EXPERIMENT ON AMERICAN WOODS.

We take from the Pittsburgh *Builder* the following paper by Prof. Sharples of Boston, Massachusetts:—

Under the act providing for the taking of the Tenth Census, the superintendent was authorized to appoint experts to inquire into special industries; accordingly Professor Charles S. Sargent was appointed to gather statistics in relation to the forest industries.

As Chief of the Department of Forestry of the Tenth Census he has been busily engaged in this work since the fall of 1879. Soon after his appointment he became convinced that it would be desirable to make an examination of the fuel value of the various woods of the United States, and this work was placed in my hands.

At the same time I made the suggestion that while we had the opportunity it would be well to test also the strength of these woods. The suggestion was adopted and Professor Sargent at once set his agents to work in various parts of the country to collect specimens of all the trees growing in their localities, employing as a rule, botanists who were familiar with the flora of the region in which they were at work. The result of this work was the collection of over 1,300 specimens of wood, comprising over 400 species and varieties, nearly 100 of which had not before been described as trees existing in the United States.

The ash and specific gravity of every specimen in this collection has been determined, in most cases in duplicate, about 2,600 ash and 2,800 specific gravities determinations having been made. About 325 species were further tested for transfer strength and resistance to crushing. In this series about 1,300 specimens were tested. As each of these was tested in three different ways, it made in all about 3,900 tests. The specific gravity of each specimen in this last series was also determined, thus making in all about 10,600 tests that were made on the specimens. Many of these tests, however, included not only a single test, but often a series of tests that required at least ten entries on the final report, as I shall explain further in this paper.

In addition to the tests already spoken, 79 tests were made of the carbon and hydrogen in a like number of specimens.

These tests have already, so far as the results of the ash and specific gravity of the dry wood is concered, been published in Forestry Bulletin No. 22. The carbon and hydrogen determinations are to be found in Bulletin No. 18, while the tannin in the bark of a few of the most promising trees found in Bulletin No. 24.

A Bulletin shortly to be published is to give the deflections under various loads of woods tested in this manner, and the weight under which they failed, together with the force necessary to crush, in the direction of the fibre, pieces, whose length was equal to eight diameters. In addition to the tables published in the Bulletins, the final report will give the force necessary to indent the wood.

This series of tests is felt to be incomplete in many ways, and with the experience that has been gained in the work could doubtless be improved. A brief description of the methods used may be of interest.

Each specimen as soon as received was given a number, and this number has been constantly repeated in all the work done on that specimen; it is designated in the reports as the office number, and wherever met with always refers to the same tree.

After numbering, the sticks were at once sawed into bars five centimeters square. These pieces were then seasoned by air drying. During the first winter they were kept in a room warmed by a stove to about 70° F. After that they were removed to a timber loft at Watertown Arsenal, where they were kept until they were dressed for the final tests.

Two blocks of fifteen centimeters in length were taken from each specimen and dried rapidly with steam heat until they had lost most of their moisture. From these pieces, blocks of exactly ten centimeters in length and about thirty-five millimeters square were dressed out. These were then placed in an oven which was maintained at a constant temperature of 100° until the blocks were perfectly dry. After they had ceased to lose weight, they were carefully measured with a micrometer caliper and weighed. From the measurement and weight it was easy to calculate the specific gravity.

The ends removed from these blocks were used for determing the ash. They weighed from ten to twenty grams and thus gave quite appreciable amounts of ash. The ash was determined by drying the wood in the same manner as the specific gravity blocks, then carefully burned in a platinum dish in a muffle-furnace heated by gas. The heat was so regulated as to burn the ash perfectly white without melting it. In most cases the ash was left in the exact shape that it occupied in the wood. It was judged best to report the ash exactly as found, and not attempt to make any correction, on account of the carbon dioxide that might have been lost from the calcic carbonate present

From these results, the approximate fuel-value was calculated, assuming that equal weights of woods have the same fuel-value. This value is supposed to be given more correctly by taking as the weight of the wood, not the specific gravity, but the weight of a cubic decimeter, minus the ash contained in it. The ash evidently adds nothing to the fuel-value, while it does add to the weight. This assumption, which is the one generally made, is not strictly true, but it is near enough for all practical purposes. It is founded on experiments made by Count Rumford and Marcus Bull.

