ADOLF BLEICHERT & CO.
LEIPZIG

RETROSPECT AND REVIEW
AT THE OCCASION OF ITS 50TH ANNIVERSARY
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BIRTH AND GROWTH OF THE ENTERPRISE
TYPE AND INFLUENCE OF ITS PRODUCTS

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Observing the conveyance of passengers by rail and tramways, trucks or ships, most people have a vague idea only of the technology and economic importance of our transportation system. The equally important conveyance of goods is noted, here and there, in form of a freight train passing by; the many auxiliary functions to collect and stack, to load and unload goods of every kind are often considered, and not only by laymen, as insignificant operational attributes.

The rail net shown on maps, whose density serves as measure of the commercial activity of the region, is sometimes compared to the branches of a tree. However, in that comparison the railroutes can only be considered the main branches and no map can reflect the many small twigs which are conduits for the goods to them.

Conveyance systems of all types (cranes, truck-tippers, loading bridges, bucket conveyors, belt conveyors etc.) move raw materials from their origin to railheads or ports, from trucks or ships to storage dumps or to places of consumption and manufacturing; they also connect the workshops within a factory. The conveyance range for the so-called "Close Range Conveyors" may usually be a few hundred feet only. A light railroad on ground tracks or a cableway on a carrying structure several feet above ground may be necessary for larger distances from the main railhead. The industrial railroads are minitures of regular railroads; on-ground transportation with pulling ropes is permitted only within fenced-in properties. Both systems divide and devalue real estate.

The so-called suspension conveying systems, Telpher Lines and Cableways, overcome this disadvantage. The first utilizes a rigid horizontal or slightly sloped track, supported in small intervals, on which self-propelled carriages run. The latter uses a flexible wirerope as a track, whose supporting towers may be spaced from a few hundred to 3,000 feet apart.

Due to its own weight the wire-rope sags so much, that, assuming each carriage has its own propulsion, the friction between the runners and the track is not enough to overcome the inclination of the sloping rope even in horizontal terrain. Furthermore, in consideration of the tension, it will be necessary to adhere to minimum intervals for the carriages (on Telpher lines this is guaranteed by an ingenious blocking device). A special haulage rope for propulsion overcomes both these difficulties.

The separation of tasks is the essence of the cableway system, It was first and entirely developed in Germany and then spread to the rest of the world. On the one hand it creates a track through the stationary carrying rope and on the other hand it provides propulsion through a circulating hauling rope. The fact that many of the larger cableways surpass the tonnage-per-mile-capacity of many of the small and industrial railroads underlines the importance of this conveyance system for the entire transportation industry.

A German engineer, **Adolf Bleichert**, was the creator of this important branch of our industry. His company, the machine manufacturing facilities of his own name in Leipzig, was founded in 1874. From small beginnings it blossomed, thanks, to the ingenuity and hard work of the founder. This book is dedicated to the history and the products of the House of Bleichert. at the occasion of its 50^{th} anniversary.

The victorious war of 1870-1871 united the German people under the imperial crown and removed all internal border restrictions. Kindled by strong faith in a great future the entrepreneurial drive knew no boundary and, after a short apparent prosperity in the “Gründerjahre” (Founding years), the economical collapse had to come. Starting in 1874 the German recovery from the ruins of the bankrupted economy, started to show a healthy growth. To nobody’s surprise, the recovery of the transportation system was a first priority.

v. Duecker, Hodgson,Obach, Carrigton and others had experimented with cableways for material conveyance ,however, these old installations could hardly be considered cableways in the modern sense.

As an engineer at the Martin Machine Factory in Bitterfeld, Adolf Bleichert started in 1870 on his own time to study the concepts of cableways. He was convinced of their essential and many advantages. The individual carriages were not to be coupled into trains like on railroads, as their total weight would exceed the capacity of the running track. Bleichert’s aim was to equally distribute the weight over the entire conveyance distance.

This could only be accomplished by designing a stronger track for the loaded carriages and a lighter track for the return of the empty. This mandated itself to be a rotation system, increasing efficiency substantially, at that time, due to the lack of any time loss. Bleichert’s first “Ropeway” (1872), built by the Halle-Leipzig Machine Factory and Foundry in Schkeuditz for the solar- and paraffin oil factory in Teuschental, had an hourly capacity of 13-14 tons and a length of 740m (2,222 feet). The propulsion for the carriers of the cableway, which was entirely the brainchild of Adolf Bleichert, was by means of a circulating hauling rope, to which the carriers were clamped. Round irons, welded together to form the entire length, served as the runway.

The tracks were suspended on cross pieces from wooden columns. The quality of the system, whose installation was supervised by production engineer Theodor Otto, was reflected by over 40 years of operation after its start-up in March 1874. Realizing, that it was impossible to built upon his success, Bleichert gave up his employment in the spring of 1874 .On July 1, 1874 he established together with Theodor Otto in Schkeuditz an independent enterprise for cableways.

The new company started modestly. Luckily, brick works owner Eduardt Brandt permitted the erection of a test installation on his grounds in Gohlis, making many important tests possible. This included the first application of cables as tracks instead of round irons. The results were favorable. Although round irons were still used for the next installations, Bleichert switched soon thereafter to wire ropes for tracks.

The first promotional letter from "Bleichert & Otto" clearly reflects the economic advantages of the new conveyance system. The technical basics described are still applicable today – except for capacity and speed. The promotional letter, written by engineers who recognized the natural limits of their work, avoided the exaggerated predictions of v.Duecker.

The young entrepreneurs earned the trust of the industrial complex through their sober approach to the cableways' development potential. Thus e.g. in 1875 Alfred Krupp ordered a larger cableway for his works in Sayn at the Lahn, providing an opportunity to apply new concepts and to gain further necessary operating experience. An important detail was the Eccentric-Clutch acting on the haulage rope and carrier hanger.

Bleichert's order book on January 3, 1876 listed "6 small Double Wheels" and on January 10, 1872 "12 Clutch Devices", to be delivered by the Martin Machine Works in Bitterfeld. By shifting a lever, a sickle shaped brake piece would press against the hauling rope, which is running over a roller on the hanger, as shown in Ill.1 (also showing the complete arrangement of runners, hanger and box). In comparison Ill.2 shows a carriage from a 1870 built cableway in Schwarhuette by v.Duecker.

The Krupp installation also allowed for travel through curve stations. This innovation extended the applications of cableways. Already after two years (on August 23, 1876) Theodor Otto left Bleichert to start his own business. Bleichert permitted his friend to use his patents within Germany. Little did he know, that that his personal invention later on were to be introduced to the market as "System Otto".It must be stressed, that in spite of some changes in later times neither Otto nor others could change the basic concepts of the Bleichert Cableway System. Until October 1, 1877 Bleichert was the sole proprietor of the Engineering Office, which than rented a small workshop in Neuschoenefeld, as a first daring step towards self-manufacturing.

An important event in 1878 was the hiring of engineer Heinrich Macco of Siegen as the company representative for Rhineland-Westfalia and Hessia-Nassau. Through this remarkable and energetic man the Bleichert Cableways were introduced to the coal and steel industry procurring a lasting group of customers. The workshop was soon inadequate. On October 1, 1881, Bleichert transferred his office staff of 20 and 70 factory workers, to the present location in Gohlis. The opening of the new facilities coincided with the celebration of the 100th cableway, which was to be delivered to Switzerland.

Years of internal expansion followed. Efficient machinery was installed, a core of trained office and plant workers developed and the production geared towards economical goals. This was accompanied by efforts to capture the technological developments and to improve upon them. For each project an innovative and best solution was found in spite of very difficult challenges at times. The Administration and sales, as well, were expanded by appointing a number of domestic and overseas agents. They functioned as an important link between customers and the firm.

As the successes of Bleichert became apparent, profit hungry competitors challenged the patents of the pioneer of the cableway-technology. However, they were defeated successfully, sometimes after hard fought battles.

During the early years railways were mostly built in terrain without significant obstacles. Similarly cableways started to spread initially in the lowlands. Some of the tasks were the transportation of coal from the mining shafts to processing, soft coal from open pits to briquette pressing plants or railheads, supply of raw materials to workshops or wood from the forest to sawmills, and the removal of cinder and other refuse. As means of raising the efficiency level of a company, the Bleichert cableway was present in all of the major industries during the last quarter of the last century. In 1890 the firm received its five hundredth cableway order!

After cableways had proven their usefulness domestically, Bleichert tackled solutions to the most difficult challenges overseas, in areas, which had not been touched by technology until that time. In some places geologist and explorer had previously discovered ores, coal and other minerals. However, due to remoteness and inaccessibility, a commercial exploitation was not possible. Now the cableway, representing the only possible connection between originating locations and processing plants, is opening up the inhospitable territory

In Karl Streitzig and Rudolf Pfaffenbach, Adolf Bleichert had capable partners who dedicated all their effort to the firm. For many years both gentlemen headed the department of cableways. Their energy inspired all other engineers and staff to reach for higher goals. The name Streitzig is connected to the invention of the self-activating clutch "Automat", which is of the greatest importancec (DRP 95537 May 25, 1896). It represents a turning point in the history of the cableway. The first cableway with Automat-Clutch, for Upper Rope, went into operation in 1897 at F.C.Th.Heye in Annahuette N-L. The clutch, mounted on the running gear, not on the hanger, is engaged by the weight of the carrier and its payload.

