5, pg. 265.) An avalanche does not stop at the bottom of the valley, but often sweeps up the opposite side, doing double damage because coming from a direction least expected. The sheds must accordingly in many instances be made of sufficient strength to withstand avalanches from either direction. Cases are on record where laborers on the tracks have been killed by not heeding an avalanche on the opposite side of the valley, which they supposed was too far below them to be dangerous.

The avalanche itself is not the only destructive agent in these regions. Currents of air are set up by the swift downward motion of the mass, & often do great damage, as they extend over a wide area & have immense power. They are called "snow flurries," & at times have sufficient power to twist off the trunks of full-grown trees, perhaps 50 ft. from the ground, leaving only the stumps standing. After the passage of a "snow flurry" the leaves are burned brown, as though subjected to great heat.

In the construction of the snow-sheds the strongest materials were used, & these were found close at hand in the forests. Cedar timbers, mostly 12 x 12 ins., formed the cribwork, but Douglas fir (Oregon pine) was employed in members subjected to severe transverse strains. The bents, usually spaced about five ft. centers, were built up of 12x15 in. timbers, securely braced & drift bolted together. Above the shed the ground is cleaned & leveled, with the object of giving the avalanche an upward motion, thus tending to shoot across the track. An idea may be gotten of the immense power of these avalanches from the fact that comparatively new sheds have been entirely demolished during the breaking up of an unusually severe winter.

In order to guard against destruction by fire systematic measures have been adopted. Where it is necessary to protect a long piece of track from avalanches, the sheds are divided into several short sections, with open spaces of about 200 ft. between them. These open spaces are protected by heavy V-shaped fences of cribwork placed above. (See figures 5 & 6.) An avalanche striking one of these fences is deflected to the right & left upon the sections of the shed, & so passes, without doing harm, to the valley below. The open spaces also allow the sheds to clear of smoke very rapidly, which in winter, when all the small openings are filled with snow, would otherwise require hours. A complete system of sluices & piping leads water from the streams above to the tops of the sheds, & in case of the occurrence of fire, the watchman, who is always on duty, will be able to control it promptly. In many cases a temporary track is laid beside the shed, which is used in summer, thus greatly reducing the fire risk, & allowing the passengers to see to better advantage some of the finest scenery.

