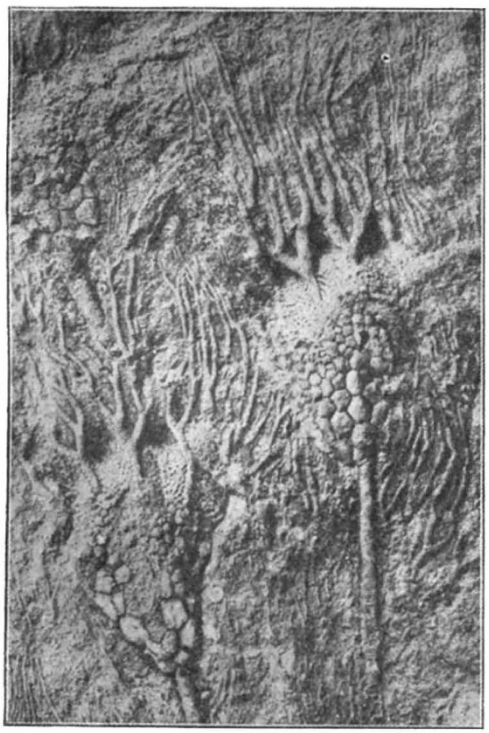
side with the first image. Both images are picked up by a reading telescope, and their relative displacement when the shaft is twisted may be read easily. The advantage of the instrument lies in the fact that the scale, as well as the optical parts, rotates with the shaft, and the reading telescope requires but little adjustment. Other types in which the scale does not rotate, require considerable adjustment in a place, viz., the shaft-tunnel, where adjustment is not easy to carry out.

Other papers read dealt with the stability of ships in damaged conditions, and the rolling of ships. Mr. H. E. Wimperis described his instrument for the measurement of velocity of roll, which depends for its action on a small electrically-driven gyrostat.

PAPERS ON INVERTEBRATES.

A REPORT on the Crustacea Schizopoda, collected by the Swedish Antarctic Expedition, 1901–3, has been published, in 4to form, by G. E. C. Gud, of Copenhagen. In his preface, the author, Mr. H. J. Hansen, states that this memoir, which is illustrated by six plates, should be regarded as a further contribution to his account of the Mysidacea and Euphausiacea (the two main groups of the Schizopoda) of the world. A considerable number of new



Two Calyces of Scyphocrinus. From Proc. U.S. Nat. Mus.

species are named, and revised descriptions of others previously known to science given, but as these appeal only to specialists, they must be passed over without further mention.

Of more general interest is Mr. R. S. Bassler's description (Proc. U.S. Nat. Mus., vol xlvi., pp. 57–9) of a remarkably fine slab of fossil crinoids from the Middle Palæozoic strata of the Mississippi Valley, north of Cape Girardean, Missouri, which has recently been placed on exhibition in the American Museum. This slab, measuring 4 ft. by 7 ft., contains eighteen complete crowns of Scyphocrinus, two of which are shown in the accompanying illustration, together with a number of bulbs of the so-called Camarocrinus; the latter, as pointed out by Dr. Bather, really pertaining to the former. In some of the specimens the crown, or calyx, retains to some extent its original globular form, but in the majority it has been flattened by contact with the Camarocrinus bulbs. The strong, many-branched arms, are frequently a foot in length.

The first American representative of the umbrella-shaped sponges of the genus Cœloptychium is described by Messrs. Shimer and Powers in vol. xlvi., pp. 155–6, of the Proc. U.S. Nat. Mus., under the name of *C. jerseyense* As the type specimen was obtained from the Upper Cretaceous of New Jersey, it is strictly contemporaneous, in the geological sense, with the European forms of the genus to which it is provisionally referred. The American species is characterised by the rounded, in place of flattened, margin of the umbel.

