The following are short summaries of each case :

S.s. Faraday.—The wave was visible like a line of high land on the horizon about five minutes before it struck the vessel.

S.s. Westernland.—A huge wave rose to a great height just in advance of the ship. No other similar waves were met with. About noon the wind had changed from S.W. to W.N.W.

S.s. Germanic.—Wind W.N.W. with terrific squalls. Shipped a tremendous sea over bow.

S.s. Umbria.—The disturbance came from N.W. and consisted of two waves. The first one was broken, the second one green. The wind had previously changed from S.W. to N.W.

H.M.S. Orontes.—While steaming in smooth water a huge wave broke over the vessel forward.

S. Festina Lente.—A steep sea fell on board from both sides.

S.s. Manhattan. The sea was high, but fairly true until a mountainous wave broke on board from N.W.

S.s. Diamond.—Lying to, awaiting daylight to enter port. The wave was heard some time before it was seen, and then seemed to be about 40 feet high. The vessel never rose to it, but was literally submerged for a time.

An examination of the chart will show that with the exception of the *Westernland* each wave may have originated at a common centre, and might therefore be due to subaqueous volcanic activity. However, as the solitary waves which strike the west coast of South America and the so-called Death Waves on the west coast of Ireland are said to be regarded as precursors of storms, it is possible that these solitary Atlantic waves may be due to a similar cause ; but even then it is inexplicable how a number of comparatively small and regular waves can be converted into one abnormal one, or how the reported changes of wind and consequent confused sea could produce such a wave. It will be noticed that the dates for the *Festina Lente*, *Manhattan*, and *Diamond* are very close together, and therefore there is a possibility that they were struck by the same wave. C. E. STROMEYER.

Glasgow, February 18.

The Presence of a Stridulating Organ in a Spider.

WHILST spending a short time at Alice Springs, in Central Australia, during the course of last year, in connection with the Horn Scientific Expedition, I found that it was firmly believed by a considerable number of people, white men and natives alike, that a spider existed in Central Australia which made a booming noise at night. Thanks to the assistance of the blacks, the spider itself was easily captured, but I could detect no organ capable of producing a booming sound. The animal forms a tubular burrow, about three-quarters of, or an inch, in diameter, which passes down for some eighteen to twenty-four inches in a slightly slanting direction until it terminates in a small chamber capable of holding the animal comfortably. In this chamber are found fragments of beetles upon which the animal has preyed, and a certain amount of web material ; but there is no regular lining to the tube or chamber. The spider, which may reach a length of two and a half inches, and a span across the legs of five inches, proves to be *Phrictis crassipes*, belonging to the tribe *Territelariæ*, to which also belongs the well-known *Mygale*.

After listening carefully for the noise, and spending with a friend a night out in the open, in a spot where the booming could be heard, we came to the conclusion that the noise attributed to the spider was, in reality, made by a quail.

However, we kept some dozen specimens under observation in tin and wooden boxes, and after a few days in captivity, during which time they were very sluggish, one or two of them began to be more active, and on irritating one of the livelier ones (a large female) with a straw, I was pleased to see her rise on her hinder legs, and to hear her make a low whistling noise, moving alternately the palps up and down on the chelicerae as she did so. Whilst doing this she would make short angry darts at the straw.

On examination it was seen that the surface of the basal joint of the palp was provided with a somewhat oval-shaped comb-like structure composed of hard chitinous rods of various lengths, each ending in a club-shaped head. The comb is so placed that when the palp is moved up and down it rubs against a special part of the chelicera, which is provided with several rows of strong, sharply-tapering spines, and the sound produced can be heard, when the spider is in a box in a quiet room, at a distance of, at any rate, six or eight feet.

I was not at the time aware of the fact that, in the *Transactions* of the Entomological Society for 1877, Mr. Wood Mason had described a very similar stridulating organ in another ground-spider, *Mygale stridulans*, and it is interesting to note the close resemblance between, as well as the presence of, the organs in these two genera, both of which belong to the tribe *Territelariæ*. The figure given by Mr. Wood Mason admirably illustrates the position of the spider when it stridulates.

