

# The Jungfrau railway : a technical achievement

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## HOLIDAY REMEMBRANCES.

1st of August on the Rütli.

"Von ferne sei herzlich gegrüsst  
Du stilles Gelände am See,  
Wo spielend die Wellen zerfliessen  
Genährt vom ewigen Schnee..."

A modest but impressive monument in honour of the author and composer of the "Rütli" Lied has been erected on the historical birth place of our beloved country. How many of us have in our past youth, on patriotic festivals, in school or in the sanctuary of our homes, sang those verses, glorifying that unforgettable spot, where the envoys from the three forest cantons met; where they banded themselves in a league "that they might better defend themselves and their own."

But I had to wait over 40 years before the significance, the beauty and the spirit of this popular folk song came like a glorious revelation to me, filling my inner-self with an ardent and never to be forgotten love for the land of my ancestors, and it dawned on me, that the proper means of increasing the love we bear our native country is to reside for some time in a foreign land.

A feeling of unaccountable excitement,—which reminded me of those golden, alas, long past days of my youth when a school treat, or a family event was imminent,—made me rise as early as 3 o'clock a.m. on the last 1st of August, which I spent at Seelisberg; and richly was I rewarded for curtailing my "beauty sleep" of which I am somewhat badly in need of,—not having been blessed with a "radiant countenance."

There stood silhouetted in the flush of dawn, the two Mythen, in whose shadows lay the still slumbering town of Schwyz. The tops of the mountains around were now bathed in the light of the rising sun. Vast and deep the mountain shadows grew, and over the silent lake grey clouds slowly mounted to the sun kissed heights. Peace,—an almost uncanny stillness reigned supremely, only interrupted by the murmuring noise of a slender waterfall leaping from a neighbouring hill. Overpowered by the beauty of this spectacle, I exclaimed in the fullness of my heart: "Oh Heimat wie bist Du so schön!"

Shortly after breakfast a happy family party, of which some of the members, like the writer, came from different parts of the globe, wended their way down through a winding pathway buried in lovely pine woods, to the historical spot whose name has been kept sacred since our childhood days.

The nearer we came to our destination, the more we lost ourselves in meditation, and when we stood on the actual spot where those sturdy sons of the cantons Uri, Schwyz and Unterwalden, vowed to stand steadfast together in distress and danger, in joy and sorrow, a feeling came over us that we too, should try to do something for our country according to our various capabilities. We shall best honour these men and the days of old by signing our own declaration of independence from all those elements of selfishness and sordidness that lead to indifference to our country's welfare. Let us not forget that Liberty is not the right of one, but of all, let our object be our country, our whole country and nothing but our country and, by the blessing of God, may that country itself, become a vast and splendid monument, not of oppression and terror, but of wisdom, of peace, and of liberty, upon which the world may gaze with admiration forever.

Far away across the lake the peaceful sound of bells could be heard, the sun had by now spread its rays over the country around; in the distance, half hidden by trees the Tell's Chapel, visible only in the dimness of an early morning mist, reminded us of the heroic deeds of our national hero. The landscape in its majestic beauty, the woody valleys, warm and low, the windy summits, wild and high, the stony seats and the naked rocks gave to each a double charm and created an indescribable impression.

And when the night had fallen, and the stars stood as thick as dewdrops in the field of heaven, the beacon lights became visible, first one then two, then another and yet another until one lost count of them all. The whole country side turned out to honour this national day of deliverance and liberty. The balconies of the pensions and Hotels were lit by fairy lights, giving the villages a streaked appearance of white and red, and in that unruffled calm of nature, broken only by the sighing of the tree-tops and the lapping of the waves, I felt the love of independence and liberty pulsating in my veins.—A wonderful spirit of independence—when one remembers that our little country was surrounded by belligerent nations during the Great War, and yet managed to maintain a strict neutrality—an Island of Peace.

There are moments of life that one never forgets, which brighten, as time passes away; they give a new charm to the happiest lot, and they shine on the gloom of the loneliest day.—

ST.

## THE JUNGFRAU RAILWAY.

A TECHNICAL ACHIEVEMENT.

The Jungfrau railway owes its world reputation not only to the fact that there exists no other railway which can transport the tourist in the midst of magnificent alpine and glacier scenery, but also because of the uniqueness and audacity of its conception. Commonly referred to as an engineering and technical marvel, this is not a mere figure of speech, but a recognised fact.