Hitherto the number of species of oligochætous annelids known from Jersey was only eleven, all belonging to the earthworm family (Lumbricidæ). A collection, including fresh-water forms, recently received from the island has, however, enabled the Rev. H. Friend, in an article published in *The Zoologist* for December, 1913, to raise the number of known species to fifty, of which three are described as new. Of the fifty species, the Enchytræidæ claim thirty-one, the Lumbricidæ seventeen, and the Lumbriculidæ and Megascolecidæ one each.

R. L.

METEOROLOGICAL REPORTS.

THE report of the Meteorological Service of Canada for the year 1909 (pp. xxi+567 and plates), has been published recently. The large mass of data furnished by this extensive system is arranged in tables giving (1) monthly and annual summaries; (2) bi-hourly and hourly temperature and barometric pressure; (3) mean and extreme temperature, daily range, rainfall, etc.; (4) daily observations from selected stations; and (5) magnetic results at Agincourt Observatory. Some of the results of observations at the Central Observatory at Toronto were quoted in NATURE of September 7, 1911. The report includes a brief monthly summary of the weather over the whole Dominion, and tables showing the number of weather forecasts and percentage of fulfilment in each district and month. The general percentage of fulfilment amounted to 86·8, after making due allowance for forecasts only partly verified.

The annual reports of the Philippine Weather Bureau for 1910 (parts 1 and 2), containing hourly meteorological observations at Manila, and for 1909 (part 3), containing observations at secondary stations have recently been published. Father Algué states in the preface to part 1:—"Were it not for a few exceptions, the history of the Weather Bureau for the fiscal year 1910 might have been condensed into the three words, 'Everything as usual.'" This statement practically holds good with regard to all the parts; the most interesting details relating to typhoons, storm-warnings, earthquakes, etc., are contained in the Monthly Bulletins, to which we have frequently referred. The number of earthquakes felt in the Philippines during the fiscal year 1910 amounted to 121, exclusive of many microcosmic movements. The most important far-distant earthquakes recorded were those in Mexico, Baluchistan, and Greenland. A new magnetic observatory has been established at Antipolo, about eleven miles east of Manila, owing to the disturbance caused by the electric railroad at the latter place.

The Central Meteorological and Geophysical Institute of Chile has issued a volume containing hourly observations and means for Santiago for the year 1911, including all the principal meteorological elements, prepared under the direction of Dr. W. Knoche. This is the first time that such values have been published *in extenso* in Chile, and it is intended to continue them regularly for Santiago in future. There are several other stations in Chile, where hourly observations are available; the publication of some of these, or at least summaries from them, would be very valuable, but the large amount of work entailed thereby is said to be more than the limited staff is able at present to cope with.

The nineteenth annual report of "Meteorology in Mysore" for 1911 contains, as usual, daily and monthly results of observations for Bangalore and Mysore, and 8h. a.m. observations with monthly means for Hassan and Chitaldrug. Synopses of the monthly and yearly results made at those observatories are carefully arranged as before, for the purpose of comparison, by Mr. Iyengar, in charge of the Mysore meteorological department. A useful table giving the means for the nineteen years 1893–1911 shows that the absolute maxima of temperature ranged from 100·2° at Hassan (3149 ft.) to 103·0° at Chitaldrug (2405 ft.). The minima at the same stations were 42·7° and 51·2° respectively. Yearly rainfall ranged from 25·0 in. (ninety-one days) at Chitaldrug, to 35·8 in. (121 days) at Hassan. The mean relative humidity was about 60 per cent. at all stations; excessively low readings were observed occasionally.

The Royal Magnetical and Meteorological Observatory of Batavia has published the results of rainfall observations in the Netherlands' East Indies for 1911 (part ii. of the thirty-third yearly series). The volume contains the monthly and yearly amounts at a large number of stations, the number of rain-days, greatest amounts in twenty-four hours, averages for the period 1879–1911, departures from those values in 1911, and other useful details. These data, in addition to their general scientific value, are of great importance locally, and it has been pointed out elsewhere by Dr. Van Bemmelen that rainfall is the ruling factor which determines the weather in the archipelago, because the remaining meteorological elements are almost constant. In Java the yearly amounts for 1911 varied from 23 in. at Sitoebondo (long. 114° E.) to 177 in. at Pelantoengan (long. 110° E.), and even more in the outside possessions. The greatest rainfall in one day was 10·2 in. at Padang (Sumatra) in November. The fullest information is given respecting the stations, but this volume contains no general discussion of the results.

