THE NEW FOREST PRODUCTS LABORATORY

By EDWIN A. START

(Last month, in AMERICAN FORESTRY, William L. Hall, assistant forester in charge of the Branch of Products, United States Forest Service, set forth clearly the key thoughts underlying the work of his branch and the significance of the new laboratory, which was formally opened June 4, and which is described in detail below.)

THERE are still lumbermen, and other citizens less directly interested, who regard the work of the Forest Service as impractical and in the air, but not one of them can come into contact with the branch of products without recognizing the immediate economic value and applicability to business of the solutions of the problems with which it deals, for the task of this branch of the service is to ascertain the best uses for all forest products and the best and cheapest way to obtain them, without waste in the forest or at the mill. That is a simple business question, is it not? And the most hardened Philistine can see it.

And because no capable business man can fail to see this, and because the work of the branch of products is only an interlocking and dependent part of the whole forestry program, this branch has in its power, with the facilities it now commands, to do more than any other agency to educate the men of the wood-using industries into true believers in the complete forestry gospel.

It is about five years since the efforts began to obtain such a laboratory, but Congress would not provide for it, and it was only through the cooperation of the University of Wisconsin that it was finally made possible. There was a keen rivalry between Minnesota, Wisconsin, and Michigan for the institution, but it was finally located in Wisconsin. No mistake would have been made in locating it in any one of these states, but to an unprejudiced observer the present surroundings seem particularly fortunate. Wisconsin still ranks near the head of the list of lumber states and its paper and other wood-using industries are important. Its prosperity rests on the fundamental industries of the soil and the forest. In the development of its university it closely followed Michigan as the western leader in higher educational work, and for many years its university has ranked with the first state universities of the country. In no state has the university so nearly met the needs of the people and made itself so much a part of their daily lives. Here is realized the ideal which was in the minds of the founders of William and Mary College, when they put it down at one end of the Duke of Gloucester Street in the old colonial capital of Virginia, looking through the long vista to the capital at the other. From

DESTRUCTIVE DISTILLATION

this juxtaposition, Washington, who was chancellor of the old Virginia college, drew the idea of a great national university in the nation's capital, an idea which was never carried out, although he made a bequest to the nation for the purpose. This northwestern state has become the heir of the tradition, and in Madison it is carried out physically and in spirit, for the university is the real leader of thought and development in the state. Its great central building looks down State Street to the capitol. Its library, an exceptionally fine one, worthily housed, is the state library as well. Educators and legislators work together for the state; not, indeed, without much of the friction inevitable in our politics, but with good results in the large.

Wisconsin also still has great forests and wood-using industries, the latter consuming annually over 900,000,000 feet of lumber, valued at $20,000,000, fifty-one per cent of which comes from without the state, the forests of which are now threatened with early exhaustion. This does not take into account large quantities of material from the sawmills that is not considered available for future manufacture. The problem of preventing waste by more complete utilization is therefore of the highest importance to the future prosperity of the state. Wisconsin also has a state forest service of great efficiency, free from political control, which goes at things in a vigorous, western way and has a definite policy that is pursued with steady purpose.

The city of Madison is rarely endowed by nature so that the environment is in every way favorable for the life and work of the products staff of the Forest Service which, as our readers know, will now have its headquarters in Madison, instead of in Washington.

THE OPENING EXERCISES

The new plant, in its extent and completeness, was a gratifying surprise to most of those who saw it for the first

WASTEFUL LUMBERING

Redwood, red fir, and spruce in California

time at the formal opening on the 4th of June. Typical operations were in progress in all the departments, and the visitors, numbering nearly 500, had an opportunity to see the plant in action. There were in attendance representatives of the American Paper and Pulp Association, Beer Stave Manufacturers' Association, Michigan Hardwood Manufacturers' Association; National Box Manufacturers' Association, National Electric Light Association, National Hardwood Lumber Association, National Slack Cooperage Manufacturers' Association, National Lumber Manufacturers' Association, National Hickory Association, National Wagon Manufacturers' Association, Wheelmakers' Club, Northern Hemlock and Hardwood Manufacturers' Association, Northern Pine Manufacturers' Association, Northwestern Cedarmen's Association, Vehicle Woodstock Company, Wood Preservers' Association, Yellow Pine Manufacturers' Association, Field Museum, Chicago; American Society of Civil Engineers, American Forestry Association, educational institutions, technical periodicals, railroads, and large concerns engaged in every wood-using industry.

