these turbines, which are perforated, and the syrup passes through the holes, while the sugar remains behind. This sugar is cooled, and is called sugar No. 1. The syrup is boiled over again so as to obtain a second sugar called No. 2, and by a similar process a sugar No. 3 is obtained. The time of crystallisation, however, increases greatly, and for syrup No. 3 it is as much as six months. The final residue is molasses, which contains a large proportion of sugar that cannot be reduced by boiling. It is sold to make alcohol, or subjected to osmosis, by which the salts contained are drawn off and replaced by water; the sugar is then revivified and rendered capable of being crystalised. The paper concluded by giving careful analyses of the juice and of the products in all the stages of manufacture.

The next paper read was "On the Application of Electricity to the Working of Coal-Mines," by Mr. A. C. Bagot. The writer described a system of electric signals replacing the old system of signalling from the bottom to the top of the shaft by a gong worked by means of a wire. Galvanised iron telegraph wire was found to form the best communication, and the most suitable batteries to be 12-cell Leclanché. The system used for signalling in underground haulage planes, which are frequently the scene of accidents, was also described. Electricity had also been applied to signal the indications of an anemometer placed in the return air-way up to the engine-room at the surface. By an arrangement of clockwork and revolving tape, the engineer obtains an automatic and continuous record of the speed of the main air current at any part of the mine. Lastly the telephone might be applied with advantage for hearing the action of the pump-valves in the pumping shaft, without having to send the sinkers down.

Electricity may, however, be brought to bear for other purposes in mines, such as illumination and transmission of power. For lighting the pit bank, powerful arc lamps are found very serviceable, and the ordinary staff of a colliery, after a week's instruction, is capable of maintaining the appliances in operation. Alternating high-tension machines are very unadvisable on account of the likelihood of accident, and the Edison low-tension machine is said to be the best that can be used. At Risca Colliery a cable is taken down the pit from a dynamo at the surface, and is connected with a series of Crompton incandescent lamps at the bottom. These give an excellent light, and greatly facilitate the work of the men about the bottom of the shaft. But Mr. Bagot's opinion is strongly against the use of electric lamps in the working stalls and faces; partly because such lamps do not, like safety-lamps, indicate the approach of gas, partly because the line-wires may easily be broken, and partly because the hewer requires to be constantly shifting his light. With regard to the transmission of power by an electric tramway, as now in use at Zankerode, the writer holds that small locomotives worked by steam or compressed air are at present far more economical; so that the question of electric haulage need not in his opinion be considered at present.

These latter opinions did not pass without challenge. M. Tresca, who was present, pointed out that there was another form of electric transmission, viz. by a fixed cable with a dynamo at each end. Where work had to be done at some special part of a colliery, especially on an emergency, he believed that this would be found a handy and economical system. At the mines of La Perronière power was thus conveyed to a distance of 500 metres, and with a useful effect of about 30 per cent. This, in spite of over-bold statements to the contrary, was about the utmost which at present could be obtained in practice. The various sources of loss in such transmission were enumerated as follows:—First getting up the speed from that of the motor engine to that of the generator; secondly, loss within the generator itself; thirdly, loss in transmission along the cable; fourthly, loss within the receiver; fifthly, loss in slowing down the speed of the receiver to that of the main shaft. These defects were all now fully recognised, and might gradually, he hoped, be overcome. With regard to the amount of power which could thus be transmitted, the well-known experiments of M. Deprez showed 5 to 6 h.p. But within the last week he had succeeded in transmitting 31 h.p. from a Gramme machine to a great distance. The facility of installation was a great advantage in this system of transmission. It was far superior to that by an electric locomotive, as to which at present he had little to say; but on the whole he was more firm than ever in the view that a negative conclusion with regard to the electrical transmission of power was at any rate premature.

The next paper was by Mr. Webb, of Crewe, upon "Compound Locomotive Engines." It described the system devised by him, and now carried out in several engines running upon the London and North-Western Railway.

The last paper read at Liége was on the St. Gothard Railway, by Herr Wendelstein of Lucerne. This paper gave an interesting description of the works of the railway, and of the Brandt hydraulic drill, which was used with great success for one of the spiral tunnels. It then passed on to the question of ventilation, which was very fully gone into. Tables were given of the temperature in the great tunnel during and after construction, together with an account of the observations made on the ventilation both of that tunnel and of the spiral tunnels. The subject is as interesting from a scientific as it is important from a practical point of view, the result being that artificial measures of ventilation, the necessity for which was fully discussed, are found to be wholly needless. We regret that space does not allow us to reproduce this part of the paper.