The force with which the clamps grip the rope is increased by levers to three to five times the carriage weight. The Automat-clutch can be used for Upper Rope (Ill.3) and Lower Rope (Ill.4) systems. The drawing of the patent, which is a miniature of the actual shop-drawing, shows clearly, that Bleichert fully understood the underlying principle. Whenever heavier loads require four-wheel assemblies (Ill.5) and inclines of approx.45 degrees have to be negotiated (Ill.6), in principle, the Automat-clutch had not to be changed for these applications.

The Automat-clutched used by Bleichert today is based on the same concept as the original patent, but has been improved by many years of experience and advanced methodology of manufacturing. The clutch allows the traversing of right and left curves without detachment from the pulling rope resulting in a simple and economical operation of the cableway. The reliable and smooth pick-up and drop of carriages, combined with the automatic setting of the gripping pressure, increased conveyance speed and improved efficiency of the Bleichert cableway. It also allowed for favorable directional layouts even in mountains and precipitous river valleys or at the coast. Demand increased to such a degree that on December 1, 1897 a further facility addition was taken into operation. There were now 200 workers.

The completion of the first quarter of a century of the firm's existence fell into a time of great expectations (July 1, 1899). The extensive work in the technical and administrative offices required the construction of a new administration building.

Celebrations arranged for this purpose were further emphasized by the completion of the one thousandth Bleichert cableway. This installation, bought by the Parisian firm “Le Nickel” and erected in New Caledonia, transported in its upper part ore from the mines to a station in the Thio river valley (Ill.7) for transfer to a small gauge field railway. Later on, loading at the coast was added and for this purpose the cableway had to be extended 1km (1.6 miles) into the sea to a loading bridge (Ill.8) since reefs prevented the freighters from anchoring near the coast. Industry favored Bleichert for its pioneering work in transport technology, over a quarter of a century, and for the enormous lead over all his domestic and overseas competitors.

By and by it was recognized that transportation should also achieve economies of wages and energy to the same high degree as achieved in the extraction, utilization and refining of raw materials. Consequently, during 1900 and 1901 Bleichert booked more orders than ever before. During this time a free span of 1km (1.6 miles) was designed and executed, although the technical realization possibility was very much in doubt at that time. Spans up to 1,650 m (4,950 feet) were achieved at later installations.

Ill fate did not allow Adolf Bleichert to enjoy in peace the fruits of his indefatigable life. His health was weakened by continuous over-exertion. Following several month of illness, at the age of 56, on July 29, 1901, death took him from his family and his work. The funeral occasioned the many friends, workers and staff of the firm to express their gratitude and admiration for the deceased. Of the five sons, Max von Bleichert as technical and Paul von Bleichert as administrative director followed the legacy of their father with youthful energy. Both had received at industry and trading houses in Belgium, France, England, South- and North America thorough basic training and established valuable connections.

Although, new specialty departments had to be created during the next years, the cableway business remained the backbone of the firm. A number of unusual installations overseas during 1903-1913 were a great tribute to the all conquering German engineering ingenuity.

In 1903 the ironworks in Portoferraio on Elba received an ore and coal unloading station (4 coastal cranes with a continuing cableway to the blast furnaces). In 1909 followed two ore-cableways for the mines in Rio Albano and Giove Portello (Ill.9) belonging to the same company, with an hourly capacity of 200mt (441 long tons). Here too, the freighters anchor a distance (100-200m) off shore. Every 18 seconds a carriage discharges into the chute at the head of the loading bridge.

In the Argentine Cordilleres 4,700-5,000m (12,121-15152 feet) above sea level, 35 km (21 miles) from the little town of Chilecito, the end of the Bueonos Aires railroad, are the silver and copper rich mines of Famatima and Upulungos. The access to them on narrow paths presented great efforts for man and mule. For many months, all access are interrupted by snow and storms. After thorough surveys and preparations, Bleichert built there, from October 1903 until December 1904 for the Argentine Government the longest and highest of all cableways (Ill.10 and 11). Previously the transport from the mines to the processing facilities costs 50 Marks per metric ton, now, at an hourly capacity of 40mt, they plummeted to 5.30 Mark .The cableway was even equipped for passenger conveyance in cabins of four seats (Ill.12).

The cableway for the Prometna Banka of Belgrade was built in the years 1906 and 1907. Over a distance of 10 km (6 miles) tree trunks of up to 4,000kg (8,818 lbs.) had to be transported from the mountains to the Drina valley (elevation differential 1,200m – 3,600 feet). The cableway traversed through two tunnels (Ill.13). The payload was distributed over four runners arranged in two travelling gears. The Automat-clutch had the not so easy task to clamp on hauling ropes of various diameters. Due to the wide play of its shoes this was possible. Very heavy lumber, for which the runner pressure, even distributed over four runners, is too great, is suspended from two four-runner gears (Ill.14).

Also dedicated to the transportation of lumber was the Bleichert cable way built for GmbH.Wilkins & Wiese in Usambara (formerly German East Africa) taken into operation in the spring of 1910. Over a length of 9km (5.4 miles) the cableway had to overcome an incline of 1,500 m (4,445 feet). It went through tropical forest and over rugged terrain (Ill.15) and had at one point an inclination of 41 degrees or 86% (Ill.16). Generally thanks to the Automat-clutch, this installation, previously doubted by renowned experts, fulfilled all expectations by the customer. Although the payloads, suspended on two single runner gears, weight 1,000kg (2,204 lbs.) only, the cableway had to bridge a deep cut valley (Ngoha) with a span of 900m (2700 feet).

Bleichert cableways conquered the North well above the polar circle. In 1908 they delivered for the Artic Coal Company on Spitzbergen at Adventbay, a coal cableway with a capacity of 100mt per hour (Ill.17), which was further substantially enlarged after WWI. Again, vessels, which had to anchor a certain distance off shore, had to be loaded. Due to the climatic conditions the installation of the cableway presented extreme difficulties.

China has a Bleichert coal cableway at the Toli Mines, which was begun in 1908 and completed during the summer of 1911 (Ill.18). This cableway was the first of its kind in China!

In Japan , at the Sumitomo-Besshi Copper Mine in Nijhama, copper ore and wood is transported by cableway from the separating plant to the rail head. Built 1903-1904. Each hour 75,000 kgs (165,350 lbs.) are travelling the aerial road over a deep valley, requiring a free span of 600m (1,800 feet) Ill.19.

If the capacity of one cableway is insufficient, there is the possibility of arranging two, otherwise completely independent parallel lines, on one set of towers. In 1910 this was done by Bleichert, at the installation for the Spanish Orconera Iron Co. in Bilbao. Here ores from the mines are conveyed for washing at the sea (Povena) and the washed ores returned on the same line through a transition station (Pucheta) for unloading at Gallarta. The total hourly capacity of these lines is 2,300mt (5,070 short tons), which represents a not exceeded maximum volume (Ill.20).

It may only be compared to the in 1913 Bleichert-built double line in Flamanville near Cherbourg on the North coast of France, with an hourly capacity of 500mt (1,100 short tons) (Ill.21). A 625m (1,877 feet) long sea cableway sitting on caissons, connects the ore-hoppers of Societe des Mines et Carrieres to the ship-loading facilities. Each carrier bucket with a payload capacity of 1,500kg (3,307 lbs.) is suspended from a four- wheel running gear, with a timing sequence of the buckets of not quite 22 seconds.

By fine tuning all engineering details, it was possible to make due with one power source of 15 HP only. The head station was also equipped with a 5mt-capacity torret-crane to unload from the ships, if necessary, coal, sand or other materials, and to transport them to the mine by cableway.

The four-wheel running gear, utilized with higher payloads, would also find application in special cases requiring the reduction of wheel pressure on the ropes for economical reasons. Bleichert equipped with them a 1913 cableway for the Solvayhall facility of the German Solvay-Works, to haul hourly 180mt (398,828 lbs.) salt from the pits to the mill of this chloride of pottassium factory (Ill.22). The speed of the buckets is 2m/sec. (6 feet/second), the bucket interval 40m (120 feet), in spite of the high speed the Automat-clutches are not disengaged during travel through curves. The cableway leads above fields and streets. At the crossing points protective ramps are provided (Ill.23)

From the great number of coal mines, which have adopted Bleichert cableway conveyance systems, by recognizing the true technical and economical advantages, only one example will be pointed out: The installation for the Mansfeld Mine in Langendreer. From shaft V coal is forwarded to shaft IV and, on the return haul, rocks back to shaft V. The uniqueness is the through-conveyance of the buckets (Ill.24), which avoids the known disadvantages of re-direction. The curve station is shown in Ill.25. The hourly capacity is 100mt (220,406 lbs.).

