesville	W. A. Cheney	East Orwell
Beach City Lbr. Co	Beach City	Elyria Lbr. & Coal (Co Elyria
E. L. Miller	····· Bedford	Parsch Lbr. Co	Elyria
Dubois & McCoy Lbr. Co	Bellaire	H. H. Fassett Estat	eFindlay
J. W. Neff & Son.	Bellaire	M. D. Neff & Co	Findlay
A. Lesourd & Sons	Bellefontaine	Parker Bros	Findlay
Gross Lbr. Co	Bellevue	J. C. Blaine	Findlay Frazeysburg Fredericksburg
J. M. Gordon	· · · · · · Belmont	M. J. Peterman	Fredericksburg Freeport
W H Wittenman	Pantan Dida	Francisco Kelly	Freeport
W. H. Wittenmyer J. E. Crabs	Barghalt	Price I by & Mr.	p. CoFremont Fremont
John W Kimmel	Bluffton	Calien I by Ca	Galion
John W. Kimmel Bremen Mill & Lbr. Co	Bluitton	A C Cladbill	Galion
J. W. Stiger	Bremen	O A Odell	Collinglia
Colter & Co	Drauner	P I Sharman	GallipolisGates Mills
White Lbr. & Coal Yard	Puctrus	F H Honking	Ghent
C. H. Johnson	Deseton	The Athens Lumber	CoGlouster
W. E. Winkler	Rutler		
W. E. Winkler. Byesville Planing Mill Co J. H. Mills.	Rvesville	Geo. E. Hersh	Gradenhutten Grand Rapids
J. H. Mills		W. H. Pommer Mfg.	CoGreenfield
The West Side Planing Mill Co		The Banner Lumber	CoGreenville
C. W. Forney	Cambridge	H. L. Wright	Greenwich
The West Side Planing Mill Co. W. Forney	···· Cambridge	Gilbert Lbr. Co	Groverhill
W. A. Hunt	Cambridge	East Ave. Planing N	fill Hamilton
Collier & Boer	Canal Dover	Panning Bros	
Wagner Lumber Co	Canal Dover	Clemmer & Johnson	
C. Gilcher	Canal Fulton		Hicksville
Canfield Lumber Co	Canfield	Enterprise Planing N	Iill CoHillsboro
Brumbaugh Lbr. Co	Canton	Holgate Lbr. Co	Holgate
David Hinton	Canton	Gross Bros	Homeworth

