

ERNST GUSTAV CONSTAM INVENTOR OF HISTORY'S MOST INFLUENTIAL SKI LIFT DESIGN

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The year was 1934. The man, Ernst Gustav Constam of Zurich, built history's first successful ski lift for pulling individual skiers uphill over the snow. Constam was a very creative engineer: his lift design was one of many inventions he patented as of 1920. In all, he held over 20 patents on machinery including steam boilers, combustion engines, aerial cableways and last but not least ski lifts.

His historic breakthrough in the field of ski lifts was a single passenger lift built in 1934 on the Bolgen slope in Davos, Switzerland. At its heart were bars - pulling the passenger's body into its center of gravity - attached to a continuously circulating overhead cable. The great commercial success of Constam's lifts however, was due to its eventual double passenger lift. It proved to be a far better investment than other designs such as Hefti¹, Moufflier², Mueller³, Pomagalski⁴ - or various types of ski-sledges. Therefore, Constam is no doubt the single most important pioneer in the history of ski lift design even though an on-snow ski and sled lift operated for a few years at the beginning of the last century in the valley of Schollach, Germany⁵.

Ernst Gustav Constam was born on December 16, 1888 in Zürich. He was the third child of Emil Joseph Constam (1858-1917) and Ida, born Stierlin. Emil Joseph was born in New York and came as a child with his family to Frankfurt am Main, Germany. He attended a commercial school there, before moving to Zürich where he studied and graduated in chemistry at the prestigious Swiss Federal Institute of Technology (SFIT). In 1880, he obtained a declaration of the Court of Common Pleas of the City and County of New York permitting him to change his name from Kohnstamm to Constam. Before, he converted from Jew to Protestant. At the time Ernst was born, his father Emil was a lecturer in chemistry at the SFIT, he was also the US Vice-Consul from 1892 to 1895 in Zurich. Due to his international reputation Emil was nominated Ordinary Professor for Organic and Physical Chemistry. He was naturalized in 1908 and even became an honorary citizen of Zürich in recognition of his merits.

The grandparents of Ernst Constam were Joseph (1811-1867) and Karoline Kohnstamm, born Gruenberg. Joseph emigrated in the 1840s from Germany to New York City. By 1848 he was an importer of paints, operating from his home in William Street. In 1851 he founded his company, J. Kohnstamm on Tyron Row, mainly supplying imported chemicals for laundries. Because of ill-health, he retired in 1865 and moved with his family to Frankfurt.

Ernst Gustav Constam studied, like his father, at the SFIT but graduated as a Mechanical Engineer in 1912. Ernst was a passionate ski mountaineer who made ascents of several Swiss peaks. He married Gertrud Johanna Gull in 1914 and they raised four children.

As a young engineer Constam was employed by different firms active in the field of construction machinery and – rather important for his future career – by the Swiss Government (1926) for the revision of regulations covering aerial cableways for passengers, which were put into force in 1933.

From 1927 to 1931 he was employed by Robert Aebi & Cie⁶, a construction machinery company in Regensdorf. They also represented Bleichert⁷ in Leipzig, Germany – at that time considered the master of aerial cableways. In fact, Bleichert had been building materials since 1872 and for passengers since 1874. Aebi themselves built one of the first aerial tramways in Switzerland in Beckenried-Klewenalp on the lake of Lucerne (1933).

Constam opened his own engineering office in Zollikon, close to Zürich in 1931. Apparently due to his good collaboration with Bleichert on the aerial tramway to the Zugspitze (highest peak in Germany at 2966 m, inaugurated in 1926) he managed to get their representation for Switzerland, not without going to court with Aebi. Constam was also involved in building the aerial tramway to the Säntis (Switzerland, peaking at 2502 m) with Bleichert and Von Roll from 1933 to 1935. Dr. Karl Meyer, Dr. Meuli and Constam had acquired the license and Constam was a member of the Administrative Board from 1933 to 1936.