Comfortable negotiating of inclines is a remarkable advantage of cableways. This feature makes them advantageous for the steel industry over other furnace-charging systems. In comparison to bin-charging, feeding by cableway has the advantage of small individual loads in steady regular intervals. The inclined furnace-bridge, consequently, can be a light steel construction .The principle of such a furnace bridge is shown in Ill.26 for the furnaces of the Maximilian Works in Unterwellenborn (Thuringa). The foot of the cableway reaches below the mouth of the ore dumps and, on the furnace-bridge, travels around the delivery chute. Usually, the tipping of the buckets is manual.

The Bleichert-invented method for bulk material depositing is another important novelty: The cableway is located in an inclined bridge and builds by itself a firm foundation under the natural gradient of slope (30-35 degrees), thus eliminating the need for supporting columns. Initially only part of the bridge is erected at the available inclination angle(Ill.27), the buckets dump their contents as they travel around the rotation wheel at the head of the incline-bridge. As the mound increases frame extensions are added out, with which new deposits can be made above the existing mount. Ill.28 shows such a dump-cableway in Marchienne au Pont (Belgium).

As the regular cableway allows for the removal of all kinds of waste into any direction and distance without utilizing valuable ground space, so represents the incline-bridge-cableway a fortunate addition. Installations with heights exceeding 100m (330 feet) and an hourly capacity of 200mt (440 short tons) highlight the versatile application of this equipment.

Forty years of hard work led the House Adolf Bleichert & Co. from success to success, strengthened its reputation and propelled its products to the forefront – as envisioned by Adolf Bleichert at the time the firm's founding. The new fifth decade was entered with great expectations– than the storm of WWI broke out.

The execution of projects in unfriendly countries was halted. Some of the overseas engineers, administrators and construction workers were either interned or made their way home on adventurous roundabout ways under great effort and privation: During the 2nd and 3rd year of war these heroes still returned to the Fatherland from India, Russia and Australia.

A few month after the beginning of the war Bleichert, initially, switched production to general war materials At the same time designs and experiments were made for Field Cableways, which could completely fulfil all requirements of the Army. It was obvious that expedient precision and light dead-weight mass production of pre-fabricated units was required, allowing for interchangeability of parts, easy erection and great adaptability even under most difficult circumstances.

The two-rope cableway was not particularly suited for this program. Bleichert successfully improved on the one-rope cableway for this purpose. Military experts approved a test installation, erected on the factory grounds early 1915.. Now the orders poured in, requiring the factory to operated at full capacity with day and night shifts and still employ sub-manufacturers. Until the end of the war 630 Cabelway-units were delivered with a total hourly capacity of 8,500mt (18,740 short tons).

Bleichert constructed Field-Cableways in three sizes: Model I – III from 100-125 kg (220/276bls.), 150-200kg (330/410lbs.) and 200-250kg (410/550lbs.) payload with an hourly capacity at horizontal installations of 20mt (44,092 lbs.), 30mt (66,140 lbs.) and 40mt (88,180 lbs.). The standard unit length measured 2.5km (1.5 miles). For our troops in advanced positions in the mountains or hilly country the cableways presented the only supply means for ammunition, entrenching materials and food.

Cableway units could be linked together without impairment of the carrier transfer, they crossed swamps and rivers and went upwards on precipitous inclines. The stations were lowered into the ground and protected against bombardment, the line itself was a hardly recognizable target, if skillfully camouflaged. They operated day and night without interruptions by wind, cold, rain and snow.Ill.29 shows a picture of the line and Ill.30 of the terminal station, Ill.31 the common platform carrier for ammunition and Ill.32 the hauling rope suspension of a field-cableway.

Bleichert engineers and foremen, supervising the erection and operation of many field cableways, accumulated much informative experience under the pressure of commanding realities, which would have taken many years to mature during peace time. Although, Bleichert had introduced the by them highly developed system of the stationary carrying and circulating hauling rope technology, here and there single ropeways (mono cable) were delivered. They were simple but reliable systems with small payloads of fast and inexpensive manufacturer and installation (construction sites, agriculture and forestry, overseas plantation etc.).

The oldest example of this type, as shown in Ill.33, is the ropeway at the Koenigin-Marien Steel Works in Kainsdorf, utilizing wooden, steel yoke or pyramid columns. The carriers are hanging on the haulage rope from saddles, whose key heads engage the braids of the rope.
The disadvantages of the device, still prevalent today on systems of foreign manufacture, were eliminated on later constructions by a net-weight–clamping device.

A variation of it, found wide application on field-cableways. These field-cableways were not only delivered to the Army, but also to other customers, such as the mono-rope cableway in Ill.34 at Nieder-Walluf for 5mt (11 short tons)

After WWI Bleichert continued to work on mono-rope systems due to the favorable experiences gained. The lack of investment capital restricted the building of larger conveyance systems, for which only two-rope cableways would have been considered, and opened the door for the mono-ropeways. The re-design of the clamp as the connection for the carriers to the cabel (braided rope) was the most important priority.

Bleichert thought of a new clutch with lever-transmission (Ill.35): The rope is gripped on a wide surface by the shoes of tongs, which will not be released by swinging motion. This device runs above the carrying and curve rollers, also allows to run below the guide rolls and permits the engineer to adapt the ropeway to the terrain, in a never before seen fashion. The operation is very simple: The carriers connect to the rope at the horizontal stretch in the station and passes under the guide rolls only at increasing inclines.

In addition, the orientation of the rope on the carrying rollers was essentially improved, extending the life of the rope substantially and decreasing operating cost due to less rope wear and tear. Bleichert developed the newest mono-cableways, which only by name still compare to the old editions, to an equel level with its proven two-rope systems. The mono-rope cableways are used, especially for small payloads and were they would be economically advantageous.

Everybody taking the time observing with appreciation the operation of a cableway, with its bold span of the carrying rope stretched between slim towers, with carriages coming and going in regular intervals; only a faint buzz of their runners and of the carrying rolls of the haulage rope to be heard, empty carriages returning to loading stations without shunts, signals or supervision; continuously day and night, in spite of storms and snow; without danger of robbery of valuable goods! –has to ask himself, without doubt, whether such a transportation system could also be utilized for passenger traffic.

Due to speed requirements competition to long distance trains would not be possible. However, for short steep distances, where track bound trains with or without cog rails ascend to the summit in laborious bends, the funicular has a number of economical advantages. On top of the list is Safety. It is the innate belief of most people, that a rigid steel track offers carriages moving on it greater safety than for carriages suspended from a wire rope. A critical comparison of both elements proves this to be incorrect.

The soundness of a rail can only be tested on material samples, for a rope, however, each individual wire is extensively and carefully stress tested. The rail suddenly breaks through wear and tear or overload, the wire rope forecasts the danger by its bristly looks.

In accordance with the than in Austria existing norms, Bleichert built in 1911/12 the well known funicular on the Kohlerer mountain near Bozen ,which conquers an elevation of 840m (2522 feet) over a distance of 1,650m (4,955 feet) with the steepest inclines of 100%.

Two cabins with a capacity of 16 passenger and one conductor each (Ill.36) travel in a regular pendulum operation. The lower station is shown in Ill.37. The funicular, licensed and certified by the Austrian Ministry of Railroads, has a number of safety features, which never before were applied anywhere else and which skillfully act together to avoid any accident as far as one can judge.

Although, statistics tell us, that breaks of carrying ropes and crashes of cabins are much fewer than derailments and collisions of trains, the primary duty for the operator of passenger cableways especially, is the inspection of carrying ropes. As the railroad line inspector must daily walk his track, so must the carrying ropes be subjected to a constant careful inspection. Through adherence to these requirements, passenger cableways will become more and more common, especially under the constant efforts for further improvement.

A gratifying result of these efforts is the passenger funicular Meran-Hafling of the Bleichert-Zuegg-System, which is the prototype for all adverse terrain material and passenger cableways. Due to its simplicity, utilizing the latest technology and high quality specialty materials, a transportation system was designed, which could be built and operated economically, under adherence to all official safety requirements.

The engineering, critically tested on thousands of installation of Bleichert cableways, whose superiority has never been disputed by any industry expert, is to be considered the fundamental element of the Conveyance Technology. Even before the existence of the ND (Association for Standards for the German Industry) in May 1917, the Bleichert workshops adhered to the principles of standardization. This made it possible for customers to install replacement parts and make additions without assistance. Even for cableways manufactured years ago, some parts are still manufactured today in accordance with old blue prints.

In regards to carrying cables and its ring wedge coupling, haulage ropes, towers, curve and spanning stations, protective nets and bridges refer to the instruction book of Prof.P.Stephan "Drahtseilbahnen" (2nd edition 1914, Chapter III). Dipl.Ing.H.Wettlich covered in the magazine "Foerdertechnik" of April 1, 1914 (page 85) the subject of clutches and their historical development.

Only one improvement of recent date should be mentioned here: The drive unit (Patent "Ohnesorge"). When larger velocity exists, the haulage rope has to move in leather lined grooves of a drive wheel under assistance of a guide wheel. This is the case regardless whether the haulage rope is powered by an Electric or Diesel motor or whether, at the incline movement of loads, the surplus force is to be reduced by braking. This system, accounting for the differences in cable tension and expansion as the source of wear and thrusts by suitable gradation of the groove-diameters, has a basic flaw.