I hope to publish a full description of the organ in the volume dealing with the work of the Horn Expedition.

BALDWIN SPENCER.

Biological Laboratory, Melbourne University,
January 24.

The Spectrum Top.

PERHAPS some of your readers may be glad to learn that the curious phenomena of the spectrum top can be shown on a screen to a large audience. It is only necessary to paint the usual black lines and sector on a suitable disc of glass, and then to mount it in a revolving stage which can be rotated in a lantern by means of a multiplying wheel. The projected disc of light must not be too large ; if the lime-light be used the disc may be about 2 feet in diameter, and about double that size with the electric arc. A great variety of effects can be obtained by interposing coloured glasses in the path of the beam ; *e.g.* with a green glass, and in diffused gas-light, the dark sector and lines appear to be mauve-coloured when suddenly stopped after rapid rotation, or when very slowly rotated, but become of a dark blue when the gas is turned off. On rotating the disc in the usual way the lines appear to be blue, green, and violet.

With a blue glass in gas-light the dark sector and lines appear to be yellow when suddenly stopped, but a fine purple without diffused light. The colours given by the lines at a moderate rate of rotation are red, grey, green, and blue. With a monochromatic red glass, the lines appear to be blue, grey, red, and dark red.

Is it not somewhat extraordinary that a rich blue colour can be obtained when dealing only with monochromatic red light? With whatever coloured light the disc is fed, the characteristic red lines at the centre, and blue at the periphery, or *vice versa*, seem almost invariably to appear. Altogether the phenomenon is worthy of further study by physiologists and physicists ; the lantern appears to throw, in a double sense, new light upon this interesting problem. The idea of employing transmitted instead of reflected light for producing the phenomena of the spectrum top is partly the suggestion of Mr. T. J. Walls, instrument maker, Edinburgh, who constructed the disc for me. DAWSON TURNER.

Edinburgh, March 4.

THE AGE OF THE EARTH.

PROF. PERRY and I had not to wait long after the publication of his article "On the Age of the Earth" (NATURE, January 3, 1895, pp. 224–227) to learn that there was no ground for the assumption of greater conductivity of rock at higher temperatures, on which his effort to find that the consolidation of the earth took place far earlier than 400 million years ago, is chiefly founded. In a letter of date January 13, most courteously written to me by Dr. Robert Weber in consequence of his having seen by my letter to Prof. Perry of December 13, that we were anxious to find how far his experimental results regarding differences of thermal conductivity and specific heat at different temperatures could be accepted as trustworthy, he tells me that he had made farther experiments on an improved plan, and that on the whole his investigations do not seem to prove augmentation of conductivity with temperature ; and he kindly gives me, with permission to communicate to NATURE, the following results, hitherto unpublished, of experiments which he made in t e years 1885 and 1886

on the thermal conductivities (k) and specific heats (c) of five rocks.

		Density	
Basalt	... ...	3·0144	... $c = 0{\cdot}1763 + 0{\cdot}000296t$ [between 0° and 60°] $c = 0{\cdot}1946 + 0{\cdot}000575(t - 60)$ [between 60° and 110°] $k = 0{\cdot}00317\{1 + 0{\cdot}00001t\}$
Marble	...	2·7036	... $c = 0{\cdot}20279 + 0{\cdot}000466.t$ $k = 0{\cdot}00540\{1 - 0{\cdot}000005.t\}$
Rock salt	...	2·161	... $c = 0{\cdot}2146 + 0{\cdot}00017t$ $k = 0{\cdot}0137\{1 - {\cdot}0044t\}$
Anhydrite of Jura	...	2·892	... $c = 0{\cdot}1802 + 0{\cdot}0003.t$ $k = 0{\cdot}0123\{1 - 0{\cdot}0024.t\}$
Quartz	...	2·638	... $c = 0{\cdot}1754 + 0{\cdot}0004.t$ $k = 0{\cdot}01576\{1 - 0{\cdot}0019.t\}$

