

AERIAL TRAMWAYS IN THE TUG RIVER COAL FIELDS.

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It is within the past three years that the use of the aerial tramway has been introduced for the purpose of carrying coal in the West Virginia and Kentucky coal fields.

In both cases, illustrated herewith, it is used to carry the coal mined on the Kentucky side of Tug River, to the railroad on the West Virginia side. The plant at Vulcan, W. Va., was first put in, and was the first adaptation of the idea to a coal-carrying process by the Leschen people. The second plant of this kind was built for the Borderland mines at Nolan, W. Va., and is similar in every respect.

The upper terminal at Vulcan is about 400 feet in elevation above the lower terminal, and the horizontal distance from saddle cap to saddle cap is a little over 1,100 feet. The empty cable is $1\frac{1}{2}$ inch, the loaded one $1\frac{3}{4}$ inch. The loaded bucket is suspended from the upper cable by a pair of trolley wheels, and is moved by the automatic attachment of the clip on the lower, or moving, cable. The trolley wheels in entering and leaving either terminal pass directly from the steel track to the standing cable at the saddle cap. The moving cable, which derives all its motion from the loaded buckets going down, passes through the terminals on sheaves, and around the ends on the large horizontal wheel. The periphery of this wheel consists of a patented anti-slip grip, through which the cable passes.

At regular intervals a clip is attached to the moving cable, whose purpose is to pick up the loaded or empty bucket at each terminal after it has been left there by the preceding clip. To regulate the strain on this clip and the moving cable, and to avoid any sudden jerking of the bucket, which would cause it to swing unduly, the A. Leschen & Sons Rope Company, of St. Louis, who manufactured the machinery for these plants, have designed an accelerating and retarding mechanism. As the bucket comes into either terminal, the pin on the clip slides between two rods and is raised, thus releasing the bucket, which stops at the proper point as it loses its own momentum. At the same instant a traveling piece is set in motion, which starts the stationary bucket out from the terminal so that when the clip has overtaken it the increase in speed is so gradual that no shock is transmitted to any part of the machinery.

Three independent bands are provided as brakes, all acting on separate circumferences attached to the axle of the large horizontal wheel, or drum, at the extremities of the moving cable line. The levers which work these brakes are all within easy reach of the operator, at the upper terminal, by whose side is a telephone connecting with the other terminal. This same operator also raises and lowers the slide at the bottom of the chute into which chute the coal is emptied from the mine cars on the tramway above, and from which the buckets are loaded.

The capacity of the buckets is 18 cubic feet (about 900 pounds), and there are 23 buckets on the entire line, which makes a complete revolution at average speed, in about ten minutes. The maximum capacity, therefore, as now equipped, is slightly over 60 tons per hour and it is generally operated so as to carry about 45 tons per hour.

To provide for the changes in the length of the standing cable, due to tension, temperature, etc., the lower end passes over a large sheave and holds suspended a weight box whose load approximates 20,000 pounds. The large horizontal wheel carrying the moving cable, at the lower terminal, is supported by a sliding carriage, to relieve any tension on the terminal machinery or cables in case of sudden stoppage. To hold the moving cable at proper tension, this sliding carriage is counterbalanced by a weight box loaded approximately to 10,000 pounds, the weight of the carriage itself being about 5,000 pounds.

The loaded bucket upon coming into the lower terminal is automatically released in the same manner as at the upper, by the retarding and accelerating mechanism, and as the preceding empty bucket passes around the end of the terminal on its return trip, it raises an engaging lever which empties the loaded bucket just coming in. In this manner the entire process may be operated by one man, at the upper terminal.

The coal, after being emptied from the bucket, passes through the tipple in the usual manner, so that by the various screens, and the three tracks, it is possible to load lump, nut, or run-of-mine.

According to dispatches from Christiania, the Ziegler Arctic expedition, under the command of Anthony Fiala, of Brooklyn, has been successfully rescued by the relief expedition under command of William S. Champ, private secretary of the late William Ziegler. The Fiala party was found in Franz Josef Land, their ship, the "America," having been lost in the ice in Teplitz Bay early in the winter of 1903-1904. The members of the expedition lived mainly on cached

stores left by the Abruzzi and André relief expeditions and their rescue appears to have been most timely. Three attempts to reach high latitude failed, though the intended scientific work was carried out successfully.