It is impossible to determine exactly in advance neither the elasticity nor the tension of the rope. In addition the changing operating conditions and the irregular wear create constantly new forces, tensions and movements. The Ohnesorge-Drive (Ill.38) utilizes between the rope windings adjustment wheels of the differential type used on trucks. This creates nearly the same force on the rope as on the wheels.

Next to the towers, the curve and span stations, which can be constructed from wood, concrete or steel, the loading and unloading installations of cableways are an important component. Increasing capacities of its cableways required Bleichert to design larger constructions and for their design to further expend the existing statical offices.

In the nineties the German crane-industry was in its infancy and could not handle the required conveyance capacity. That Bleichert soon held a leading position here too, will be illustrated by a few examples covering installation for loading and unloading of ships with coal, ore, stone, coke or other bulk materials and for the servicing of storage facilities.

Ill.39 shows a ship's unloading facility, built at the bank of the Maas in Corphalie near Huy (Belgium) for Austrian/Belgium Metal company. A telpher line has an hourly capacity of 30mt (66 short tons) of coal or ore for delivery to the storage bunkers or for crushing.

Ill. 40 shows at the terminal of a cableway of an hourly capacity of 200mt (441 short tons), gravity discharging silos for loading of barges in Aingeray (North of France) at the Rhine-Marne-Canal belonging to the Solvay Works. By travelling above the silos, the carriers are being tipped.

For the Portland Cement Factory in Ruedersdorf near Berlin, Bleichert built the in Ill.41 shown loading- and unloading station, which is the head for several cableway lines. The buckets of the individual carriages are lifted and lowered by hoist from and to the barges.

The tremendous amount of coke consumed by city gas-works, always makes delivery by water desirable. Two Bleichert automatic grab loading bridges at the Gas Work of Mariendorf near Berlin (capacity 200mt/hr., 4.4 short tons) are shown in Ill.42.

Two slewing cranes with 20m (61 feet) reach are utilized for unloading of limestone and coal (Ill.43) at the Alby-Carbid Works in Odda (Norway). The cableway travels below the dumping silos and crosses an inlet.

How to resolve the challenges of a rugged coast with a 120m (364 feet) landing bridge is shown in Ill.44. At the loading facilities of the Vivero Iron Ore Company at Ferrol in Northern Spain, the ore feeds from a chute at the head of the bridge into the ship.

On New Caledonia the cableway with two double jib cranes, sold to the mining company "Le Nickel" of Paris, reaches one kilometer (.625 miles) into the sea (Ill.45). It brings 100mt (220 short tons) per hour of nickel ores to the vessels, but also can unload from them coal and sand.

Where access to ship-bunker is restricted by on-deck superstructures like masts, radio installation etc., the loading and unloading cranes have to be equipped with sliding or folding jibs. Bleichert's Trestle Crane of this type is shown in Ill.46.

At the Midgaard-Seeverkehrs A.G. in Nordenham built loading bridge with sliding jibs (Ill.47) for 97m (294 feet) horizontal freight travel, Bleichert has shown that the overall design of a steel structure does not have to be influenced by the mere intended purpose only.

A highly economical installation has Bleichert constructed for the Gewerkschaft Deutscher Kaiser (now August-Thyssen Mills) in Nikolajeff at the Black Sea (Ill.48). The ore is unloaded from railroad cars by portal cranes, deposited on storage dumps and by the same crane lifted on a loading bridge with a span of 37m (111 feet) and a movable jib, which positions a conveyor over the vessel. This way 250mt (550 short tons) of ore can be loaded hourly.

Connecting the Rhine barges and the coal cableway at the Anilin-and Soda Works in Ludwigshafen are three loading bridges with folding incline jibs (Ill.49), calculated for an hourly capacity of 100mt (220 short tons), but have handled up to 160mt (352 short tons).

Only in very rare cases fuel and raw materials for power stations and factories will arrive just in time to allow elimination of storage facilities, which act as supply equalizers. The mostly open air storage facilities are usually served by loading bridges with upper flange slewing cranes and lower flange travelling winches. With telpher lines a movable distribution bridge having rampes travels over the rectangular surface.

That above type of equipment is part of the reloading and conveying installations of large manufacturing facilities. Here as well, Bleichert can claim excellent results based on both design and operational performance.

Ill.50 shows the distribution bridge, erected at the main works of the Cologne-Rottweiler Powder Works in Duenneburg, for a telpher gripper line with a length of 156m (473feet) and an hourly capacity of 20mt (44 short tons). The bridge covers the coal storage dump with a span of 41m (124 feet) and a height of 13m (39 feet).

The Gas Works in Posnan are equipped with a loading bridge with a span of 33m (100 feet) and a waterside length of 17m (52 feet) complete with a slewing gripper crane reaching 12m (36 feet)(Ill.51) having an hourly capacity of 70mt (154 short tons). The lower flange of the bridge serves as the track for the telpher line whose carriages are being filled from a built-in funnel.

For improved capacities, two independent installations may be needed one for deposits, the other for pick-ups. For this reason, the Gas Works Tegel-Wittenau near Berlin are equipped with a loading bridge having a gripper travelling winch above the distribution bridge of the cableway spanning the coke dump. The gripper travelling winch lifts the coke into a funnel from which the buckets of a telpher line can be filled (Ill.52).

Bleichert's ability to execute the most difficult steel constructions demonstrates Ill.53: A construction steel depot loading bridge for the corporation "formals Gebrueder Stumm" in Neunkirchen. Lift capacity 6000kg (13,228 lbs.), track length 60m (182 feet), the legs had to be spread wide to allow beams and rails to pass through without turning of the load.

Amongst the heaviest crane constructions are loading bridges for ore dumps at steel works. The gravity of the ore increases the weight of the payloads and the storage bins separating the various ores have to be arranged over a large surfaces. This requires high operating speeds and strong motors. Bleichert delivered such an ore crane e.g. to Krupp's Friedrich-Alfred Works in Rheinhausen (Ill.54). It has an hourly capacity of 100mt (220 short tons) and a track length of 105m (316 feet).

A important challenge is the design of equipment for feeding bulk goods from bunker silos into the buckets of cableways and telpher lines or into the tubs of furnace incline elevators. Measuring exact quantities in a few seconds without involvement of much manpower are required. There is no problem with fine ground and uniform goods, However, ores or pit coal with rough and ham-sized pieces make a solution difficult. In addition, when pouring out the drop- height should be limited as much as possible.

At past installations, it was not yet necessary to pay attention to reduction of heights, when designing storage bins. Often it was not even permissible to reduce the pouring height below a certain norm. At the loading of ships, the water level had to be taken into consideration and for the loading of rail cars all solid structures had to stay outside of the available clearance. For this purpose bins with drop doors were used, in which the goods would slide and which would be pulled up after the bin was empty (Ill.55).

Time and manpower required for this operation were considered excessive. Therefore, Bleichert designed the K-Closure, which warranted the protection of the bucket by gradual flow-out and with easier operation (Ill.56). Closures of this type have been built with door openings measuring 3.0 x 1.6m (9x5 feet) for operation by one worker. If the quantity to be drawn has to have an exact weight, it is customary to cut-off and stop the flow from below (Ill.57) without interference by bigger pieces or dust pushing along. The force of gravity will be balanced through correct arrangement of levers enabling the operator to measure without difficulties the required quantity (Ill.58). In front of the opening is a pendulum rake, which prevents injuries from flying pieces.

The Bleichert O-closure is an effective door for fine ground materials whereby a round slider, coming from atop, blocks the chute (Ill.59). Here as well, the design of the rods achieve a balanced power requirement, however, the operator does not have the flow of the material under as much control as with the U-closure. The slider falls down on its own as soon as the flow is to stop; fine ground material could continue to flow should some larger pieces hinder the slide to fall completely.

Bleichert avoids at all his closures forceful cutting or smashing to eliminate all vibrations, which would loosen rivets of metal containers and could crack walls of concrete bins. Combining the U- and O-closures resulted in a double closure, whose upper slider is opened by a pulling rod and whose lower slider is operated by a foot pedal (Ill.60). The later regulates the flow of the finer mesh and the upper controls the larger pieces. The closing is done in reverse order.

The double closure fulfills all technical requirements in regards to exactness of measurement. However, it could be tiring for the operator, if the process requires frequent and speedy loading of large quantities. Such conditions are the norm in steel works, where ore has to be conveyed from enormous storage bunkers. Similar requirements prevail at potassium works.

For these highest requirements Bleichert has designed a motor-driven closure, consisting of a regular flat slider, opening and closing from the back of the chute (Ill.61). The sprocket rod attached to the lower side of the slider is operated by a pinion gear, which is powered by a connection from a motor sitting aside. Each chute opening has three individual sliders of the same width, which can be moved slowly backwards or quickly forward, individually or in pairs or all three together.