The exercises were simple and appropriate. The building was inspected and the work explained during the forenoon, and, after luncheon, attended by about 150, in one of the university halls, there were addresses by Governor Davidson, Henry S. Graves, forester of the United States; Charles R. Van Hise, president of the University of Wisconsin; Capt. J. B. White, chairman of the Committee on Conservation, National Lumber Manufacturers' Association; B. R. Goggins, of Grand Rapids, Wis., representing the American Paper and Pulp Association, and O. B. Bannister, of Muncie, Ind., representing the implement and vehicle industries. The speaking was in every way suited to the occasion, each speaker filling well a distinct place. Ex-Governor W. D. Hoard, chairman of the board of regents of the university, presided.

Governor Davidson, speaking for the state, set forth with abundant facts its relation to this national institution that has been placed in Wisconsin with the cooperation of the state. He used an array of statistics in regard to the forest products of the state, which are just being made available through joint investigations of the United States and Wisconsin forest services. Of the inter-dependence of natural resources, the governor well said:

Every one of our great natural resources exerts far-reaching influence. Every industry in this country has profited vastly by the existence of our iron and coal deposits. In the same way, every industry in the United States has been helped—indeed, has been more than helped: has been in part created—by an abundant supply of the most useful kinds of timber.

The forest, in fact, bears a relation to other resources and to their dependent industries which is entirely peculiar. If we speak of the right use of the forest, and understand the full meaning of our words, we know that we cover not only the products which come from the trees themselves, but the influence which the forest bears to resources and industries outside of itself. If we speak of forest waste, we should bear in mind that our meaning extends not only to wood that is not used, but to soil which cannot be used, water which cannot be used, improvements which cannot be used, and even power which cannot be used, because of the misuse of that controlling factor, the forest.

I want to make very clear this point—that when we misuse the forest, we waste not only its products, but, also, other very important resources. Nature has placed in effect a direct and vital relation between forests and soils, and forests and streams, that must be heeded by man if he is to reap a full harvest from any of these resources.

And of waste in lumbering, he said (and in Wisconsin people know something about this):

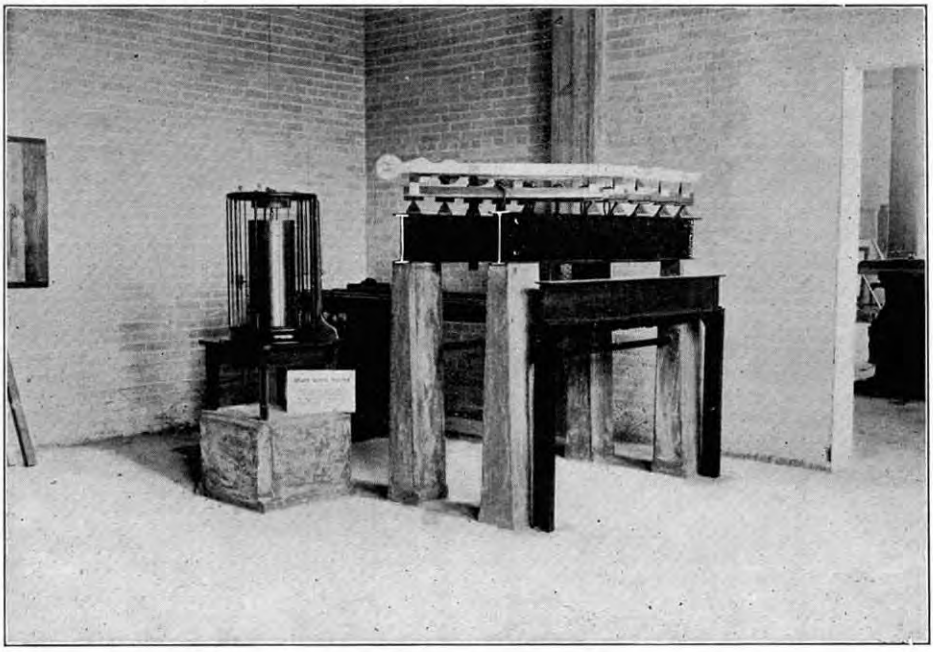
It is of great importance to all wood-using industries of the United States to bear in mind that our present imperfect use of the forest also causes great waste of wood itself, which is a most important material. This waste begins when the lumberman first sinks his ax into the tree in the woods, and does not end until the piece of wood is fitted into final form and goes into use. We waste about half of the tree getting the other half into useful form. It has been the practice to leave a considerable part of the tree, and oftentimes the very best part, in the stump. A lot of wood is wasted in the tops. Many trees are cut and felled, but never taken out of the woods, because they are in part defective. Yet they contain much sound wood. In the old white pine operations in Michigan and Wisconsin, only prime logs were taken. Lumbermen working near these old operations during the past few years found it profitable to take out a considerable number of these which still remain sound. Many logs are also lost. Some are left in the woods, but more sink into the streams. Probably as much as twenty-five per cent of the wood which is cut down in the forest is left there to decay.