The carbon and hydrogen determinations were made by burning fine sawdust in a platinum boat in a current of oxygen and collecting the products in the usual way. These analyses were calculated on the dry wood. The determinations may be conveniently divided into two classes—those of the coniferous and non-coniferous.

The coniferous woods examined, with two exceptions, gave larger amounts of carbon than the hard woods. These two exceptions were the common white cedar or arbor vitæ of the Gorth, and the black spruce or Picea nigra, neither of which would be selected as valuable fuel. The average composition of twenty-nine specimens of coniferous woods examined was—carbon, 53·21; hydrogen, 6·45; ash, ·32; specific gravity, ·5624. Fuel-value be weight, 4488·3; by volume, 2524·2.

For the non-coniferous woods the average results of forty-one determinations were—carbon, 49·53; hydrogen, 6·33; ash, ·66, specific gravity, ·6951. Fuel-value by weight, 3993·9; by volume, 2776·1. These latter values agree very closely with those given in the books, as the results of the analysis of European woods. It is rather singular that with the exception of fir, no coniferous woods have been reported on in Europe.

After the long sticks of wood had become thoroughly seasoned, they were dressed out to the exact size of four centimeters square, and were sawed as near as possible to the length of eleven decimeters. They were then tested on the Watertown machine. In testing, the stick was placed in a perpendicular position resting on supports that were exactly one meter apart. The force was then applied at the centre of the length by means of an iron bearing, which had a length a little greater than the width of the stick and a radius of 12·5 millimeters. The weights were slowly applied, fifty kilograms at a time, and after each weight was added a deflection was noted. After 200 kilograms had been added, the weights were removed and the set read; the weights were again applied, the reading again taken at 200 kilograms, and then at every fifty kilograms until the stick was broken, the breaking weight being noted. In making the report, the co-efficient of elasticity for the weights 50 and 100 have been calculated; also the modulus of rupture.

So far I can only give the most general results in regard to these tests. In the first place we have not been able to establish any general law in regard to the direction in which a stick is the strongest, that is, parallel or perpendicular to the annual rings.

The results have shown however, that it is by no means necessary to break two sticks to show which is the strongest, provided they are of the same kind of wood. The weak stick will show the strongest deflections from the start. The strongest stick found was a specimen of locust, but following closely after it were specimens of hickory and Southern pine. Ash was found to stand well up to a certain point, and then it gave way suddenly and without warning, generally shattering badly. The California redwood was another that shattered very much. White oak was found to be inferior in strength to several other oaks, and to Southern pine; the average breaking weight of eight specimens of Quercus prinoides or the cow oak of the South was 523 kilograms.

The average of ... specimens of Pinus Australis was 490 kilograms.

The average of 36 specimens of the Douglas fir from the Pacific coast was 374 kilograms, and of 6 specimens of the Western larch was 523 kilograms.

13 specimens of the white pinus (Pinus Strobus) gave 274 kilograms.

11 specimens of beech gave an average of 454 kilograms.

16 specimens of Carya sulcata averaged 464 kilograms.

20 specimens of white hickory (Carya alba) averaged 512 kilograms.

24 specimens of white ash (Fraxinus Americana) averaged 378 kilograms.

8 specimens of locust averaged 378 kilograms.

The next series of tests which were made, consisting in taking specimens of the same size, square as before, and 32 centimeters long, and compressing them in the direction of their fibres. Here again both locust and Southern pine stood up well.

9 specimens of locust stood an average weight of 11,206 kilograms.

4 specimens of the Western larch stood an average of 10,660 kilograms.

35 specimens of white oak stood an average of 8,183 kilograms.

24 specimens of Pinus Australis stood an average of 10,493 kilograms.

The third series of tests was to find the force necessary to indent the wood at right angles to the grain. These tests are not finished yet, and I have made no examination of the results. They are made on blocks 4 centimeters square and 16 centimeters long, the bearing of such a size that it makes an impression on the block, which extends from side to side of the block and is of the same length.

In closing this paper I wish to express my thanks to Colonel Ludley for valuable suggestions made during the progress of the work, and to Mr. Howard for the able manner in which he has executed the tests. These tests have been made at the joint expense of the War Department and the Census Bureau, the machine having been put at our service by order of the Secretary of War.