The job of the attendant is to operate a clutch manually. This does not require any substantial effort, although closures have been built with opening of 1,535 x 700mm (61 x 28 inches). Many repeat orders from the steel works and foundries are proof of the great advantages of this MS-closure.

The enormous dimensions of modern ore and coal hoppers would require an uneconomical quantity of motors for the operation of the sliding-closures. That is why Bleichert changed over to operating the chute-closures by a non-stationary machine, which moves electrically below the selected position, locks-onto the track and is switched to "opening" mode. In the travelling direction of this discharge-winch, the entire silo has no separation walls. To prevent bridging and jamming, the long and short sides of the floor rectangular are separated by sliders in a checkerboard pattern at various levels, which to be operated in any sequence required.

A known advantage of the continuous conveyors (steel plate, steel band or belt conveyors) is the "stretching effect": Without any special loading equipment, uniquely they are able to empty out the entire contents of a silo and stretch it into a uniform stream. Vertical or sloping discharges are used for this purpose. For middle sized and fine mesh materials, Bleichert invented a horizontal sloping-grate-closure (DRP No. 393227), which is located at a suitable height above the conveyor (Ill.62). It reduces the gravity pressure greatly, the power usage is reduced and an even flow is achieved.

The inspiration for this innovation Bleichert may have gotten from its belt and steel plate conveyors of which they have delivered several hundreds from the smallest to the largest size. A belt conveyor with a movable discharge device can be seen in Ill.63.

Due to its light weight and easy operation the belt conveyor is suitable for the loading and unloading of railway cars and for throwing up storage dumps. (Ill.64). Contrasting this small equipment are the conveyor systems at the Rhine-Herne Canal port of the Gelsenkirchen Bergwerks A.G., for discharging at the storage dumps and for loading of ores (Ill.65). The hourly capacity is 300mt (661 short tons) at a length of 102m (309 feet)

A disadvantage of belt conveyor is its inability to overcome considerable inclines. Ladle conveyors are utilized in the event material has to be conveyed to higher elevations. At the city gas works of Hannover (Ill.66) a plate conveyor has an hourly capacity of 60mt (132 short tons) with a 16m (48 feet) lift to the retort house. However, starting at a certain slope (60 degrees), even ladle and plate conveyors are insufficient, which are less adaptable than the bucket conveyor to space condition requirements.

Bleichert started building bucket conveyor twenty years ago and initially preferred the one rail arrangement, of which several were built with an hourly capacity of up to 200cbm (262 cubic yard)) (Ill.67). Later on they switched to two track conveyors, where the pendulum bucket hangs between two driving chains (Ill.68 and 69). The buckets are loaded from a filler, which is operated by one of the driving chains and whose slider opening is worked by an oil brake (Ill.70). A movable block tips and empties the bucket over the discharge opening (Ill.71). The drive of a heavy coal conveyor is shown in Ill.72 (Gas works Hamburg-Grasbrook). Hourly capacity 150mt (336 short tons), lift up to 33m (110 feet).

The basic USA concept of the bucket conveyor has been successfully improved upon in Germany by dividing the driving chain into individual frames. This makes it now not only possible to travel through horizontal curves into another direction, but also to obtain for many installation very economical screw movements of the conveyor, by installing pivot gears between the individual frames (curve- and spiral-conveyors).

Based on this concept Bleichert redesigned the bucket conveyor, which had become very heavy due to the multipartite chain and the necessary guides and supports, by inserting cable pieces between the various bucket groups, resulting in lighter and cheaper equipment. This "Rope-Conveyor" represented economical equipment suitable for small capacities as well as for long distances of conveyance. Without guides the rope-conveyor can be pulled through the air horizontally, sloping or vertically and can run over rollers like a belt drive Rails are necessary only at the point of loading and discharge.

The Division "Transport- and Loading Equipment" designed also rope and chain conveyors with a circulating driving element for small wagons (Ill.73 with Upper rope, Ill.74 with Under chain), as well as shunting devices with brakes (Ill.75) or capstan drums (Ill.76) and self-acting inclines to slow down V-tipping cars etc.(Ill.77). As a rule Bleichert built such equipment only to complement his cableway and telpher lines, therefore, its volume cannot be compared to his main products.

The selection of cranes and other loading equipment, discussed above in words and with pictures, confirm Bleichert as the leading German crane manufacturer. Bleichert resisted the obvious temptation to expand his field of activity, by applying the knowledge gained from building this equipment, to piece good and heavy-duty crane production, with the exception of the cable-crane. Its basic feature of a cable, stretched between to stationary points, coincides with the manufacture and requirements of a carrying rope for cableways.

Precursors to modern cable cranes can be traced back into the Middle Ages. As early as 1411 a manuscript of Johann Hartlieb shows the drawing of a cable crane with a movable rope, which carried loads across a castle-moat (Ill.78). In a book by Faustius Verantius "Machinae Novae…" of 1617, one can find an illustration of a cable crane, which served for the transport of passengers (Ill.79), utilizing a tightly stretched carrying and a continuous hauling rope. No single cable crane survived to the present, since all carrying and hauling ropes, until the invention of the wire rope by mining consultant Albert in Claustal, could be produced from hemp only, which rotted in a few years.

The main horizontal and vertical rigid beams of loading bridges with spans of 100-150m (330-455 feet) would be so heavy, that for economical reasons the building of such installations over large storage areas would not be justifiable, even if continuously operated. Further more, the time required to build such an installation, would not be acceptable to buyers. The temporary utilization of loading bridges of such spans for the building e.g. of locks, portsides, dams etc , would be out of the question.

The cable crane is the only and complete solution to bridge over a storage area or working space with an easily movable crane of 200-500m (606-1515 feet) width, which can be manufactured quickly and cost effectively.

Everybody knows the ugly picture of a middle-sized or large building construction site with the chaotic confusion of stone, beams, concrete, wood etc. amongst which narrow gauge tracks of V-dump cars are leading. Here and there are groups of workers occupied with the removal of dirt and the operation of winches propelling individual conveyance carts. Exact plans are required to run such operations, however, often these plans have to be changed due to unexpected occurrences. Cable cranes, removing conveyance from the ground into the air, would eliminate most of these disturbing incidents and assure that each point of the construction site can be reached without tracks - from unloading, the preparation of materials (concrete mixing) to the removal of excavated dirt.

The design of cable cranes has been substantially improved upon several times by Bleichert, the leader in this field of crane technology. A few examples may support this statement.

The underlying concept of the modern cable crane are the end towers, which are moving on tracks and on whose tops the carrying cable is anchored. Three Bleichert cable cranes of this type are shown in Ill.80 at the construction site of the Argentine naval base in Bahia Blanca. In side view the towers have the form of a triangle framework. From an operator's cabin on the right tower, its movement and the lifting and propulsion of the traversing gear are controlled. The driving unit is located in the base of the tower.

The excavated material is conveyed in wooden tipping boxes to the removing track and the concrete, in bins with side flaps, from the mixers to the working site. Lightweight carriers, which are expanded and pushed together by the trolley, support the lifting and travelling ropes. The span is 215m (652 feet), the payload capacity 4,500kg (9920 lbs.) and the hourly capacity 40cbm. Three similar cable cranes with larger spans of 360m (1,090 feet) and higher payload capacities of 5,000kg (11,023 lbs.) are shown in Ill.81. These cranes delivered by Bleichert for the construction of the Brunsbuettel Locks of the Northeast-Sea Canal differentiate themselves from the previous example by a control booth-hoist with a gripper travelling on the cable. If necessary they will also work with bins.

The nearly endless paper consumption of modern times – alone for newspapers, has created an unexpected flourishing of the pulp industry, whose raw material is harvested mainly in the forest rich countries of the North. The pulp mills in that region receive the wood from various directions. The cheap transportation by water, however, will be interrupted due to ice during the winter. Consequently enormous inventories have to be accumulated during the summer.

Ill.83 shows the storage facilities of the Sulfitfabrik A.G. in Stoemsbruck (Sweden) with a cable crane installation. In Ill.82 one sees the waterside tower between whose legs the logs move along in a water canal. The wood is lifted in bundles of up to 5,000kg (11,023 lbs.) and move by means of a trolley with an electric motor driven winch. The span of this Bleichert crane is 220m (667 feet) with an hourly capacity of 50,000kg (110,200 lbs.). Another cable crane at this company has a reach of 480m (1,455 feet).

Many years before the war, cable cranes were important for the designs of slip ways of shipyards. The first large and very successful attempt was the 1907 installation at the Reiherstieg-Shipyards in Hamburg (Ill.84). The main advantages of these cranes are: cost effectiveness, a short construction time, small space requirements and maximum adaptability, co-serving of construction and storage sites while extending slip ways.

Consequently, Bleichert cable cranes were the choice in 1919/20, when Deutsche Werft A.G. in Hamburg decided to equip its shipyards in Finkenwaerder with cranes. A full picture of the completed installation is shown in Ill.85. Between the 168m (509 feet) long and 40 and 45m (121 and 136 feet) traverse bridges, 24 cables of 280m (848 feet) length each are stretched in intervals of 6.5m (20 feet) for trolleys with a lifting capacity of 4000kg (8,818 short tons) each. The drives are installed on the land side bridge together with the control booths.

