The Jungfrau Electric Railroad.

In a paper read at the International Congress of Railroads, Paris, Messrs. Auvert and Mazen gave some interesting details regarding the Jungfrau Electric Railroad, from which we select the following facts: The construction of this road was begun at the end of 1896, after several years of study, this having been necessary owing to the importance and difficulty of the work to be executed. The line will unite the Bernese Oberland railroad system with the station of Petite Scheidegg, situated on a rocky plateau about 200 feet below the summit of the Jungfrau. An electric elevator will take the passengers from the plateau to the summit of the mountain. The distance between the terminal stations of the road is about 7½ miles and the maximum grade is 25 per cent. After a stretch of 1½ miles in the open air, the line runs in a tunnel for nearly 6 miles. The track is narrow-gage (39 inches) and is laid on iron ties; a rack and pinion system is used on account of the heavy grade, the rack being of the Strub pattern and laid between the rails; the curves have a radius of 325 feet in the open road and 650 feet in the tunnel. After an international concourse which was held in order to make a thorough study of the system, the commission appointed for the purpose decided to adopt electric traction, using the three-phase system of alternating current. The energy necessary for the trains as well as for the electric elevator and different installations is to be furnished by hydraulic plants at Lauterbrunnen and Busglauenen, using the power of the Rutschine; at the first point 2,200 horse power may be obtained, and at the second, 9,000 horse power. The first hydraulic plant was installed at Lauterbrunnen. It consists of four alternators of the Oerlikon type connected by elastic coupling to Girard turbines with horizontal shaft.

The overhead line which carries the current from Lauterbrunnen to Petite Scheidegg at 7,000 volts is of hard-drawn copper, carried on porcelain insulators. The line is fed by 12 sub-stations distributed at intervals which depend upon the grade of the road; the last sub-station supplies the electric elevator. At the sub-stations the voltage is lowered by transformers from 7,000 to 500 volts for the line; each of these stations has two Oerlikon transformers of 200 kilowatts capacity. The rolling stock of the system consists of electric locomotives, a type of passenger car with single truck and connected to the locomotive at the opposite point, ordinary cars with two axles, and freight cars. The locomotives, of which the first were built by the Swiss Company of Winterthur, and the electrical equipment furnished by Brown, Boveri & Co., have two axles and carry two tri-phase motors of 150 horse power each, working at 800 revolutions. Each of the motors operates a toothed pinion engaging in the rack. The cabins of the locomotives are entirely inclosed, owing to the low temperature which prevails at times in these regions. The locomotives carry two trolleys for each of the two overhead wires. The system of brakes has been made the object of special study, owing to the heavy grades; five different methods of braking are used. In the first, the rotating magnetic field of the motor is reversed in direction, causing the armature to stop and then rotate in the opposite direction; in the second the armature is simply put in short circuit, and as the train descends by its own weight the motors become generators and a braking action ensues. A third disposition applies a brake when the current is interrupted; this brake is formed of a steel band passing around a drum mounted on the axle of each motor and is applied by a system of powerful springs. These springs are normally held back by an iron core which plunges into a solenoid connected to the circuit of the line; a centrifugal regulator cuts the current when the speed of the locomotive passes a fixed limit, and the brake is applied; the current may be also broken by a switch when necessary. Lastly, a brake screw and levers act upon brake shoes working against a drum mounted on the shafts of the pinions and a clutch brake acts upon the rack. The passenger cars are entirely inclosed and are electrically lighted and heated. The freight cars are open and weigh when loaded about 11 tons. The elevator which is designed to convey the tourists from the plateau to the summit of the mountain is to be operated by a three-phase motor mounted directly with the cabin; this motor operates two pinions, each of which engages with a rack fixed to the sides of the elevator shaft, thus lifting the elevator; besides, two other racks will be run over by pinions which operate the automatic speed regulators. The mechanical installation of the elevators will be contained upon a platform placed underneath the cabin. The tunnel will be lighted by incandescent lamps placed at 80-foot intervals: the stations will be well lighted and heated by electric radiators taking 1½ horse power each.