Mr. Graves set forth the work and plans of the service of which he is the head, as expressed in this new realization of its ideals. His address, "The Work of the Government in Forest Products," is printed elsewhere in this magazine, as is the address of Mr. Goggins, of the American Paper and Pulp Association, setting forth the relation of his constituency to this work.

Captain White gave some instances showing the early interest of the lumbermen in the work represented by the new laboratory. Among others, he made the point, a favorite one with him, and a just one, of the cost of conservation. On this he said:

Once the farmer reaped and put nothing back for the soil. He gathered all, and the consumer got the benefit of cheap farm products. But he has now learned that he must put back into the soil the chemical food necessary to sustain it. He must add this to the cost of the product, and the consumer must pay the bill. Hence, conservation doesn't necessarily mean that through its practice everything is to be cheaper, but it does mean that all the necessaries of life, with its comforts and blessings, shall continue, and that there never shall be famine, human suffering, or want caused by useless waste and extravagance.

There will be no more 10-cent corn and no more $10 lumber. The farmer who feeds 50-cent corn to his hogs and his steers will necessarily get higher prices for his beef and bacon. And the lumberman, now that the day has passed when there was an enormous surplus of timber, when it had to be burned to make way for settlement and cultivation of the land; now that he has to conserve and grow his forest, has got to add thereto the cost of the forest growth, and the consumer will pay the bill. Yet we are each and all consumers of each other's products, and thus it is all evened up by our paying each other's bills. There is no economical



THE FOREST PRODUCTS LABORATORY

Timber Physics. Dead load testing machine

principle through which one can continue to secure to himself any product at less than it costs to produce that product.

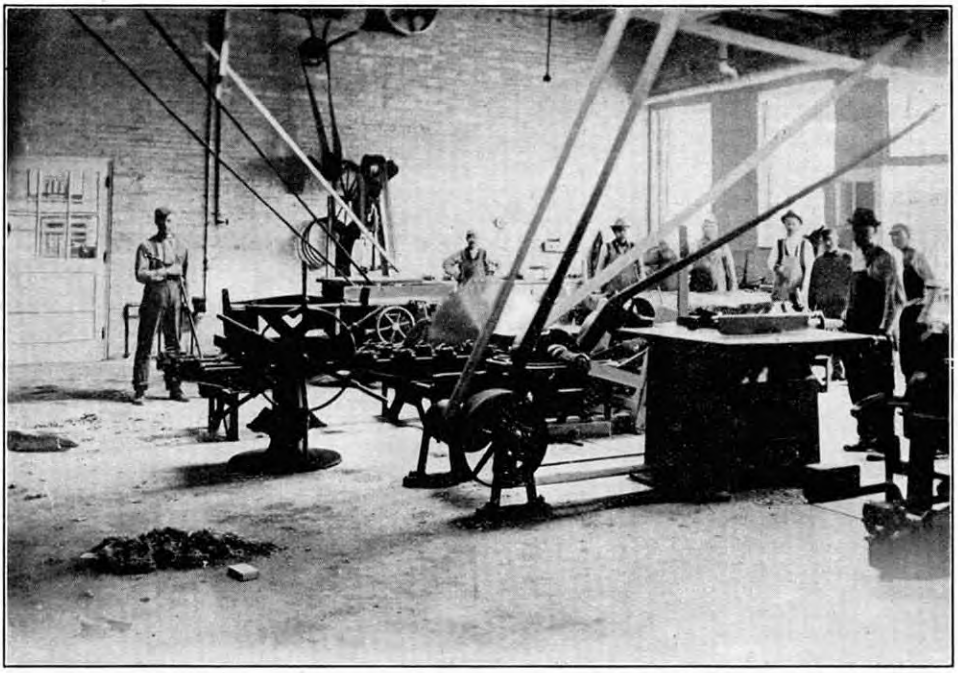
President Van Hise spoke on conservation and on the relation of his great university to this new project with the force and cogency which his scientific knowledge and his profound convictions give to all his utterances on these subjects.

The speaking was well closed by Mr. Bannister, who aptly represented an industry that has already learned the practical business value of the work of the forest products branch, whose tests made possible the reclassification of hickory and the use of the formerly discarded red hickory. Mr. Bannister referred to this in his address.

That there was general interest in the new laboratory and great satisfaction with it on the part of the visitors no one who was present could doubt. As one cooperage man was heard to say to another after watching a demonstration of the structure of different varieties of oak: "This shows us the reason for things we have simply run against in our experience without understanding them." This more perfect knowledge is certainly worth something.

THE PLANT

The laboratory is a substantial, attractive two-story brick building, 180 feet long and eighty feet wide. It was erected, and will be supplied with water, light, heat, and power by the state of Wisconsin. The United States, through the Forest Service, provides the equipment and the staff and all other maintenance. As a further evidence of the fine spirit of cooperation which is embodied here, it may be noted that the railroads are furnishing free carriage for the supplies of the laboratory, and that lumber companies and associations are giving material of great value for experimental purposes.



