

same species, therefore, converted into building material offers a different problem as to its properties, especially its strength, and each stick taken from a different part of the tree shows different quality.

"This endless variability it is that has kept us in ignorance as to the capabilities of our timbers. While, by experience, we have learned that these differences exist, and even learned to find some of the relations between physical appearances, anatomical structure, and mechanical properties, the enormity of the enterprise has baffled investigators and deterred them from carrying on, in a systematic and comprehensive manner, such tests and examinations as would furnish us not only with reliable data as to the range of capacity of our timbers, but also as to the exact relation of their properties to their structure and physical condition.

"This investigation, the most comprehensive of the kind ever undertaken anywhere, in this country or in Europe, differs from all former attempts in similar direction in this, that it starts out with the fullest recognition of three facts:

(1) That in order to establish reliable data as to mechanical properties of our timbers, it is necessary to make a very large number of tests, by which the range as well as the average capabilities of the species is determined.

(2) That in order to enable us to make the most efficient practical application of the data thus obtained, it is necessary to know the physical and structural conditions of the test material, and bring these into relation with the best results.

(3) That in order, further, to deduce laws of relation between mechanical properties and the physical and structural conditions, as well as the conditions under which the material was produced, it is necessary to work on material the history of which is thoroughly known.

"Briefly, then, to solve the problems before us, it is necessary to make our tests on a large number of specimens of known origin, and known physical condition. While the tests in themselves appeal at once and first to the engineer, inasmuch as, by their great number, they will furnish more reliable data regarding the capabilities of the various timbers, the chief value and most important feature of the work lie in the attempt to relate the mechanical properties to the