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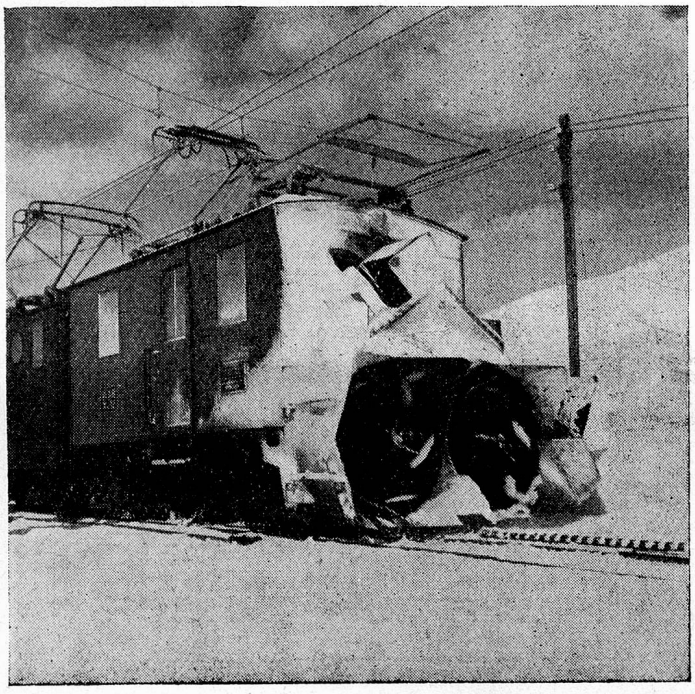
RAIL AND ROAD TRAFFIC IN THE SWISS MOUNTAINS

By H. O. ERNST,

Manager, London Office, Swiss National Tourist Office & Swiss Federal Railways.

(*Continued.*)

The highest mountain railway in Europe is the Jungfraubahn. Scheidegg is the starting point, where the line connects with the Wengernalp Railway from Lauterbrunnen and Grindelwald. Scheidegg is 6770 feet above sea level. Jungfraujoch, the highest point, $5\frac{3}{4}$ miles away, is at an altitude of 11,340 feet. The line was opened to traffic on August 1st, 1912. Building costs including additions up to 1945: 14,479,000 francs or about $2\frac{1}{2}$ million francs per mile. This does not include the 4,600,000 francs spent on the two power stations which supply the current for the 650 volt locomotives, other installations and the hotel at Jungfraujoch. This enormous capital outlay is of course by itself a great handicap and means correspondingly high passenger as well as goods rates. Traffic receipts, mostly from passengers, in 1945 were 928,611 Swiss francs, operational costs 450'245. I mention these figures to show that the audacious idea of building this railway, conceived as early as 15 years before the end of the last century, at a time when tourist traffic was in its infancy, was fully justified by commercial results. It has, furthermore, done a great deal to bring the mountains to the people. Except for the section Scheidegg to about 100 metres above Eigergletscher Station, the trains run in a 7.1 km. long tunnel. The Jungfrau Railway keeps open to traffic throughout the year. The greatest operational difficulties during snow and frost are encountered along the 2 km. of open track where snow-drifts up to a depth of 4 m. or 12 feet are not uncommon. I hear, however, that a gallery 230 m. long is under construction at a cost of 320,000 Swiss francs. The expense is well worth while, as it will, as far as it is possible to say, guarantee an uninterrupted service during the winter season, without interfering in the summer with the magnificent view from the train. This is achieved by building the valley side of the gallery with movable boards which can be taken off in the spring. Rotary snow ploughs which cost £14,000 each are now used, but only after careful inspection of the surrounding slopes for incipient avalanches or snow slides. Frost is a serious problem, as it causes buckling of the rails owing to ice forming in the bedding. Careful drainage and the use of clean material free from earth are the only efficient remedies. Once a year the tunnel walls are tested, and loose rock which might endanger the trains, removed. Throughout the winter a careful watch is kept on danger areas in order to prevent accidents from avalanches, snow slides or rock falls. This service is organised in co-operation with the Wengernalp Railway which is under the same management and in whose running the Jungfraubahn is vitally interested, as it brings the traffic from Grindelwald and Lauterbrunnen up to Scheidegg.



Wengernalp Railway Rotary Snow Plough.

