

timber up at once if the rock is at all liable to be weak, as so often the rock under strong tension will collapse without any warning or immediately after examination, and timbering will then be far more expensive in the end.

Spruce, pine and hemlock are mostly available for such service in our American mining and then they are best if the trees have been killed but not damaged by fire, and stand straight, dry and strong, as the green wet stuff is very heavy to handle underground. Such timber cut above altitudes of 7,000 or 8,000 feet, was found, in Colorado, to be much inferior in strength to that from lower down, being less resinous and brashy.

Some sketches have been made to show the styles of timbering mostly used in American tunnels, those requiring the fewest cuts and simplest framing while preserving the maximum strength.

Fig. No. 1 shows a cheap sett consisting of cap and posts of round timber and poles split or unsplit for lagging.

Fig. No. 2 is a full sett of round timbers better framed with or without collar braces.

Fig. No. 3 shows a sett for single track with different kinds of joints, and of timber sawn on two or four sides.

In putting in the timbers every sett is made perfectly firm with wedges and blocks on top and sides, and in lagging up, if the ground is not very wet and loose, the lagging is spread out, not put close together, by leaving out every other piece and filling in between with bits of rock, and to make the most of the lagging's strength it is put in with the round side next to the timbers.

Figs Nos. 4 and 5, show the sett used in the double track tunnel mentioned, with collar-braces and water-box. Before framing, the sticks were squared on two sides by two French-Canadian axemen, at a cost no more than that of the timber squared at the mill, as was afterwards used in the arched setts. This form and size of sett was found to stand very heavy ground, even when spiling had to be used, but finally it was supplanted by the arch sett, (Figs. No. 6 and 7), when the pressure became excessive and as it was better adapted to spiling. This sett was designed to give ample room for working, but in the least possible space and with the simplest form of framing. It withstood tremendous pressure when the cost of progress for some time was \$600 per foot, and