number used of all kinds, while in 1912 these percentages increased to 4.4 and 3.1 respectively. There are about 19 different kinds of wood used for ties in this country and Table I. gives the approximate percentage of each kind used.

Table I.

Kind.	Properties.	Percentage.
Jack pine	Light, soft and durable	36.5
Cedar	Light, soft and durable	15.6
Douglas fir	Hard, strong and durable	10.2
Hemlock	Light, soft, not strong or durable, brittle	9.1
Tamarack	Heavy, strong, hard and durable	8.5
Western larch	Heavy, strong, hard and durable	5.6
Oak	Tough, hard, strong	4.4
Eastern spruce	Light and soft	3.9
Hard Pine	Hard, tough, elastic and durable	3.1
Chestnut	Light, soft, not strong	1.2
Beech	Very hard, strong, tough, not durable	0.5
Western cedar	Light, soft and durable	0.4
Maple	Tough, heavy, hard and not durable	0.2
White pine	Soft, uniform and durable	0.2
Birch	Heavy, strong, hard	0.2
Red Pine	Heavy, strong, not durable	0.1
Balsam fir	Soft, light, not durable	0.1
Western spruce	Soft, light, not strong	0.1
Elm	Heavy, hard, very strong	0.1

Although the jack pine, cedar, and hemlock have prominent positions in this table their use is practically limited to tracks where the traffic is light, the railways in Eastern Canada having practically discarded these softer woods in favor of oak and hard pine, which are better able to withstand the heavy traffic common to these lines.

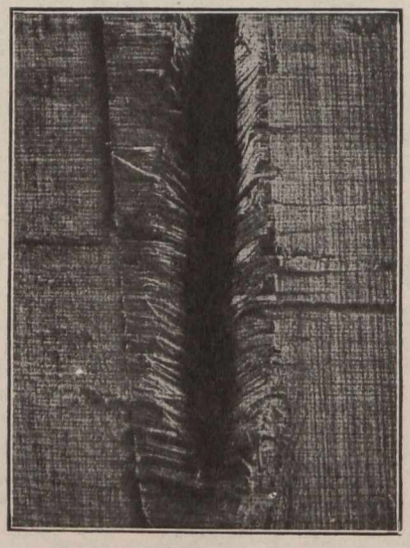

Fig. 2.—Effect of Driving Spike in Oak Tie.

The fourth item on the list of causes of the increased cost of ties to railways is the shorter life of ties. This at first may not be apparent, but it is nevertheless true; the actual time it takes for a tie to decay is no less to-day than it was in the past unless the decay is hastened by some extraneous cause—and that is what actually happens. As the traffic and tonnage over a track increases, so does the rail cutting and mechanical wear of the ties, and once the wood fibres are damaged in this way vegetable decay sets in much quicker, and the life of the tie is shortened by this decay, as well as by the mechanical disintegration.

As is naturally to be expected, both the railways and the governments are doing a great deal to counteract this tendency of increased expenditure on ties and timber, and briefly summarized, the following are the methods adopted for this end: Government legislation and conservation of forest lands; the maintenance of suitable tree plantations by railways; the reduction of mechanical wear by screw spikes, tie plates, etc.; the chemical treatment of ties to prolong their life; and the

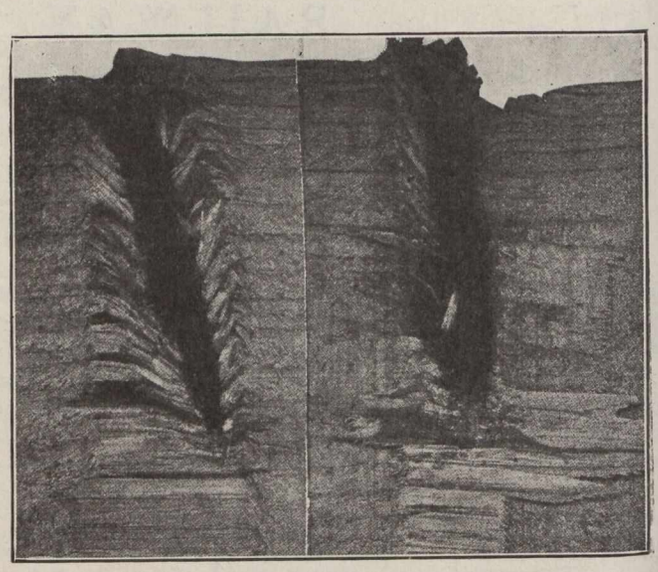

Fig. 3.—Effect of Spike on Tie After One and Three Years' Service.

use of ties of other materials than wood. It might be said that practically all these methods are still in the experimental stage, but it is of interest to note what has been done on these lines.

The Commission of Conservation of Canada has done considerable work in the past few years towards the conservation of the timber supply of the Dominion. In the year 1911 the attention of the Commission was largely paid to the prevention of forest fires, and from careful investigation it was found that about 34% of the forest fires to which causes could be assigned had been started by railway locomotives. As a direct result of this, an amendment was made to the Railway Act requiring railway companies to establish and maintain a service of fire rangers whenever so ordered by the Board of Railway Commissioners, and also requiring the railways to pay damages within certain limits for any fires caused by them. In addition to this legislation, a great deal was done in connection with forest reserves, and as a result the Rocky Mountain Forest Reserve Act was passed setting aside 17,900 sq. mi. in Alberta on the eastern slopes of the Rocky Mountains for a perpetual forest and game reserve. This national forest being the largest and most important in the Dominion, is worthy of a few words of description. As shown in Fig. 1, the eastern boundary is approximately defined by a line at elevation 4,000 ft., the western boundary is determined by the Interprovincial boundary, and the reserve rises to the west to peaks as high as 10,000 ft. The timber line is at an elevation of about 7,000 ft. The most useful trees found in this tract are the Engelmann spruce, the Douglas fir, and the Lodgepole pine. The Engelmann spruce is a tree with a light, soft wood, not very strong and found only in high altitudes. The Douglas fir is of the same species as some of the largest trees in the world, but does not reach such a size in the national