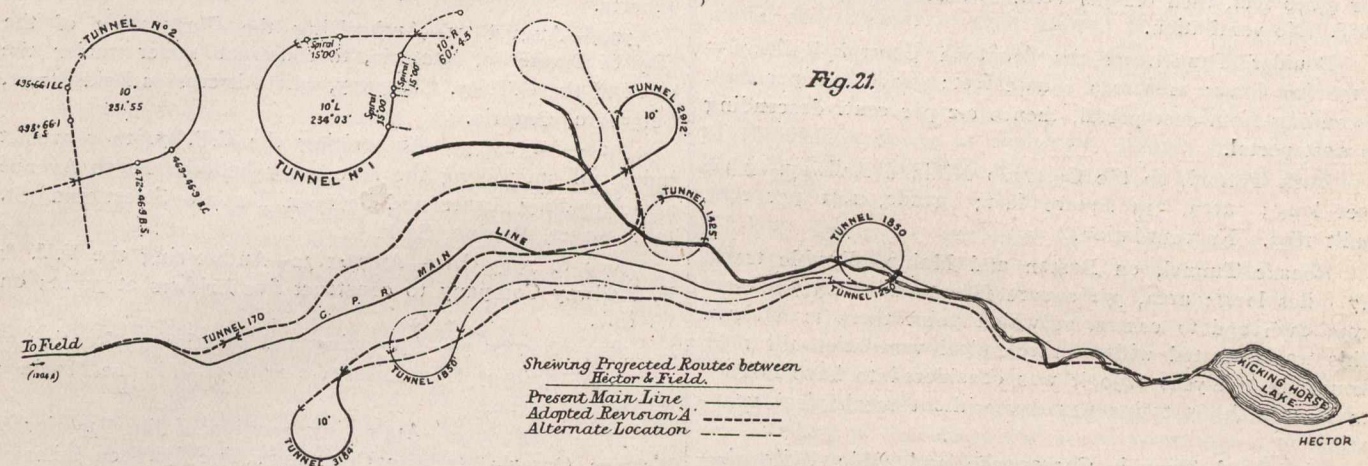


shown in the plan, Fig. 21, page 327. The line which is marked "A" required the abandoning of Field and moving the terminal at this point, besides being very expensive work, running into a series of slides. From the appearance of the ground, the Yoho Valley, or the north branch of the Kicking Horse River, appears to lend itself readily to a location in this direction; but on account of the exceedingly steep banks, and a large number of snow and rock slides, this line was abandoned. It therefore necessitated the consideration of the lines shown in dot-and-dash line and dotted line on the plan (fig. 21). The dot-and-dash line required running parallel to the bed of the river at several points in order to secure the gradient; this would require the railway and the river to be carried through the same cuts, and on account of the danger of ice blocking the river, besides being a very expensive project to divert the river, this line was

700 tons over this grade, while it is estimated that with two engines of the same class the company will be able to haul 982 tons. The engines used in operating over this grade are what are known as 180 per cent. engines, having a total tractive force of 46,900 lb., the weight on the drivers being 173,700 lb., the total weight of the engine and tender loaded being 154 tons.

The amount saved on account of reducing this grade at the time the estimate was prepared was not in itself sufficient to warrant the expenditure; but, taking into account the question of handling passenger traffic so much more safely, as well as allowing longer trains to be operated, besides doing away with the terminal at Laggan, the terminal of the Western division being moved to Field, it was decided to go on with the work.

The work was started on this grade revision in September



abandoned, and the dotted line adopted as a general location.

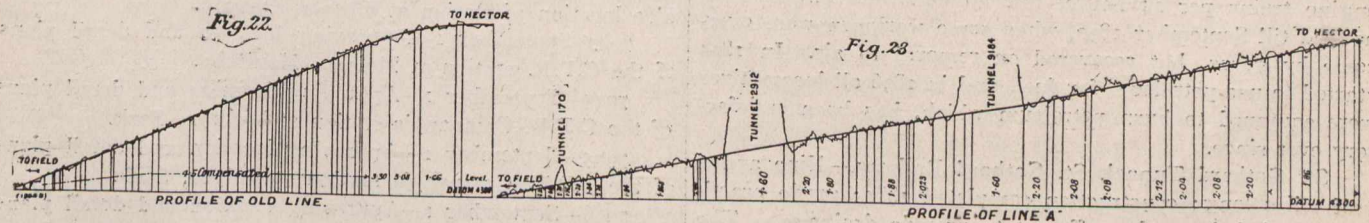
After having further surveys made, and in order to save length of tunnel, this was changed to the line shown in dot and dash; while this increased the curvature by 102 degrees and lengthened the line by 362 feet, the tunnel was shortened by 1,000 feet, and on account of the cost of the tunnel work it was decided to adopt this line.

Before actually starting the work on this line, further investigations were made up the Yoho Valley, and it was decided that it was impracticable to build a line up the valley, as, for a distance of two miles or more, it would be on the face of perpendicular rock-slides, ranging from 3,000 feet to 5,000 feet, besides which there would be several snow-slides to contend with, which would endanger the operation of the line. It was decided by the management to undertake

ber 1907, and it is estimated that it will be finished by August 15 of the present year.

The work on the tunnels was started from both ends, the contractor at first using an old-style Jumbo, but steam-shovels were later substituted in these tunnels, and the work progressed a little quicker. No great difficulty was experienced in the tunnel work, as it is through medium hard limestone, with a dip of about 20 degrees. A large quantity of timber was required in both the large tunnels on account of striking slides in the rock, and a little trouble was experienced from water, but this was kept under control at the upper ends with two small steam-pumps. The two headings in the tunnels met on May 22, the levels checking in Tunnel No. 1 within two-hundredths of a foot, and Tunnel No. 2 within one-hundredth of a foot.

The question of ventilation was investigated, but it was



this work in 1907, the contract being let to Messrs. McDonnell and Gzowski for the construction work.

There was no work of any particular interest outside of the ordinary grading except the tunnels. The tunnel known as No. 1 is 3,184 feet long, on a reverse curve shown on plan marked "A"; Tunnel No. 2, 2,912 feet long, being partly on a 10 degree curve radius 573.7 and partly on a tangent. Each of these curves have 300 feet of spiral at each end. The grade is 2.2 per cent., compensated at 0.04 per degree of curvature throughout, except in the tunnel, where 0.06 is used, and on the tangents in the tunnels an allowance of 0.02 was made for slippery rails.

As already stated, the maximum grade on the present line is 4½ per cent. for a distance of 3.71 miles, and the balance of 0.2 mile varies from 3.5 to 4 per cent. At the present time it requires four engines to handle a train of

not considered that any would be required in either of these tunnels until the traffic increases to such a degree that it will be necessary to double track outside the present tunnels. On account of the tunnels being on a spiral, and the portals being in such close proximity to each other, there will practically be the same atmospheric conditions at the portals of each of the tunnels, and the tunnel should have a complete change of air in about 2½ minutes.

On account of the nature of the rock, which appears to slack after being exposed to the air for some little time, the greater part of the tunnels were taken out, so that they might be lined with concrete when that may be necessary. This will give a maximum grade of 2.2 per cent. through the mountains, of which there will be 12.7 miles east bound and 5.1 miles west bound.

As a comparison between other tunnels it might be stated that the present tunnels would have an area of 376.9