Scottish Antarctic Expedition, was read at Cape Town. Two new buntings, a rich marine fauna, and three new species of plants were obtained. The desirability of further exploration from South Africa was pointed out. In the course of the discussion it was suggested that a meteorological station on Gough Island might be of use to South African weather services. Mr. Yule Oldham gave a summary of the history of the discovery of the coasts of Africa, illustrated by an admirable selection of lantern slides of contemporary maps, showing the various stages in the progress of discovery. The proceedings at Johannesburg were opened by Mr. Douglas W. Freshfield, who described the Sikhim Himalayas, and the route followed by our troops towards Lhasa; this was the only other record of travel. Mr. Freshfield delivered one of the evening lectures at Durban, choosing for his subject "Mountains."

Some interesting discussions took place on questions of physical geography at a joint meeting with the geological section, an account of which will shortly be published. At Johannesburg, Prof. Davis, of Harvard, communicated a paper on the geographical cycle in arid areas—a deductive essay based on observed facts. Starting from suggestions in Prof. Passarge's great work on the Kalahari Desert, he traced the probable sequence of land forms in an elevated and arid region rarely subjected to water erosion, illustrating his remarks by admirable blackboard sketches. He pointed out that, starting with a rough, uneven land, the occasional water erosion would not be related to sea-level, and at an early stage the depressed areas would be slowly filled up, forming lakes of rock waste. In course of time, the slopes would be so worn down and adjacent basins so filled that one communicated with its neighbour. Ultimately a large "integrated" basin would be formed; wind action would increase with smoothness, and might even transport waste outside arid area. This would waste the whole surface and reduce it to a common level, and wearing away by wind might even lower the surface below sea-level. It was suggested that wind erosion might explain the pans of the Transvaal, the origin of which had occasioned considerable speculation.

Two papers were of special interest to teachers of geography. Captain Ettrick W. Creak, F.R.S., vice-president of the section, maintained that the use of globes was essential in teaching geography, and that systematic lessons should be given with globes.

Mr. J. Lomas showed how excursions could be used in teaching geography, and illustrated his points by views taken on some excursions which he had conducted.

The committee of the section asked for the re-appointment of the committees on researches in the Indian Ocean, and on the local names given to geological and topographical features in different parts of the British Isles. They, along with sections B, C, and E, asked for the appointment of a committee to report on the quantity and composition of rainfall and the discharge of lakes and rivers in different parts of the globe.

The whole journey from England to the Victoria Falls and back may be regarded as the longest, most interesting, and most profitable geographical excursion ever made by the section. This has been described in NATURE by another pen, and so need not be recapitulated here. In South Africa the most elaborate special excursions were those arranged by the geologists, and the long trek from Pretoria to Mafeking. These permitted members to see the country more intimately than was possible from the train. The thanks of those geographers who were allowed to take part in these must be recorded.

Since the above was written, the sad news has come that the president of the section, Admiral Sir William Wharton, died at Cape Town on Thursday, September 28, after a short illness. The value of the proceedings in this section was greatly increased by his intimate knowledge of many parts of the world, by his keen interest in all geographical problems, and by the genial way in which he induced those present to take part in the discussions. An account of his career was given in NATURE of October 12 (p. 586), but the writer may be permitted to say how very much the success of the meetings of the geographical section was due to the president, whose loss will be deeply deplored by all who were privileged to come in contact with him.

THE CHELSEA POWER STATION.[1]

THE development of electric traction as applied to railways in Great Britain is about to make one more step forward with the electrification of the underground railways in London, and as this scheme is almost complete, a short description of the power scheme may be of interest.

In most large power schemes that have been completed during the last few years, it has not always been convenient to place the main power station near the centre of the system of power distribution, owing to cost of ground, &c., but this difficulty is got over by employing a number of small distributing stations which are conveniently situated in the area of supply, and are supplied with power from a large main generating station.

The main generating station of the underground electric railway will supply the entire power necessary for the working of the Inner Circle, which it is working in conjunction with the Metropolitan Railway Company's station at Neasden, and for the whole of the District Railway. It will also furnish power to the Baker Street and Waterloo, and the Great Northern, Piccadilly, and Brompton tube railways on their completion.

