

which is to drive a very small heading and take out the bench working from several headings into this small drift. Tunnels in Europe have been driven by this method at two or three times the speed that any tunnel was ever driven in the United States or Canada, and I would like to be able to place before the management figures for doing this work according to this method. I would be glad if you would state in your proposal the amount per day that you would be willing

have been driven through the Alps. I have given the matter considerable study since and have come to the conclusion that the European method of driving a small lower heading and stoping out the remainder of the tunnel would be too expensive on this side on account of the difference in the cost of labor. I have been thinking out and studying methods that would tend to expedite this work. I first thought of driving a heading in the centre of the tunnel, about 9 ft. x 12 ft.,

have the proper credit for first suggesting a pioneer tunnel."

The sheets 1 and 2 referred to in this report are the accompanying figs. 3 and 4. These figures will serve to illustrate the methods which were adopted for the construction of the tunnel. A pioneer tunnel was driven entirely outside the regular section of the tunnel, and a centre heading was driven along the centre of the main tunnel. The functions of the pioneer tunnel were to provide a means of transporting the material from the heading to a point back of where the en-

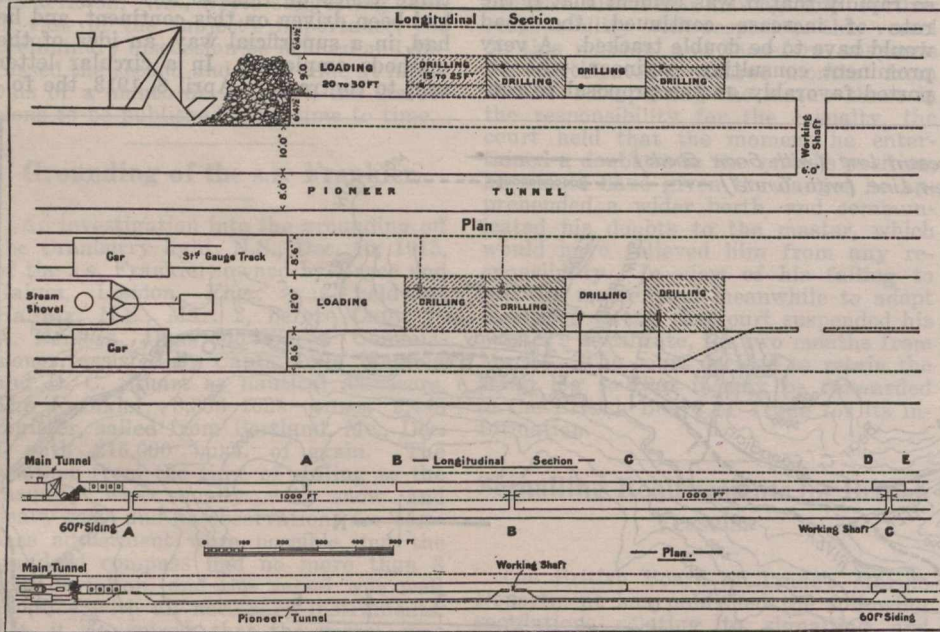


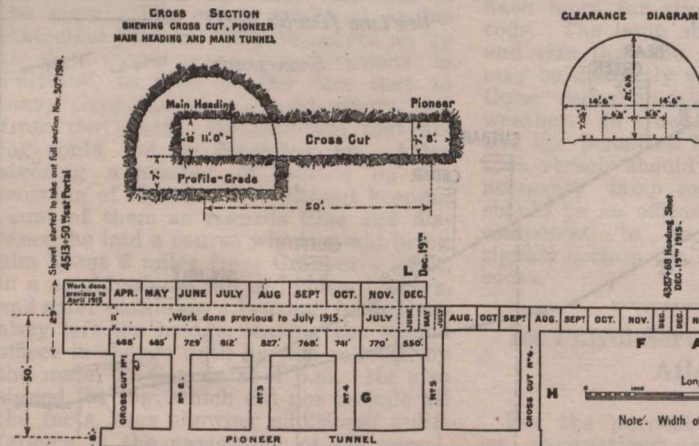
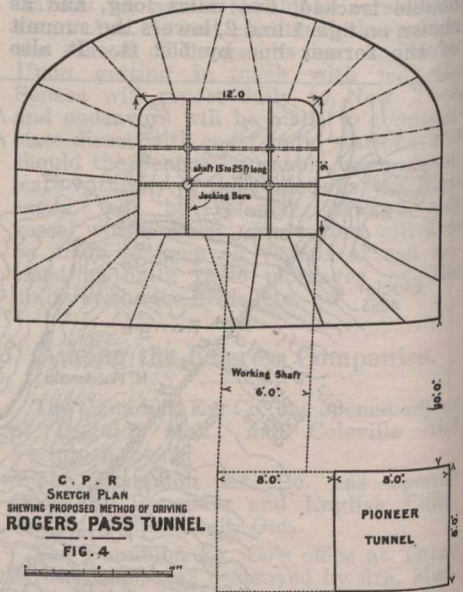
Fig. 3. Rogers Pass Tunnel. Proposed Method of Driving.