During a subsequent visit of the Institution to Antwerp, a paper was read by M. Royers, describing the great harbour works which are now being constructed at that city, especially the long quay wall which is being built far out in the river by a special system of floating cofferdam designed by Mr. Hersent. In addition to these papers a large number of notices of the various works to be visited, &c., had been prepared and were distributed at the meeting. We understand that copies of any of these, or of the papers above mentioned, may be obtained on application to the Secretary, 10, Victoria Chambers, Westminster, S.W.

GEOGRAPHICAL NOTES

IN the *Transactions of the Berlin Geographical Society* (May-June) is an interesting paper by Herr Arthur Krause on Southeastern Alaska, or that strip of coast stretching from Mount Elias to Fort Simpson, comprehending about 120 miles breadth of continent, and the numerous islands lying alongside of it. Herr A. Krause passed the winter of 1882 with his brother at a factory to the north of the Lynn Canal, making short tours the following spring into the interior, as far as the Yukon district, and Herr Krause's paper is the result of his observations. The lower course of the Yukon River, as far as Fort Yukon, has been traced and astronomically observed by Raymond in his "Reconnaissance of the Yukon River, 1871." Its upper course and sources, on the other hand, have only seldom been visited by people of the Hudson's Bay Company and by gold seekers. The most important head stream is the Polly River, which springs from France's Lake on the west of the Rocky Mountains. From the south the Polly receives a powerful current, figuring in certain maps as the Lewis River. A northern offshoot of the Lynn channel cuts so deeply into the interior that in two short days' marches you can pass thence to the Yukon river. To the north of the Lynn Channel is the varied district of Chileat, forming the watershed between the coast and the Yukon river, and parting two distinct zones of flora and fauna. The Chileat district, like the whole of the west coast, is mountainous, and its peaks condensing the vapour driven by western winds from the warmer region of the sea, the whole western tract is distinguished by its violent falls of rain in summer and snow in winter, as also by its abundance of glaciers. Glacier Bay, to the west of the entrance of the Lynn Channel, is quite filled with ice in consequence of vast glaciers falling into it. All the valleys, too, along the coast abound in glaciers. As soon, however, as the watershed and the slope towards Yukon river are reached, the glaciers disappear. With this change also appears a corresponding change in vegetable and animal forms. The low banks and islands along the coast are covered with poplars, alders, willows, and thickets. Higher up on the slopes you meet a thick belt of pine. A few green trees of diminutive size, birch, maple, and mountain ash, may be observed, but these are mostly interwoven in the enormous thick underwoods of the pine forests. In some lower-lying spots an almost tropical luxuriance of vegetation surprises the traveller. On the inland side of the watershed the whole physiognomy of vegetation is in striking contrast with that on the sea side—is barer, drier, and lighter. Instructive particulars are also given by Herr Krause regarding the fur and fishing trades of this region.

IN the *Bulletin of the Italian Geographical Society* for July is a paper giving a historic survey of the Harar district, Somaliland, by the Rev. P. Taurin Cahague. Great interest attaches to this place since Frederick Müller has shown that it forms a distinct ethnologic enclave allied to

the Semitic group of Abyssinia in the midst of the Hamitic populations of Somaliland. The town of Harar itself was never the capital of an independent kingdom, as has been wrongly stated by many writers, but simply a large emporium and station of great importance between the old Abyssinian empire and Massawa on the Gulf of Aden. Some years ago it was attached to the possessions of the Khedive, but on the withdrawal of the Egyptian troops the district was overrun by the fierce Oromo (Galla) people, who exterminated most of the old Amharic (Abyssinian) population.—In the same number is an editorial note, with illustration, on a human foot incised by the Bushmen of South Africa on a stone, which has been presented by Dr. Holub to the Society, and is now deposited in the Royal Prehistoric Museum, Rome.

THE general census of Japan, taken on the first day of the present year, gives the total population of the country at 36,700,110, made up of 18,598,998 males, and 18,101,112 females. The population of the larger towns is given as follows:—Osaka, 1,772,333; Hiogo, 1,418,521; Nagasaki, 1,204,629; Tokio, 987,887; Kioto, 835,215. To avoid erroneous conclusions it may be well to state that the figures here given are not the populations of the towns and cities mentioned, but of the administrative districts, locally known as *fu* or *ken*, bearing these names. In some instances, *e.g.* Hiogo and Nagasaki, these districts are as large as a medium-sized English county, and in all cases they include the towns and villages for several (from ten to thirty) miles around. Thus these statistics can by no means be accepted as data for the respective sizes of the towns. These would run, we believe, as follows: Tokio, Osaka, Kioto, Nagasaki, Hiogo; the two latter being smaller than probably a dozen other Japanese towns which might be mentioned—Nagoya, Sendai, Niigata, Kagoshima, Shimonoseki, &c. Statisticians should therefore receive these figures with the explanation here given.

