

mountainous regions than the improvement of the C.P.R. line in British Columbia. It has involved the construction, some six years ago, of one of the most interesting systems of tunnels in existence, and also the construction, now under way, of the longest tunnel on the continent. We refer in the former instance to the spiral tunnels in

of safety. Unless the engine-driver of a descending train signalled to the switchman that his train was under control, the normal setting of one of these switches would divert the train to a catch siding.

Increase in the density and extent of traffic made grade reduction practically a necessity. Reference to Fig. 2 will enable the reader to clearly understand the manner in which this was accomplished. The main line now traverses the valley of the Kicking Horse River between these two stations with an increased length of 8.2 miles and a maximum grade of 2.2 per cent. (compensated).

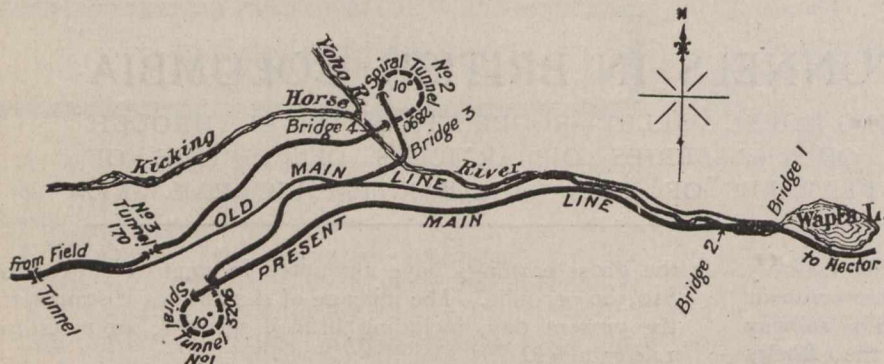


Fig. 2.—Grade Reduction Work on the Canadian Pacific Railway Between Hector and Field, B.C.

the valley of the Kicking Horse River, and in the latter to the Roger's Pass tunnel that is being driven through Mount Macdonald in the Selkirk Range.

**Spiral Tunnels Between Hector and Field, B.C.**

Prior to 1908 these two stations were separated by such extreme grades that four 154-ton consolidation (2-8-0) locomotives were required to haul a trainload of 710 tons of freight over this section of the main line. For about three miles a grade of 4.5 per cent. prevailed, decreasing to 4 and 3.5 per cent. for the remainder of the distance. These grades involved the use of spring switches at different points along the line for the purpose

This development of length was rendered a difficult problem owing to the steep mountain sides on either bank of the river. The only solution lay in tunnelling a loop on each side and in the construction of bridges, as illustrated in the sketch. The driving of these spiral tunnels has been regarded by many engineers as one of the most interesting engineering features of the whole Canadian Pacific Railway improvement. Tunnel No. 1 is 3,206 feet in length, turning an angle under Mount Stephen of about 234 degrees on a 573-foot radius with a grade, as reduced by compensation, of 1.6 per cent., producing a difference of level at the portals of 48 feet. Tunnel No. 2 has a similar radius of curvature through an angle of 232 degrees. It is 2,890 feet long and the grade produces a difference in elevation of about 45 feet at the two portals. Thus the road now traverses the valley by three lines at different elevations. It crosses and recrosses the river by four bridges. The improvement further necessitated the

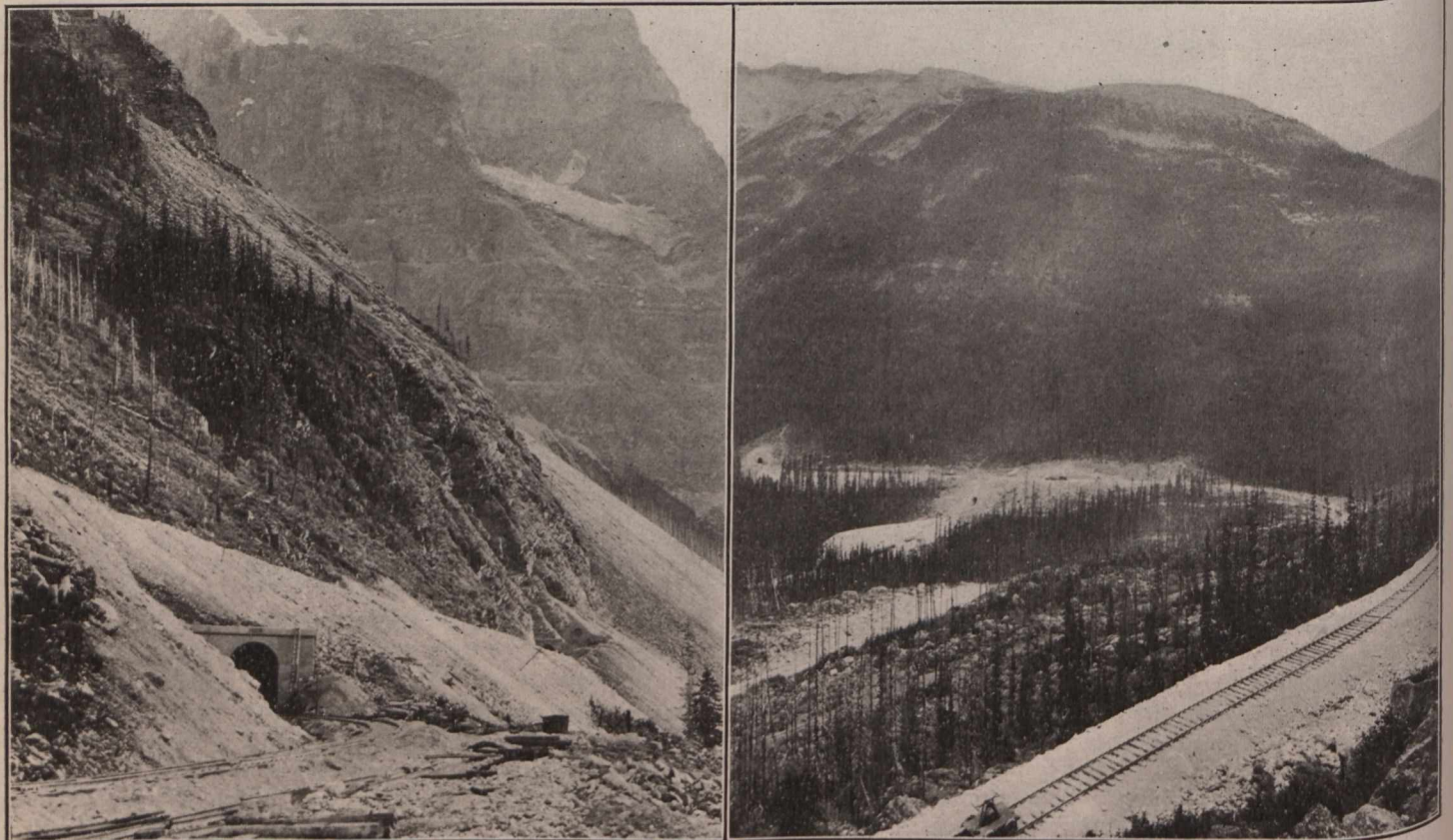


Fig. 3.—Portals of Spiral Tunnels Between Hector and Field, B.C.