Iron Crystals and Curious Figures.

In a series of recent researches, M. Osmond, the eminent metallurgist, finds that very curious figures are formed on the surface of crystallized metals by pressing upon them with a fine point. A crystal of the metal is well polished and the point of an ordinary needle is brought down upon it. The needle is best mounted in a jointed lever. It is carefully placed against the surface of the crystal and perpendicular to it, then weights are put on the lever to press down the point. The surface is examined by the microscope in a vertical light. The figures which are formed around the point consist of groups of lines which in the case of iron are curved, but for other plastic metals of the cubic system are usually straight. The phenomena seem to be observed only with the plastic metals. He makes most of the researches upon iron, using large crystals which can be cut in different planes. The figures vary according to the plane of the section. The figures in some cases have the form of a cross with the point as a center, and are formed of streaks superposed. This happens upon the full face of the cube. In the sections the cross is imperfect, and in some cases there are three branches, in others two or only one. The figures are characteristic of the position of the sectional surface with reference to the crystalline structure, like the corrosion figures. Thus they can be made the base of a new method of research which will help in the following work: To differentiate two different bodies which have the same form of crystals. To find the crystallographic direction of an unknown section. This may have a practical value, as the fragility of iron and soft steel is connected with the position of the cleavage of the cube, and Stead's researches show that rolling of the plates may have an influence on the crystallographic position of the grains, in some conditions which are obscure at present. We also obtain a gage of the drawing of a metal, as the figures are smaller on drawn metal than on annealed metal. It is also found that a mechanical pressure or other action on a metal tends to change the character of the figures. At the breaking strain the figures almost disappear, showing that the crystalline structure is destroyed.

High-Tension 1,200-Volt Electric Railway from Grenoble to Chapareillan.

The electric railway which is now in operation from Grenoble to Chapareillan, twenty-six miles in length, is distinguished by the fact that it uses the three-wire direct-current system at a high voltage. This is one of the first electric lines in Europe where this method has been applied on a large scale. Up to the present the highest tension which has been employed for direct current tramways and electric roads is from 550 to 650 volts. This limit of tension makes it necessary to use wires of large section for conducting the current. In the lighting and power distribution lines we have the three-wire system which allows of increasing the tension and cutting down the expense of the lines. But for traction purposes, especially on long-distance lines, no application had been made of the three-wire system before the Grenoble-Chapareillan line. The Thury system is used here. The tension between the outside wires is 1,200 volts, and the middle wire is grounded by connecting to the rails. The track is of meter gage. Motor cars and trailers make up the trains, the cars having been supplied by the Ivry shops, near Paris, and the Schneider Company of Creusot, while the Thury electric equipment is used. The cars are of the ordinary tramway type and carry a motor on each axle. The motors are of the Thury four-pole 35-horse-power pattern and are coupled in series. A tension of 1,200 volts is used directly upon the motors. Controllers and resistances are placed on the roof of the cars and the driver works them by a hand wheel. The trains are usually made up of three cars and are supplied with magnetic brakes. Electric heating as well as lighting is used. At last accounts the road was in very successful operation, and this latest of M. Thury's exploits is attracting attention. There are about ten trains of thirty tons each now on the line. Current is obtained from a 1,400-foot fall at Lancey, some ten miles from Grenoble, where the hydraulic plant contains Bénézet-Négret turbines and Thury dynamos.

The Current Supplement.

The current SUPPLEMENT, No. 1546, opens with an interesting illustrated article entitled "Experiments with the Langley Aerodrome," written by Prof. Langley, of Smithsonian Institution. "The Scientific Lantern" is by the late G. M. Hopkins, and is fully illustrated. "The Motor Cycle Race for International Cup" is by the Paris correspondent of the SCIENTIFIC AMERICAN, and is profusely illustrated with interesting engravings. "Electric Power from Blast Furnaces" is a timely article upon an important subject. Dr. Henry

Draper's very valuable paper on "The Construction of a Silver Glass Telescope Fifteen and a Half Inches in Aperture, and Its Use in Celestial Photography" is concluded. There are the usual Science Notes, Engineering Notes, and Trade Notes and Recipes.

Electrical Notes.