NAME	TOWN	NAME	TOWN
Abele-Kimmels Lbr. Co	Ironton	The S. M. Cole Co	Oberlin
W. E. Dawkins Lbr. Co	Ironton	Fred Kinney & Son	Orrville
Vellow Poplar Lbr. Co	Ironton	E. A. Sellers	Orwell
Ward Lumber Co	Ironton	Cramer & Johnston	Oxford
Buckeye Mill & Lbr. Co	Jackson	S. L. Malin & Son	Oxford
Jackson Mill & Lbr. Co	Jenera	Laroo CompanyP	ainesville
J. B. Hodges	Johnstown	Brooke Lumber CoP	ataskala
John Callam & Co	Kenton	H. F. SteffensPe	mberville
Robinson-Gage Lbr. Co	Killbuck	American Wagon Stock & Walnut Mfg. (Co Piqua
Joseph Kuhn & Bro	Kuhn	C. L. Wood	Piqua
John Darfus	Lancaster	Nimmons & Nimmons I	Plymouth
Edward Delancy	Lancaster	Pomerov Lumber Co	Pomerov
West Side Lbr. Co	Lancaster	Port Clinton Lbr. & Coal CoPor	t Clinton
Jos. A. Slauser Lbr. Co	Larue	H Leet Lumber Co	rtsmouth
Monroe & Johnston	Lebanon	River City Lumber CoPo	rtsmouth
The James McDonald Lbr. Co	Leipsic	D. L. Webb CoPo	rtsmouth
Ruhlen & Miller	Lima	A. Cochran Co	Prospect
Lockland Lumber Co	Lockland	L. J. Hath	Randolph
C. E. Stockwell	Lockwood	J. P. Hoffman	Randolph
The Lorain Lbr. & Mfg. Co	Lorain	O. E. Sigler Rick	Kavenna
The Wood Lbr. Co	Lorain	The Ripley Mill & Lbr. Co	Ripley
M. O. Sherer	Louisville	G. G. MeyersR	ising Sun
Loveland Lbr. & Mfg. Co	Loveland	Lewis Bros. Lbr. Co	Rockford
M. C. True & Co Lo	wer Salem	The Peoples Lumber Co	Salem
Jones Lumber CoMcCo	nnellsville	The Salem Lumber Co	Salem
A. N. Benjamin	Malta	Schoepfle Mfg. & Lbr. Co	Sandusky
Fred Buel & Son	. Malvern	Peterson-Hiss Co	Sandusky
Constance Lbr. Co	Mansfield	S. WilcoxS	Sciotoville
Mansfield Lbr. Co	. Mansfield	Buckeye Churn Co	Sidnev
A. L. Jeffrey	Marengo	B. Worts Sou	th Euclid
Central Mfg. Co	Marietta	Springfield Planing Mill & Lbr. CoSi	pringfield
The Marion Lbr. Co	Marion	J. H. Good	Struthera
The Slouser Lbr. & Coal Co	Marion	Stryker Boat Oar & Lbr. Co	Stryker
Brown Lumber Co	.Massillon	Jenkins & Davenport	St. Marys
Jacob Horr Mech	anicsburg	Sugar Creek Lumber CoSug	ar Creek
Stoker Bros	McComb	Mast BrosSug	rar Creek
Chas. E. Denny	Iiddletown	A. Laux	Swanton
Geo. Dome, Jr	liddletown	J. A. Petty	Sycamore
Middletown Lbr. Co	liddletown	Seneca Lumber Co	Tiffin
Adams, Marchland & Co	fillersburg	Shilling & Son	· · · · Tiro
Millersburg Lbr. Co	lillersburg	Gotshall-Goodyear Co	Tole-io
Emerson Cox	Minerva	Witker Mfg. Co	. Toledo
Mowrytown Lbr. Co	Iowrytown	The C. H. Schroeder Co	Toledo
John Leonhart	. Napoleon	Campbell Lumber Co	Toledo
Napoleon Lbr. & Handle Co	. Napoleon	Goulet & Company	Toledo
Robert Hug	Navarre	Kelsey & Freeman	Toledo
Orwiler & Armstrong	Nevada	J. O. Goodwin & Son	Toronto
E. H. Cochlan	Newark	The Francis & Clemm Co	Troy
Nutter & Sons	Newark	W. A. Pearson	Troy
Reebe Mfg. Co	w Bremen	C. BachmanV	ermillion
John L. Noble Ne	w Concord	Wadsworth Lumber & Mfg. CoWa	adsworth
