it and increase its flexibility, as is well illustrated in the manufacture of bent-wood furniture, barrel staves and hoops, the bending of wooden rims for wheels, veneer peeling, etc.

Toughness.—This is a more or less general term applied to woods which are both pliable and rather difficult to split. When the dry wood permits of an aggregate distortion in compression and tension of at least 3% and resists a longitudinal shearing force of 1,000 pounds per square inch it may be pronounced "tough," as for example, hickory, ironwood, oak, elm, ash.

Resilience.—This term is often confused with toughness and may be defined as ability to withstand impact, and explains the use of oak and hickory for wagon spokes, where each spoke is dealt hundreds of terrific blows in a mile journey over a rough road. Maple, beech, hawthorn and dogwood also have a high resilience.

Weight and Strength.—Broadly speaking, the strength of well-seasoned wood increases with its weight per cubic foot, the exceptions being confined mainly to the oaks which have an exceedingly complicated structure. To state the case more accurately, we may say, the higher the density of the wood the greater is its crushing strength, although density is no criterion of tensile strength.

Effect of Long Immersion in Water.—Sixty-five tests on alternate sections of the same sticks tested in the regular way indicate that soaking in water for six months produces no apparent loss of strength. Whilst soaking in cold water does not diminish the strength of wood, it is a well-known fact that heating the water weakens it considerably and boiling the water causes a still greater dimunition in strength, as noted already under the heading of flexibility. Timber which is first kiln dried and then soaked in water is found to be weaker than air dry timber containing an equal percentage of moisture, and fails much more suddenly because kiln drying increases the permanent brittleness of wood.

Effect of Hot Air Drying.—Apart from the checking action which results from a too rapid drying of the exterior portions of the test pieces, the result of over 200 tests shows that with the temperatures commonly used for drying lumber no detrimental effect was observed on the strength of the material.

Effect of Creosoting.—The following figures (Table VII.) for compression tests made on pieces of loblolly pine which had been soaked in water and in creosote for six days are interesting:

TABLE VII.

	Length of soaking (days).	Moisture %	Relative load.
Air dry wood	0	9.1	1.00
Soaked in water	6	71.5	.42
Soaked in creosote	6	70	.80

These figures show that creosote diminished the strength of the wood approximately one-half as much as soaking in water. It should be remembered, however, that these tests were made on very small pieces, and the results should be received with caution. More recent experiments show that whilst the strength decreases immediately after being creosoted this decrease is only temporary. Apparently the presence of creosote does not of itself weaken the wood but only retards the seasoning process, so that after a time it should become as strong as the original seasoned wood.

Safety Factors.—On account of such defects as knots, season checks, star-shake, etc., present in most structural timber and the great variation constantly occurring in its moisture content, it is customary to design timber structures so that they will carry several times the load ordinarily required—this multiplier being known as a safety factor. In the case of ordinary timber structures a safety factor of four is generally sufficient, provided the modulus of rupture has been determined from a large number of tests on fairly large-sized pieces, but in the case of structures carrying moving or jarring loads (bridges and foundations for machinery) a safety factor of five or six should be allowed.

In 1896 a committee of the American International Association of Railway Superintendents of Bridges and Buildings recommended the following factors: For timber in shearing and compression across the grain, 4; for columns under 15 diameters high and for end bearing, 5; for extreme fibre stress in transverse rupture, 6; in tension with and across the grain, 10.

Testing of Canadian Woods.—Because of the importance of this subject to all classes of wood users, the Forestry Branch of the Department of the Interior is about to undertake an exhaustive series of tests at McGill University. Beginning with a few of the more important of the commercial species, every kind of wood in the country will be tested for its strength in various ways, and for different conditions of growth and moisture content. At present the only information we have on this subject is based upon tests of wood grown in the United States; many of which were grown under entirely different conditions to what we find in our own country.

Provisional Table.—In the absence of more satisfactory information, the writer has therefore compiled the following table (Table VIII.) for 84 species of wood found growing in Canada. The necessary information has been gleaned from numerous sources and will be of considerable assistance to the designers of timber structures until such time as the Forestry Branch has completed its investigations along this line and furnishes fuller information regarding the strength of our native woods.

(Continued on following page.)

CANADIAN FOREST FIRES IN 1913.

The Forestry Branch, Department of the Interior, announces that the loss of timber by fire in Western Canada was smaller during last season than ever before. On several of the reserves in Manitoba and Saskatchewan fire occasioned no damage whatever, and on the Dominion reserves in the Railway Belt, B.C., the only green timber injured by fire was four acres of young lodgepole pine. Even on the Rocky Mountains reserve in Alberta, with the immense area of 13,373,856 acres, most of which is remote from settlement, fire destroyed only 1,150 acres of young timber, whose present value was small, and mature timber to the value of $150. The total area burnt on this reserve was but two one-hundredths of one per cent. of the above acreage, and it is likely, when the reports are complete from the other reserves, which are smaller and usually better protected, that the aggregate area burnt over by fire will be no greater than one one-hundredth of one per cent. of the total reserved area. The significance of this figure is apparent by comparison with the corresponding figure for the National Forests in the United States, where the area burnt over by fire in 1913, although admittedly the smallest in recent years, was about 0.03 per cent. of the total area.