The British Admiralty propose offering facilities to Mr. A. T. Johnson for testing his selective system of wireless telegraphy upon a practical working basis at sea. The characteristic feature of this invention is that when a message is dispatched to a certain point it is impossible for it to be received by any other than the requisite station, neither can it be intercepted or dispersed during transmission. In this device the inventor utilizes in his transmission apparatus the ordinary Ruhmkorff coil. On the base of this, however, is attached a reed disk. Armatures provided with weighted heads are fitted to this disk, and carry tuning reeds. The electric contact is made in the usual manner. The receiver comprises permanent magnets, strengthened with electro-magnets, and with an arrangement of steel reeds similar to those fixed to the transmitter, and with those on which they can be timed in unison. In transmitting a message the operation at the transmitter revolves the reed disk until the timing reed and its speaking reed are brought immediately in front of the center cone or cones of the electro-magnet. The contact pillar is then placed in connection with the speaking reed so that the vibrations thereof cause synchronous vibrations in the timing reed, which is the indicator. The vibration of this latter reed indicates to the transmitting operator that his companion at the receiver is getting the message satisfactorily, since the indicator must vibrate in unison by the law of syntonism. Experiments are being made in London with the system daily, and so far have proved successful. It would seem, however, that the great difficulty would be to obtain perfect unison in two stations situated at great distances from one another, owing to the liability of the reeds being affected by climatic and temperature conditions which are constantly varying.

The Grenoble Light and Power Company are now operating a system of current distribution throughout the region surrounding that city. The generating station, which is operated by hydraulic power, is situated at Avignonnet on the Drac River, a mountain stream which affords a large supply. The overhead lines are now furnishing current for the mines at La Mure, as well as for the towns of Voiron, St. Victor, Moirans, and others in the region. The farthest point lies at 100 miles from the hydraulic station. This distance is now to be increased as far as Annonay, and this will make the longest distance which has yet been reached in Europe for power distribution, as the total distance from Avignonnet to Annonay will give nearly 140 miles of overhead line. Another long-distance line is now in construction, and the same company is undertaking it. The line starts from the new hydraulic plant which lies at the Plombières Falls near Moutiers, and is to run to the city of Lyons at a distance of 112 miles. The current from the new plant is to be used for operating the tramway system of Lyons, which is very extensive, and is constantly increasing, both as to length and traffic. The present dynamo plant in the city is operated by steam engines, but this has now proved insufficient to meet the demands for current. The Compagnie de l'Industrie Electrique, of Geneva, is charged with the equipment of the station and lines for the new plant, which is to have four pairs of double dynamos in the Moutiers station and five corresponding sets of double motors, which will be placed in a station at Lyons. The latter station will receive the current from the overhead line and transform it into the proper current for operating the tramways. The new plant is unique in several ways. It will have one of the longest lines in Europe, as the distance of 112 miles has not yet been reached, and will be only exceeded by the Grenoble system mentioned above, when the latter is completed. One remarkable point about the Lyons system is that it is to carry out the distribution of current on the high voltage direct-current system, known as the Thury system, which attracted so much attention in the St. Maurice-Lausanne plant in Switzerland. In the present case we have 6,500 horse-power coming from a 200-foot fall. The Thury system was selected as having the greatest advantage in the present case owing to the economy in the line, which was but two small wires, and to the great distances which can be covered at a small cost. The voltage on the new line is to be higher than any which is yet employed, namely, 57,000 volts when the machines are running at their full load. With this high tension we are able to transmit 6,500 horse-power over 112 miles by using two copper wires of 9 millimeters. The line will follow the Isère valley for part of the way, and in general it passes through a mountainous region. Where it enters the city of Lyons the line is formed of two very highly insulated and armored cables, as the tension is still 50,000 volts.