Shortly after the opening of the Bernese Oberland railway connecting Interlaken with Lauterbrunnen and Grindelwald in 1890, three plans were simultaneously elaborated for the creation of a Jungfrau railway line. According to these plans, a tunnel starting from the Lauterbrunnen valley was to continue to a little below the summit of the Jungfrau in order to put through a railway to be operated by steam, cable or compressed air. None of these plans, however, were executed. In the meantime, the Wengernalp line was completed whereby the Small Scheidegg, situated at the foot of the three giants, the Eiger, Mönch and Jungfrau, could be easily reached from Grindelwald as well as from Lauterbrunnen. Adolf Guyer-Zeller, a manufacturer of Zurich, was the first to recognise clearly that the Small Scheidegg was the only practicable starting point for the Jungfrau railway, and his creative mind rapidly conceived the audacious plan in its minutest details. In 1894, the Swiss Federal Assembly granted the concession and two years later, construction was started.

The line measures a total length of 9.3 kilometres. From *Small Scheidegg* (2064 m. above the sea), the line stretches in the open along the watershed of the Black and White Lüttschne valleys up to the *Eigerletscher* station (2000 m. from Small Scheidegg, 2323 m. above sea level, opened in 1898). This first stretch offers a magnificent panorama extending from the glacier covered flanks of the Eiger, Mönch, Jungfrau, Schwarze Mönch, to the Trümmlen valley and the snow capped mountains of the Lauterbrunnen valley and still farther to the Männliche, Faulhorn, Great Scheidegg and Wetterhorn summits above Grindelwald. The *Eigerletscher* station is situated in extremely wild and romantic surroundings at the foot of the Eiger and Mönch on the border of the imposing Eiger glacier. Here are, in addition to a hotel and restaurant, the technical operating basis of the Jungfrau railway, the administration premises, lodgings of officials and staff, workshops, sheds, store houses, post office, etc... In the course of time the station developed into a small village.

Two hundred metres above the *Eigerletscher* station, the train enters a tunnel, 7.1 km. in length, passing through the colossal ramparts of Eiger and Mönch and does not regain the open before reaching the terminus station, *Jungfrau-joch*.

After an ascent lasting 17 minutes, on a 25% grade, the Eigerwand station is reached (4400 m. from Scheidegg, 2867 m. above sea level, opened June 18th, 1903), consisting in a vast hall drilled in the solid rock and supported by powerful rock columns. In order to build this station, the perpendicular rocky walls of the Eiger had to be blown up. Three large glass windows offer an extended view of Scheidegg, the Grindelwald valley, the Männliche and Faulhorn summits, the blue Lake of Thun, over the whole of Central Switzerland to the Jura, Black Forest and Vosges. To the East, one perceives the mountains of Obwalden and the Canton of Lucerne. The railway line continues for 10 minutes, at a 25% grade before reaching, after a sharp curve southwards, the *Eismeer* station (5700 m. from Scheidegg, 3161 m. above sea level, opened July 25th, 1905). The station is here again a vast rock hall, a portion of which has been planked and transformed into a pleasant restaurant. Six large glass windows, pierced in the Eastern flanks of the Eiger, let in floods of light, which owing to the strong glacier radiation is almost intolerable to the eye. Far beneath one looks down on the Grindelwaldfiescher glacier, a network of unfathomable crevices and strewn with gigantic blocks of ice which roll down from the perpendicular sides of the Fieschergrat. Innumerable are the glaciers covering the rocky surface of the Grindelwaldfiescherhorn, Strahlegg, Lauteraar and Schreckhorn peaks which border this chaos of ice and snow on the North and East.

From the *Eismeer* station, the tunnel rises at a 6.6% grade only in a straight line to the South-West for 3.1 km. passing directly under the summit of the Mönch, before ascending at a 25% grade the last 500 metres leading to the entrance of the Jungfrau-joch station (9300 m. from Scheidegg, 3457 m. above sea level, opened August 1st, 1912).