The aggregate tonnage of American vessels is 5,164,839 tons, and the vessels having a tonnage of 1,565,587 navigate the Great Lakes. The aggregate tonnage ten years ago, or in 1891, was 4,684,759.

A NEW INSTRUMENT FOR THE MEASUREMENT OF HIGH TEMPERATURES.*

Up to a comparatively recent date, there had not been invented an instrument which would permit of measuring with facility and in a continuous manner temperatures of 1,000° F. and over. Among the systems in use may be mentioned the air thermometer, thermo-electric couple, the electric method with platinum resistance coil, fusible alloys, and other methods, but none of these is suitable for ordinary and continuous service. They lack the element of continuity; the apparatus are too delicate for ordinary use, they are inexact, or, on the other hand, lack the qualities necessary to assure a regular and easy manipulation. The system which is to be described has been tried for several months, and seems to be eminently fitted for measuring and registering temperatures up to the point at which platinum softens. Its principle of working is shown in the first diagram. *A* and *B* are openings made in platinum diaphragms at each end

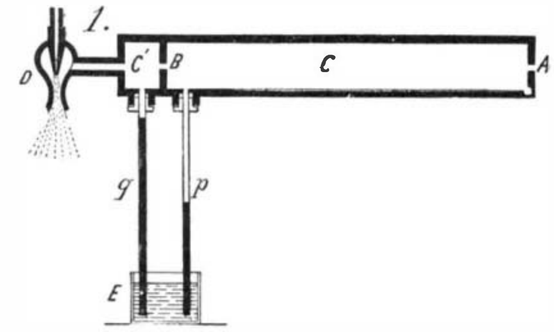

Fig. 1.—NEW PYROMETER.

of a chamber, *C*; at *D* is a steam aspirator which maintains a uniform exhaust in the chamber, *C'*, on the left of the diaphragm. Air is drawn through the diaphragm by the aspiration in *C'* and a partial vacuum is formed in the chamber, *C*, which causes air to enter it through the opening, *A*. The equilibrium is established in a few seconds, and the vacua in *C* and *C'* are measured by the water-gages, *p* and *q*. If the air arriving at *A* is kept hot, while the temperature of *B* and the vacuum in *C'* remain constant, the vacuum in *C* will be increased, and the temperature of the ingoing air will be measured by the height of the water in the gage, *p*. The apparatus constructed upon this principle is shown in the second diagram. At *B* is the aspirator, which keeps a constant vacuum

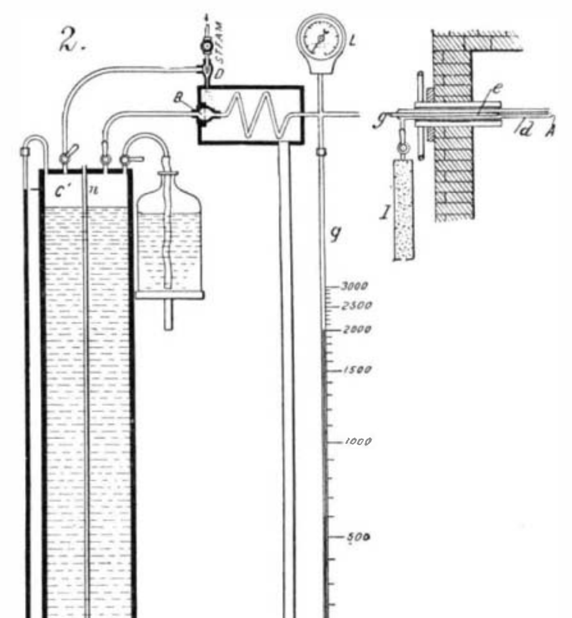

Fig. 2.—NEW PYROMETER.