These results show practically no change of thermal conductivity with temperature for Basalt and Marble. For Rock Salt, Anhydrite of Jura, and Quartz, they show diminutions of thermal conductivity amounting per 100° C. to 44 per cent., 24 per cent., and 19 per cent. respectively. They contrast curiously with the 75 per cent. *augmentation* of thermal conductivity per 100° C. (NATURE, January 3, p. 226), used by Prof. Perry in his estimate of the age of the earth, and they form a practical comment on his statement (NATURE, January 3, p. 226) :—"From the analogies with electric conduc-"tion, one would say, without any experimenting, that as "a metal diminishes in conductivity with increase of "temperature, so a salt, a mixture of salts, a rock, may "be expected to increase in conductivity with increase of "temperature."

Since the beginning of January I have myself been endeavouring to find by experiment the proportionate differences of thermal conductivity of rocks at different temperatures; and before the end of January I had made some preliminary experiments on slate and sandstone, from which I was able to tell Prof. Perry that the thermal conductivity of each of these two rocks is probably less at higher temperatures than at lower. Since that time I have been arranging for experiments on granite, in which as rapid progress as I would have liked has been impossible for many reasons, including the necessity of standardising a Kew certificated thermometer of 1886, now for the first time being compared with an air thermometer in my laboratory. Unless its differences from the air thermometer are much larger than can be expected from what we know of the behaviour of mercury-in-glass thermometers generally, it is already almost proved that the thermal conductivity of granite is *less* between 150° C. and 250° than between 50° and 150°.

As to specific heats there can be little doubt but that *they* increase with temperature up to the melting point of rock, but the rate of augmentation assumed by Prof. Perry is about five times as much as that determined up to 1200° by the experiments of Rücker and Roberts-Austen (*Phil. Mag.*, 1891, second half-year, p. 353) for Basalt, and of Carl Barus (*Phil. Mag.*, 1893, first half-year, pp. 301–303) for Diabase; these being apparently the only experiments hitherto made on specific heats of rock at temperatures beyond the range of the mercury-in-glass thermometer.

Taking the primitive temperature as 4000° C. and the thermal conductivity and the specific heat at this temperature respectively 30 times and $14\frac{1}{2}$ times their values at the surface, and throwing in a factor 3 for three-fold density at the greater depths (though the average density of the *whole* earth is scarcely double that of the upper crust) Perry takes the product of three factors $30 \times 14\frac{1}{2} \times 3$ and so finds in round numbers 1300 times my estimate as his corrected estimate of the age of the earth!! (NATURE, January 3, p. 227.)

But even if the ratios of thermal conductivities and of specific heats at the higher and lower temperatures were as assumed, Prof. Perry's product of the two corresponding factors vastly over-estimates the age. Of this I thought I had given a sufficient warning when I wrote to him (December 13), "But your solution on the supposition of an upper stratum of *constant* thickness, having smaller conductivity and smaller thermal capacity than the strata below it, is very far from being applicable to the true case in which the qualities depend on the temperature." (NATURE, January 3, p. 227.) It is obvious that the supposed higher thermal conductivity and the higher specific heat, if beginning suddenly at a short distance below the surface, and continuing constant to the great depth, would greatly prolong the time of cooling to the same surface-gradient, beyond what it would be with these qualities increasing continuously with temperature. For the simple case of conductivity assumed to increase in the same proportion as specific heat, Prof. Perry has himself since given in a later communication (NATURE, February 7, pp. 341–342) the necessary correction of his previous mathematics: and in an example of his own choosing (50 per cent. augmentation of each quality per 100° elevation of temperature), he now finds 121 times my estimate for the age of the earth, instead of 441 times as by the formula which he used in his first article.