The John Nagley Lbr. Co New Pt	ew Militord	Warren Lumber CoV	wakeman Warren
Wm. M. Thompson New Ph	iladelphia	Western Reserve Lumber Co	Warren
Union Lbr. Co New Ph	iladelphia	The West Side Lumber & Coal Co	Warren
Peifer & Son New	New Riegal	Parker & Wood Mfg. Co Washing	ton C. H.
William May New S	pringfield	Oliver Lumber Co V	Vaterford
Newton Falls Basket Co	Springfield	H. H. Williams & Co	Wayseen
C. W. Wager Ne	wton Falls	Phelps Bros. & Co	ellington
New Washington Lbr. & Mfg. CoN. W	ashington	The Cellar Lumber CoW	esterville
Henry J. Everett	Baltimore	West Unity Mfg. Co. W.	Weston
H. H. Lynn Nor	th Jackson	A. E. Baker	Wharton
Abele-Kimmels Lbr. Co. W. E. Dawkins Lbr. Co. Fearon Lbr. & Veneer Co. Yellow Poplar Lbr. Co. Buckeye Mill & Lbr. Co. Jackson Mill & Lbr. Co. John Callam & Co. Robinson-Gage Lbr. Co. John C. & W. Duncan. Joseph Kuhn & Bro John Darfus Edward Delancy. Orman Bros West Side Lbr. Co. Jos. A. Slauser Lbr. Co. John Armstrong. Monroe & Johnston. The James McDonald Lbr. Co. Ruhlen & Miller F. McGirr. Lockland Lumber Co. C. E. Stockwell. The Lorain Lbr. & Mig. Co. The Louisville Lbr. Co. The Wood Lbr. Co. Mo. O. Sherer Loveland Lbr. & Mig. Co. Lowell Planing Mill Co. Mo. C. True & Co. Lowell Planing Mill Co. Mo. C. True & Co. Lowell Planing Mill Co. Mo. Sherer Loveland Lbr. Co. S. N. Ford & Co. Mansfield Lbr. Co. S. N. Ford & Co. Mansfield Lbr. Co. The Moore Co. A. L. Jeffrey. Central Mig. Co. The Blouser Lbr. & Coal Co. Marysville Wire Fence & Lbr. Co. Brown Lumber Co. Jacob Horr Stoker Bros. Caldwell & Iseminger Mechase. Caldwell & Iseminger Mechase. Caldwell & Iseminger Mechase. Millersburg Lbr. Co. Marysville Wire Fence & Lbr. Co. Brown Lumber Co. Jacob Horr Stoker Bros. Caldwell & Iseminger Mechase. Candwell & Iseminger Mechase. Chase. E. Denny Mechase. Mechase. Millersburg Lbr. Co. Millersburg Lbr. Co. Minster Lbr. Co. Mechase. Me	Norwalk	The S. M. Cole Co. The Oberlin Lbr. & Coal Co Fred Kinney & Son E. A. Sellers. Cramer & Johnston Thomas C. Lloyd S. L. Malin & Son P. Laroo Company. P. Brooke Lumber Co. P. H. F. Steffens. Pe W. A. Clay American Wagon Stock & Walnut Mig. Co. L. Wood. Nimmons & Nimmons John Genheimer Pomeroy Lumber Co. Port Clinton Lbr. & Coal Co. Port Cly Lumber Co. Port Clinton Lbr. & Coal Co. Por E. M. Funk. Pol. Leet Lumber Co. Po D. L. Webb Co. Po Po. L. Webb Co. Po Porspect Lumber Co. A. Cochran Co. L. J. Hath. J. P. Hoffman P. L. Frank. O. E. Sigler. Ricl The Ripley Mill & Lbr. Co. G. G. Meyers. Brown Van Orman Co. Lewis Bros. Lbr. Co. The Peoples Lumber Co. Sandusky Sash. Door & Lbr. Co. Schoepfle Mig. Co. Schoepfle Mig. & Co. Schoepfle Mig. Co. Waster Ellis. J. O. Goodwin & Son The Pearson. Wh. Suyder C. Bachman. Very Waster Lumber Co. Schoepfle Mig. Co. Wastern Reserve Lumber Co. Wastern Re	.Whipple