THE FOREST PRODUCTS LABORATORY

The wood working shop

On the ground floor are the paper and pulp mills, laboratories for timber physics and timber testing, wood preservation, and wood distillation, and the woodworking shop. The last is fully equipped with saws, planers, and all required woodworking machinery. In the rear of the building is a spur track by which timber and other supplies can be brought to the door on the car. There is also a roomy storage shed, and there are two large tanks for storing preservatives.

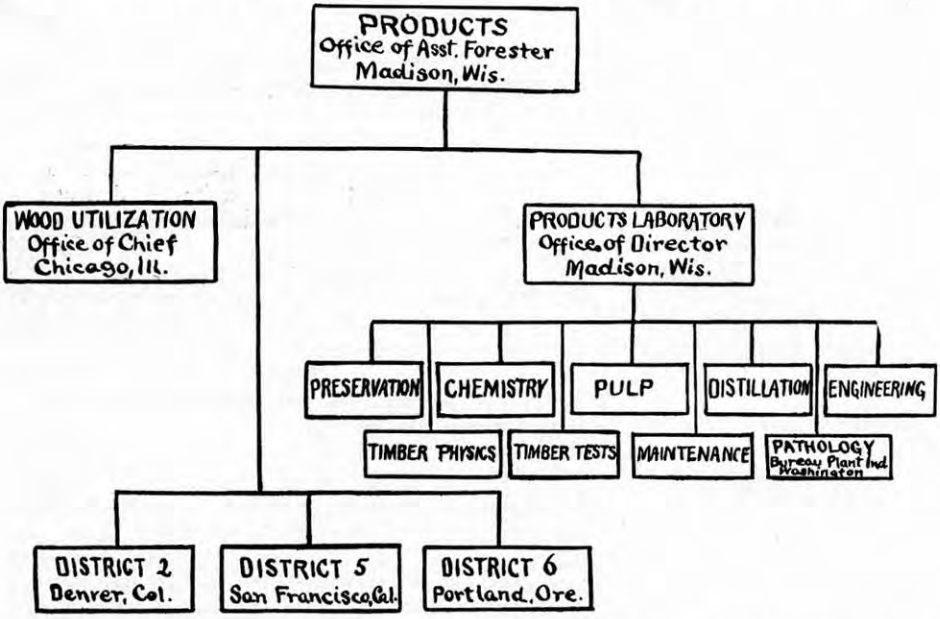
On the second floor are the offices of the assistant forester in charge of the branch of products, William L. Hall; the director of the laboratory, McGarvey Cline, and the assistant directors, H. S. Bristol, and H. S. Weiss. There is a large lecture room and there are offices for the computing clerks, files and other requirements of a highly organized modern business. Also on this floor are the chemical laboratories, drafting room and photographic dark room. The building is airy, well lighted, and attractive—yet already the young enthusiasts of the service, who dream of to-morrows while they work at the tasks of to-day, are talking of possible enlargement in the near future. This is a healthy sign. The work grows constantly, not only in scope, but in real value as well.

THE BRANCH OF PRODUCTS

The branch of products undertakes to conduct investigations and disseminate information regarding the mechanical, physical, and chemical characteristics and properties of wood, utilization of forest products, air seasoning and artificial drying of wood, agencies destructive to wood, wood preservation, wood distillation, production of naval stores, pulp and paper and other chemical industries using forest products, chemical analyses of forest products and materials used in their treatment; statistics of production, consumption and prices of forest products, proc-

esses and waste in their manufacture and use, standard requirements, and substitutions of wood with other materials. In carrying out projects along these lines, it is required that there be a clear and definite object, method and record, for it is the part of this organization to do those things which business men need to have done but cannot do because of pressure of the immediate business of the day. Here there can be experiment, study, computation, and so full and exact a record that the results will always be of use, and available.

Forest products is not a new branch of the service, and a very complete organization and method of procedure have already been worked out. The scope and plan of the organization are shown in the accompanying diagram.



The work of the laboratory is divided into nine sections:

1. Timber Physics, in charge of H. D. Tiemann.
2. Timber Tests, in charge of J. A. Newlin.
3. Wood Preservation, in charge of F. N. Bond.
4. Wood Distillation, in charge of L. F. Hawley.
5. Wood Pulp, in charge of E. Sudermeister.
6. Chemistry, in charge of Ernest Bateman.
7. Engineering, in charge of Rolf Thelen.
8. Pathology. (This is conducted in connection with the Bureau of Plant Industry at Washington, by C. J. Humphrey.)
9. Maintenance, a non-technical section, in charge of W. K. Kempfer.

