

Contents

PREFACE TO THE THIRD EDITION	vii
PREFACE TO THE FIRST EDITION	viii
PREFACE TO THE SECOND EDITION	ix
ACKNOWLEDGMENTS	xi

CHAPTER 1

<i>Introduction</i>	3
Wood and the Human Race.	

CHAPTER 2

<i>What Wood Is</i>	6
Origin of Trees. The Form of Cellulose. Construction of Trees. How Wood Is Formed. How the Root and Stem Function.	

CHAPTER 3

<i>The Life of the Tree and Its Relation to the Human Race</i>	28
Function of the Green Leaves. The Leaf a Laboratory. What Makes the Sap Rise?	

CHAPTER 4

<i>The Structure of Wood</i>	35
Wood under a Magnifying Glass. Microscopic Structure of Wood. Tracheids and Bordered Pits.	

CHAPTER 5

<i>How to Identify Species of Wood by Visible Structure</i>	56
Two Classes as to Structure. Gymnosperms. Angiosperms: First Group—Woods with Pores of Uniform Size; Second Group—Woods with Pores of Variable Size. Keys for Identification.	

CHAPTER 6

The Structure of the Cell Wall 76

Action of Life. Submicroscopic Particles; Electron Microscope. Visible Features of Cell Wall. Polarized Light. X-ray Diffraction Spectra.

CHAPTER 7

Chemistry of Wood and Cellulose. 89

Wood Substance and Cellulose. Lignin.

CHAPTER 8

Modified Cellulose: Textile Fibers and Plastics 99

Production of Cellulose. Trees' Production of Cellulose. Modified Cellulose; Plastics and Textile Fibers. Synthetic Resins, Plastics, and Fibers. Definitions. Polymerization. Kinds of Synthetic Resins. Chemical Uses of Wood. Wood Distillation with Heat. Hydrolization.

CHAPTER 9

Paper and Pulp from Wood 123

Distinction between Pulp and Paper. Pulp-making Process. Chemical Processes. Forest Requirements for Pulp. Hydrolyzed Pulp. Vulcanized Fiber.

CHAPTER 10

Moisture Relations of Wood 138

Properties Affected by Moisture. Equilibrium Moisture Content and Hysteresis.

CHAPTER 11

The Shrinkage and Swelling of Wood 145

Wood Compared with Other Materials. Superior Qualities of Wood. Swelling and Shrinking. Pressure from Swelling. Possible Approaches to Problem. How Does Wood Shrink? Significance of Research. Stresses. Set. Relation of Shrinkage to Cell-Wall Structure. Compression Wood. Holes and Knots. What Happens to Mitered Joints? Explanation of Set. Compression Shrinkage. Set-in-Tension. Energies Involved in Adsorption of Water. Swelling in Relation to Volume of Water Absorbed and Density of Block. Three Possibilities in Swelling of Cellular Structure.

CONTENTS

xv

CHAPTER 12

Collapse: Its Cause and Its Significance 175

Where Collapse Occurs. Conditions Which Cause Collapse. Effect of Temperature. Too Rapid Drying Should Be Avoided. Restoration of Collapsed Wood. Illustrations of Collapsed Lumber.

CHAPTER 13

Dimensional Stability 188

Retarding the Shrinkage of Swollen Wood. Retarding the Swelling of Dry Wood. Accomplishments in the United States. Heat Treatment. Acetyl, Butyl and Allyl Treatments. Accomplishments in Foreign Countries. The Effect of Cane Sugar on Stabilization.

CHAPTER 14

Drying Lumber; Procedure in Kiln-Drying Operations 202

Need for Fundamental Knowledge. How Wood Behaves in Drying. The Time Schedule. Average Moisture Schedule. Stress Method. Progress of Stresses during Drying. Procedures in Kiln-Drying. Inspection of Kiln. End Coatings. Preparation of Samples. Log of the Run. Placement of Samples. Tests for Stresses, and Modifying the Drying Conditions. Short Cuts—How to Calculate Internal Moisture.

CHAPTER 15

Physical Properties of Wood 221

Heat Relations and Hygroscopicity. Heaviest and Lightest Woods. Amount of Water Which Wood Can Absorb. Thermal Expansion. Swelling in Other Liquids. Time Required to Heat Wood. Heat Conductivity of Wood. Specific Heat. Heart Break. Spiral Grain.

CHAPTER 16

Mechanical Properties of Wood 234

Early Strength Tests. Beginnings of Government Research on Wood. Fundamental Facts Concerning the Strength of Wood. Moisture-Strength Relations. Wood Bending. Wood as a Plastic: Dead-Load Tests. What Is Strength? Yield or Plastic Strain. The Effect of Time: Dead Loads. New Series of Dead-Load Experiments. Results of the Beam Tests. Standard Tests. Standardization for Speed of Testing. Impact Tests. Vibration and Fatigue. Brittle-Heart and True-Wood.

CHAPTER 17

- Effect of Temperature and Kiln-Drying: Temporary Exposure: Yale Tests* 261

Tests at Yale Forest School. Species of Wood Used. Results of Treatments. Comparative Effect of Treatment. Results Applied to Commercial Treatment. Effect of Kiln-Drying. Temperature of Chemical Disintegration.

CHAPTER 18

- Effect of Temperature at Time of Use* 271

Kollmann's Research. Tests of Frozen Wood. Compression Tests of Frozen Wet Wood as Compared to Unfrozen. Compression Tests of Frozen, Completely Saturated Wood of Different Densities. Bending Tests on Frozen Wood. Sulzberger's Research. Greenhill's Cross-Tension Tests on Beech.

CHAPTER 19

- Plywood, Glues, Adhesives* 286

Plywood, Laminated Wood, and Wood-Metal Combinations. Sandwich Panels. Adhesives. Synthetic Resin Adhesives. German Developments. Metal-to-Wood Adhesives.

CHAPTER 20

- Dielectric Heating for Gluing and Drying* 296

Heating by Ordinary Electric Current: Resistance. Ideal Conditions for Drying Wood. A New Principle. Condensers and Electric Fields. Heating Effect in a Dielectric. Why Moisture Increases the Heating Effect. Economic Aspect for Drying Purposes. Application to Adhesives.

CHAPTER 21

- Biological Destructive Agencies and Preservative Measures* 306

What Causes Wood to Decay. Kinds of Fungi. Temperature Effects. Saprophytes. Sap Stain. Chemical Stain. Mold. Conditions Essential for Decay. Natural Durability. Insects and Animals. Artificial Preservation. Does Paint Preserve Wood? Commercial Preservatives. Fireproofing.

CONTENTS

xvii

CHAPTER 22

Permeability of Wood 319

Penetration of Creosote as Seen under the Microscope. Theories of Penetration of Tracheids. Sapwood Always Per-vious. Lyophilic Liquids Wet the Walls. Definitions. Per-vious and Impervious Kinds. Soap Test for Permeability. Application.

CHAPTER 23

Distinguishing Features of American Woods 326

Explanation. Gymnosperms. Similarities in Conifers. Angio-sperms. Notes.

APPENDICES

A. HOW MUCH SAWED TIMBER FROM A LOG? 365
B. THE FUEL VALUE OF WOOD 367
C. HOW MUCH SOLID WOOD IN A CORD? 373
D. LINEAR SHRINKAGE AT ROOM TEMPERATURES 375
E. BOTANICAL PRODUCTS AND EXTRACTIVES 378
F. HUMIDITY DIAGRAM 381
INDEX 385