Coal for the boilers' furnaces is lifted out of barges by two large cranes, each working a 27-cwt. grab bucket, which deposits it in a holder where it is automatically weighed. From the holders the coal is carried by means of automatic conveyors to the coal bunkers, which are situated in the top of the boiler house immediately over the boilers. The coal falls from these through chutes to automatic stokers as required, and as the ash accumulates beneath the boiler furnaces it is removed by means of an ash railway. Thus the handling of the coal is almost wholly automatic from the moment the coal leaves the barges until it is returned to the barges as ash.

The boiler house consists of a basement and two floors, and is 450 feet long by 100 feet wide. In the basement there are eight pumps for pumping the water into the boilers. The boilers are on two floors, each containing thirty-two boilers, with floor space available for eight more boilers on each floor should they be required. They are divided into groups of eight, and each group supplies steam direct to the steam turbine engine to which it is permanently connected. Each group is fitted with economisers for heating the water before it is pumped into the boilers.

The main engine-room is 75 feet wide by 450 feet long, and consists of a basement and one floor.

The eight horizontal steam turbine engines are each coupled direct to a three-phase alternating current generator, and it seems hardly conceivable that each one of these sets is capable of transforming the heat energy of the coal into electrical energy equivalent to 7500 horse-power, while the total output of the station is 76,000 horse-power. The electrical generators are of the fixed armature type, having a four-pole revolving field, and generate at a pressure of 11,000 volts. A system of forced lubrication is employed on the turbines, thus ensuring efficient lubrication.

In addition to the above, there are four high-speed engines of 175 horse-power connected to generators which supply the magnetising current for the revolving fields. The condensing system for condensing the steam after it has performed its useful functions in the engines is very ingenious, and is so arranged that the pumps for pumping the cooling water through the condensers have merely to overcome the friction of the pipes.

One of the most interesting features of the whole system is the switch-board and control system. The system employed aims at having the entire control of the generating in a small space, and at the same time having no dangerous voltages on any part of the control board.

The system is almost analogous to the nervous system of the human body, having the control board as the brain, which it virtually is. All the big high-voltage switches are operated by small electric motors, and it is these motors which are operated from the control board, and as a low-voltage current is used for this purpose

[1] Abstract of a paper read before the students section of the Institution of Electrical Engineers by Richard F. Chaffer.

there is little or no danger to the operator through faulty switch-gear.

The switch-board proper is carried by three galleries extending the whole length of the north side of the engine-room and continued along the east end. The control board is on the middle gallery and projects slightly, so that the operator has a clear view up and down the engine-room. From the switch-board the energy is distributed to the various substations situated at various points along the system, and it is there converted to low-voltage direct current at 550 volts, and thence distributed to the live rail. Throughout the whole station it is remarkable to find the extent to which labour-saving devices are employed.

