

	Content of nitrogen	Price per ton		
	Per cent.	£	s.	d.
Sulphate of ammonia from gasworks...	19.75	13	0	0
Nitrate of soda from Chile	15.50	9	15	0
Nitrate of lime made by electricity ...	12.75	8	10	0
Calcium cyanamide made by electricity	18.00	10	0	0

The Rjukanfos Installation.

The Rjukan installation is situated in Vestfjordalen. The saltpetre factories are situated at Saaheim, and the hydro-electric power-plant on the Maane River, half a kilometre away. The power installation utilises part of the well-known "Rjukanfos," and has a working head of some 274 metres and a discharge of water of 47 cubic metres per second. The total power plant in the generating station is about 140,000 horse-power, divided into ten units, each of 14,450 horse-power. Each unit is, however, capable of producing 16,500 horse-power, and they are thus the largest hydro-electric units which have yet been constructed.

In the factory most of the furnaces are of the Schonherr construction, Fig. 3 (Badische Anilin und Soda Fabrik), each of 1000 kw. They are 23 ft. long, and require 40,000 cubic feet of air per hour. The other furnaces are of Birkeland-Eyde's construction, similar to those at Notodden (Fig. 1), but of 3000 kw. each.

The annual production will amount to 70,000 tons of nitrate of lime and 8000 tons of nitrite.

Mr. Sam Eyde wrote on February 10 last:—"The results now at hand from the trial management are not sufficient to entitle us to judge which of the two systems—the Badische or the Birkeland-Eyde system—is the most profitable one. For the present it may be declared that the proceeds by both systems very likely will turn out to be approximately the same.

"A second power-plant is now under construction at Rjukan, intended for the installation of some 120,000 horse-power, which will likewise be used for the manufacture of nitrate of lime.

"Our company is further constructing a third power installation, Vamma on the Glommen River, by which will be produced 70,000 horse-power, of which 50,000 horse-power will be utilised for the manufacture of nitrate of lime. Including the factory at Notodden, we will thus in a short time utilise in all 370,000 horse-power for the manufacture of nitrate of lime."

The present plant consists of ten generator turbines of 14,450 horse-power each, five of which were constructed by J. M. Voith, of Heidenheim, five by Escher Wyss and Co., of Zurich, and one exciter turbine of 1000 horse-power by Kräerner Brug, of Christiania. The three-phase electrical generators were made by the Allmänna Svenska, of Västerås, Sweden, and by Brown, Boveri and Co., of Baden.

The turbines are fed by individual pipe-lines of 1250 mm. inside diameter at the top end and 1000 mm. inside diameter at the bottom end. The length of each pipe is 720 metres (2360 ft.); the upper 300 metres consist of riveted pipes, and the longer lower part for higher pressure consists of welded pipes.

The turbines are provided with twin Pelton wheels, each of which is driven by two nozzles. In the Escher Wyss turbine the lower jet does not strike the buckets until the latter have cleared the upper jet.

The maximum increase of speed was 15 per cent., whilst the increase of pressure above static head did not exceed 10 per cent.

The Escher Wyss turbines are each coupled to

three-phase generators made by Brown, Boveri and Co., of Baden.

At a power factor of 0.6 each machine gives 17,000 Kva. at 11,000 volts, fifty periods per second. One of the machines gives the whole of the 17,000 Kva.

Four of the units are of the double-generator type, with a shaft common to the two. The two armatures are separated by a fireproof partition, so that if a coil of one should be burnt out, the coils on the other machine are not affected.

Allowing for windage and friction, the guaranteed efficiency is 94.8 per cent. for the double generator and 95.3 per cent. for the single generator. This is at full load and with a power factor of 0.6.

The total weight of one generator is 205,000 kg. (200 tons); 92,000 kg. going to the rotating field and shaft. The armature weighs about 90,000 kg.

The outside diameter of the armature is 6 metres and the inside diameter is 4.4 metres. The radial depth of the armature lamination structure is 215 cm.