On the staff of the laboratory are four Yale men, including the assistant directors; three Cornell men, two from Purdue, two from Massachusetts Institute of Technology, two from Ohio State University, and one each from Stevens Institute of Technology, University of Maine, University of Michigan, and University of California.

An outline of the different sections, the projects that they have in hand, and the equipment with which they have to work, will give a comprehensive idea of the function of this laboratory.

TIMBER PHYSICS

It is the business of the section of timber physics to study the structural and physical properties of wood and

to ascertain how these properties are affected by different methods of drying and handling. This section has in hand at present a miscroscopic examination of American woods for the purpose of developing a key to their identification based on the structure of the wood; experiments to determine heat conductivity and other heat constants for the principal commercial timbers. In the kiln drying of lumber and in the treatment of woods with preservatives it is of importance to know how much heat is required, and how long it takes to heat wood to a given temperature. A third line of experiments is the study of different methods of drying wood.

The equipment of this section includes microscopes, microtomes, and other apparatus required for microscopic work, apparatus for taking microphotographs, a cylinder designed for the study of the different methods of drying wood, and an experimental dry-kiln, balancers, ovens, calorimeters, and other miscellaneous equipment.

TIMBER TESTS

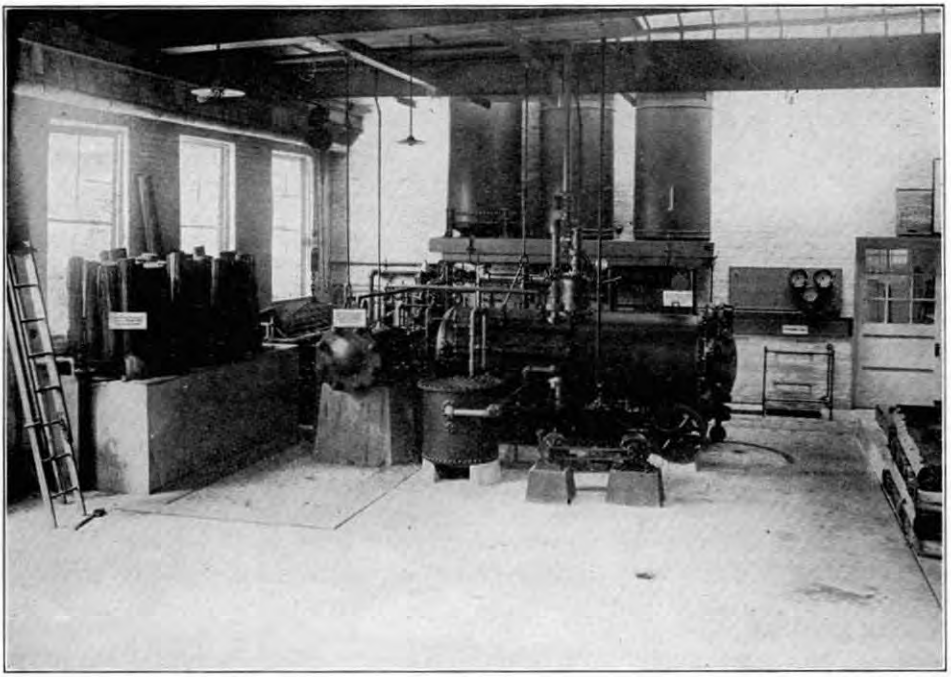
In the section of timber tests studies are made of the strength, stiffness, hardness, and other mechanical properties of commercial wood. There are some very interesting machines for determining these points. Tests are made on woods that have been treated with preservatives and other substances to determine the effect of the preservative treatment upon the mechanical properties of the natural wood.

The lines of work to be taken up in this section include tests of the different commercial woods to determine their relative strength, toughness, hardness, etc. This work is of particular value to wood users in finding substitutes for woods now becoming scarce. It is the same type of work that led to the discovery which has already been referred to of the value of red hickory. Tests will also be made to determine the influence of knots, checks, and other defects used in grading structural timbers upon their strength and other mechanical properties. The results of these tests, of course, will be of great value to architects, engineers, and lumbermen in making specifications and grading rules for structural timber. Tests will be made to determine the strength of wood under dead, impact, or repetitive loading. Such tests will assist in determining the working stress that may be used upon timber structures. One of the interesting pieces of apparatus used in this laboratory is the machine for making the dead-load test, and one of the surprising results which the record of this machine shows is that the rapidity of loading does not affect the elasticity of the wood. The mechanical properties of wood that is impregnated with creosote and other preservatives will also be determined in this section.

The equipment of this laboratory includes one 200,000-pound extension-base Reihle testing machine, one 150,000-pound extension-base Olsen testing machine, three 30,000-pound Olsen universal testing machines, one 60,000-inch-pound Reihle torsion machine, one Dory abrasion machine, one impact testing machine, deflectometers, and other instruments used in testing structural materials. Our illustrations show some of this machinery. The nature of some of the timber tests is also shown in some of the accompanying illustrations.

