THE CANADIAN ENGINEER

April 17, 1913.

THE MITTENWALD AND RJUKAN RAILWAYS.

A description of the above two single phase railways appeared recently in the February number of The Electrical Review. With the present day tendency towards electric



Fig. 1.-Mittenwald Railway, Showing Power Transmission Line.

railway construction in Canada, there is no doubt many of Our results and publish our readers will find the abstract of the article we publish

The Mittenwald Electric Railway.-This railway system

is sub-divided into four lines; the eastern line from Innsbruck to Scharnitz, 33 km. long, is frequently referred to as the Karwendel Railway, and, like the Western line, 32 km. long, from Rente Reutte to Griessen, passes through Austrian territory; between these lines comes the Scharnitz-Griessen section, which runs through Bavaria and has a length of about 40 km. This curious inter-connection of the sections lying in different emdifferent countries is, of course, emphasized in the electrical equipment and the arrangement of the service.

On the Austrian sections there are ¹⁸ tunnels with a total length of 4,305 Metro metres, one of which alone is 1,787 metres long. In addition there are humerous viaducts and bridges.

formed one of the reasons for the selection of electric traction. This, in fact, allowed the railway track to be better adapted to the nature of the ground and permitted a gradient of 36.4 per mille mille to be used on a large scale; the

railway reaches a height of 1,185 metres above sea level at Seefeld Seefeld, so that in a distance of 21.2 km. a difference of 600 metres b metres has to be overcome. The adoption of steam traction would have to be overcome. would have necessitated the lengthening of the line by at

least 4 km. just at the most difficult part, and the saving effected amounted to more than the total cost of the electrical equipment. Another factor making electric traction more economical is the cheap water power, the Tyrol occupying a still more unfavorable geographical position as regards coal supply than the adjoining country of Bavaria.

The Mittenwald Railway possesses a power station of its own, which is situated about 6 km. to the south of Innsbruck in the vicinity of the Sill Works, and utilizes the power of the Ruetzbach, a river close to the Sill.

In the Ruetz Works two 4,000 h.p. Voith-Pelton turbines have been installed for the time being, which are directcoupled to single-phase generators with continuous outputs of 3,000 k.v.a. and maximum outputs of 4,500 k.v.a. The turbines and generators have been designed with due regard. to the special conditions involved in railway operation, so that the plant cannot be endangered by heavy short-circuits or sudden alterations of load. The generators, which ran at a speed of 300 r.p.m., have six poles corresponding to the frequency of 15 cycles per second, which entails a somewhat higher cost as compared with the four-pole type, but enables the pole cores to be fixed with absolute rigidity to the rotor hub. The generators are wound for a pressure of 3,000 volts, and are self-ventilated, the magnet wheel being fitted with fan blades, and the stator enclosed by covers.

On entering the power station, one is struck by the perfectly noiseless running of the generators. The energy from each generator is led to a transformer which raises the pressure to 50,000 volts; from the point of view of the switchgear, each generator forms a separate unit with its transformer. As there are, therefore, no bus-bars or switches for 3,000 volts, extreme simplicity in switching operations is ensured.

Each transformer has the same maximum output as the generator, the continuous rating, however, is 1,800 k.v.a. The transformers are of the core type with disk windings and have oil and water cooling, The core with its windings is 23 tons in weight. Each transformer is placed in a



Fig. 2.-Locomotive and Train.

separate fireproof compartment provided with an effective air circulation; the 50,000-volt switchgear is also enclosed in concrete cells so arranged that the switchroom, in the event of a breakdown, may be entered from two sides with-