The magnet wheel has a cast-steel hub and arms, and the periphery of the wheel is made up of solid forged steel rings. To these rings cast-steel poles are fixed, the inner ends of the poles being dovetailed and held by cotters.

The field poles are wound with bare annealed copper on edge, and all the pole windings are in series.

The slip rings are of cast steel, and carbon brushes are used. The exciter is direct coupled, and gives 130 kw. at 220 volts.

Every rotor was tested for mechanical strength by being rotated at 1.8 times the normal speed for half an hour, that is, at 450 revolutions per minute.

The bearings are supplied with oil under pressure, and the oil is cooled by water coils.

The other five turbines supplied by J. M. Voith are very similar to the above, with double-runner wheels and two nozzles to each runner. At the official tests all the guarantees were exceeded. Coupled to each of the Voith turbines is a double 8400 Kva., 11,000 volts, 50 cycle three-phase generator made by the Allmänna Svenska Co.

(To be continued.)

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Dr. H. K. Anderson, F.R.S., has been elected to the mastership of Gonville and Caius College, in succession to the late Rev. E. S. Roberts.

THE University of Manchester on June 29 conferred honorary degrees of Doctor of Science upon Prof. D. H. Scott, F.R.S., and Mr. Dugald Clerk, F.R.S. On the same day the University of Durham conferred honorary degrees of Doctor of Science upon Prof. P. C. Ray, of the University of Calcutta, and Prof. L. P. Anderson Stuart, of the University of Sydney, delegates attending the Congress of the Universities of the Empire, which is being held this week.

THE May issue of this year of the Johns Hopkins University Circular takes the form of the "University Register" for 1911-12. The historical statement with which the volume of 267 pages opens points out that the original endowment of the University amounted to rather more than 600,000l., which has since been supplemented by several large gifts. The income-bearing funds now have a "book value" of 916,000l. The real estate and buildings, books, scientific apparatus, and general equipment are valued at 380,000l. The assets of the University have thus a total value of something like 1,300,000l. By the act of the Legislature of Maryland, at its session of this year, the

sum of 120,000*l.* was granted for the purpose of constructing and equipping buildings for a school of technology as a department of the University, and an annual grant of 10,000*l.* was added for maintenance. It is expected that the preliminary engineering courses will be inaugurated at the beginning of next session.

THE friends of the late Miss Rosa Morison (lady superintendent of women students at University College, London, 1883-1912) desire to raise a memorial as a tribute of the affection and respect in which they held her and as a means of commemorating her work in connection with the higher education of women. To give effect to this desire, some of those associated with Miss Morison in her work at University College, Queen's College, and College Hall, Byng Place, together with some of her personal friends, have formed a committee, the president of which is Lord Reay; chairman, Dr. T. Gregory Foster; hon. treasurer, Lady Lockyer; hon. secretaries, Miss E. Chick and Miss E. Goodyear. The precise form of the memorial will be left for decision until the funds are raised. The hon. secretaries invite those who wish to take part in this memorial to communicate with them forthwith: address, Rosa Morison Memorial Committee, University College, London (Gower Street, W.C.).

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, June 14.—Prof. A. Schuster, F.R.S., president, in the chair.—T. H. **Blakesley**: Demonstration of the use of specific gravity balls for determining very small differences of density. Experiments were quoted which indicate a sensibility such that the error which might be expected in a properly conducted experiment would be of the order 5 in the sixth decimal place. Specific gravity balls have been employed for the purpose of discriminating between the qualities of potable waters in respect of density and of testing the efficacy of softening processes. A thermometer of open scale is employed to give the temperature at which a specific gravity ball is in equilibrium with a liquid being slowly warmed or cooled through that point of temperature. If such a determination is made in distilled water at ordinary atmospheric temperatures it fixes the specific gravity of the ball at the temperature of equilibrium within four or five units in the sixth place of decimals. If a second observation with the same ball is made in a slightly heavier liquid, the temperature of equilibrium will be considerably higher, perhaps 2° or more, than in distilled water. By applying the coefficient of cubical expansion the density of the ball at the higher temperature can be obtained, and this is the density of the second specimen of water at the second temperature. Reference to a table of densities of distilled water will furnish its density at the higher temperature, and the difference between the two numbers will give what the author calls the density excess of the second liquid over distilled water at the higher of the two temperatures. This density excess is best quoted in parts in one million.—Dr. H. F. **Haworth**: Maximum sensibility of a Duddell vibration galvanometer. The maximum sensibility of a moving coil vibration galvanometer as a voltage detector is obtained when the flux through it is so adjusted that the back E.M.F. of the coil is equal to its CR drop; then the back E.M.F. is equal to half the applied voltage, and the current is equal to $V/2R$, and is in phase with the applied voltage. Increases of current sensibility of about 30 per cent. at 200~ and 40 per cent. at 1000~ were obtained on running the instrument in a vacuum, thus showing that a large part