According to Constam's son Robert, the idea of a ski lift was actually brought up by his wife: skiing one day together, she asked him whether he – as an experienced aerial cableway engineer – could imagine an affordable on snow device so as to avoid climbing up hills. Maybe, as a consequence, in 1930 he filed a patent "Schleppseilbahn für Skifahrer" (Drag Cable Train for Skiers), Swiss patent CH147025, registered and published in 1931. It consisted of an overhead steel cable with retractable hand grips. For unknown reason, it was never built.

At the time, there was no way, other than a few short rope tows, for a skier to be taken up a slope at little cost. On the other hand, there were rack and cable railways to several mountains. The first ones especially built for skiers were the Corviglia in St. Moritz (1928) and the Parsennbahn in Davos (1931). They had an immense success: the Parsennbahn transported 60,000 passengers the first season and 230,000 after the second section were opened in 1936. For many years it opened the most fabulous ski runs in Europe, among others the 13 km "Parsenn" down to Küblis.

With regard to rope tows, Gerhard Mueller (1915-1985), at the age of only 19, patented (CH174250) in 1934 the first one. It consisted of a 1 inch continuous rope, driven by an electric motor. Some say that he already built one in 1932 on a slope close to a hotel powered by a motorcycle engine.

Also in 1932, the first North American rope tow, powered by a Ford Model T engine, was installed in Shawbridge, Quebec, Canada. Two years later the first US rope tow operated in Woodstock, Vermont. Obviously, rope tows were exhausting for the hands and arms of skiers. They had some success in North America, but not in Europe. By the way, ropes were used centuries before by Laplanders to move on skis behind reindeers.

According to an unproven story, Constam made some trials behind a horse before building his first documented ski lift in 1934 – at the age of 41. It was a single passenger lift (Swiss patent CH179310, filed in 1934, registered and published in 1935 – US patent 2077232). It consisted of a continuously circulating 18 mm overhead steel cable 4-8 m above ground except at the lower station where it was 1.5 m respectively 0.5 m over the snow level. There were 5 pylons about 4.5 m wide with 2 x 3 cable supporting rollers. Every 36 m approximately, 1.5 m long steel hooks ("J-bar" – as it became known in the US because it resembled the letter "J") were attached to two steel cables, both attached to the circulating cable. One, approximately 13 m long, served to draw the bars, the other, 7 m long, to retract them into a round casing incorporating a spiral spring fixed under the circulating cable.

Safety was ensured by hand operated electric stop switches. One was in the cashier room close to the lift attendant, one each on pylon #2 and #4 and one on top should a skier exceed the track. The lift was driven by a 24 HP electric motor coupled to a gearbox fixed to a 3 m bull wheel installed at the lower end station, the cable tension being at the upper end. Not astonishingly, Bleichert supplied the mechanical parts whereas the A-frame logs were local. Lift speed was 1.5-2.5 m/s which permitted a respectable capacity of 150-250 skiers per hour. Later the distance between the bars was reduced to around 18 m thus doubling capacity. This was obviously much higher than rope lifts or contemporary stop-and-go designs, such as ski-sledges.

The crossbar was designed to be placed behind the skier's upper thighs. It was not a seat but simply a bar that allowed a skier standing on his skis to be pulled up the hill and to get off the crossbar at the top. The skier had to maintain balance. If a skier went off balance at any point, the crossbar could swing to the side and drop the skier into the snow. The Constam lifts proved very safe. Even if the lift brake failed, at worst the skier was dumped on the snow. As a consequence, most skiers found the J-bar easy to handle – a wonderful means to get up the hills.