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Henry J. Everett Wm. Himberger & Co Goodsell & Bostwick D. C. Shank Co S. L. Malin & Son Paulding Lumber Co H. F. Steffen Pomeroy Lumber Co H. Leets Lumber Co H. Leets Lumber Co The Ripley Mill & Lumber Co The Salem Lumber Co Schoepfe Mig. & Lumber Co Springfeld Planing Mill Go. Co Springfield Planing Mill Go Springfield Planing Mill Co Springfield Planing Mill Co St. Marys Planing Mill Co Schoepfel Bros Walter Ellis The Pilliod Lumber Co The Pilliod Lumber Co J. A. Petty The Enterprise Mig. Co. Lease & Collier Seneca Lumber Co The Booth Column Co Campbell Lumber Co The Goodsell Mig. Co Che Goulet & Co The Goodsell Mig. Co The Goodsell Mig. Co The Holedo Screen Co The Goodsell Mig. Co The Holedo Screen Co The Western Reserve Lu. The Western Lumber Co Parker & Wood Mig. Co Gehres Bros Bert Leighminger Oswald Bros West Unity Mig. Co The Joleob Screen Co The Heller Bros. Co The Hel	TOWN	NAME
Henry J. Everett	North Baltimore	Columbus
Wm. Himberger & Co	Norwalk	Crawford, Internation
D C Shark Co	Norwalk	The Burk
S. L. Malin & Son	Painesville	The Durk
Paulding Lumber Co	Paulding	
H. F. Steffen	Pemberville	11-0-1
H Leete Lumber Co	Portsmouth	Ada Coal Bean Spra
Prospect Lumber Co	Prospect	Hauser, I
A. Cochran Co	Quaker City	Hauser, I J. A. Ort Buckeye l J. C. Blai The Rond
Trares Bros		Buckeye I
Lewis Bros. Lumber Co.	Rockford	The And
The Peoples Lumber Co.	·····Salem	
The Salem Lumber Co	Salem	East Ave
Sandusky Sash, Door & I	amber CoSandusky	East Ave John Call J. P. Rida W. R. Ha
G. D. Spiker & Son	Scio	W. R. Ha
S. Wilcox.	Sciotoville	The Helle
Shelby Lumber Co.	Shelby	The Helle R. T. Arr The E. W Wm. F. D Meek Cist
E. E. Gilbert	Smithville	Wm. F. D
C. J. Miller & Co	Smithville	Meek Cist
Snider-Flautt Lumber Co	Spencerville	
Springfield Planing Mill	& Lbr. CoSpringfield	
John C. Fitzsimmons Lui	nber CoSteubenville	Geo. H. K N. Drucke
W. McDowell & Son	Steubenville	N. Drucke
Jenkins & Davenport	St. Marys	Mendel & Schneider
F. Weber Planing Mill Co	Strasburg	Jas. Dunr
McFeely Bros	Steubenville	Jas. Dunn Likly & I John R. E
The Pilliod Lumber Co	Swanton	F A Sta
J. H. Good	Struthers	F. A. Sta Wood Nov John B. D
Mast Bros	Sugar Creek	John B. I
J. A. Petty	Sycamore	The Gots
Lease & Collier	Tiffin	VEH
Seneca Lumber Co	Tiffin	
The Booth Column Co	Toledo	Akron-Se Geo. A. C
The Goodsell Mfg. Co		Anna Spo
Goulet & Co	Toledo	Athens L
Kelsey & Freeman	Toledo	J. B. Heis
Toledo Trimming Co	Toledo	Baltic Be
Witker Mfg. Co	Toledo	J. E. Dou Buckeye
The Toledo Screen Co	Toledo	A. J. Mill
Western Mfg Co	Toledo	Sheets Mf
Stephen Lumber Co	Toledo	Bryan Mf Buckeye I Bucyrus I
The Wadsworth Lumber	& Mig. CoToledo	Bucyrus J
Warren Lumber Co	Warren	The Card
The Western Reserve Lu	mber CoWarren	Carey Ber The Card Ames Ber Valley Mi Ahr & Ro
The West Side Lumber &	z Coal Co Warren	Valley M
Coffman Lumber Co	Washington C. H.	Ahr & Ro American
Gehres Bros	Washington C. H.	O. Armle
Bert Leighminger	West Lafayette	Bellvue P Bode Wag
Oswald Bros	Weston	Bode Was
A. E. Baker		Buschle &
Shepherd & Son	Wilmington	Crane &
Fisher Mfg. & Fuel Co	Wilmington	Haberer &
Winchester Lumber Co	Winchester	Highland
Geo. H. Dingledy Lumber	CoYoungstown	Geo. Keye James Ki Philip Kle
Huffman Bros	Youngstown	Philip Kl
The Heller Bros. Co	Youngstown	Mill Creek Ohio Seat
The Mahoning Lumber Co.	CoYoungstown	Sayers & C. B. Van The Well:
Scheetz Lumber Co	Youngstown	C. B. Va
The B. C. Tibbits Lumber	er CoYoungstown	The Well:
The Herdman Sash, Door	& Lbr. CoZanesville	Withrow Wm. Gab
F. L. Israel	Zanesville	Theo. Ku
SPORTING AND A	THI PTIC COOPS	Olstyn Ca Peerless N
SPORTING AND A	THEFTIC GOODS	The Rauc
Am. Billiard Table & Sa	loon Fixtures Co.	Gustaves
	Cimpinneti	