The cranes are operating over a surface of 47,000qm (35,250 sqyds.) At such distances and with inclement weather, the operator is no longer able to follow the load and to approximate the lift and travel direction. The operation booth is, therefore, equipped with two indicator gauges, which always pinpoint the current position of the load. If a large surface had to be covered by a cable crane for one time only construction or dismantling, the side by side arrangement of cables is replaced by mobility of the bridges.

A two-rail track for each side tower would be considered wasteful. Substantial cost savings, however, can be achieved by utilizing a flat pendulum beam with a wide wheel base traveling on one rail and held in place by a counter weight, at 45 degrees in opposite direction of the cable pull. This design concept is shown on a Bleichert cable crane over an open coal pit in Ill.86. The lower edge of the counter weight barely touches the ground thus avoiding damages by the falling beam in case of cable breakage. An electric operator’s cabin with hoist is travelling on the cable (Ill.87), which carries the pit coal in a bucket over a funnel chute from where it is removed by V-dump cars.

Without difficulties, loads can be picked-up or discharged outside of the foot of the beam, as shown in Ill.88 of a cable crane at the Paper Mill Eichmann & Co.in Arnau at the Elbe. Span width 170m (515 feet) , lift capacity 1,800kg (3,968 lbs.)

If the layout of a storage or working facility, to be served by a cable crane, is shaped more like a triangle, than the rail of the mobile support beam can be bend in a circular arch, in the center of which the stationary support will be installed. An example of a circular travelling cable crane is the installation at C.F.Foerster in Riesa at the Elbe (Ill.89). There, logs of up to 5,000kg (11,023 lbs.) are being loaded from a storage area of 150m (455 feet) length. As a rule, however, the loads are not heavier than 2,500kg (5,511 lbs.). Therefore, the cable crane has two carrying ropes, whose trolleys can work together resulting in convenient suspension of the logs. Note worthy are also the guides of the counter weights, which prevent their swaying.

The usefulness of a cable crane in the construction of high buildings shows Ill.90. The main building of the Polytechnic Institute in Stockholm was spanned by a Bleichert cable crane with a circular arc mobile pendulum tower (300m x 2500kg) (9,091 feet x 5,512 lbs.). The assumption, that the cost of the crane hardly would exceed the cost of the scaffolding, necessary to build such a structure, may be correct in this case. The faster progress of construction is obvious, without the restrictions of all sorts of scaffolding.. The illustration also shows that there are no height limitations.

The cable cranes, used by Dyckerhoff and Widemann at the construction of the Century Hall in Breslau, were even more adapted to the area and height requirements of the building (Ill.91). The outside triangle-towers traveled circular with a 100m (303 feet) radius around a center tower of 52m (158 feet) height.

The hall could be completed within nine months, through the quick conveyance and erection of scaffolding, the transfer of mortar and steel in loads of up to 2,500kg (5,512 lbs.).

Experts have to consider the Bleichert cable crane with a sweep-jib (DRP 279069) as the ultimate in cable crane development, combining smallest dead weight and cheapest manufacture with shortest delivery time and easy transfer to another construction site. The incline rafter, braced with iron rods and held by three cables in the correct position, is the only part subject to buckling stress. All other components to pulling stress only and, consequently, can be cables. The top of the rafter can tip several meters from its middle position, thereby moving the loads within an area, which is sufficient for the construction of locks, dams, harbor jetties and similar projects.

Lock I of the Rhine-Herne Canal was constructed with the aid of two sweep-jib cable cranes (Ill.92). Each of the two cranes has a span of 320m (970 feet), a lifting capacity of 3,000kg (6,614 lbs.) and a hourly capacity of 25cbm. Two versions of the cable crane, built at the beginning of WWI at the mines of Moeller and Rheinbaben near Gladbeck in Westphalia, found a new application in the servicing of large coke storage dumps.

It was necessary due to a falling market, at the time, to store coke in enormous quantities after extraction of the by-products (tar, benzole ammonia). The existing storage facilities at the coke works were insufficient and areas further away had to be utilized. At the Moeller mine a sweep jib cable crane was constructed with a reach of 400m (1,212 feet) and a height of 37m (112 feet), which fulfilled its requirements to full expectations (Ill.93). Having a carrying capacity of 3,300kg (7,275 lbs.) a trained operator could move with this equipment 50mt (110 short tons) hourly from the plant to the storage dump. By varying the inclination of the jib in increments of 4.5m (13.6 feet) from the middle, the dumping volume could be increased by 50,000cbm.

The considerable proportions of cantilever cable cranes are shown in Ill.97 on the Bleichert crane built for the Gas Works of Ostende. If required by the superstructures of a ship, the water side jib of the circular travelling cantilever can be folded. The reach is 130m (394 feet). Similar reaches have been achieved also by regular loading bridges, however, with a multiple of dead weight of cable cranes. The operator cabin-winch with automatic gripper has a capacity of 5,000kg (11,023 lbs.). If the jib of the cable crane does not have to be folded, the carrying rope can go right to the top of the jib.

Bleichert built such an installation for Thyssen .Handelsgesellschaft at the East port in Frankfurt on Maine (Ill.94).The entire length of the cable from the weighted-down left cantilever to the top of the jib measures about 150m (455 feet) with the jib itself 50m (152 feet). At first view it appears that this daring structure is lacking proper footings and still it balances the horizontal pull of the cable in such a way, that the vertical feet are only slightly strained in extreme cases. The loads (6,000kg – 13,228 lbs.) are lifted at .6m/sec. (2’/sec.), conveyed at 4m/sec. (12’/sec.) and the crane is parallel movable.

A crane built by Bleichert for the piano factory Arthur Franke in Liegnitz reflects the full impact of a loading bridge (Ill.95). One end of the gantry rests on a rotary suspension, the other, which is extended by an outer self-contained jib, on a pendulum stanchion traveling on a circular track.

However, the bottom of the gantry does not contain the runway, as seen so far, but a cable, which can slack freely under its own and that of the payload-weight, is stretched between the two supports. Consequently, the supports have to absorb only horizontal tension of the cable, eliminating all bending stress on them. This makes it possible to construct such “Bridge-Cable Cranes” with very small dead weights. The length of the main gantry measures 60m (182 feet), the length of the outrigger beam 220m (61 feet). The raw material – logs – is being distributed over the storage area in lengths of 24m (73 feet) at a travelling speed of 1m/sec. (3’/sec.).

During its development, the three-phase motor Travelling Crane has been standardized to such an extend, that it can be considered standard equipment for all inside spaces (workshops, foundry, forges etc.). Only unimportant design differences distinguish the various manufacturers. Bleichert, however, went into a completely different direction, by utilizing a cable stretched under the gantry as the travelling way for the trolley, as previously shown above (Ill.96). The bending stress of the main gantry is caused now only by its own weight, the horizontal cable tension exerts length stress, the vertical stress dissipates from the points of attachment over the top to the runners. A travelling crane of this type was installed at the exhibition hall for the Association of German Tool Manufacturers at the Leipzig Fair grounds.

Resulting from the fast development of street tramways, experiments were made before 1900 in England and USA to utilize electricity to power suspension tramways. During his travels in USA Max Bleichert saw such “Telphers” and recognized also its weaknesses. Soon after he assumed the technical management, his company began to design this new mode of conveyance, naming it “Electro Suspension Trams”. In 1903 the first installation was built and from thereon, the demand increased from year to year. Today Bleichert can lay claim to have delivered by far the most telphers in Germany.

As a rule telphers are not a substitute for cableways. The higher dead weight of the running track and the carriages require supports in closer intervals and, therefore, telphers can not compete if wider spans are required. For cableways the correct spacing of the carriages is achieved through the haulage rope to avoid crashes of carriages, which could lead to derailments. For the telpher lines, the spacing of the carriages is assured by dividing the running distance into short pieces and in addition to an automatic block device..

There are some further fundamental differences: Cableways are suited for straight line conveyance, but can travel also through curves as well, whereby the carriages move on rigid tracks. Telphers, in contrast, manage curves with a radius of curvation of up to 3m ((9 feet) and transfer through shunts or turntables. Consequently, the fields of application are inside spaces of factories, coaling and removal of cinders at power plants and gas works, but also including storage lots in the open air, to charge furnaces and other industrial facilities. Aided by the Automat-clutch the cable way carriages overcome the steepest inclines and down-slopes, in contrast, the carriages of the telphers manage inclines of 1:30 only, as otherwise the friction between runners and track does not produce enough travel motion.

For larger inclines over a short distance with a few carriages only, an auxiliary rack can be installed next to the track, which is engaged by a pinion gear of the drive, as seen on mountain railways. For substantial changes in elevation, the track can be installed at the highest required elevation and each carrier is equipped with a hoist, for lowering the box at the loading and discharge stations (Hoist Telpher).