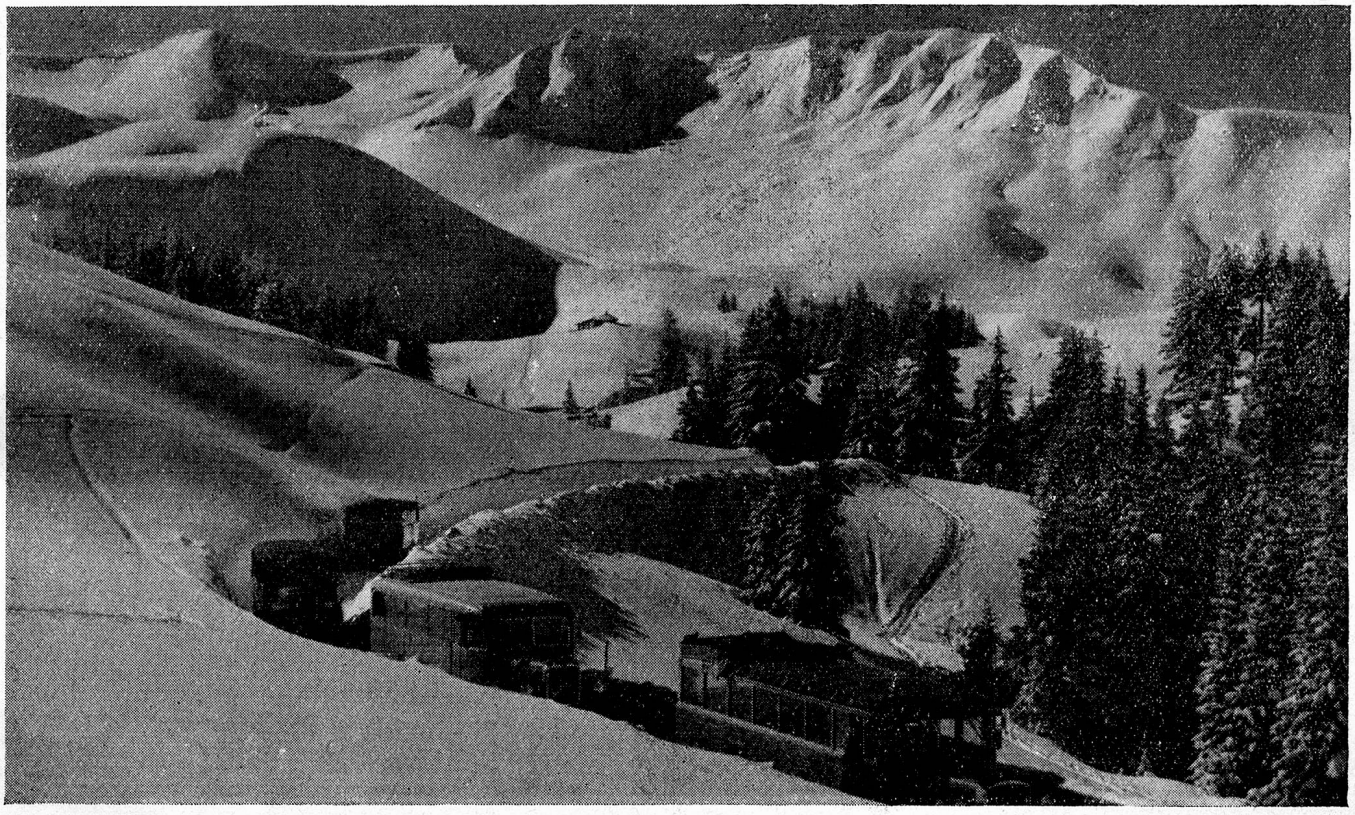
I have before mentioned the Rhaetian Railway system. It is the largest narrow gauge undertaking in Switzerland. It connects at Chur and Landquart with the Swiss Federal Railways, and via the Bernina Railway with Italy. The Grisons region which it serves is rightly called the canton of the 100 valleys. There are 394 km. of track, and the original building costs were 236 million francs, not counting rolling-stock and power stations. You will observe that this is considerably more than half a million francs per track km. It seems enormous. Here again, we have to do with a typical mountain railway. Especially in view of the configuration of the country and high altitudes, numerous and costly constructions for the protection of the line and the safety of the passengers are needed. There are also 1,278 km. of road in the Grisons. Here too, measures to assure uninterrupted and safe traffic are essential. Deep cut valleys, gorges, mountain streams, avalanche courses and danger from rock falls on steep slopes are the main dangers. Many of these constructions guard both the railway and the roads. Perhaps the largest avalanche barrier in Switzerland consisting of solid stone walls has a length of 10 km. It is situated 700 m. above the track at an altitude of 2,300 m. on the Albula section. In other exposed places trees planted for the same purpose offer similar protection. The danger from falling rock is very real and is countered by construction of galleries or echelonned stone walls. The many torrents and especially the river Rhine which has its source in the Grisons overflow during heavy rain or when the snow melts. The swift flowing waters are likely to undermine or carry away both railway track and roads. To guard against such possibility, large corrective dams had to be built.

