

new instrument two copper plates are suspended in an electrolytic cell containing sulphate of copper in solution, and placed in a branch circuit through which a known fraction of the main current is shunted. The copper plates are hung upon a lever arm so adjusted that when by electrolysis one has grown a certain amount heavier (by deposition of copper) and the other grown an equal amount lighter, the lever tips up and reverses the current through the cell, and at the same time moves a registering dial-apparatus through one tooth. The action goes on again until the tilting lever is again overbalanced, and tipped back, when the current is again reversed, and another registration effected. Each "tip" clearly corresponds to the passing of an exact quantity of electricity through the cell, and the registered indications are therefore proportional to the total consumption. *But will it work?*

HERR ED. DORN has investigated the relation between the absolute diameters of molecules of gases and their dielectric capacity on the lines of a suggestion due to Mossotti, that the properties of dielectrics might be explained by supposing them to consist of non-conducting material, in which innumerable minute particles of conducting matter are imbedded.

EVERYONE knows that the very feeblest currents produce audible sounds in the telephone, which is more sensitive than any galvanometer to feeble currents. M. Pellat lately declared that the heat necessary to warm a kilogramme of water one degree would, if converted properly into the energy of electric currents, suffice to produce in a telephone an audible sound for ten thousand years continuously.

#### GEOGRAPHICAL NOTES

THE preparations for the International Geographical Congress, to be held in September next at Venice, together with a Geographical Exhibition, are advancing rapidly. The *Bolletino* of the Italian Geographical Society announces in its last number that the saloons for the Exhibition are already distributed among the exhibitors, and that the nations which will occupy the most space will be Italy, France, Germany, Austria and Hungary, Russia, and Switzerland. The saloons allowed for the Exhibition in the royal palace being insufficient, it was agreed immediately to proceed to the construction of provisional buildings. The Italian railway companies have granted a reduction of 30 per cent. on the prices of tickets, and of 50 per cent. on goods for members of the Congress. The Austrian Lloyd and the Navigation Company, "Rubattino e Florio," grant a reduction of 50 per cent. on passengers' fares. As to the questions to be discussed at the Congress, the Commission has already published in the *Bolletino* its reports on most of them. Among the questions are:—On the Present State of Telegraphic Determinations of Longitude, by G. Lorenzoni.—On the Determination of the Temperature of Sea-water at Different Depths; on the Measurement of Depths; on the State of the Surveys of Coasts, &c., by G. B. Magnaghi; on the Extinction of Aboriginal Races, by L. Hugues; and on the Teaching of Geography in Schools, by L. Schiaparelli. We do not hear of any great activity in the collection of British exhibits for the annexed exhibition of geographical apparatus, &c. In England, indeed, no great interest is felt in these congresses. In Russia, on the contrary, a collection of apparatus has for some time been in preparation. M. Grigorieff is to represent the Russian Government and the Imperial Geographical Society at Venice.

The Swedish Government has decided to send a scientific expedition to Mossel Bay in the course of next year, for the purpose of collecting meteorological information. The expedition will be directed by Capt. Malmberg, and will have to remain during the summer of 1882 and the winter of 1883, in order to obtain the observations of an entire year. Mossel Bay is situated to the north of Spitzbergen, lat. 79° 54', long. 16° 15'. The locality is well known to the Swedes. Prof. Nordenskjöld stayed there in the winter of 1872-73 with three ships. A Swedish man-of-war will take the expedition to Mossel Bay, under the command of Capt. Palander, who, after having fixed the special meteorological station of Capt. Malmberg, will return to Sweden.

WE find in the last number of the *Bolletino della Società Geografica Italiana* a paper on the journey of the late Signor G. M. Giulietti from Zeila on the Gulf of Aden to Harar. This journey was accomplished in 1879, and the narrative was intended to form part of the complete description of all Signor Giulietti's travels, but after his death M. Guido Cora published

this small fragment with a map of the country. We notice also in the same publication a paper by Prof. G. Pennesi on the Italian missionaries who travelled in Lower Guinea during the second half of the seventeenth century; also accompanied with a small map of the country. The author speaks at some length of the two most interesting journeys of P. Dionigi Carli from Piacenza, and of P. Gio. Antonio Cavazzi from Montecucullo.

COUNT WALDBURG-ZEIL, the well-known scientific explorer, started from Bremerhafen on board the steamer *Luise* for the River Yenisei on the 22nd of last month. The journey is undertaken solely for scientific purposes, Count Waldburg-Zeil intending to make collections illustrating the fauna of the Siberian coast and the sea in that district.

IN a letter just received from the Gaboon Père Delorme reports the foundation of a mission station on the Ogowé River, which the French are making peculiarly their own. The station is placed at the east end of a large island in the river, called by the natives Ozangé-Nengé, *i.e.* Island of Light, which is conveniently situated for communicating with the tribes on the banks of the Ogowé and the Ngunié, one of its principal affluents. Immediately round the station are the Galois; next to them, on the right bank of the Ogowé, come the Eningas, while further south, on the left bank, or rather on the banks of a branch of the Ogowé, which goes to form Lake Ajingo, are found the Adyombas. Père Delorme expresses a decided opinion that these three tribes are really one people; they all speak the same language and have the same laws. All of them are very vain and voluptuous. The Galois despise agriculture, and are a trading people. They go up beyond the rapids of the Ogowé in search of india-rubber, ivory, and ebony. The slaves, or in default of them the women, are left to attend to the cultivation of manioc, banana trees, ground-nuts, and sugar-cane.