The hoists required for a large number of carriages would make this design too costly and result in high electricity consumption due to the dragging along of dead weights. For longer inclines up to 1:4, Bleichert, therefore, designed its electric cableway: Entering the inclines each carriage is attached to a circulating hauling rope by means of an Automat-clutch and again released when reaching the top. Simplification is achieved by exchanging the haulage-rope with a haulage-chain (Chain Telpher). This design has been applied to several charging plants for foundries. However, the necessary space is not always available for the slope-construction.

Minimum space requirements for the lifting of telpher carriages to any desirable height are addressed by "Spiral Elevators", which are towers of approx.8m (24 feet) diameter with a fixed screw-shaped track. The axle of the tower is a vertical shaft, which is rotating continuously powered by gears from a motor. The axle is equipped with a device, which aided by arms slides the telpher carriages up or down on the inclining track.

The carriages of the cableway receive their propulsion through the haulage-rope from a single drive. Each carriage of a telpher has its own motor. Thanks to this independence the carriage can be stopped at any desired point. When stopping the box can be loaded, for this purpose it can be lowered to the ground and afterwards again lifted to the level of travel. A great number of telphers are equipped with grippers (Gripper-Telphers), which are operated electrically.

Self-operating or remote controlled telpher carriages have a travelling speed of 60-90m/min. (182-273 feet/min), trolleys with operating cabin as a rule 180m/min.(545 feet/min). Capacity of the boxes is generally 1-2cbm (1.3 to 2.6 cubic yards) but can be as much as 4cbm (5.2 cubic yards).In factories, storage facilities, power houses etc., there is hardly any corner that can not be serviced by a telpher. Insufficient room on ground level is freed and obstacles are removed by diverting the conveyance needs into the space above the ground. The cycle of empty carriages for manual loading will set the pace of operation.

A single operator can operate a gripper telpher, without any physical exertion on his part. The multi-facet adaptability of telphers is documented by the ability of the same installation to convey coal to a furnace as well as to remove its ashes and cinders to dumps or railroad cars. Economically the telphers have one advantage over other means of conveyance. For start-up companies it allows initially a smaller number of carriages to be add to as required by growth. Also the length of the tracks can be extended step by step over time.

For the past twenty years, Bleichert has held the leadership position in this field of transportation technology and has created the most important innovations either itself or caused other firms to make them.

The adaptability of the telphers to special operations will be highlighted by the following examples.

Ill.99 shows a trolley with a carrying capacity of 2,500kg (5,512 lbs.) at a tannery for the dipping and lifting of skins in and out of lime pits.

Equipping iron and steel works with telphers offers the operators great advantages. In addition to charging the furnaces with ore, coke and lime, other tasks can be accomplished. There is unloading of pig iron, coke and form-sand from railroad cars and ships, conveyance of sand to the dressing area and from there to the casting house, supply of forms and cores, transfer of cast iron to the finishing plant etc. The absence of obstacles on overhead rails lets the carriers and their freight move with little resistance and without any bumping.Ill.100 is showing a telpher carrier after discharge over the furnace funnel.

As mentioned above, there is also a choice to suspend grippers of any kind (one or two-rope grippers) for the handling of bulk materials. Such telphers can be either automaticly or remote controlled. The later is shown in Ill.98 picturing an installation with tipping-bin carriers (Magnesite Work in Veitsch, Styria).

Another gripper-telpher for the charging of a power plant is shown in Ill.101. For small and medium capacities of river barges and lighters without deck superstructures, the rail of the telpher runs along the riverbank (Ill.102). The carriage will be lowered at the correct point, the bin filled and after hoisting moves on to the coal dump or to consumption, the next carriage arrives and the same sequence is repeated. The barge does not have to be reset.

For small piece coal, which has to be discharged without dusting into chutes of travelling grate furnaces, boxes with sloped bottoms and tipping discharge openings are utilized (Ill.104).

For the best filling of a wide rectangle storage dump by a telpher line (Ill.103), a traversing loading bridge is required, which is connected by dragging gears to the stationary travelling track. When a carriage moves from a straight track into a curve and by doing so the flanges of his runners are lifted above the stationary rail, then the switch blade has to be very pointed, which results in fast destruction of its tip. For heavy-duty installation Bleichert, therefore, provides in addition to the actual switch-blade two auxiliary blades (Ill.105) on which the wheel flanges can travel up without the actual surface of the wheels touching the sensitive switch tongue.

For the coaling of gas production at steel works and similar facilities, the telpher has received great attention. Although, capacities are generally small, the telphers also have excelled in this branch of industry by providing free selection possibilities for the coal dump area and its clearly defined construction without requiring much of the oft scares surface space. Ill.107 depicts the coaling of power generator in Upper-Silesia. An unique design of a telpher is presented by Ill.106 for the loading of pig iron during removal from the foundry house of the steel works (Trzynietz) to storage or on rail cars. The distribution-bridge travels above the casting bed, the pig iron is loaded into grate-like containers, which are placed on the ground. After filling, they hook onto the carrier of the telpher, are hoisted and moved. The automatic operation of hoist and trolley are an advantage in this environment of fire-damp and dust.

Although manpower can be saved by replacing manual loading of raw materials with gripper telphers, expensive track and supports construction is required due to the heavy weight of gripper and hoists. On the one side there is overhead of wages, on the other side cost of assets from financing and depreciation. A comparison cost study based on the annual volume to be handled will always be necessary.

How the gripper buries itself into the coal is seen in Ill.108. The design of the grippers depends on the material to be lifted, especially the size of the material and its dead weight.

If the gripper is designed for work on railroad cars (Ill.109) its capacity cannot exceed 2cbm, otherwise its filling would require too much manual assistance.

The gripper telpher at the power plant in Lemberg for the conveyance of coal from cars or storage dump to the furnace house, is designed with concrete columns. They also support the track of the one end of the distribution bridge (Ill.110). With this bridge the material can be dumped for storage and picked-up again. A clear view of the gripper in the process of unloading a car is seen in Ill.112.

Ill.111 serves as an example of how a telpher can free valuable ground space for utilization as a storage area. It shows the coke dump "B" at the coke works in Hamburg-Billwaerder, left the traversing distribution-bridge, right the coke silos from which road vehicles can be loaded. Although sometimes, the heights of cupola furnace-charging has been overcome by an elevator between the lower and upper levels (Ill.113 Installation at the Hoerder Union in Dortmund), in most cases, the exacting continuous operation of the cupola furnaces requires a telpher cableway. It runs inside a long gantry bridge from the loading tracks, where the cars are filled, inclining to the charging platform (Ill.114 Steel works Trzynietz), travelling around the charging chute (Ill.115) and then return.

The cars travelling downwards are prevented from running away by the cable. The Bleichert telpher cableway for the charging of cupola furnaces in Gross-Iselde, is a design addressing a multitude of operational requirements and an unusual capacity (300mt (661 short tons)/hour). The plan (Ill.116) shows the complicated line directions of the various conveyance requirements from ore-dump, coke works and from the coke-dump to the charging platform with approx. 250 carriages. At this point, it is worthwhile noting, that the Bleichert Cableways built for charging of furnaces run straight up, if enough distance between loading and the furnaces is available (Ill.117 & 119), otherwise, however, they run in incline bridges with curve stations (Ill.118).

The mechanical and electrical requirements are extremely high for motor and operating panels of telphers. They are expected to operate under adverse conditions, often without expert maintenance, in the smallest space, being of the lightest weight. The frequent stopping and starting are exacting demands, which a regular motor could not handle. Breakdown can only be avoided by designing special motors and panel switches. Based on this experience and the substantial number of motorized carriages required by large installations, Bleichert decided in 1903 to open its own Electro Technical Department and to manufacture all equipment for its telphers themselves.

As a rule the drive motors are built for side installation, the lifting motors (for hoists and grippers) for suspension or standing. Normally all motors are equipped with an electromagnetic disc brake. Reduction of breakdowns is achieved by using ball bearings, selecting correct capacity dimensions, proper sealing of motors and by observing other relevant requirements.

The high requirements of gripper hoists, resulting from constant lifting of the full weight, need special attention. At a motor testing facility all motors are tested and also the runner gears in neutral.

In addition to the motors, Bleichert's electrical plant also produces starters, brake and emergency switches.

Many decades after Industry labored under the motto "Time is Money", nobody denied today the correctness of this saying.. Still, many factories even today are still progressing carelessly, mostly by their indecision to replace limited and expensive manpower through more efficient and economical machines.

The transportation of heavy loads by humans has always been considered slave labor. Since the beginnings of time, knowledge existed, how to use hoisting and moving equipment, in whatever form, for the lifting and conveyance of the heaviest loads. However, for small loads the wheel barrel and pulleys were void of the most elementary power drive until electricity came into being. In the beginning, just the electric motor was added to the traditional tools without changing the basic design of the lifting and conveyance device. Only at a later date, these machines were completely re-designed to lower their weight and space requirements, to facilitate operation and to increase capacity and adaptability.

In its telpher division Bleichert had the basic pre-requisits for the manufacturer of hoists and electric carts, which they designed with various improvements of their own.Ill.120 shows the compact all-weather Bleichert hoist. The round middle housing encloses the rope drum and the transmission gears (rotation sprocket gear), the motor is on one side and the emergency off-switch and starter on the other. The drums are moving in opposite direction, so do the rollers in the hook assembly, the rope attachments are on opposite sides. With this skillful piece of equipment, it is possible to double the hoisting speed and lift for loads of half the stated capacity, with a few quick adjustments. It is standard design that the cable length adjusts without the aid of auxiliary pullis.