When the ratio of thermal conductivity to specific heat per unit bulk varies with the temperature, the problem of secular cooling presents mathematical difficulties which, so far as I know, have not been hitherto attacked; but I find it quite amenable to analytical treatment, and I hope before long to be able to offer a paper to the Royal Society of Edinburgh on the subject, as an appendix to my original paper "On the Secular Cooling of the Earth," published in its *Transactions* (1862). I have already worked out numerically two cases, in one of which both conductivity and specific heat increase with temperature, and in the other the specific heat increases with the temperature but the conductivity is constant. The first of these is at present only interesting as a mathematical exercise because, according to present knowledge, it is more probable that the thermal conductivity decreases than increases with increasing temperature. To the results of the second I shall refer later as substantially helping us towards a revised estimate of the time which has elapsed since the consolidation of the earth.

Twelve years ago, in a laboratory established by Mr. Clarence King in connection with the United States Geological Survey, a very important series of experimental researches on the physical properties of rocks at high temperatures was commenced by Dr. Carl Barus for the purpose of supplying trustworthy data for geological theory. Mr. Clarence King, in an article "On the Age of the Earth" published in the *American Journal of Science* (vol. xlv., Jan. 1893), used data thus supplied, to estimate the age of the earth more definitely than was possible for me in 1862 with the very meagre information then available as to specific heats, thermal conductivities, and temperatures of fusion. I had taken 7000° F. (3871° C.) as a high estimate of the temperature of melting rock. Even then I might have taken something between 1000° C. and 2000° C. as more probable, but I was most anxious not to *under*-estimate the age of the earth, and so I founded my primary calculation on the 7000° F. for the temperature of melting rock. Now we know from the work of Carl Barus (*Phil. Mag.* 1893, first half-year, pp. 186, 187, 301–305) that Diabase, a typical Basalt of very primitive character, melts between 1100° C. and 1170° and is thoroughly liquid at 1200°. The correction from 3871° C. to 1200° or 1/3·22 of that value, for the temperature of solidification, would, with no other change of assumptions, reduce my estimate of 100 million to $1/(3{\cdot}22)^2$ of its amount or a little less than ten million

years; but the effect of pressure on the temperature of solidification must also be taken into account, and Mr. Clarence King, after a careful scrutiny of all the data given to him for this purpose by Dr. Barus, concludes that without farther experimental data "we have no "warrant for extending the earth's age beyond 24 millions "of years."

By the solution of the conductivity problem to which I have referred above, with specific heat increasing up to the melting point, as found by Rücker and Roberts-Austen and by Barus, but with the conductivity assumed constant, and by taking into account the augmentation of melting temperature with pressure in a somewhat more complete manner than that adopted by Mr. Clarence King, I am not led to differ much from his estimate of 24 million years. But, until we know something more than we know at present as to the probable diminution, or still conceivably possible augmentation, of thermal conductivity with increasing temperature, it would be quite uninteresting to publish any closer estimate.

In the latter part of Mr. Clarence King's paper on the "Age of the Earth" the estimates of the age of the sun's heat by Helmholtz, Newcomb, and myself, are carefully considered, and the following sentences with which the paper is brought to a conclusion will, I am sure, be interesting to readers of NATURE:—"From this point of "view the conclusions of the earlier part of this paper "become of interest. The earth's age, about twenty-four "millions of years, accords with the fifteen or twenty "millions found for the sun.

"In so far as future investigation shall prove a secular "augmentation of the sun's emission from early to pre-"sent time in conformity with Lane's law, his age may "be lengthened, and further study of terrestrial conduc-"tivity will probably extend that of the earth.

"Yet the concordance of results between the ages of "sun and earth, certainly strengthens the physical case "and throws the burden of proof upon those who hold "to the vaguely vast age, derived from sedimentary "geology." KELVIN.

NOTES.

IN addition to Lord Aberdare, the Royal Society has to mourn the loss of two more of its Fellows. Sir Henry Rawlinson, the distinguished Orientalist, died on Tuesday, in his eighty-fifth year. He was elected into the Society so long ago as 1850. Sir William Savory, who died on Monday, at the age of sixty-nine, was admitted eight years later.