	d Table & Saloon	
		Cincinnati
National Bi	lliard Mfg. Co	Cincinnati

Columbus Bar Fixture Co	Columbus
Crawford, McGregor & Canby Co.,	Dayton
International Golf Shaft Co	Dayton
The Burke Golf Shaft Co	Newark

TANKS AND VATS

Ada Coal & Lumber Co	
Bean Spray Pump Co	Berea
Hauser, Brenner & Fath Co	Cincinnati
J. A. Orth	
Buckeye Lumber & Bldg. Co	East Liverpool
J. C. Blaine	Frazeysburg
The Anderson Tool Co	Hamilton
The Bender Co	Hamilton
East Avenue Planing Mill	Hamilton
John Callam Co	Kenton
J. P. Ridge	
W. R. Harrison & Co	Massillon
The Heller-Aller Co	
R. T. Arrowsmith, Jr	
The E. W. Ross Co	
Wm. F. Dahlmeyer Tank Co	Toledo
Meek Cistern Co	Toledo

TRUNKS AND VALISES

Geo. H. Kephart & Son	Ada
N. Drucker & Co	Cincinnati
Mendel & Co	Cincinnati
Schneider Bros	: Cincinnati
Jas. Dunn Co	Cleveland
Likly & Rockett Trunk Co	Cleveland
John R. Hughes Co	
F. A. Stallman	Columbus
Wood Novelty Co	
John B. Duguid	Toledo
The Gotshall Mfg. Co	Toledo

VEHICLES AND VEHICLE PARTS

Akron-Seile Co	Akron
Geo. A. Collins & Sons	Akron
Anna Spoke Works	Anna
Athens Lumber Co	Athens
I B Heiser	Atwater
J. B. Heiser Baltic Bending Co	Raltic
J. E. Doudna	Pannock
Buckeye Carriage Body Co	Pollofontaino
A. J. Miller & Co	Pollofontaine
Sheets Mfg. Co	Detring
Sheets Mig. Co	David
Bryan Mfg. Co	Bryan
Buckeye Bending Co	Bucyrus
Bucyrus Bending Co	Bucyrus
Carey Bending Co	Carey
The Cardington Cabinet Co	Cardington
Ames Bending Co	Celina
Valley Mfg. Co	Chillicothe
Ahr & Rost Co	Cincinnati
American Wagon Co	Cincinnati
O. Armleder Co	Cincinnati
Bellvue Planing Mill Co	Cincinnati
Bode Wagon Co	Cincinnati
Buschle & Wuest	Cincinnati
Cincinnati Panel Co	Cincinnati
Crane & Breed Mfg. Co	Cincinnati
Haberer & Co	Cincinnati
Highland Body Co	Cincinnati
Geo. Kever Co	Cincinnati
James Kidney Co	Cincinnati
Philip Klopp & Son	Cincinnati
Mill Creek Wagon Co	Cincinnati
Ohio Seat Co	Cipcinnati
Sayers & Scoville Co	Cincinnati
C. B. Vandervort	Cincinnati
The Welland Co	Cincinnati
Withrow Mfg. Co	Cincinnati
Wm. Gaberail Co	Cleveland
Theo. Kuntz	Cleveland
Olstyn Carriage Co	Cleveland
Peerless Motor Car Co	Cleveland
The Rauch & Lang Carriage Co.	····· Cleveland
Gustave Schafer Carriage & Wago	n Co., Cleveland
Winton Motor Carriage Co	Cleveland
The Columbus Buggy Co	Columbus