The tests will probably be published in the annual report of the testing machine, calculated in feet and pounds.

THE HON. O. B. POTTER ON FREE LUMBER.

The following is a letter from the Hon. O. B. Potter in reply to a leading lumber firm in Albany, whose lumber interest lie in Michigan, and whose views have evidently been against the repeal of the lumber duties.

[In reference to it the *Sun* says:—"We are against the maintenance of the lumber duty; we are against the swift destruction of our forests which is now going on."]

GRATWICK, SMITH & FRYAR LUMBER CO., Towanda, N. Y., and the HON. ERASTUS CORNING, Albany, N. Y.

GENTLEMEN,—I am unable to agree with the conclusions expressed in yours of March 12.

In reply to your first position, that lumber can be produced at least 25 per cent. cheaper in Canada than in the United States, I say, if this is limited to white pine, I wholly agree to your statement. This is the best and strongest reason why this lumber should be admitted free of duty. White pine, as you know, has already on account of its growing scarcity in the United States, reached a price which makes its use in dwellings of the middle and laboring classes very burdensome, if not beyond reach. Why should the use of this timber be made difficult or impossible in the dwellings of the great majority of the people of the country in order to increase the profits of the capital engaged in the lumber business, and to hasten the destruction of the remnants of our pine forests in Michigan and elsewhere in the Northern States?

To your second point I reply: If the three hundred million dollars and one million men now engaged in hastening the premature destruction of our remaining pine forests cannot continue this destruction profitably without the stimulus of a tax to be paid by the thirty-five millions in the Northern States, to whom this white pine lumber is a necessity, I am glad. The removal of the duty will then preserve for some time longer our own pine forests. While they grow and greatly increase in value for our future use, the growth of our towns and cities and the building of houses for our people will not be retarded, but be helped and hastened by cheaper white pine lumber.

Your third point that "nine-tenths of the people who use lumber are above the laboring classes, and the duty is not in any sense a burden upon the community," cannot be maintained. This duty is a most oppressive and unnecessary tax upon and against the homes of the middle and laboring classes. It is within my own experience that houses in New England have remained for years unfinished in order to meet the more necessary expenses of education, while sons slept under bare rafters in unfinished rooms. I am mistaken if this is not the case now with many homes throughout the country of large families and small means, who would appreciate and enjoy well finished rooms.

To your fourth point, that without this duty lumber for the Eastern States will come from Canada, and that railroads would lose the profits which would result from the early destruction of the forests still remaining at the West, and their transportation by rail to the East, I hope this is so, because then, with the removal of this duty, the East will be more cheaply supplied with lumber, while the forests of Michigan will remain for the use of the great and growing West, for which they will soon all be needed, and will be wholly inadequate. I cannot think 35,000,000 people should be oppressively taxed in order to enable railroads to make profits in the premature destruction and transportation of our remaining Western forests.

To your fifth point I answer that the price of pine lumber wholly negatives your position. This price has nearly or quite doubled within thirty years, and is constantly advancing. But if your statement be true, that the forests of Michigan and Wisconsin will last for fifty years, I ask what will be the condition of the vast and still growing West then with 100,000,000 people and no forests remaining? Fifty years is a short time in the life of a nation.

In reply to your sixth and seventh points, you cannot be unaware that the yellow pine of the Southern States is not, and never can be, advantageously used for the inside finish of houses, including doors, sashes, and casings; nor in the manufacture of furniture, where white pine is a necessity; nor for anything beyond beams, floors and wainscoting. Yellow pine and white pine are, as you know, best used together in the same finishing purposes, the greater will be the demand for Southern pine for beams, floors, and other purposes for which it can be used. All the white pine and yellow pine of the country will not be too much for its certain growth during the lives of those now born, if our Government shall be steadily administered to the great ends of liberty and self-government for which it was created.

Very truly yours,

O. B. POTTER.

House of Representatives, Washington, March 14.

Herr Lasker on Forest Conservation.

Herr Lasker, the eminent German statesman, deprecated the prodigal waste of the forests with which this continent is so prodigally endowed. He pointed out the fact that, while naturally we are so far superior to Germany in this regard, the older country was far more enlightened in its policy as to forests. There the people and government were at the utmost pains to conserve and replace the occasionally denuded parks. While there the grand, primeval trees were not encountered in anything like