WE have also to announce the death of Dr. D. H. Tuke, well known for his works on psychological medicine.

IT is announced in the *British Medical Journal* that Dr. Armand Ruffer has tendered his resignation of the post of Director of the British Institution of Preventive Medicine.

WHEN the news of Prof. Cayley's death reached America, American mathematicians were not slow in expressing sympathy with their English brethren. We are informed that—"In that great American University, the Johns Hopkins, in which, not many years ago, Prof. Sylvester and Prof. Cayley, at the same time, gave instruction in advanced mathematics, the death of Prof. Cayley was the occasion of universal mourning, and all was appropriately draped with black."

IT appears from a correspondence between the Board of Trade and the Electric Lighting Committee of the St. Pancras Vestry, that Major Cardew, the electrical adviser of this department, has discovered, during his investigations into the recent explosions in the street boxes used for electrical supply in St. Pancras, that a remarkable deposit on some of the insulators contained a considerable quantity of the metal sodium. The presence of this metal appears to be so grave a source of danger, and to afford so reasonable an explanation, in connection with the accumulation of escaped coal-gas, of the several explosions which have recently occurred, that the Board of Trade intends to investigate the causes of the deposit of this substance with a view to its prevention, and in this investigation they have asked for the assistance of the Royal Society and of the Institution of Electrical Engineers.

PROF. CHARLES STEWART will deliver a course of six lectures on "The Internal Framework of Plants and Animals," at the Royal College of Surgeons, Lincoln's Inn Fields, on March 11, 13, 15, 18, 20, and 22, at five o'clock. Admission to the lectures can be obtained on presentation of visiting card.

A CORRESPONDENT, writing from Brooklyn on February 16, says:—The severity of the weather and depth of snowfall throughout the southern United States for the past few days are unparalleled. On the 14th inst. the temperature at Abilene, Texas, was 15°, and in the State of Georgia it ranged about 9° lower than in New York city. Yesterday there was snow five inches deep in Atlanta, four inches at Darien, three inches at Thomasville, and two inches at Savannah, all in Georgia; two feet at Birmingham, Alabama; eight inches at New Orleans, Louisiana; six inches at Galveston, Texas, with snow falling as far south as Corpus Christi. In many places there had never before been snow enough to cover the ground to any measurable depth.

FROST prevailed during the greater part of the past week in nearly all parts of the United Kingdom, and in the northern and midland districts the thermometer in the screen has on several nights fallen as much as 10° below the freezing point. Snow has fallen over the greater part of the country, and in Scotland the amount has been heavy. The type of weather has been chiefly anti-cyclonic, and an area of low barometer readings was for several days situated to the eastward of our islands, so that strong and cold northerly winds were experienced over the entire country. A correspondent at Dundee states that the temperature in that district during the last two months was unusually low. The average maximum temperature of January and February was 36°·6, and the average minimum, 24°·9, so that the average mean temperature for that vicinity was about 30°·7. The normal values published by the Meteorological Council for Leith, a little more to the south, give 39°·5 as the average mean temperature for the two months.

PROF. M. MÜLLER contributed an article to the January number of *Globus* (Brunswick) on meteorology and the figure of the earth, which contains much useful information upon the subject of atmospheric circulation, and the results of the author's own investigations. He points out very clearly the effects of the earth's rotation and of the polar compression on the motion of the air, and strongly opposes the theory of equatorial and polar currents as propounded by Dove and his adherents. He explains the enormous forces that would be required to transpose a kilogram of air from the pole to the equator, and shows that the motion of a particle closely resembles that of a ball which is kept in circular motion on a revolving plate by a juggler, the rapid rotation of the plate, and of the earth, acting similarly on both ball and air, and keeping both moving in comparatively small and nearly closed curves.

DR. A. CANCANI notes the existence of two systems of undulations in the Constantinople earthquake of July 10, 1894, one propagated with a velocity of 4·9 km. per second, the other with a velocity of 2·3 km. per second (*Rend. dell' Acc. dei*