of the mechanical work produced was used in overcoming the molecular friction of the system.—F. **Stroude**: An accurate examination of the Steinmetz index for transformer iron, stalloy, and cast-iron. Experiments to provide an experimental basis, suitable for mathematical analysis, with the view of discovering some relation connecting hysteresis loss and flux density which will accord with results obtained practically to a greater extent than the empirical law due to Steinmetz. Experiments were made with transformer iron stalloy (3 per cent. silicon iron) and cast-iron, two rings of each material being tested. A set of comparative tests on one of the transformer iron rings was made by the ballistic method, and these tests show that, in general, for a given value of **B** the hysteresis loss and the value of **H** for the ballistic tests are higher than the corresponding values for the slow cyclic tests.

Royal Meteorological Society, June 19.—Dr. H. N. Dickson, president, in the chair.—Dr. G. C. **Simpson**: Coronæ and iridescent clouds. During September, 1911, the author was one of a party led by Captain Scott to survey McMurdo Sound, and on September 24, while enveloped in fog, he observed a fine fog-bow. It was opposite the sun, and a measurement of the radius with a theodolite gave 38°. The bow was practically white, but a reddish tinge could be seen on the outer side. As the fog dissipated the upper sky became clearer, and the sun shone over the top of a heavy bank of fog. For some minutes the sun had a brilliant corona with bright colours, and the diameter of this corona seemed unusually large, but there was no opportunity to make a measurement. As the fog still further cleared away glimpses of the corona appeared again, and the fog under the sun became fairly brilliantly illuminated with iridescent colours, which did not appear to be part of the corona, but in places blended into it. During the whole period the temperature was between -15° and -21° F. The fur of the sleeping bags and the wool of sweaters became covered with hoarfrost. These observations show that water can exist in the atmosphere at much lower temperatures than has generally been supposed by meteorologists. It is now generally admitted that while halos are caused by the refraction and reflection of ice crystals, coronæ are due to diffraction effects of either small drops of water or thin ice needles. From certain observations made in the Antarctic, Dr. Simpson was led to doubt the possibility of ice crystals ever forming diffraction effects. This is an important question for meteorology, for if it is true, we have a powerful instrument for determining the constitution of a cloud; if there is a corona the cloud must be composed of water, while if there is a halo it must be composed of ice.—W. W. **Bryant**: The adoption of a climatological day. When observations are made only once a day, viz. at 9 a.m., it is the practice to enter the reading of the maximum thermometer to the previous day, and the reading of the minimum thermometer to the current day. Mr. Bryant does not consider that these give correct results, but that they are higher than if the readings were taken at 9 p.m. or midnight and applied to the civil day.

Royal Microscopical Society, June 19.—Mr. H. G. Plimmer, F.R.S., president, in the chair.—Lord **Avebury**: Short account of the development of pollen and of recent researches on fertilisation. The author divided pollen into: aerial pollen carried by the wind, aerial pollen carried by insects, and subaqueous pollen. The various forms of pollen were described and their distribution in the different orders enumerated. The most common form of pollen is elliptical, with three ribs, for which Lord Avebury believes there is as yet