The first ski lift could be built thanks to Leonard Fopp, Lieni to his friends. He was an hotelier, farmer and properties holder from Davos. It is reported that during the Christmas season of 1932 Fopp met with Constam a number of times in his Hotel/Restaurant Löwen (The Lion). The lift was logically built on Bolgen, one of his properties, next to the existing ski jump hill and the Geissloch, the training slope of the Davos Ski School. Fopp risked 45,000 Swiss francs during a period when nobody knew when the economic world crisis would end. Fortunately for Fopp, the lift was a tremendous success. Incidentally, Fopp's heirs sold the lift to the newly opened Jakobsbahnen in 1952.

Fopp recouped his investment by selling day tickets to Davos hotel guests for half a Swiss franc. This was at a time when an average clerical salary was 10-15 francs a day, making the lift affordable certainly for any skier who had sufficient money to book a hotel in Davos. As it was free for those attending the Davos Ski School, there must have been some sort of arrangement between the latter, Fopp and the resort.

The lift opened December 24, 1934. It was an immediate sensation. The newspapers "Le Matin" in Paris and the "Morning Post" in London ran stories with pictures. Crowds like this had never spent an entire day on such a small ski area. The lift was a magnet attracting ski beginners to Davos. That first winter, 70,000 skiers used it. For the first time it became obvious that a ski lift could not only make money for its owner but create customers for a ski resort.

One or two season later, Constam significantly improved the lift at the suggestion of Jack Ettinger, the 27-year old, dynamic head of the Davos Ski School. Ettinger told Constam that if the lift had a crossbar extending both sides, it could carry two skiers and make the lift easier to ride, that is less likely to dump skiers in the snow. His father, a carriage builder in Davos-Glaris, built a model of a T-bar, partly of wood.

Constam immediately realized the economic advantage: doubling the capacity with almost the same investment and operating cost. Further, the T-bar had two advantages for the skiers one of which was unexpected. Made of wood instead of steel, it was warmer to the touch in cold weather and it encouraged conversation – and flirting. For this reason the T-bar was quickly referred to as the "Sie and Er lift" – in America the "he and she stick". Constam acknowledged his moral debt to Ettinger by voluntarily paying him several hundred Swiss francs whenever a new lift was installed. Interestingly, the T-bar – as far as the authors of this paper could find out – was never patented. Constam had obviously taken a giant step forward and, from 1937, all his lifts were equipped with T-bars.

The prospect of avoiding the boring climb on a beginners slope between each ride became more popular with each new ski lift. Instead of a couple of runs a day, a skier could get many – if the skier's legs held out. According to the Ski School of Davos the average pupil descended 26 minutes per hour compared to 6½ before the lift and learned in three days what previously took five. As a result, the lifts introduced thousands of men and women to the sport of skiing.

Because of the cost of the tickets, many skiers nonetheless scarcely used the lifts and climbed back after a turn to the right for one to the left – and vice versa. Of course, good skiers preferred the cable trains if they could afford it. It must also be remembered that many traditional mountaineering skiers were aghast at this “idiot digger”. They just loved the somewhat masochistic endurance rite of plodding up mountainsides for hours – before often having a good time drinking and sleeping in huts.

Constam's T-bars were becoming very popular. Between 1935 and World War II, he had built 15 in Switzerland, 6 in France, 2 in Germany, 1 in Italy, 1 in Austria and even 1 in Norway, the country that has been the cradle of skiing. Soon, he was advertising “More Constam ski lifts have been erected in the world than those of any other design”.

Interestingly, Austria (the country with the largest ski school - Hannes Schneider, well known for its Arlberg technique - but economically poorer and with fewer skiers than Switzerland) had their first ski lift in Zürs only in 1937. After the locals got to know about the Bolgen lift, Austrian ski experts Sepp Bildstein and Victor Sohm went in 1935 to look at the Mouflier lift (mentioned before) in Val d'Isère, France. It had been built by the Doppelmayr Company but Constam got notice and found an infringement to his patent. As a result Doppelmayr had it changed in 1938 to the Constam design as well as all the lifts they sold thereafter.