The two great rivers Rhine and Rhone have their source in Switzerland. The former we have met in the Grisons. The Rhone whose birth place lies in the icy fastness of the glacier of the same name flows east to west. It gathers the waters of numerous tributaries on its way to Lake Geneva. Parallel with the stream runs the international Simplon line of the Swiss Federal Railways. At Brigue it meets the Lötschberg route from Berne and carries on to Italy through the Simplon Tunnel. Although the river has been corrected in many places it does from time to time overflow its bed and constitutes, especially in its low reaches, a danger to the railway and the Simplon road.

A number of lateral valleys reach up from the Valais to the snow and ice covered chain of the Pennine Alps. The principal and best known is the Visptal, opened up to passenger and goods rail traffic by the narrow gauge Visp-Zermatt Railway opened in 1891 and extended to the Gornergrat in 1898. Brigue is also the starting point of the Furka-Oberalp Railway which winds its way eastwards to Gletsch, Andermatt and Disentis where it connects with the Rhaetian Railway and forms in the summer a through-train link from Zermatt to St. Moritz. A branch line at Andermatt leads down to Göschenen where it reaches the Gotthard Line.

The Central Administration of these four mountain railways at Brigue does everything in its power to keep communications open. In the summer, apart from careful watch on mountain torrents and possible rock falls, this presents few difficulties. The winter season, however, needs additional precautions. On the Furka-Oberalp Line the train service between Oberwald and Realp is suspended, as it would be too costly and therefore uneconomical to protect it sufficiently against avalanches. In order to save the bridge spanning the Steffenbach Gorge situated in this section from being carried away, it is dismantled and stored out of harm's way until early June. So proficient are the crews who tackle this difficult task that one day is as a rule sufficient to pack the three spans away and to reassemble them in early summer. With the onset of heavy snow falls the security and watch service on all lines is intensified. All vulnerable sections are constantly observed for avalanches and snow slides by local people thoroughly familiar with the country and the weather conditions. They are in constant touch by telephone with the technical services at Brigue. This facilitates immediate mobilisation of crews and mechanical means for snow and avalanche clearance. Four wedge-shaped ploughs and three rotary power sweepers are kept ready for this purpose. Both types are especially suitable for cutting through heavy falls and drifts. Avalanches present more serious problems. More often than not they are, as already mentioned, mixed with tree trunks, boulders and other debris gathered on the way. In such cases snow excavators are used. They run on caterpillar tracks and can be used away from the railways. They are extremely efficient and clear away in 10 hours as much as 45 men would by hand in the same time.

However, prevention is better than cure, and here, as elsewhere, nothing is left undone to shield the track by means of snow and avalanche barriers, galleries, and thousands of trees planted for this purpose. The galleries mean, of course, absolute safety, but are expensive to build. Barriers, of which there are many types, are generally situated high up the slopes, above the tree line. Where and how to place them is of great importance and needs an intimate knowledge of the country, great familiarity with weather conditions, especially the force and direction of the wind. It



Convoy of Alpine Coaches near Hahnenmoos.

speaks well for the foresight, the vigilance and the technical skill of the engineers as well as the staff that not a single passenger has ever lost his life through an avalanche. The financial burden due to snow clearance and the great strain of winter traffic on rolling stock, permanent way and constructions caused by snow, frost and ice is, of course, great. During the winter 1950/51 the four railways spent 140,000 francs or roughly 12,000 pounds on snow clearance alone.

We have now examined the operating conditions, the special difficulties as well as some of the remedies as they apply to five railways or groups of undertakings. There is, of course, a far greater number of mountain lines in Switzerland. Some of them are closed in the winter; those which keep open wage a similar war against the destructive forces of nature encountered at high altitudes. It has not escaped you that there is a great deal of similarity in the examples I mentioned. I shall, therefore, not prolong the list. It seems, however, pertinent that I should say something more about road traffic in the mountains.

If we look at the map of Switzerland, we find a well-developed system of main roads, not only in the lowlands but also in the alpine districts. Many years before man's ingenuity brought the railways up to and through the great alpine wall, the Gotthard and Simplon road carried passengers and goods over the watershed between the North Sea and the Mediterranean. These two roads are by no means the only ones. From east to west, from the Grisons to the shores of Lake Geneva, passing through the Bernese Oberland, the principal mountain passes can now be crossed by private car or in one of the comfortable motor coaches run by the Swiss General Post Offices. These alpine roads were originally built to assist and further the economic development of otherwise inaccessible regions, and to provide connections to places beyond the railheads. Needless to say, they are also an important factor in the development of tourist traffic, especially in the summer. Thousands of holiday makers travel over these passes merely in order to enjoy the wonderful scenery.