The Jungfrau-joch is the highest railway station in Europe. It is situated on the ice covered saddle between the Mönch and the Jungfrau. Two transversal galleries open on to the quay, one leading to the waiting-room and the Berghaus Hotel, the hotel of Europe situated at the highest altitude, the other to the restaurant. A tunnel, 250 m. long, pierces lengthwise the Sphinx ridge and leads to a vast snow field, sloping from the upper

Mönchjoch down to the frozen surfaces of the Jungfrau, and which remains, even throughout the summer months, an ideal practise ground for ski amateurs. A lateral branch of this Sphinx gallery leads to the International Jungfrau-joch Research Institute, still under construction. In the Berghaus Hotel a life takes tourists up to a gallery, about 100 m. long, situated under the roof, leading out on to the Jungfrau plateau. Here the panoramas successively viewed from the Eigerwand and Eismeer form an imposing contrast. To the North, the eye travels from the green pre-Alps and plains of Central Switzerland, over lakes, cities, and villages, to the distant Jura chain, to the Feldberg and Belchen, the highest summits of the Black Forest and Vosges. Southwards, one perceives, the endless expanse of the Aletsch glaciers with its affluents and the innumerable snow capped peaks of the Alps of Berne and Valais.

Rock conditions greatly favoured the construction of the tunnel. After the first 7.1 km. the hard marble-like mountain lime was replaced by a still harder gneiss. With the exception of a few dislocations, it did not prove necessary to wall the interior of the tunnel. The mountain line was drilled by means of electric drilling machines, and for the gneiss special boring machines, operated by highly compressed air were employed. In order to expedite the evacuation of the loose material and facilitate ventilation, a gallery was drilled between the *Eismeer* and *Jungfrau-joch* (Mönch gallery) in the southern wall of the Mönch. In this gallery a search-light, of 96,000,000 candles has been placed and on clear nights its brilliant rays sweep the dark sky, illuminating the surrounding mountain sides as in bright day light.

The Jungfrau railway is a mountain line operating on a mixed system, that is, by cog-wheel and adhesion. On the cog-wheel stretches (7 to 25% grade) the cog-rail employed is that of the Swiss engineer Strub, who superintended personally a part of the operations. The train's average speed is 9 km. per hour, on the stretches operated by adhesion (6.6% grade), between the *Eismeer* and *Jungfrau-joch* stations, it attains a speed of 18 km. In accordance with the combination of these two systems on the so-called upper stretch, of the twelve locomotives, five of the newest are equipped for both systems, whereas the older ones are only adapted to the cog-wheel system and can, therefore, only be employed on the stretch Scheidegg-Eismeer. This difference in locomotive equipment is due to the successive phases which the construction of the line underwent in the course of a number of years.

The Jungfrau railway was electrified from the start. Its locomotives rank among the first mountain locomotives of the world. They are equipped with every safety contrivance imaginable. The slightest speed variation, while descending, operates an automatic brake, bringing the train instantaneously to a stop. In case of the current being suddenly cut off it is possible to regain the valley independently of the main direction, the current necessary to operate the brakes being furnished by the movement. Each locomotive possesses two rotary current engines of 150 HP., each, of approx. 800 rev. min. The current is collected from the two-phase aerial line by means of two trolleys. The rail current (third phase) is captured in the under-carriage. The twelve train compositions, of which the latest was bought in 1929, consist in a locomotive and two passenger carriages, with 40 seats each. The new cars have an elegant and semi-pullman appearance with spacious windows. The rolling stock may be said to be of the best quality and of modern and pleasing outer appearance.

The supply of electric current forms a part of the operation of an electric railway. The Jungfrau line produces its own current in its two power stations in Lauterbrunnen (White Lüttschne) and Berglaenen (Black Lüttschne). They also furnish the current for the Bernese Oberland line, the Schynige Platte, the Lauterbrunnen-Mürren and Wengernalp mountain railways. The electric energy necessary to operate the Jungfrau railway is conducted to the consumption centers on high-masted copper conducting wires and after transformation from 7,000 volts to 650 is turned on to the railway wires.

Owing to the excellency of his equipment, the Jungfrau railway is not only one of the most remarkable of the kind, but also one of the most efficient mountain lines. The observant traveller is presented with unrivalled natural beauty as well as with technical achievement of the highest interest.

Swiss Industry and Trade.

## TO OUR READERS.

The holiday season coming shortly to an end, we intend publishing a few articles giving the experiences of some of our readers who spent their holiday either here or abroad. We therefore invite any of our subscribers, especially those who were lucky enough to visit the "old country," to send us an account of their experiences. The articles can be written in English, French, Italian or German.