NAME	TOWN	NAME	TOWN
	Oslamban	Diddle Cooch & Hoome Co	Pawanna
Excelsior Seat Co	Columbus	Riddle Coach & Hearse Co Crane & MacMahon	St. Mary's
The Seagrave Co	Columbus		
The Seagrave Co	Columbus	G. N. Galbreath	Sherwood
		The W. H. Mullins Co. G. N. Galbreath Pioneer Pole & Shaft Co. Sidney Mfg. Co. Sidney Tool Co. The Tucker Wood Work Co.	Sidney
Borchers Carriage Co	Dayton	Sidney Tool Co	Sidney
S. N. Brown & Co	Dayton	The Tucker Wood Work Co	Sidney
Chas H Cook	Dayton	F. F. Kohler	Zanesville
Snutz Wagon Co. Borchers Carriage Co. S. N. Brown & Co. Buckeye Wagon & Motor Co. Chas. H. Cook. Dayton Body Co.	Dayton	E. E. Gilbert. F. F. Kohler S. Zanesvilie Gearwood Co. S.	Zanesville
UITO (Frail	a a a a a a a a a Da VIOII		
Meeker Mfg. Co	Dayton	W S Fulton	Stout
Pinneo & Daniels		Shilling & Son	Tiro
Pioneer Wagon Works	Dayton	Sas. Workman & Soils S Rome Spoke Works. W. S. Fulton S Shilling & Son The Tiffin Wagon Co. Gendron Wheel Co. Milburn Wagon Co. The LIW Stieres Co.	Tiffin
Speedwell Motor Car Co	Dayton	Gendron Wheel Co	Toledo
		The J. M. Skinner Co	Toledo
Zwick & Greenwald Co	Dayton	The Toledo Bending Co	Toledo
Defiance Box Co	Defiance	Toledo Carriage Woodwork Co	Toledo
Weber Bros Zwick & Greenwald Co. Defiance Box Co. Defiance Carriage Co. Turnbull Wagon Co. Delphos Bending Co. Oak Mir. Co.	Defiance	Milburn Wagon Co. The J. M. Skinner Co. The Toledo Bending Co. Toledo Carriage Woodwork Co. Toledo Wheelbarrow Co. Bickel & Null. E. H. Brandenburg J. W. Devers. Pioneer Pole & Shaft Co. The Star Storm Front Co.	Trotwood
Delphos Bending Co	Delphos	E. H. Brandenburg	.Trotwood
		J. W. Devers	Trotwood
J. F. Haury Bending Works D. E. Heisey	Farmersville	The Star Storm Front Co	Troy
Findlay Carriage Co	. Findlag	The Star Storm Front Co The Troy Carriage Sunshade Co	Troy
M. D. Neff & Co	Findlay	Troy Mfg. Co	Troy
Birnel Spoke & Auto Wheel Co	Fort Pecovery	Wertz Buggy Co Upper	Waden orth
Cunningham Mfg. Co	Fostoria	Stevenson Buggy Co	Wadsworth
Koss & German Co	Fostoria	The New Wapakoneta Wheel Co W	apakoneta
J. C. Blaine	Frazeysburg	Warren Handle Works	Warren
Koss & German Co. J. C. Blaine. A. J. Peterman. G. A. Berger.	Fremont	Wayne Lbr. & Mfg. Co	Wooster
Laurn-Thergens Wotor Car Co	Bremont	Warren Handle Works Winchester Lbr. Co. Wayne Lbr. & Mfg. Co. Brown Mfg. Co. The Andrew Kimble Co. H. J. Kimble Est.	.Zanesville
West Wood Turning Co	Fremont	The Andrew Kimble Co	Zanesville
F. M. Arnold	Grand Rapids	The Zanesville Gear Wood Co	. Zanesville
John Donges & Co	Hamilton	The Zanesville Gear Wood Co The Youngstown Carriage & Wago Co	n
Panning Bros	Hamler	Co Y	oungstown
L. B. Miller The M. F. Carroll & Sons Co	Hillsboro	WOODENWARE AND NOVEL	TIES
Ketter Buggy Co	Ironton		
J. W. Talga	Ironton	Ashtabula Pail Co	Ashtabula
Toconh Kuhn & Deo	Washen	J. E. Doudna Gibbs Mfg. Co. Cardington Cabinet Co.	Canton
Edward Delancy	Lancaster	Cardington Cabinet Co	Cardington
The Cass Hardwood Lbr. Co	Lima	Cincinnati Turning & Carving Co	Columbus
The Cass Hardwood Lbr. Co. The Louisville Lbr. C. Madison Wheel Co.	Madison	Cincinnati Turning & Carving Co Scioto Box Co. The Seagrave Co. Novelty Advertising Co	Columbus
Ohio Valley Wagon Co		Novelty Advertising Co	. Coshocton
Cook Wagon Co The Houghton Sulky Co	Marion	F. A. Requarth Co	Dayton
McMurray Sulky Co	Marion	Tettenborn & Co	Dayton
W. R. Harrison & Co. Bookwalter Wheel Co.	Massillon	Hughes & Smith	Galena
Bookwalter Wheel Co	Miamsburg	The Weaver Bending Co	Galion
Mitchell Wheel Co	Miamsburg	Crook Son & Co	Hicksville
Enterprise Carriage Mfg. Co	Milford	The Wood Lumber Co	Lorain
Napoleon Lbr. & Handle Co	Millersburg	The A. J. Root Co	Medina
The Burke Golf Shaft Co	Newark	Crook, Son & Co. The Wood Lumber Co. The A. J. Root Co. Ohio Pail Co. The Ward Stilson Co. N. L. Shoup The Newton Falls Mfg. Co. Co. Stewart Co. Consolidated Pump Co. Lyn N. Narley.	ew London
The Burke Golf Shaft Co. Newark Gear Wood Co. Blair Mfg. Co.	Newark	N. L. Shoup New S	Springfield
The Wyeth Co	·····Newark	The Newton Falls Mfg. Co Ne	wton Falls
The Wyeth Co	w Philadelphia	The King Mfg. Co	Piqua
S. L. Malin & Son	Palnesville	Consolidated Pump Co	Toledo
F A. Witzler. Port Clinton Buggy Co. Breece Mfg. Co. E. M. Funk	Perrysburg	John Nagley Phoenix Box Factory	
Breece Mig. Co	Portsmouth	The Lyman Mfg. Co	Warren
E. M. Funk	Portsmouth	The Lyman Mfg. CoWest	Lafayette