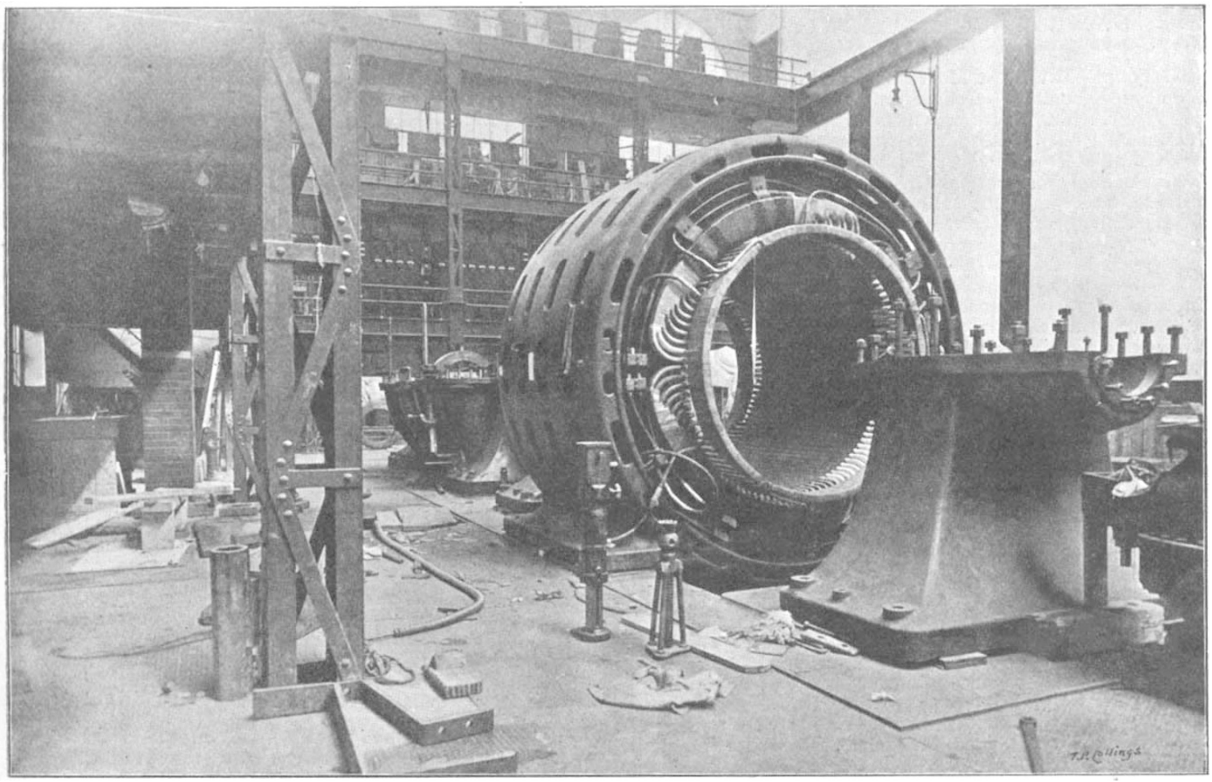

FIG. 1.—Armature of 5500 K.W. Generator.

Thanks are due to Mr. Chapman, general manager and chief engineer, for permission to view the station, and to the Institution of Electrical Engineers for the accompanying illustration of the armature of one of the generators.

REPLICAS OF DIFFRACTION GRATINGS.

FROM an article in No. 2, vol. xxii., of the *Astrophysical Journal,* we learn that Mr. R. J. Wallace, of the Yerkes Observatory, has attained great perfection in the production of replicas from plane diffraction gratings. After some amount of previous research, he decided on following Thorp's method in its essentials with several modifications which his experience suggested. Mr. Thorp first flooded his original grating with high-grade oil before pouring on the celluloid solution on which the replica was made. Mr. Wallace found it better to omit the oil. In the original method a solution of gun-cotton in amyl acetate with camphor added was employed as the material for the replica, but Mr. Wallace found that he could obtain much clearer and brighter copies by not adding the camphor. His successful solution is made by dissolving 38 grains of Anthony's pure snowy cotton in $2\frac{1}{4}$ ounces of pure amyl acetate, precipitating the resultant collodion in a large tray of pure water—constantly agitating the mixture—thoroughly drying the precipitate, and then redissolving it in the same quantity of pure amyl acetate. The collodion thus obtained is carefully filtered, and is then ready for use.

The grating to be copied is levelled in a roomy drying cabinet, which, in order to preclude dust particles, should be as free from draughts as possible, the surface dusted with a soft camel-hair brush, and the collodion flowed over it evenly. The author uses about twenty-five drops of the solution in copying a 2-inch grating. The grating is then replaced on the levelled support and left to dry for about eight to twelve hours; the longer the drying period the better is the resulting copy. After being thoroughly dried the grating is placed in pure distilled water at normal temperature together with the glass ("white optical crown") support, which has previously been evenly coated with the adhesive medium, plain hard gelatin. After a few minutes' soaking the edge of the film may be sprung from the grating, and the whole of it is then detached and *immediately* placed on the previously prepared gelatin surface and clamped there. Perfect contact is obtained by drawing a piece of the softest velvet rubber *very lightly* over the surface in the direction of the length of the lines.

The contraction suffered by the replica during the twenty-four hours' drying period slightly alters the number of lines per inch, but the effect is very small. In some of Mr. Wallace's copies this alteration produced 572 lines per mm. instead of the 568 lines that occupied the same space on the original. Two reproductions of the solar spectrum, one taken with the original grating, the other with the copy, show the resulting increase of dispersion caused by the contraction, and also show that everything which is resolved by the original grating is also resolved equally well under the same conditions by the copy.