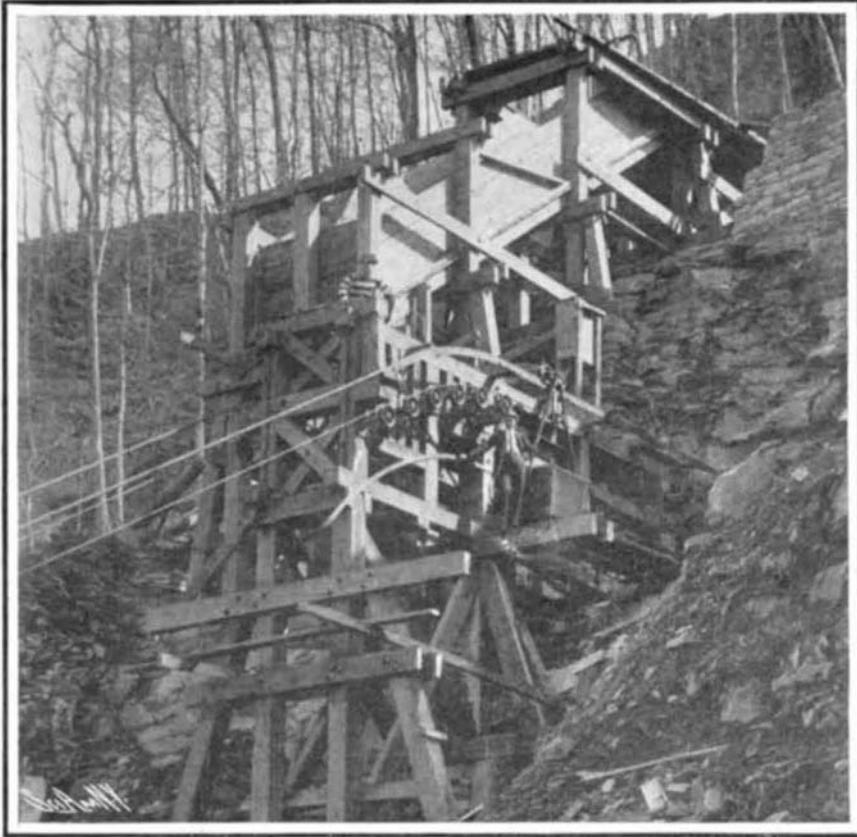
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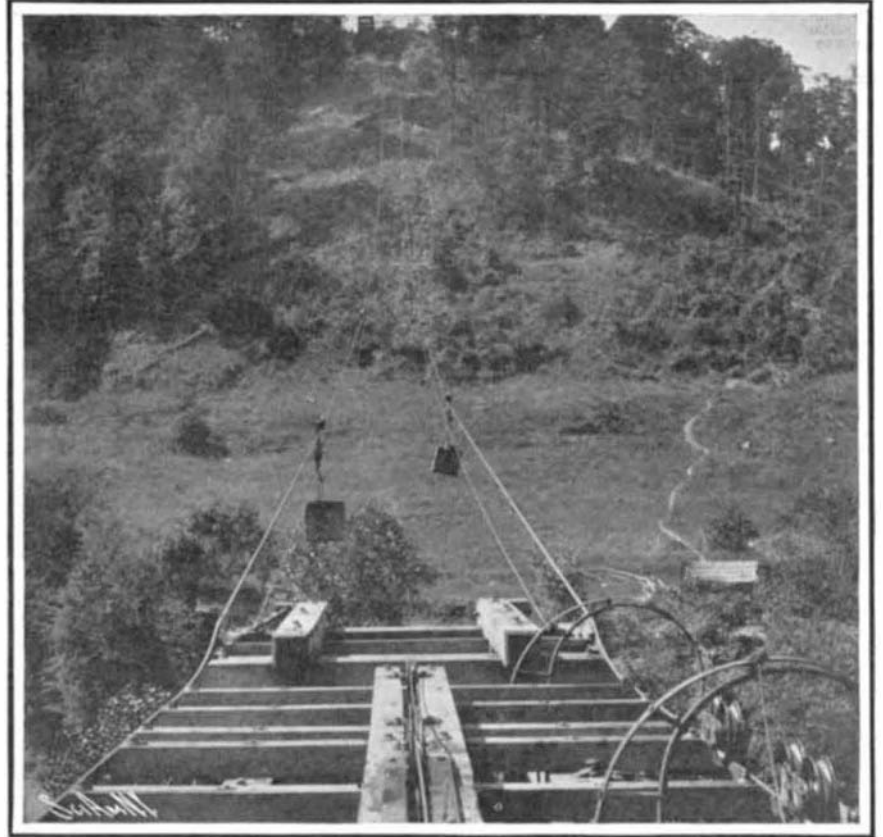
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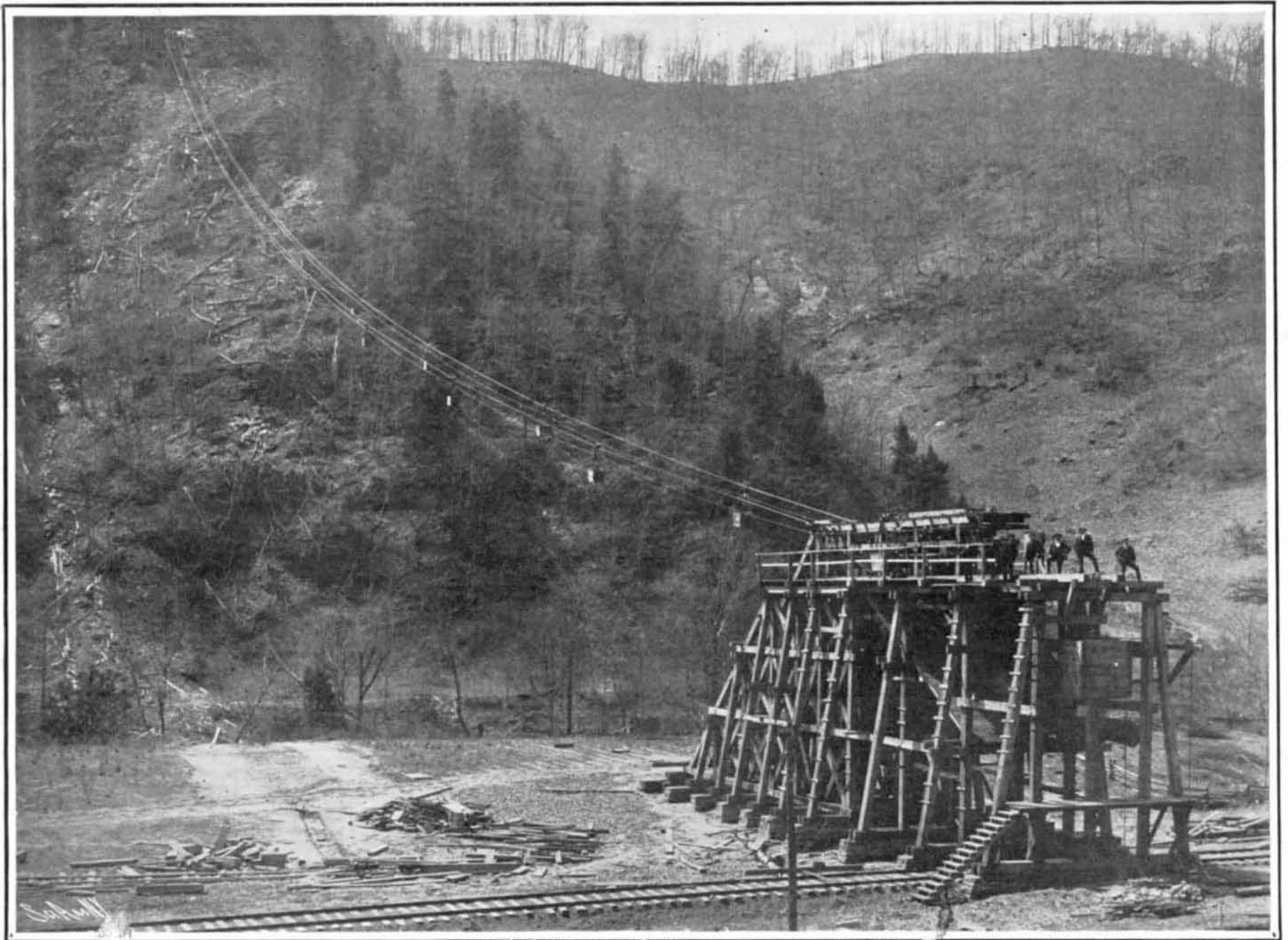
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End of Tramway from Mines and Loading Chute at Headhouse.



The Second Cableway Seen from the Top of the Lower Terminal.



The Sliding carriage, Weight Box, Screen Chutes, Buckets, and Cables in Working Condition. Since This Picture Was Taken Two Additional Tracks Have Been Laid.

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