The load ascends straight up. At the highest lift position the load switches the motor off by engaging a stop-switch. These hoists are built with suspension hooks (not an eye), or manual carrier or an electric carriage for loads from 900 to 2,500kg (1,980-5,512 lbs.), without a loose roller from 450 to 1,250 kg (990-2,756 lbs.).Instead of the hook assembly they can be equipped with a bucket, a lifting magnet or a light one- rope gripper. The completion with a seat results in a very cheap operator trolley. Needless to say, the mechanics (ball and roller bearings, central greasing, brake etc.) incorporated the latest technology in this field.

Bleichert's "Eidechse" is an electric cart, i.e. a low vehicle with four full rubber wheels whose platform (approx.1 x 2m/3 x 6') can be enlarged by rearranging the box walls. Under the carriage frame is a battery case, which feeds the motor. The loaded cart has a faster speed than going by foot. That is why the operator drives along, standing on a foot board with steering and brake at a comfortable level in front of him on a vertical board.

The above description applies also to electric carts of other manufacturers. The main feature of the Bleichert "Eidechse" is the simple and reliable steering, not by muscle power of the arm, but by the body weight of the driver, combined with extra ordinary turning capabilities, which allows the traversing of curves with an inside radius of approx. 1m (3').

The direction of the electric cart (Ill.121) to the right and left is determined by see sawing the foot -board. Therefore, for steering the driver does not have to be in a special position as required with hand and lever controls, but he has one hand available for the brake lever and the other for the speed control. At the moment the driver descends from the cart and releases the brake lever, the brake is activated and at the same time the speed control switches to zero. The operation of the electric cart is so adaptable to the natural movement of the driver that even after hours of work no exhaustion is noted.

In addition to these advantages, it must be pointed out, that the mechanics of the drive and the details of the steering are designed with the latest technology. The indexing of the batteries (two equal halves), either in sequence or side by side, results in a regulated and favorable utilization of all cells. The self-manufactured motors and electrical equipment combine the best ideas of Bleichert's telpher division. The "Eidechse" comes in two sizes, for 750 kg (1,653 lbs.) and 1,500kg (3,310 lbs.) pay-loads.

This summary of the most important achievements of Adolf Bleichert & Co. must convince any expert, that the company as manufacturer of cableways, telphers and cable cranes is not only the leader of the conveyance technology, but actually dominates this field by size and quality of 123 products. This is further evidenced by the quantity over its fifty years existence. During the first twenty five years cableways accounted for nearly half of sales in addition to only a few short range conveyors.

With nearly 4,000 cableway installations, Bleichert exceeds today by far the total combined output of all cableway manufacturers of the world. In 1899 the first cable crane was built. Increasing steadily, this side of the business grew to 500 systems. The telpher division started in 1903 developed promising, but was retarded by WWI. After the peace treaty it experienced a steady order flow, closing the fiftieth business year with 1000 units. Bucket elevators, belt conveyors, shunting installation and short range conveyors increase the total of Bleichert installations to 7000. The graph plotting this development (Ill.122) projects also for the future continuous progression..

Another fact may underline Bleichert accomplishments in the technological development of cableways, telphers, cable cranes and short distance conveyance systems: The number of domestic and overseas patents registered from 1877 to 1923.These patents total more than 600 as indicated in Ill.123. A tremendous treasure of intellectual work is contained in the inventions, to which all department of the firm have contributed.

It is obvious, that a prerequisite for the economical mash of a company of Bleichert's size, is an effective organization of the various departments. Over the decades the development of the company has been nearly exemplary. Since 1901 the immediate management of the company, an open partnership, has been in the hands of Economic Counselor Dr.Ing Max v.Bleichert for the technical and Economic Counselor Paul v. Bleichert for the administrative sector.

Max von Bleichert, born May 24, 1875, attended the Koenig-Albert-Gymnasium in Leipzig, and afterwards completed a1-1/2 long workshop training at the well -known machine factory Gebrueder Klein in Dahlbruch. It was followed by a year of military service with the Field-Artillery Regiment 12. The studies at Polytechnic Institutes in Karlsruhe and Dresden lasted from 1895 until 1899.

An informational trip through the industrial districts of France and Belgium served to complement the acquired knowledge, followed by employment at the Trenton Iron Works in USA for further training. From there M.von Bleichert was recalled due to the serious illness of his father .Max v. Bleichert is especially recognized for the development and improvement of the telphers .In 1912 he was appointed Economical Advisor to the King (of Saxon) and in1918 raised to nobility. He is also an honorary Senator of the Polytechnic Institute of Dresden, which bestowed on him in May1924 the honor of a Doctor of Engineering "in recognition of his outstanding personal contributions to the development of the Conveyance Technology, especially the cableways and telphers".

Paul von Bleichert was born on May 14, 1877. After graduation from high school in Leipzig he completed a three-year apprenticeship at the export firm H.Schuette in Bremen. Here he learned the important details of world trade. After completion of his apprenticeship Mr. Paul von Bleichert traveled in administrative functions to Columbia, Mexico and New York (Kunhardt & Co.), followed by major firms in Brussels and Paris. His military obligations he completed with the heavy cavalry in Borna. He too returned to Leipzig in 1901 to assume the administrative management. In 1911 Mr.Paul von Bleichert traveled for six month in South America to represent his company,s interests. In 1915 he was appointed Economic Counselor and in 1918 raised to nobility.

The good employment conditions at Adolf Bleichert & Co. are validated by 69 clerks and workers, who celebrated on July 1, 1924 twenty five years of employment by the firm, with another 27 deceased clerks and workers having had the same anniversary before that. Fate has willed that even the earliest employee of the company, chief installation engineer Herman Kelin, who had erected the first cableway with Adolf Bleichert, is still working in full health and is hoping to celebrate together with the firm the anniversary day.

When manufacturing started in 1881 in Gohlis, nobody could anticipate the enormous future progress, the first part of which by now is behind us as the past .The City of Leipzig expanded and in spite of acquiring many neighboring properties, it was not possible to assemble enough land to satisfy the space requirements. Workshops and administrative buildings are utilizing every inch of space (Ill.124). Already ten years earlier expansions had to be planed at other locations.

In 1912 "Neusser Eisenbau Adolf Bleichert & Co.GmbH in Neuss on Rhine, had been formed as a sister company for the manufacturer of heavy steel constructions (Ill.125), building crane structures, loading bridges, extraction towers, industrial buildings, charging platforms etc. The annual capacity is 25,000mt (55,100 short tons). Starting in 1919 to 1922 the manufacturer of heavy-duty equipment was able to expand at the new facilities in Eutritzsch (Ill.126). Built on 10ha ((25 acres), vast halls equipped with all possible machine tools, transportation systems and storage facilities were available.

Bleichert's extensive connections in all countries, resulted, partly before and after WWI, in establishing overseas subsidiaries, which under direct management of the home office could benefit from its knowledge. The first Russian cableway factory, Bleichert & Eichner G.m.b.H., was established in 1909 in Charkow. At the beginning of the war the facilities had to be closed down. The German staff and workers either escaped or were interned.

Due to the conditions prevailing in Russia at the present time, it was impossible to start-up manufacturing once more. Adolf Bleichert & Co. Seilbahnbau K.G. was founded in 1921 in Prague with the purpose to maintain Bleichert's leadership position in Czechoslovakia in spite of the economical difficulties after the war.

A day of pure joy of all attained accomplishments could be the day on which the House Bleichert can glance back to its one half century's existence. This day, however, falls into a time during which our nation has to struggle with all its remaining resources for a meager existence. The system of our economy and industry, interrupted by the unfortunate war, still has not returned to its orderly and smoothly running effectiveness. Inner exhaustion and external dangers paralyze all entrepreneurial spirit, after the revaluation of the currency squandered away all previous assets following several turbulent post war years.

The once mighty tree has been broken and cut down to the roots. Only from there, shoots can sprout and grow again to the old strength. Brooding will not be the moving power, but it will be the German innate affinity and gift for technical innovations. Our people have available only limited resources, no mines with valuable ores and no vast areas for farming or ranching. We have become an industrial nation. Technology under the guidance of proven leaders has to bring us up! Following the law of effect and counter effect, all organized work lifts and enriches men!

In its field the House of Adolf Bleichert & Co. always has been an unsurpassed example and a living inspiration and nobody can doubt that it will maintain its great prominence in the future. This represents an important part in the reconstruction of our Fatherland. Therefore, the many wishes, which surround the name Bleichert on July 1,1924 are also the hopes for our entire German nation:

Exalt Nevertheless!

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G = (Gesamtausfuehrung) Total Production
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------- *=(Deutschland) Germany*
\- - - - *=(Ausland) Overseas*

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All additions and comments in *Itallic* are by Rolf von Bleichert for further illustration and supported by the actual contents of the book

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