The same year, Constam moved his offices from Zollikon to Küsnacht and later to Zurich. He was obviously prospering in his business life but had reached a crisis in his married life. As a consequence, or the fact that Germany could invade Switzerland or that opportunities during the war were few compared to the huge North American market, he decided in 1940 to immigrate to the United States.

However, the Constam design continued to flourish in Europe. Before leaving Switzerland, he concluded an agreement with Henri Sameli-Huber (1893-1981) in Meilen, Zürich for latter to acquire the rights for his licenses in Switzerland and to sell them in Europe. Sameli-Huber had already installed or been general contractor for Constam lifts since 1937. He became even busier than Constam selling and licensing ski lifts. Even two of the leading European firms offering ski lifts, Doppelmayr in Austria and Ceretti & Tanfani in Italy, paid license fees as they found the Constam design best. Between 1940 and 1952, Sameli-Huber installed over 25 ski and chairlifts in Switzerland and licensed over 40 more in the rest of Europe.

He also significantly improved the original design in the following ways:

- 1) Preventing the T-bar from oscillating when retracted by making a slot -occasionally called vagina (1938)
- 2) Reducing the two cables attached to the T-bars to one (1939)
- 3) Combining the cable tension with the drive station and this on the lower part of the ski lifts instead of the upper end
- 4) Replacing the wooden pylons by steel pylons (although he had to re-use wood during World War II because of the lack of steel; for the same reason, he was permitted to build far less than he could have sold).

In 1942 Sameli-Huber also began commercializing chairlifts based on photos Constam sent him from the US.

The Constam and Sameli-Huber engineering heritage went later on to Karl Brändle & Co in Meilen (1953), and to Gerhard Müller (mentioned earlier), an ex Sameli-Huber employee who started his own company in 1947 (GMD the abbreviation of Gerhard Müller in Dietikon). Brändle resigned in 1970 and as compensation became Sales Manager of Habegger AG in Thun, an innovative aerial cableway manufacturer. The same year, they had already acquired the aerial cableway section of Oehler⁸ from Georg Fischer AG (GF) in Schaffhausen. As a matter of fact, Oehler had been the main competitor of Constam since 1937. They had acquired the license from Beda Hefti (mentioned earlier). Their lifts were cheaper, could cope with curves but their capacities were less, and the attachment with a belt was inconvenient to skiers. Nonetheless, Oehler continued building ski lifts equipped with belts until the early 50s before changing to T-bars.

GMD sold their business to Rowema AG (1985) whereas Habegger went bankrupt (1980). The bank which acquired the latter, sold it to Von Roll AG in Balsthal (1982), a steel conglomerate with Europe's largest cableway division. Its history goes back to 1883 when they constructed the first cable railway from Territet/Montreux to Glion on the Lake of Geneva. In 1888, Von Roll built a second one in Hong Kong (to the Peak) and in 1908 the first aerial passenger cableway on the Wetterhorn in Grindelwald. They sold their aerial cableway activities to Doppelmayr Seilbahnen AG in Wolfurt, Austria (1996), which, a couple of years earlier, had merged with Garaventa AG of Goldau (2002) to form Doppelmayr / Garaventa, now the world's largest aerial cableway (nowadays often called ropeway) manufacturer.

After arriving in the United States in 1940, Constam spent most of the winter of 1940/41 supervising the construction of the lifts in Pico Peak, Vermont and Tremblant, Quebec. Incidentally, both were ordered by the ski resort owners, Brad and Janet Mead, respectively Joe and Mary Ryan, while in Davos in 1939/40: they came, they saw, they ordered.

While in America, Constam became aware of copycat J-bars. During the first year of operation of Davos-Bolgen (1934/35), two Dartmouth graduates took photos of the lift and passed these on to the Dartmouth Outing Club in Hanover, New Hampshire. The school's Engineering Department found that they could build a lift from the photos and the Dartmouth coach Otto Schniebs chose Oak Hill, just off the Campus, as location. The first modern ski lift in North America was born in time for the winter of 1935/36 – only one year after the Bolgen lifts in Davos!