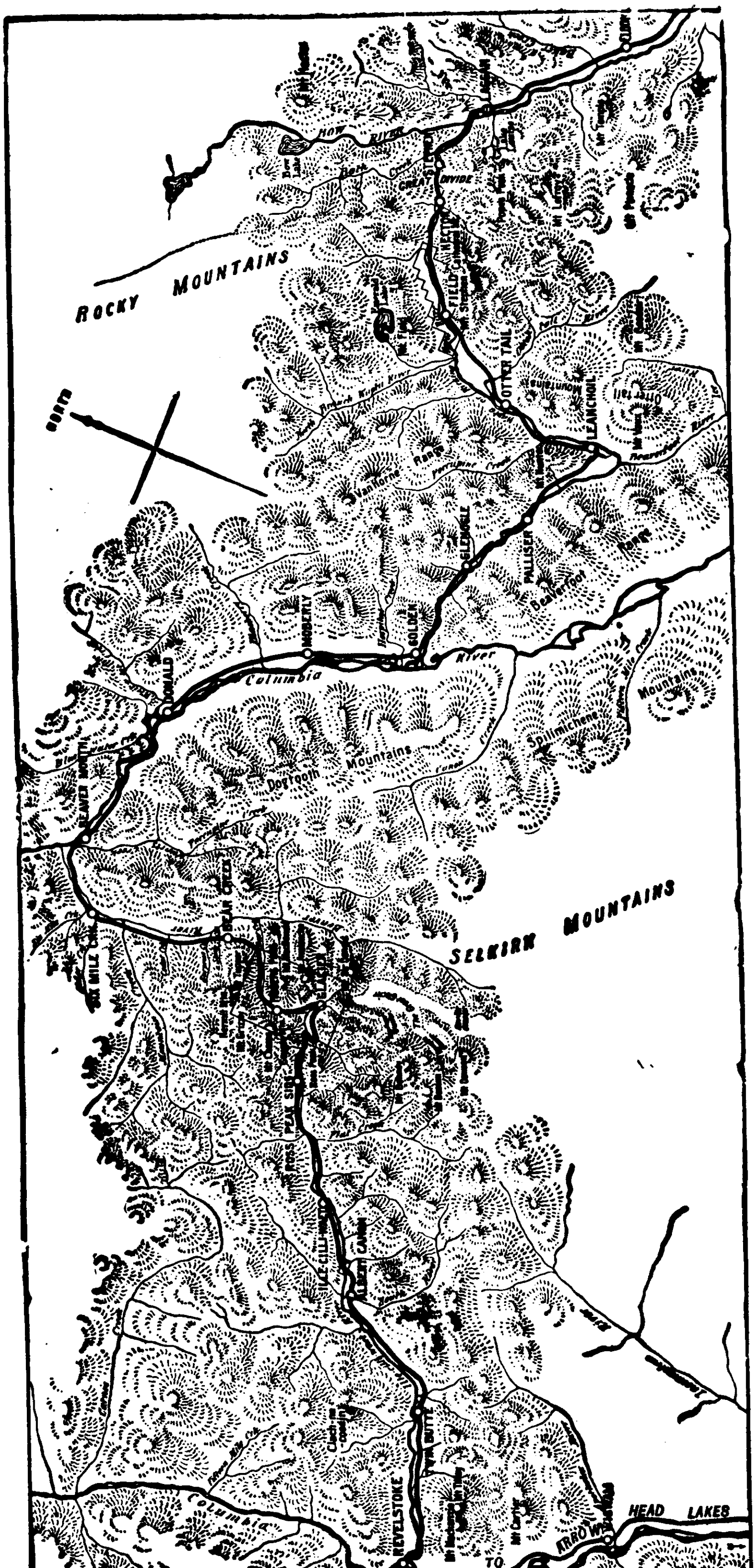

FIGURE 2.—MAP OF THE C.P.R. BETWEEN LAGGAN AND REVELSTOKE, B.C.

Where avalanches cannot be made to pass over the track, bridges are provided, so that they may go beneath them. On the east slope of the Rogers Pass grade several great ravines are crossed, which at first were spanned by wooden trestles, these now being replaced by more permanent structures. The largest of these crosses Stony Creek. It was originally built of continuous Howe trusses, having spans of 33, 161, 172 & 86 ft. respectively, & supported on wooden trestle towers 200 ft. high, resting on concrete footings. While still in good condition in 1893, it was decided to replace it with steel, a continuous arch of 336 ft. span & 300 ft. above the chasm being completed just before a destructive forest fire swept over the region. (See figure 7, pg. 269.) Several other bridges have been reconstructed in a most substantial way, one of the principal factors in the design being to allow the avalanches of mud & snow to pass safely beneath them. In the old wooden bridges, a few examples of which still remain, the "flurry" caused by the slide passing beneath was withstood by heavy rods of iron anchored to "dead men" on the upper side of the valley. Cribwork to the right & left deflected the side so that it passed between the supports instead of carrying them with it. But even with the most substantial construction & care in design it has not been possible to save some of the bridges from total destruction. The structure spanning Cascade Creek was swept away six times before it was replaced by a single arch of masonry, which, it is expected, will withstand all attacks. It is an interesting fact that this entire stream emerges from the ground a few hundred feet above the line of the railway.

While in many cases it was possible to span the courses of streams by bridges, a number were of such width that long trestlework became necessary. The problem of reconstructing these was a very serious one, owing to the cost of labor & the difficulty of moving material on the steep grades. At certain points, however, it was only possible slowly to fill in an embankment from cars loaded with gravel obtained from cuttings. This method is being pursued in the case of the trestlework at The Loop, where many hundreds of thousands of yards will be required. The operation is necessarily slow, & its completion may not be expected for many years to come.

A much more expeditious & satisfactory method, & at the same time one which costs but about one-half of the dumping method, has been employed in two or three cases where abundant water-power was at hand, & also immense banks of gravel or morainic material. Reversing the methods followed by the goldwashers of California, water was brought down from the streams above under great pressure, & with it the gravel & boulders were washed into large sluices, which carried them to the points where the filling was