AMONG the papers in parts 3 and 4 of the *Verhandlungen der Gesellschaft für Erdkunde zu Berlin* for the current year, we find one by Dr. Schwarz on Montenegro, the land and people; another by Dr. Uhle of Dresden on the divinity *Batara Guru* of the Malays; and also some geographical sketches of Portugal by Herr Müller-Beeck.

SOCIETIES AND ACADEMIES

PARIS

Academy of Sciences, July 30.—M. Blanchard, president, n the chair.—Active or dynamic resistance of solids. Graphic representation of the laws of longitudinal thrust applied to one end of a prismatic rod, the other end of which is fixed (continued), by MM. de Saint-Venant and Flamant.—Experiments on the reproduction of albite (white shorl) in an aqueous medium, by MM. C. Freidel and Ed. Sarasin. From a composition of silicate of soda and albite (Na_2O, Al_2O_3, $6SiO_2$) in a temperature ranging from 432° to 517° C., abundant precipitates of albite were obtained in the form of minute particles, which appeared as fine needle-points and short thick crystals with facets distinctly visible under the microscope. Steel and platinum vessels strong enough to resist this high temperature were specially constructed by MM. Golaz, père et fils.—Separation of gallium (continued). Separation from vanadium, by M. Lecoq de Boisbaudran.—Experimental researches on the action of a liquid introduced by a special process into the tissues of the vine for the purpose of destroying phylloxera (continued), by M. P. de Lafitte.—Capacity of various soils for retaining water under conditions suitable for viticulture, by M. P. Pichard. Appended is a comparative table showing the various degrees of resistance offered to the infiltration of water by siliceous, argillaceous, calcareous, and other soils in the south-east of France.—On the integration of a certain class of partial differential equations of the second order with two independent variants, by M. A. Picart.—On the critical temperature and critical pressure of oxygen, by M. S. Wroblewsky. The critical point is approximately determined at −113° C.—A determination of the inward inert resistance of any electric system, independently of the disturbing action of ts interior electromotor forces, whose number, seat, and size remain unknown quantities, by M. G. Cabanellas.—On the visibility of the ultra-violet rays, by M. J. L. Soret.—A silicophosphate of crystallised lime obtained by liberating phosphorus in the process of iron-smelting, by MM. Ad. Carnot and Richard.—On the artificial production of rhodonite (silicate of manganese) and tephroite, by M. Alex. Gorgeu. A new and easy method is explained for producing these two natural crystallised silicates of manganese based on the reciprocal action of silicium and the red chloride of manganese in aqueous vapour.—On the "chloride of menthylum" obtained by Oppenheim from menthol by the action of a concentrated solution of chlorhydric acid, by M. G. Arth.—Experiments on poisoning by the oxide of carbon, with a view to ascertain whether this gas passes from the mother to the fœtus, by MM. Gréhant and Quinquaud. The authors, who experimented on bitches, arrived at an opposite conclusion from Andreas Hogyes of Klausenburg, who experimented on rabbits, and who concluded that the fœtus remained unaffected by the poison which was fatal to the mother.—On the open epithelium ("cellule epithéliale fenêtrée") of the closed follicules of the intestine of the rabbit, and its temporary stomata, by M. J. Renaut.—Researches on the structure of the constituent parts of the vent in Cephalopods, by M. P. Girod.—Observations and experiments on the circulation of the sap in plants under the tropics, by M. V. Marcano. From the experiments carried on at Caracas, Venezuela (10° 30′ 50″ N. lat.), the author considers that in intertropical vegetation the cycle of circulation is completed within a period of twenty-four hours, presenting two *maxima* of relative fixity, and that the inner pressure of the sap is inferior to that of the atmosphere during the dry but far greater during the rainy season, a phenomenon attributed mainly to the water directly absorbed by the leaves.—On the differentiation and anatomic variations of the branches of forest and fruit-bearing trees, and some other plants, by M. Laborie.—On the action of silica on the growth of maize, by M. V. Jodin.—On the alterations produced by age on wheat-flour preserved in bins and sacks, by M. Balland.—Experiments on evaporation made at Arles during the years 1876-82, by M. A. Salles. In his remarks on this paper, M. Lalanne dwells on the great importance of the subject in connection with the projected inland sea towards the southern frontier of Tunis.—Observations on Part IV. of M. de Koninck's work on the carboniferous fauna of Belgium, by M. Hébert.

CONTENTS