Fred Pabst, of the Milwaukee beer family, saw the Oak Hill lift. As an entrepreneur he quickly realized the potential. He leased ski areas in Vermont as well as in New Hampshire and already for the 1936/37 season had built no less than five copycat J-bars on them! There were also at least two J-bars operating with no connection to Constam, in the West, one at Cold Spring California, the other in Hyak, Washington. The burst of ski lifts may have been the result of rope tow drawings published in such magazines as "Popular Mechanics".

Constam had started a revolution in America without having left Zurich! Americans found the J-bar infinitely easier to ride than the notoriously difficult rope tows – of which there were nonetheless over 200 in North America.

In 1941 Constam opened his national office in Denver. At that time, he licensed the Mine and Smelter Supply Company in Denver, Colorado, to build his T-bar lifts in the West and John A. Roebling Sons in Trenton, New Jersey in the East Territories. However, as sales were not according to Constam's expectations, he ended the licensing agreements in 1944. In these years, he could also convince Dartmouth and Pabst to pay license fees for the use of his

patents (Pabst mentioned to a reporter that he paid \$ 20,000 in today's Dollars as a one-time settlement). Also in 1941, Constam divorced and found a new spouse in Ellen Peterson, an American.

The number of Constam lifts installed in the United States had been growing as he became the leading pioneer US lift builder in the 1940s, and remained a considerable force in post-World War II during the 1950s. His design had widespread effects in the United States beyond J-bars and T-bars. In fact, the continually circulating overhead cable became the heart of the chairlifts. Averell Harriman (son of a railroad Baron and Statesman under President Truman), decided as Chairman of the Union Pacific Railroad, to build a ski resort at the terminal of the railroads spur line in Ketchum, Idaho. His Public Relations Manager, Steve Hannagan, named the place "Sun Valley". Charley Proctor, who was a full time advisor for the resort, had seen the Dartmouth J-bar and Jim Curran, an engineer of Union Pacific, had worked on a banana lift in Panama. They submitted a sketch to Proctor who in turn recommended it to Harriman. The chairlifts were built by Union Pacific in close collaboration with American Steel & Wire. The world's first two chairlifts opened in 1936.

But in spite of the publicity given to the chairlifts in Sun Valley, resort builders were quick to find that Constam's T-bar was a thriftier buy than a chairlift. Constam also advertised that chairs were less safe had less capacity and cost 75-100% more than T-bars; he even compiled a list of chair lift accidents and sent memos to potential clients. Nevertheless, Constam eventually built from 1946 chairlifts (3), ski lifts which could be converted into chairs (3) and gondolas (2). All had elaborated braking systems to satisfy his rigorous standards.

He also continuously improved on the design of the lifts, amongst others the shock absorber which changed in the 50s from a coil spring to a long box spring integrated with the stick and later to a super-smooth, hydraulically dampened telescoping stick. By 1945 he offered lifts handling 1000 skiers per hour and by 1954 even 1200.

By the 1947/48 winter, Constam had installed around 50 T-bars in North America, nearly twice the number of chairlifts. Some were gasoline, others electrically driven. The T-bars were the ideal investment for most applications so that several ski areas, such as Sugarloaf, Maine, relied exclusively on them.

Now, for most skiers, the main attraction of skiing was no longer climbing a mountain to a grand view and then descending slopes at a slow pace but enjoying short sections of a slope many times. This meant that skiing could be restricted to a relatively compact area within reach of a resort where they would be safe. The term "ski area" was coined to designate the restricted terrain where skiing was first learned and practiced by novices – and as the lifts expanded into a larger and larger ski area, by good skiers.

There is little doubt, that Ernst Constam's lifts played a crucial role in skiing's great gain in worldwide popularity. There must be over 200 lifts based on his design (refer to annex), besides an even much higher number of copies – all to the joy of skiers.