IMPROVEMENTS IN LONG-DISTANCE TELEPHONY.

THE subject of improvements in telephony is one in which the general public is very closely interested, and a large audience, including many experts, therefore followed with attention the expositions given by Dr. J. A. Fleming, F.R.S., at the Royal Institution on March 27, in which he described the inventions that of late years have enabled a great increase in the practicable distance of telephonic communication to be made, and also rendered possible the use of submarine telephone cables over distances not hitherto attainable. In his opening remarks, Dr. Fleming gave first a brief description of the construction of the modern telephone transmitter and receiver, and of the transformations and sources of loss of energy in transmitting electrically articulate speech between two places. He stated that he would confine attention chiefly to the action of the line of cable, neglecting the imperfections of the transmitter and receiver *per se* owing to limitations of time.

An experiment was first shown with an instrument which projected upon the screen in the form of a line of light, the motion of the diaphragm of a telephone, when sounds musical or articulate where made near it The sound of an open organ pipe was thus seen to produce a smooth wavy or simple harmonic curve, whilst the less pure sound of a harmonium reed or of the voice uttering a vowel sound produced a complex curve, and a spoken sentence an irregular wave line.

The use of the oscillograph in recording photographically or visually the wave form of the electric current sent into a telephone was next explained, and photographs of various vowel and syllabic sounds shown.

A few words of explanation were then given concerning Fourier's theorem in virtue of which any irregular but single valued curve can be resolved into the sum of a number of simple harmonic curves of various amplitudes and phase differences having frequencies in the ratio of 1, 2, 3, etc.

It was then explained that the action of the transmitter on the line was equivalent to the imposition of a complex electromotive force which in virtue of Fourier's theorem could be regarded as the sum of a large number of simple harmonic electromotive forces of various amplitudes, wave-lengths, and phase differences.

Every telephonic cable has four primary qualities, two conservative, viz., its inductance and capacity, in consequence of which it can store up kinetic and potential energy in the form of a magnetic or electrostatic field. Also it has two dissipative qualities, viz., its conductor resistance and dielectric leakance, which convert a part of the energy given to it into heat. Hence an electromotive impulse given to the cable at one end is propagated along it as a wave. The current in the cable at each point is oscillatory, but the current is not, so to speak, at high tide simultaneously at all points in the cable, but successively, the maximum value travelling along the cable with a certain speed. The mode of propagation of a wave along a string or wire was illustrated by various wave models.

In the case of a wire or string of finite length the wave is reflected at the far end, and if the time taken by the wave to travel to and fro is equal to some exact multiple of the periodic time of the impulses, stationary waves are produced on the cord or wire. These effects, together with a demonstration of the laws of string vibration, were proved by the aid of Dr. Fleming's vibrating string apparatus in which a light cotton cord has one end fixed to a slide rest and the other end twirled uniformly with an irrotational motion by an electric motor.

The production of stationary electric waves on wires was also beautifully shown by the use of a long wire coiled into a helix on an ebonite rod. One end of this helix was connected to the earth and the other to a high-frequency oscillator. On adjusting the frequency of the oscillator, stationary electric waves of wave-length equal to some exact multiple or fraction of the length of the helix were produced and shown to exist by the brilliant glow of a neon vacuum tube held near the ventral segments and its non-glow when held near the nodes.

Dr. Fleming then explained that in the case of a telephone wire the velocity with which the waves travel along it is greater the shorter the wave-length, and also that in virtue of the resistance and dielectric leakance, these waves attenuate in amplitude at a rate which is greater for short waves than for long ones. In the case of the helix operated on by high-frequency currents the wave velocity is the same for