

saved over sixty millions of dollars by the use of this valuable invention. In fact, all inventions are utilized, not simply because they are convenient, but because they are cheaper and better. Touching the statement that laborers are thrown out of employment and wages reduced by the use of patent devices, it is sufficient to say that the allegation is entirely at variance with the best information obtainable from the returns of the last census. The utilization of valuable inventions does not throw laborers out of employment, but re-distributes labor and opens up new avenues of employment, calls into requisition a higher order of skill and secures an increase of wages. For example, take the boot and shoe industry, where a few hundred machines have changed the whole course of labor. The census of 1870 showed that there was an average of twenty-nine persons employed in every shoe factory in this country, whereas in 1880 there were fifty-six persons so employed. The same number of persons in 1875 made three times as many shoes as in 1845. In a table prepared by Colonel Wright, Chief of the Bureau of Labor, it is shown that in 1870 there were employed 91,702 men, women and children, while in 1880 there were 111,152. In estimates based upon four hundred and sixty shoe manufacturing establishments in Massachusetts, it is shown that three millions of dollars more are paid in wages than the capital invested, and that the labor-saving machinery has given to the laborer in 1880 almost double the wages of 1850.

"But for the growth of our industries, due to the patent system, there would have been no employment in this country, otherwise than in the field, for ten per cent. of the immigrants who have come among us. While an important invention may result in utilizing a machine which will do the work of a dozen men, the result is to open up an avenue of employment which will give work to double the number. The comforts and conveniences of life are made more abundant and cheaper, the consumption larger."—*Benjamin Butterworth, U. S. Commissioner of Patents in 1884.*

THE GOVERNMENT TIMBER TESTS.

Comprehensive timber tests have been inaugurated in the Forestry Division of the Department of Agriculture, concerning which we have received the following information:

To define the objects of the work more in detail, some of the questions which it is expected ultimately to solve may be formulated as follows:

What are the essential working properties of our various woods, and by what circumstances are they influenced?

What influence does seasoning of different degree have upon quality?

How does age, rapidity of growth, time of felling, and after treatment change quality in different timbers?

In what relation does structure stand to quality?

How far is weight a criterion of strength?

What macroscopic or microscopic aids can be devised for determining quality from physical examination?

What difference is there in wood of different parts of the tree?

How far do climatic and soil conditions influence quality?

In what respect does tapping for turpentine affect quality of pine timber?

It is also proposed to test, as opportunity is afforded, the influence of continued service upon the strength of structural material, as, for instance, of members in bridge construction of known length of service. This series of tests will give more definite information for the use of inspectors of structures.

Besides these problems, many others will arise and be solved as the work progresses, and altogether a wealth of new knowledge regarding one of our most useful materials must result. It is proposed to publish results from time to time.

The collection of the test material is done by experts (Dr. Charles Mohr, of Mobile, Ala., for Southern timbers). The trees of each species are taken from a number of localities of different soil and climatic conditions. From each site five trees of each species are cut up into logs and disks, each piece being carefully marked, so as to indicate exactly its position in the tree; four trees are chosen as representative of the average growth, the fifth, or "check tree," the best developed specimen of the site.

Disks of a few young trees, as well as limbwood, are also collected for biological study. The disk pieces are eight inches in height and contain the heart and sapwood of the tree from the north to the south side of the periphery. From fifty to seventy disk pieces and from ten to fifteen logs are thus collected for each species and site.

A full account of the conditions of soil, climate, aspect, measurements, and determinable history of tree and forest growth in general accompanies the collection from each site.

The disks are sent, wrapped in heavy paper, to the Botanical Laboratory of the University of Michigan, at Ann Arbor (Mr. F. Roth in charge), to be studied as to their physical properties, their macroscopic and microscopic structure, rate of growth, etc. Here are determined (a) the specific weight by a hygrometric method; (b) the amount of water and the rate of its loss by drying in relation to shrinkage; (c) the structural differences of the different pieces, especially as to the distribution of spring and summer wood, strong and weak cells, open vessels, medullary rays, etc.; (d) the rate of growth and other biological facts which may lead to the finding of relation between physical appearance, conditions of growth and mechanical properties.

The material thus studied is preserved for further examinations and tests as may appear desirable, the history of each piece being fully known and recorded.

The logs are shipped to the St. Louis Test Laboratory, in charge of Prof. J. B. Johnson. They are stenciled off for sawing and each stick marked with dies, corresponding to sketch in the record, so as to be perfectly identified as to number of tree, and thereby its origin, and as to position in tree. After sawing to size, the test pieces are stacked to await the testing. One-half of every log will be tested green, the other half after thorough seasoning. A determination is made at the time of testing of the amount