WOOD PRESERVATION

This is an interesting and important section. More and more it becomes necessary, in the face of a diminishing timber supply, to preserve in some fashion poles, posts, ties, and all timbers that are exposed to influences that will cause them to deteriorate. Somehow their life must be extended until supplies can be regrown. Much progress has been made in the work of wood preservation, but a great deal remains to be learned. This section is making a broad study of the problems involved. These deal with the preservatives themselves and their effects upon wood, and with the methods of impregnating the



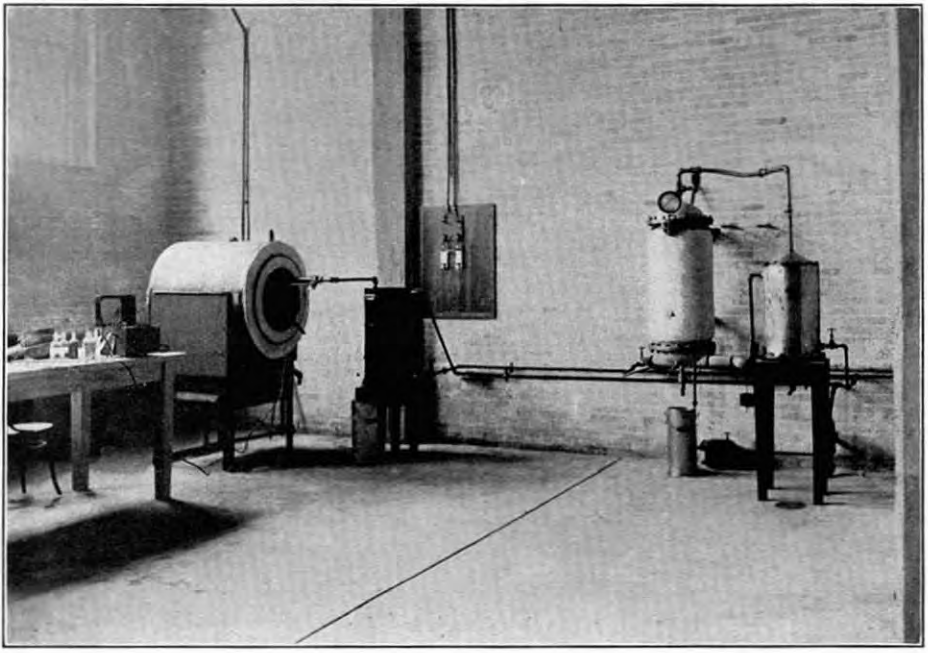
THE FOREST PRODUCTS LABORATORY

Wood preservation. Open tank treatment on the left; commercial treating plant in the centre

wood most effectively with the preservatives.

To study the first class of these problems, the laboratory is provided with a fungus pit, which contains chambers in which the wood can be thoroughly inoculated with various destructive fungi. The humidity and temperature of the pit can be regulated to produce conditions most favorable to fungus growth. Woods treated with different preservatives are placed in this pit, where they can be isolated in chambers. The efficiency of the preservative is indicated by the ability of the wood treated with it to ward off the attacks of fungi under these conditions.

The second class of problems involving the impregnation of wood are chiefly those of mechanical engineering and the plant of the laboratory is most complete in this respect. It is, in fact, a reproduction of a fully developed commercial plant. The machinery is provided for forcing any required amount of preservative into the species and forms of wood which may be tested. This is done under high pressure, and the treated cylinders are tested for great resistance. The outfit includes one treating cylinder three and one-half feet in diameter and twelve feet in length, which will withstand a working pressure of 300 pounds to the square inch. There is also a small experimental cylinder one and one-half feet in diameter and three feet long, designed to withstand a working pressure of 600 pounds to the square inch. This apparatus is connected with a system of tanks, force, air, and vacuum pumps for handling these preservatives and forcing them into the wood. There is also an open tank outfit for the simpler treatment of butts of posts and poles, such as is practicable for farmers and others using much of this material but not enough to justify having recourse to a commercial plant. In this connection it may be suggested that time only can tell what and how much superior value the closed tank



THE FOREST PRODUCTS LABORATORY

Wood distillation

pressure treatment has over the simpler and far less expensive open tank process. The theory is, and there is no reason to doubt its correctness, that the deeper the preservative is forced into the wood the less will be the opportunity for fungi to enter. Those who cannot use this elaborate treatment, however, need not despair, for there is known to be great value in open tank treatment, or even in the application with a brush of good preservatives.