THE statement that an instalment of the Geographical Society's large map of Eastern Equatorial Africa will be issued this month is, we learn, unauthorised; and though, probably owing to the long delay which has already occurred, the propriety of issuing the map in parts has been discussed, the question is still left open. When ready, the map will be published by Mr. Stanford.

THE fourteenth Congress of the Italian Alpine Club will meet at Milan on August 29 to September 2 next. An Alpine exhibition will also be held, and three excursions will be made: the first to Erba in the Brianza and the grotto of Pinto, the second *via* Como to Varenna on the Lake of Como, and the third to Etico, coupled with an ascent of Monte Grigna.

THE death is announced of the well-known African traveller Herr J. M. Hildebrandt. He died on May 29 last at Tananarivo (Madagascar).

DR. O. FINSCH, the Polynesian traveller, safely arrived at Sydney from New Britain at the beginning of May. He stayed over eight months in New Britain, and has thence sent forty-five cases containing natural history collections to Berlin *via* Hamburg. These collections consist of no less than 12,000 zoological specimens, a large number of anthropological objects, besides a series of ethnographical specimens, surpassing in number and completeness any collections yet made in this field. Dr. Finsch intends staying only a short time at Sydney, and then proceeds to New Zealand in order to become acquainted with real Maoris, for the sake of comparison with the Polynesian and Mikronesian races he has studied so minutely. Afterwards the traveller, in continuation of his Melanesian researches, intends to visit North Australia to see and study the so-called Australian negroes. For the same purpose he will try to stay upon New Guinea for some time, as he considers the minute study of real Papuans of great importance.

NEWS has been received from Commander van Boekhuysen, the leader of the Dutch North Polar Expedition. He writes from Vardö to say that the *Willem Barents* could not reach Spitzbergen. The ice extended in a compact mass from 68° 30' N. lat. and 6° W. long. to 73° 30' N. lat. and 14° E. long., some twelve geographical miles to the north of Vardö. There was ice also some thirty geographical miles south of Bear Island. Commander van Boekhuysen will make another attempt to get northwards in 72° N. lat., and then return home after a month, as he is convinced that Novaya Zemlya is completely inclosed in a barrier of ice.

LETTERS from Dr. W. Kobelt have just been received by the Rüppell Institution at Frankfort, who are the promoters of the expedition. The letters are dated from Oran. Dr. Kobelt's

travels were much impeded by a revolution among the natives and the prolonged drought. Nevertheless four cases, containing collections of seeds, plants, reptiles, insects, and mollusks, have arrived at Frankfort, and Dr. Kobelt has obtained valuable results concerning the geographical distribution of mollusks. With regard to the revolution among the Arabs it appears that they are of opinion that the fifty years during which the Prophet has permitted the French to hold Algiers are now over. Dr. Kobelt has left for Spain, where he will continue his researches.

WE are informed that Mr. J. M. Schuver, the adventurous Dutch traveller, who not long ago started on his formidable journey from Cairo to the Cape, is not at Famaka, on the southern frontier of Fazokl, as has been stated, but has established his head-quarters for the present a considerable distance to the south, and actually in the Galla country. A quantity of stores have lately been sent from London to Fazokl for him by way of Suakim, and it is Mr. Schuver's intention to return to Fazokl for them in November next, before proceeding on his southward journey. In the meantime he has established a dromedary post between his camp in the Galla country and Khartum.

IN the July number of *Petermann's Mittheilungen* Lieut. Kreitner describes at considerable length the observation made by him while in company with Count Szechenyi, journeying from Sayang in Yunnan to Bhamo in Burmah; a useful map accompanies the paper. Dr. Junker continues his letters describing his travels in the Niam-Niam country, concluding with some important observations on a visit he paid to some of the Moabuttu tribes. Dr. Radde concludes the narrative of his journey to Talysh, Aderbéjan, and Savulan.

WE have received from Perthes of Gotha parts 23 to 26 of the new edition of Stieler's Hand-Atlas. This edition has continued to appear with praiseworthy regularity, and will be completed in other six parts.

AMONG the papers in No. 20 of the *Bulletin* of the Lyons Geographical Society are the following:—The Economic Unity of the Globe, by Prof. C. Stewart Merritt; the South Pole, by M. E. Chaabeyrin; the Slave Coast, by Dr. Chappet; South Africa, a lecture by the Rev. M. Coillaird, the missionary who succeeded Serpa Pinto; Lake Fucino, by M. Math. Desgrands.

THE U.S. steamer *Alliance*, in search of the *Jeanette* expedition, arrived at Hammerfest on its way to the Siberian Arctic Seas on the 24th inst.