APPENDIX

Several wood-using industries of Ohio were not included in this special study because they are covered by the annual reports of the Bureau of the Census. In considering wood consumption in Ohio these industries are of much importance and with a view of making this report more complete to the extent with which Bureau of Census statistics refer to Ohio, they have been copied and presented in the following compilations:

LUMBER, LATH AND SHINGLES

There were 1,148 sawmills in operation in Ohio in 1910. The cut, 490,000,000 feet, gave the State the rank of twenty-five among 41 lumber producing States. The increase was 9.7 percent over 1909, and 28 percent over 1908. The lumber cut according to kinds of wood reported by the sawmills was as follows:

Softwoods

Species	Number active mills	Sawed lumber M feet b. m.
Yellow pine White pine Hemlock Spruce. Cedar Tamarack	42 14 36 8 2 3	2,568 252 2,845 176 31 17
Total softwoods		6.889 490,039

Hardwoods

Species	Number of active mills	Lumber sawed M feet b. m.
Oak	1,076 634 131 400 765 26 447 755 650 673 162 5 277 320	224, 676 32, 179 31, 122 1, 1534 14, 576 39, 498 15, 116 20, 022 24, 199 22, 815 2, 99 4, 139 6, 915 3, 086
Total	•••	483,150

Of the total sawed hardwood lumber, oak comprised approximately 46 percent, tulip poplar 15 percent, beech 9 percent, maple 7 percent, elm 5 percent, and the other woods in varying small amounts constituted the remainder. It is interesting to note that

Ohio stood first in the production of walnut lumber, though walnut is by no means the most important species of those manufactured in the State.