in the chamber, *C'*, partly filled with water and in which plunges the tube, *n n'*. If the vacuum is greater than the water pressure, this will allow air to enter through the tube and the vacuum will be diminished. In practice a small quantity of air always passes in the tube and the vacuum is kept constant. To maintain a constant temperature of the diaphragm, *B*, the latter, as well as a portion of the air-inlet tube, is inclosed in a recipient traversed by the steam coming from the aspirator. The air arrives slowly enough to take the temperature of the steam before reaching the opening, *B*. The vacuum is measured by the water gage, *g*, and the registering vacuum gage, *L*, above. On the right of the diagram is the disposition of the apparatus in the furnace. The entering air passes first through a tube, *I*, filled with cotton, then into the platinum tube, *d*, inside the furnace, where it takes the temperature of the surrounding medium. Inside of it is a second tube, *e*, which has an opening, *A*, by which the air enters; this is connected at *g* to a copper tube leading to the apparatus on the left. The instrument is graduated by comparing it directly with a standard pyrometer, as its practical curve differs considerably from that calculated by the formula. A number of trials lasting for several months have shown that the graduation is sufficiently exact, that the indications do not vary and that the temperature at *A* is always measured by the pressure of the gage. The instrument is not appreciably affected by a change of barometric pressure, as this produces effects which tend to counterbalance each other. The advantage of an instrument which will measure high temperatures need not be insisted upon. At present, in the case of a battery of gas furnaces or water gas apparatus, the proper temperature is decided upon after experimenting for a certain time, and the men in charge are instructed to work to these points. It is impossible, however, to keep a constant heat in this manner, and it is important to have an instrument which will assure a regular working. An efficient pyrometer will undoubtedly prove of great value in many industries in which high temperatures are used.

* Extract by Paris Correspondent of Scientific American from a paper read before the International Congress of Gas Industries by Mr. Alten S. Miller, of New York.

Report of the International Hydrographic Congress.

The full report of the International Hydrographic Congress, which met at Christiania a short time ago, is now published, and it only now awaits the support of the various governments before the recommendations of the Congress are carried out. It is suggested that the explorations of the Northern Atlantic should be carried on for at least five years, and that each nation should be assigned a certain area of the ocean to study thoroughly. The conference also suggested the establishment of a permanent Hydrographic Council for the co-operative hydrographic and biological investigation of the waters, with a central bureau and international laboratory. It is estimated that the cost of maintaining this central establishment would only amount to about $25,000 annually, so that the contribution of each government would be trifling. The Congress also strongly recommended the inclusion of Iceland and the Faröe Islands in the European telegraph system as soon as possible in order to facilitate and to render more thorough the weather forecasts for long periods, and also for the purposes of the deep sea fisheries.

Preserve Your Papers.

Each issue of the Scientific American should be preserved, after having been read, by securing the same in a neat and attractive binder, which is supplied by the publishers. It will prevent papers from being mislaid, and at the end of the half year the numbers will be in perfect order to send to a book-binder, and all of the numbers of six months will be available for reference at any time. Binders for both the Scientific American and Scientific American Supplement are provided. They are covered with cloth and the names of the periodicals are stamped in gilt on the sides. One binder will last many years, and if the subscriber does not wish to bind the numbers permanently, he can fasten them together by cord through the holes which have been punched after removing from the binder. This affords an inexpensive and satisfactory way of keeping volumes that are not to be referred to frequently. The binder for either publication is mailed on receipt of $1.50.

The Current Supplement.

The current Supplement, No. 1331, has many articles of unusual interest. "The Excavations of Timgad" is accompanied by several illustrations showing the important archæological discoveries which have recently been made. "Protection of Ferric Structures" by M. P. Wood is concluded in this issue. "A Remarkable Railway Crossing" shows a point where 1,135 trains pass daily at Newcastle, England. "Progress of Photography" by George G. Rockwood is concluded. The present installment deals with the reproductions of paintings, photographs in natural colors, instantaneous photography, photography for war purposes, photography as legal evidence, etc. "Electrolysis of Water in Gas Pipes" is by W. W. Brigden. "Milk Contamination and How Best to Prevent It" is by Dr. D. S. Hanson.

Contents.

(Illustrated articles are marked with an asterisk.)