In the only known interview with Constam (by Bill Dunaway, later publisher of the Aspen Times I in 1954), he describes Constam as a buccaneering spirit, of extraordinary talent, rare courage, blunt speech and boasts that seem nevertheless backed by facts. Asked how he felt about the 20th anniversary of his first lift, he answered: "Feel, I feel good. Why shouldn't I after 20 years of building the best dammed lifts in the world?" or to what achievement had made him proudest: "I have made over 200 lifts that I know of and Lord only knows how many I don't know about. And most are as good as the day they were built. There has never been a serious accident. Skiers may fall off, but it is practically impossible to be dragged or hurt by the lift itself" or to which lift gave him most satisfaction "Most satisfaction? They all gave me satisfaction. Everything I do gives me satisfaction!"

Probably due to his family and his Swiss background, Ernst (Erny to his American friends) had a strong work ethic. Constam, not a man of little ego, refused a good many deals if he felt that the buyer did not stand a good chance to profit because of location and did not make any compromises regarding safety issues.

After a heart attack in 1960 he concluded a partnership with Chuck Dwyer from 1961 to 1964. Ernst Constam died September 1st, 1965 in Denver at the age of 77.

Constam was elected to the US National Ski Hall of Fame in 2003.

¹ Beda Hefti (1897-1981), Swiss; patent CH201814

² Jacques Yves Moufliier, French; patent FR839715

³ Gerhard Müller (1915-1985); Swiss; patent CH174250

⁴ Jean Pomagalski (1905-1969) Pole/French; patent FR818660

⁵ Europe's first documented on-snow ski and sledge lift (patent CH44626 of 15.7.1908, AT38844, AT472228) had been built that year in Schollach, Schwarzwald, Germany by innkeeper and mill owner Robert Winterhalder (1866-19??). Apparently inspired by the drive mechanism of the mill, the lift was powered by a water wheel. The lift itself consisted of a continuous aerial steel cable to which at some distance two handgrips were attached. The length was around 800m with a vertical rise of 28 m. The lift was abandoned in the beginning of the First World War. No similar lift is recorded to have been ever constructed – www.eisenbach.de/html/skilift.htm

⁶ 1881: Rösti Frères (founded by Rudolf & Johann Rösti), Swiss representation of foreign companies; 1903: collaboration with Von Roll for machinery in the building sector; 1921: Robert Aebi AG, special wheelers for railroads and industries; 1930: Von Roll takes majority of shares – www.robert-aebi.com

⁷ 1874-1926: Adolf Bleichert & Co, Transportanlagen GmbH, Leipzig-Gohlis, Germany; 1926-1932: Bleichert AG; 1933-1946: Bleichert Transportanlagen GmbH Leipzig; 1946-1953: SAG Bleichert; 1953-1955: VEB Bleichert (Volkseingener Betrieb); 1955-1970: VEB Verlade- und Transportanlagen Leipzig; 1970-1991: VTA (Verlade- und Transportanlagen Leipzig).

⁸ 1920-70: Eisen- & Stahlwerke Oehler & Co, Aarau, a manufacturer of steel and transport equipment – which built their first aerial cableway already in 1904 – acquired the license of the Hefti patent in 1937. They were founded by Alfred Oehler and Robert Zschokke in 1881 as Oehler & Zschokke – which built their first aerial cableway in 1904. Their factory was initially located in Wildegg before transferred to Aarau in 1894. Robert Zschokke died in 1883, Alfred in 1900. Latter's son, Alfred junior took over from 1907 to 1955. Same as his father, he was a colonel in the Swiss Army and during World War II, head of the aerial cableway section. The company was taken over by Georg Fischer (GF) in Schaffhausen in 1970. Already the same year, GF sold the ski lift section to Habegger in Thun, an innovative aerial cableway manufacturer.