WOOD DISTILLATION

Alcohol, turpentine, wood creosote, and acetates are the present best known products of wood distillation. It is the task of this section to conduct experiments to determine what products of this kind can be secured from different woods, and the best processes for obtaining them; to study the design and operation of machinery best adapted for the production of these by-products so that they can be produced most economically, both as to quantity and quality, and to study the refining of crude products. It is obvious to anyone who has noted the development of these industries that here is a large field for the utilization of much material that now is wasted. Already, great advances have been made, and there is no question in anybody's mind that greater still are not far distant.

The species to be first studied are southern pine, Douglas fir, Norway pine, and other resinous woods. Already the products that can be obtained from these woods are known, but there is greater room for improvement in the methods of production and refining. The distillation of different hardwoods will also be studied. Slabs, sawdust, stumps, and all forms of mill and forest waste are material for such a laboratory as this.

The equipment includes a steam distillation and extraction retort; one oil-jacketed destructive distillation retort, and three product continuous refining still and accessory apparatus.

WOOD PULP

No section deals with problems of greater interest to the country than this, and none is better furnished for its work. There is a working model of all the apparatus of the paper and pulp mill, with the exception of a mill for making groundwood pulp. This omission is to be filled at an early date. All the apparatus for making pulp by the soda and sulphite processes is here and a system of grinders and beaters, culminating in a complete Fourdrinier paper machine, making a roll of paper fifteen inches wide. This miniature of the giant machines is equally serviceable for experimental purposes, and much more economical to operate.

This section is grappling with problems of the great paper industry—problems which are growing more pressing every day. The special points of attack at present outlined are methods of making ground-wood pulp to determine whether or not commercial pulp can be made from species other than spruce; the practicability of treating different woods with the sulphite and soda processes; the qualities of paper which can be made from different grades of the various sulphite, soda, and ground-wood fibers; and the practicability of using different forms of wood waste for the manufacture of paper pulp and other fiber products. There is here a great field and one beset with difficulties such as only experimenters in it can realize. There is so much paper required by our modern civilization that to produce wood pulp by sufficiently economical processes to meet our demands for paper is entirely another question from producing it experimentally. It has been satisfactorily determined that wood pulp well adapted for many purposes can be produced from a number of annual plants, but the production of these plants and the elimination of certain troublesome constituents make the process too expensive to be at present of commercial value. The remedy for this must be found by long and patient experiment. At present the principal end in view is the study of the utility of different varieties of wood as substitutes for the fast-disappearing spruce.

CHEMISTRY

The section of chemistry has a hand in nearly all of the problems that are presented to the branch of products. The laboratory in which the chemical analysis is performed is thoroughly equipped and arranged with great convenience, with due regard to the comfort and safety of the experimenters and to efficiency of work. Experiments with noxious gases are conducted in a glass hood so that the chemist is not exposed to the effect of the gases. The special purposes of the section are to find uses for products at present having little or no commercial value, to secure data upon which to base commercial specifications for wood products, wood preservatives, and other chemicals used in the treatment of wood, and to study chemical problems that arise in connection with the work of the other sections. In carrying out these purposes, the present lines of investigation are the analysis and grading of commercial creosote, the analysis and grading of wood turpentine, and methods of analyzing treated wood to determine the kind and quantiy of preservative in it. This last is necessary to check up the results of the timber tests with the treated woods, and also to gauge the treating process itself.

ENGINEERING

This section has to do with the design of machines and apparatus to be used in saving wood waste. It is only a part of the problem to find how a given wood may be used or what products can be made from waste material. It is equally necessary that machines and equipment should be designed which will accomplish the desired results. Problems at present engaging the attention of this section are the design of an experimental grinder for the manufacture of ground-wood pulp from woods other than spruce; the de-

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The chemical laboratory

sign of a dry-kiln for experimental purposes; the design of a hack for shallow chipping in turpentine experiments; the preparation of standard designs for different types of treating plants, including portable plants for the treatment of posts and poles, low and high pressure plants of varying capacities, receiving and storage tanks, gauges and accessory apparatus, plans for the general arrangement of equipment and for yard storage and transportation. The importance of this task will be understood by those who are aware of the fact that it is just this development of a satisfactory economic plant that many of the larger electric companies and railways which are deeply interested in preserving timbers are waiting for. The section of engineering has charge of the woodworking and machine shops in the laboratory.

The remaining technical section of the branch of products is that of

PATHOLOGY

This section investigates the diseases which cause the decay of wood. Its work is closely allied with that of wood preservation, and the problems will be of the same kind, although the work of the two sections will be entirely distinct. The work in forest pathology is conducted in the bureau of plant industry of the Department of Agriculture in Washington, and that bureau provides the working staff and has charge of the technical methods.