Not so many years ago it was considered impossible or inadvisable to keep these roads open in the winter. If motorised traffic can now get to — and even over — the mountains, the merit lies mainly with the progress made in road building and motor engineering. In order to facilitate circulation, many aids have been devised. I would only mention the following:—

1) Wind-screen defrosting by means of electric heating wires let into the glass.
2) Great improvements in the design of head and fog lamps with great intensity of light.
3) The use of heavy, deeply grooved tires which provide a good grip on the snow covered road surface.
4) Re-designed and more efficient snow chains.

To these technical improvements on the vehicles must be added the greater experience gained by the ordinary motorist and the professional driver. Both have learnt to drive slowly but regularly, never declutched and at a speed which makes the use of wheel brakes unnecessary. Most of the alpine coaches are provided with motor brakes, which are a great help. Starting very slowly on icy roads will avoid skidding or, if chains are fitted, prevent them digging into the thin layer of snow on a frozen road. The professional road builder has done a great deal to make mountain roads safe for winter traffic. Cantonal authorities responsible for maintenance, recognising the importance of service throughout the year, are also helping financially towards this end and, in addition, thereby provide employment for local labour. It should perhaps be mentioned in this connection that in Switzerland it is not a central government but the cantonal authorities who build and maintain the roads, although the Confederation does, if necessary, grant subsidies.

Winter traffic on mountain roads is for these reasons made much easier to-day. They are built with a hard surface, and by applying the most modern principles of civil engineering both in the straight sections and in bends. The almost flat cross section of the present alpine road renders the clearance of snow by mechanical means much less difficult, less costly and quicker. It is now recognised that in order to keep the road open and in good traffic condition throughout the winter, the work of clearance should start after the first snow fall. The whole width is freed, but depth of 3 to 4 inches is left on the surface. As further snow falls and drifts occur, the work is repeated. This layer of few inches is necessary for the wheels to get a grip. If the snow is cleared down to the road surface, the latter will ice up and become dangerous both to horse-drawn traffic and motors, especially the former. Wherever the roads are exposed to danger from drift snow, wooden palisades are built. They break the force of the wind and cause the snow to bank up behind them.

Considerable improvements have been made in the design of snow ploughs. The simplest form is a wedge-shaped triangle fixed to the front of large vehicles. They are comparatively light, soon fixed and travel normally at a speed of 15 to 20 miles per hour in fresh snow to a depth of 3 feet. By fitting an extension to one side of the triangle, the snow can be thrown to one or the other side of the road. When the snow surface is made uneven through changes in the weather and deeply rutted by heavy traffic, a snow plane is used to turn the uneven surface into a smooth track.

Rotary power-driven snow sweepers are used on certain mountain roads, especially in the Grisons. They run on caterpiller tractors and their progress in deep snow is fairly rapid. Under favourable conditions they should clear about 1 km. per hour.

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OPEN MEETING

Tuesday, 29th April, 1952, 7 p.m.

CHRISTOF BON,
Dipl. Arch. ETH, Zurich,

will speak (in English) on

"DOMESTIC ARCHITECTURE IN THE GRISONS"
(illustrated by lantern slides)

at the

Vienna Café, Berkeley Arcade,
opposite Baker Street Station, N.W.1.

All Swiss and Friends are heartily welcome.

New and improved snow chains have greatly helped towards the maintenance of regular services, and most of the postal motor coaches are now fitted with them. There are various types. Some can be mounted by one man in 10 minutes, others are more elaborate and garage fitted. They consist of caterpillar tracks fixed on the endless chain principal to the two rear tires on each side. This permits on some roads the use of skids under the front wheels.

Summing up, it can be said that the Automobile Section of the Swiss General Post Office has done pioneer work in this field and now possesses the technical knowledge and means to assure traffic over some alpine passes throughout the winter. On the other hand, not all the questions concerning efficient and quick snow clearance have been answered yet and new ways are constantly under review. In any case, what has been achieved benefits not only the postal coach services but opens the way to private motor traffic. Winter motoring in the mountains puts a heavy strain on men and machine. In spite of all the precautions and safety measures, accidents and breakdowns do happen. This is where the S.O.S. telephone boxes installed by the Swiss Automobile Club at many points along the roads render excellent service.

I would not like to pretend having giving you a complete review of all the difficulties connected with road and rail transport at high altitudes. My purpose was merely to give you a general idea how these manifold problems are approached and solved in Switzerland.

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