sleepers by the New Zealand Government in 1905, stated as being 120,000 annually, absorbing 2½ gallons of creosote each, equal to 300,000 gallons, treated by the existing plant, a saving of 180,000 gallons per annum would be effected by using the Rueping process, equal to £5,625 per annum in cost of creosote alone, reckoning the cost of creosote at the price at which the Department was then landing it—viz., 7½d. per gallon. Added to this very substantial saving, a much better penetration, with necessarily better lasting results, would be obtained by the adoption of the Rueping process.

Effect on Mechanical Strength of Timber.

In a report of mechanical tests made on specimens cut from loblolly-pine sleepers treated by the Rueping process, by Mr. E. O. Faulkner, issued by the Bureau of Forestry, United States Government Department of Agriculture, December, 1904, it is set down that an average increased strength equal to 15 per cent. was discovered in the treated specimens as against specimens of the same natural wood.

Machinery necessary for the Rueping Process.

The impregnating-works consist principally of (1) impregnating-cylinders strong enough for a pressure of from seven to fifteen atmospheres, equal to 102 lb. to 226 lb.; (2) a creosote-tank capable of a pressure of 75 lb. to 120 lb.; (3) an air-compressor, which at the same time may serve as a vacuum-pump; (4) a pressure-pump; (5) a steam-boiler; (6) trollies for running timber through cylinders.

The cost of constructing such impregnating-works would be largely controlled by the capacity required, as well as the local prices for boilers and machinery.

Suitability of New Zealand Timbers for Treatment by the Rueping Process.

Specimens of birch, rimu, white-pine, and other native timbers have been treated, and found readily adapted to the process in every way.

In conclusion it may be stated that timber properly treated with creosote is absolutely and permanently impervious to destruction from insect-life of any species, whether termite, white ant, or teredo. In marine piling the latter pest has been always especially troublesome, and an instance of the effectiveness of creosote, officially given, is before us, where 1,100 piles driven at Leith, Scotland, in 1848, were reported by the engineer in charge as perfectly sound in 1882, having been treated with 10 lb. of creosote per cubic foot. (*Vide* American Society of Civil Engineers' Report on the Preservation of Timber, 25th June, 1885, p. 340.)

(3.) Powell Wood Process.

As the name implies, the process is the discovery of Mr. Powell, and it is patented the world over.

The process, from its initial stage, has been subjected to some very severe tests by several scientists and experts, as to the lasting properties and other virtues of Powellised wood; and the process is concisely described in the book "Wood," by Professor G. S. Boulger, F.L.S., F.G.S., &c., Lecturer on Botany, Geology, and Forestry in the City of London College:—

"Powellising consists in boiling the wood in a saccharine solution without pressure, so as to expel air and moisture, and coagulate the albumen, and then drying it at a high temperature. Green wood; and some species, such as spruce, which cannot readily be creosoted, can be treated by this process, and the wood is not only seasoned within a few days of being felled, but small cracks are closed up, the porosity of the wood is much diminished—a very important point in connection with wood paving—and its strength, toughness, resiliency, and durability are enhanced. The process need not discolour the wood, but may be made to bring out figure, and thus, in more ways than one, to render it possible to substitute a lower-grade timber for the more expensive grades now in use. The processed wood will take paint or varnish, and is completly immune to the attacks of dry-rot. Having no unpleasant odour, Powellised wood is adapted for furniture as well as for paving or railway-sleepers; whilst a slight modification of the treatment protects it from the attacks of termites."

Professor Boulger also states, "Effective wood-preservation—certainly if it is to be expeditious, and so obviate the prolonged locking-up of capital—must be accomplished by some impregnation method. It might not seem *a priori* probable that sugar would answer the purpose, but the Powell process has demonstrated that it does so. Sugar, especially beet-sugar, is a simple, stable carbo-hydrate, incapable, in the absence of soluble nitrogenous matter, of nourishing septic organisms, while in solution it has a high boiling-point, and has been shown experimentally to have a greater power of diffusion through the wood than water has."

The following statement by Dr. Morris Travers, Director of the Indian Institute of Science, Bangalore, explains the reason of sugar being so readily accepted by the timber when submitted to its treatment: "Sugar-solution, being an amorphous form of wood, is readily taken in by the wood-fibres, and actually becomes part of the wood itself, and is not held in a merely mechanical position."

Past experience has proved that in Powellising timber the following results are obtained: (1.) It enables timber to be rapidly and thoroughly seasoned. (2.) It renders all woods immune to the attacks of insects, such as white ants, the borer, and the *Teredo navalis*. (3.) The treated timber is absolutely immune to attacks from dry-rot. (4.) Timber so treated is very much lighter and stronger than the untreated green wood. (5.) It renders timber more close and impermeable, lessening its porosity, and reducing its tendency to absorb moisture. (6.) It brings out the grain and markings of figured wood, improving its appearance. (7.) In painting Powellised timber, owing to its relatively non-absorbent nature, from 20 to 40 per cent. less paint is required.