THE OFFICE OF WOOD UTILIZATION

An important division of the branch of products is the office of wood utilization in Chicago, in charge of Homer S. Sackett. This office takes up the problems of the branch of products

which do not require laboratory work, those which can be solved by cooperative studies with the manufacturers, or which can be worked out by statistical study. The question is sometimes asked why this office is located in Chicago. The answer is in a sense an explanation of the nature of its work. Chicago is not only central, but it contains every industry that is concerned with forest products. When any information is needed in regard to the results and requirements of any industry, Mr. Sackett can get into communication with representatives of that industry without delay. Seventeen of the great wood-industry organizations have secretaries or managers in Chicago. Chicago is the greatest lumber and wood-manufacturing center in the country. These are a few of the most cogent among many reasons for the establishment of this office here.

The nature of the work of this office is suggested by some of the projects at present on the program. A report has already been made on the vexed question of odd lengths. This shows that in the yellow pine district of the south one and twenty-one one-hundredths per cent of the products of the planing mill are wasted annually because of the nonmanufacture of odd lengths. This entails a loss of about $600,000. The report urges the manufacture of odd lengths with some concession to the buyer.

Samples of red cedar, alligator juniper, western juniper, redwood, incense cedar, western red cedar, Port Orford cedar, and Alaska cypress from the national forests of the Rocky Mountains and mountain cedar from a private forest in Texas have been furnished to four of the largest pencil manufacturers of the east, and they will give them a thorough trying out for pencil manufacture. A report is about due on this work. In a similar way, several western woods are being sampled for the manufacture of shuttles. With the assistance of manufacturers of butter and tobacco boxes, a test is being made of short lengths of cypress for these purposes, and of incense cedar for tobacco boxes.

At the request of the National Hickory Association, a study of better methods of utilizing hickory will soon be begun and is expected to occupy about four months.

Studies are being made of markets and market reports; and statistics of consumption have been gathered in cooperation with Massachusetts, North Carolina, Kentucky, Wisconsin, and Maryland. The service alone has gathered the statistics for Illinois. These reports are of great value. "They show what part of the total demand, and of the demand for each species, is met by forests and woodlots in the state, and what part is supplied from without. The kinds of wood demanded by the various industries are shown, together with the amount of each species used, the prices paid at the factory, and into what product each wood is manufactured. With this information before them, the woodlot owners who are looking to the future can determine what kinds of timber promise best returns and can give preference to those kinds. Those who have timber or lumber to sell can form an intelligent opinion as to where the best market can be found for what they have to offer. On the other hand, the manufacturer who is in the market for woods of certain kinds, will have the means to determine whether he can buy near home or whether he must look beyond the state; and a study of average prices paid by others will show whether or not he has been buying on an equal footing with others."

The Massachusetts report is printed, by that state, and those for Wisconsin, North Carolina, and Maryland are in type. These studies will be continued the coming season in Louisiana, Michigan, Missouri, and Pennsylvania.

The office also gathers statistics of cost and prices, giving data not heretofore available in any form.

The office has taken up the question of fiber and wood boxes. While be-

lieving that fiber as a box material has its place, and has come to stay, Mr. Sackett has reached certain conclusions under which he regards wooden boxes as more desirable for general use under present conditions. As an element in conservation, fiber has the same drawback as wood pulp, for since everything can be used its adoption on a large scale tends to more complete forest destruction. The question is now being taken up by the National Box Manufacturers' Association and National Lumber Manufacturers' Association. Accurate information is sought on the amount of business lost by wooden box manufacturers, and on the character of the material going into the fiber, whether mill waste or material that should go into high-grade lumber.

These few examples illustrate the wide range of inquiries continually opening before this office, which, through close relations with the manufacturers, can do much to promote the most complete and economic utilization of all the products of forest and mill. It is the business of the office to show the manufacturer how he can add to the profits of his business by reducing waste and economizing production.

CONCLUSION

For several days following the opening of the laboratory, the heads of the sections and divisions of the branch of products from all of the different offices were in conference at Madison, with the purpose of developing their program and organizing their work so as to take up slack all along the line, cut red tape as much as possible, and bring the methods of their branch up to the highest standard of business efficiency. In the systematic methods and the actuating spirit of this conference, with its strong *esprit du corps,* there is something admirable and full of assurance for the future of the great work entrusted to this group of young men.

The fact cannot be too strongly emphasized that the new laboratory, as well as every office of the branch, wherever located, is national in its work and outlook. Removal from Washington does not localize it in the least. In fact, it broadens the outlook, inasmuch as it takes it out of the official atmosphere of the national capital, right among the people who are doing the work with which its activities are directly concerned. Through its several offices, it reaches into all parts of the country, touching the users of wood at all points, and supplementing with its admirable facilities for experiment the daily practical experience of business.

The new laboratory is the most extensive and best equipped of its kind in America, and probably in the world, and it is in the hands of a group of men qualified to make good use of it in the country's service.