Shingles are manufactured principally from white pine, cedar, spruce and chestnut, and had in 1910 an average value at the mill of \$2.98 per thousand. The total number of shingles manufactured in 1910 was 1,339,000, with a total value at the mill of \$3,990.

The species used for lath are white pine, hemlock and yellow pine. The average value per thousand in 1910 was \$3.57 at the mill and 14,737,000 were manufactured.



Fig. 29. A scene in yard of an Ohio stave factory. Mostly elm bolts but also some ash, maple, red oak, hickory, sycamore, and buckeye.

COOPERAGE STUCK

Two kinds of cooperage stock, slack and tight, are produced. Slack cooperage stock is the term applied to the materials essential in making barrels to contain apples, flour, cement, nails, etc. Tight cooperage stock is distinguished from slack by the fact that it is made usually to contain liquids or articles requiring a strong container.

Twenty-three kinds of wood were used for making slack staves in 1910, and red gum, pine, beech and elm were the woods used in greatest quantities. For heading the same woods were reported as were reported for staves except that maple takes the place of elm. OF OHIO 131

The total production of heading was 969,000 sets. Hoops, which are the coiled or patent hoops, are made of elm and in the quantity manufactured Ohio leads all states, the total being 92,494,000.

Species	Staves produced Thousands
ed gum	27 70
ine	70
eech	1,771
dm	11,479
hestnut	296
Iaple	1,973
.sh	719
ak	1,626
ottonwood	596
.ll other	9,567
	00.100
'otal	28,123

VENEERS

The manufacture of veneers in Ohio has shown a steady increase in the last decade, due to the widening range of uses. Formerly veneer making was confined to a few hardwoods selected for beauty of grain and used as an exterior finish for high-grade furniture and cabinet work. The improvement of veneer machinery and methods of drying has developed a large demand for veneers made of cheap woods which are used for packing boxes, berry cups, fruit baskets, veneer barrels, drawer bottoms and filling in three-ply lumber.

Due to the increasing price of hardwood, built-up lumber of three-ply veneer has been extensively substituted for making furniture, fixtures and cabinets. Woods which have a tendency to twist and warp when sawed into boards can be used to advantage in the manufacture of this built-up lumber.

There are three principal methods of manufacturing veneer: rotary cutting, slicing and sawing. Rotary cutting is the method most extensively used, and by it all the cheap veneers are cut. Veneers made by slicing and rotary cutting are less expensive than by sawing, and the last method is therefore largely confined to the manufacture of high-grade finish veneers. Ohio is one of the unimportant states for manufacturing high-priced cabinet veneers. These not only include oak veneer, but mahogany and other foreign woods that are shipped in in the form of logs and veneer flitches.

In 1910 the wood consumed for veneers in Ohio was 11,832,000 feet log scale, which is more than twice the amount used in 1907 for the same purpose.



Ffg. 30. Coiling patent barrel hoops made from white elm. Ohio in 1911 leads all other States in the production of this commodity.

. Year	Wood consumed M feet, log scale
907	5,821
908	7,873
909	10,985
910.	11,832

PULP WOOD

The consumption of pulp wood in Ohio from 1907 to 1910 shows a decided decrease. The following table illustrates this fact:

Year	Number of mills	Wood consumed cords	Pulp produced tons
1907	4	59,110	31,205
1908		46,183	23,253
1909		55,275	26,977
1910		38,693	16,932

OF OHIO

The average yield per cord of pulp wood for 1910, irrespective of the kind of wood or process used, was 1,238 pounds. The average approximate yield per cord by the ground wood process is 2,000 pounds, and by the sulphate and soda process 1,000 pounds.

The following table shows the consumption of Ohio pulp wood by kinds:

Kind of wood	Consumption in cords
Spruce. Hemlock	3,000 474 784 6,209 28,226
Total	38.693