to have inserted in a contract to be paid as a bonus for time saved over the agreed time, the same amount to be exacted as a penalty for the time lost, being the time between the fixed day of completion and the actual date of completion. We are of the opinion that this should be about \$750 a day."

It was, however, considered unlikely that American contractors would tender at a reasonable figure on the European method, and after having studied some of

as is shown on sheet 1, and keeping this heading close to the bench, carrying the air pipes over the muck in front of the steam shovels. I pointed out to him that I believe that this method in rock that will stand, is better than an upper heading. A. C. Dennis, however, suggested driving a pioneer tunnel and taking out an upper heading through shafts into this tunnel, taking out the rest of the bench with steamshovels. I pointed out to him that this was impracticable, for the reason

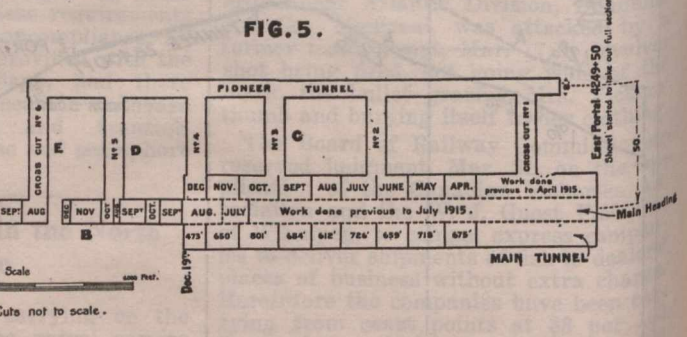
largement of the tunnel was being made, and to provide for the carrying of high pressure air pipes, water pipes, ventilating suction pipes, etc. In other words, to provide a means whereby the "shoot-ing" at any one point in the tunnel would not interfere with operations at other points. In regard to the idea of carrying the drills on a horizontal shaft held in place by heavy jacks to enable these shafts and drills to be carried in narrow gauge tracks so that they could be moved backward and forward as required, it was



ROGERS PASS TUNNEL

DIAGRAM SHOWING MONTHLY PROGRESS.

FIG. 5.



the prices paid for labor on certain large Swiss and Italian tunnels, the author was forced to the conclusion that the same methods were not practicable in this country, where labor is so expensive. On Mar. 13, 1913, he reported his ideas on the subject to the company in the following terms:—"Referring to the progress that we hope to make in the driving of Rogers Pass tunnel. I advised you in my report of Oct. 22 regarding the relative speeds of driving tunnels on the American continent compared with those that have

that from an upper heading you cannot drill to the bottom of the tunnel, and therefore would have to clean up all the muck in the bench before you could put in a round of breast holes to break more rock. I have now made plans showing a combination of my ideas and Mr. Dennis', which I think is well worth studying. The plan is to drive a small working pioneer tunnel, 8 x 8 ft. underneath the main tunnel. I am sending you this for your information, and further, if this method should be adopted, that Mr. Dennis may

supposed that heavy drills, such as have been used in the past, would be required, but it was found that the Leyner drills actually used were so light that they could be operated by one man. The result has been that all drilling in the enlargement has been done from vertical shafts as shown in figs. 6 and 7.

Fig. 5 is a progress diagram, and shows the condition of the work to Dec. 19, 1915. The pioneer tunnel at the east end was located 50 ft. to the north of the centre line of the main tunnel. The mode of