THE Egyptian Geographical Society does not often issue a *Bulletin*, but when it does the number usually contains some good matter, often drawn from the archives of the General Staff, the chief of which is President of the Society. The number just published contains, among other matter, a paper on Cape Guardafui by Col. J. Graves of the Staff, and another on the country between the coast and the lofty plateau of Abyssinia by Gen. Stone Pasha.

COMMANDANT TITRE, who was formerly at the head of the Survey Department in Algiers, has lately published a large map of Algeria, which embodies all the most recent topographical information.

### SOLAR PHYSICS—THE CHEMISTRY OF THE SUN<sup>1</sup>

WE have next to consider another method, which enables us to determine the motions of the solar gases. It has been already noticed that it is easy to see the prominences rushing with extreme velocity upwards in radial lines from the photosphere, and that while they are thus being carried up by some violent motion of ejection from below, they are twisted out of the radial line, now to the right, and now to the left, by what we are justified in describing as winds in the atmosphere of the sun. Those were the mere visual phenomena which were incidentally observable the moment a method was obtained of viewing the forms of prominences as well as the bright lines produced by the vapours of which they were built up, and they afforded us an opportunity of getting an insight into solar meteorology.

It was soon however perfectly clear that there was another method, in some respects a much better method, of doing this work. When we consider how it happens that we get any

<sup>1</sup> Lectures in the Course on Solar Physics at South Kensington (see p. 150) Revised from shorthand notes. Continued from p. 274.

phenomena visible in our universe at all, we are driven to the conclusion that it depends on the fact that bodies in a state of agitation reflect, so to speak, their own state of agitation on the ether, and that the ether carries those vibrations, those agitations to our eyes. So that if we can assume, as we must assume, that the sun with its gases, consisting of hydrogen, magnesium, &c., was communicating its vibrations to the ether, and the ether was communicating in its turn its vibrations to us, it was obvious we had there an opportunity of testing a view which had been put forward by Doppler a good many years ago, to the effect that the light from a moving light source is not the same in all its qualities as light from a fixed one.

The colours which we see in the spectrum are exactly analogous to the notes which we hear in a piano when we go from one end of the scale to the other. Doppler imagined the equivalent of a piano going away from or coming towards the listener with considerable velocity—a velocity comparable, in fact, to the velocity of sound through the air. It is perfectly clear that under these circumstances we should no longer get true concert pitch, for the reason that the note which gives us a certain tone, because it produces in the air so many waves per second, will change its tone if the source of the note is coming to us. Take, for instance, a tuning-fork giving concert C, and imagine it rapidly coming to us: the waves of sound will be crushed together, we shall have more waves in a second falling on the ear, and we shall get a higher note. If we imagine, on the other hand, the tuning-fork is going away from us, the notes will be paid out at longer intervals, so to speak, and we shall get a lower note. In neither case shall we continue to have concert C. A very familiar instance where we do get this change of pitch due to change of motion, is produced in these days of very rapid railway travelling. Any of us who have been at a country railway station when the express is coming by will know that as the train approaches us the note of its whistle is at one pitch, and as it goes from us after passing it changes and gets lower, according to the velocity of the train.

A familiar experimental illustration of this principle is to attach a whistle to the end of a long india-rubber tube. If then a person sounds the whistle by blowing through the open end of the tube, and while still blowing whirls it round rapidly in a vertical plane in which an observer is standing, that observer will note that when the whistle is approaching him in one part of the curve, and the waves are therefore being crushed together, the note will appear higher than when it is receding from him in the opposite part of the curve, where the waves are being, as it were, pulled asunder. Now apply that to the light of the sun. The long notes of light are red, and the short notes are blue, and if we sharpen or shorten any light note in any part of the spectrum we shall give that light a tendency to go towards the blue, and if we lengthen or flatten it we shall give it a tendency to go towards the red, so that, for instance, if a mass of magnesium gas giving the line or note in the green indicated by "b" is approaching us with a velocity comparable to the velocity of light, the line will change its position in the spectrum towards the blue; and if we are careful to note the exact amount of change of refrangibility as it is called, we shall have then an absolute method of determining the rate of motion of that mass of gas. This will help us in more ways than one. Suppose we observe the gas at the limb of the sun, we shall then, if we get any change of refrangibility, be justified in calling it a solar wind, because the motion thus indicated would be very nearly parallel to the surface of the sun; but if on the disk of the sun itself—take a spot, for instance, in the very middle of the disk—we get any change of wave-length such as I have referred to, it is perfectly clear that we shall no longer be dealing with what we can justly call a wind, it will really be an upward or downward current. So that this principle enables us at the limb of the sun to determine the velocity of solar winds, and at the centre of the sun to determine the velocity of those up-rushes or down-rushes, in fact, those convection currents to which Prof. Stokes has already directed attention.

The accompanying drawings (Fig. 16) were made when the sun was in a considerable state of agitation in the year 1872. They give us one of the lines of hydrogen, and indicate, I think, amply this kind of phenomenon. We have in the first figure on a large scale the "F" line of hydrogen, the line in the green at the edge of the sun. The slit—the perfectly straight slit—has been worked round the limb in search of a prominence, and it has found one. But the slit is no longer shown us as a perfectly straight line, it is in fact a very irregular one; and further than this it branches