THE NATIONAL ACADEMY OF SCIENCE.

The second session of this body (the first meeting was held, it will be remembered, at Washington, during the spring) met on November 3, at Philadelphia. The attendance has been large, and includes the names of many of the most distinguished scientists and scholars in the country. We give below brief abstracts of the papers read.

CAUSE OF SUDDEN COLD WEATHER.

Professor Elias Loomis has made careful studies of the weather maps of 1872–3, with a view to the discovery of laws governing the relation between the direction and velocity of the wind and barometric pressure. In the center of an area of low barometer, a strong upward movement has been observed, and it now appears certain that a downward movement prevails over areas of high barometer. The result of this downward flow must be a considerable fall of the thermometer. These considerations appear to prove that the extremely low temperatures which occur at irregular intervals in every month, and particularly in the winter months, are due mainly to the descent of cold air in the neighborhood, and that this descent of air results from the outward movement which generally takes place from the center of an area of high barometer. In summer, during a thunderstorm, the temperature often falls 10° in a few minutes, but observations show that there was no current of air from the north. These sudden gusts of cold must descend from the higher atmospheric regions.

In the discussion which followed the reading of this paper, Professor Joseph Henry suggested the possibility of currents from the north in the upper atmospheric regions bringing down the cold air, which is afterward precipitated on the earth's surface in the areas of high barometer where the outward motion of the wind is observed.

Professor Packard detailed some observations on the specific gravity of water in the Gulf of Maine, and stated that the bottom water is considerably denser than the surface. The average specific gravity of bottom water is slightly less than that of surface water; yet, from 50 to 800 fathoms, the specific gravity increases with the depth, from 1·0272 to 1·0277.

Professor Sterry Hunt delivered an extemporaneous address on the

DECAY OF CRYSTALINE ROCK.

In Western Connecticut, the brown hematite iron ores of Salisbury and Kent are associated with what is locally called fuller's earth, but consists, according to Shepard, of nearly vertical strata of crystaline formation decayed in place.

From a comparison of the masses of iron ore thus found with the similar masses observed in the decayed crystaline rocks of the Blue Ridge, which were recognized as the results of the alteration of beds and lodes of iron pyrites, and in some cases of beds of spathic iron ore, found in these rocks where the decay has not reached them, professor Hunt argued that such had been the source of much of the hematite ore found along the great Appalachian Valley.

The iron oxide in these and similar decayed rocks had, by its solution, furnished the whole of the iron ore which, in various forms, is interstratified in our palæozoic rocks at different horizons. From these decayed strata had also come the materials for all the clay rocks and sand rocks of various ages.

RELICS OF AN ANCIENT RACE.

Dr. F. V. Hayden mentioned his discoveries of ruined cities in the cañons leading to the Colorado river. He said that there once existed, in what are now the arid plains and savage gorges of Southeastern Colorado, a race so far civilized that they built large cities, constructing their houses of well hewn blocks of stone, with timber floors, well formed windows and doorways, and smoothly plastered walls, and that they possessed the art of making glazed pottery.

Professor Henry produced a eulogy upon

JOSEPH SAXTON,

the inventor of the magneto-electric machine, who died October 26, 1873. Mr. Saxton also invented the locomotive differential pulley; an apparatus for measuring the velocity of vessels; and a metal ruling machine, a contrivance for tracing lines on metal or glass at a minute distance from each other. Mr. Saxton returned to this city in 1837, and during his connection with the United States Mint constructed the large standard balances still used in the annual inspection of the assays and the verification of the standard weights for all the Government assay and coining offices of the United States. Mr. Saxton's inventive powers were exercised rather for the pleasure their employment gave him than for any gain to himself. Others reaped the profit from many of his most valuable inventions. He rarely sought to bring into use his devices and discoveries. Among a great many valuable inventions, for which he never received proper credit or any pecuniary return, was that of metallic cartridges.

Professor Packard described the indications of the nervous system of the limulus (king crab) which he succeeded in discovering in a fine transverse section of an embryo in an early stage of development. He also mentioned a bright red gland in the crab, hitherto undescribed, which, he thinks, is renal in Nature, and homologous with the green glands of normal crustacea.

MEASURING MINUTE CHANGES IN ATMOSPHERIC PRESSURE.

Professor Mayer described a machine accurately measuring the most minute variations in the pressure of the atmosphere—changes so slight as not to affect the barometer. A hollow metallic vessel, with unyielding walls containing air, has adapted to it an open glass tube. In this tube is a short liquid column. The glass tube is in a horizontal position. The vessel is surrounded with melting ice, which keeps the air in the vessel at a constant temperature. In this condition the liquid in the tube remains stationary, if the pressure of the air outside the apparatus remains constant; but any increase of pressure in the atmosphere will cause the liquid in the horizontal glass tube to move toward the vessel. The contrary motion takes place when the atmospheric pressure diminishes. These motions of the liquid column are registered continuously by photography. A standard mercurial barometer is observed at stated times, so that the values of the motions of the liquid column can be determined. This apparatus, if placed at certain important stations of the United States Signal Service, would be of good use in studying the variations in atmospheric temperature in connection with the development and progress of storms.

Professor Mayer spoke afterward of the change in dimensions of solid and hollow iron cylinders on their magnetization, and described experiments made on solid and hollow cylinders of iron three feet in length and five or six inches in diameter. He found that solid cylinders elongate on being magnetized, but at the same time so contract in their transverse dimension that the volume of the cylinder remains constant. In the case of hollow cylinders, however, it was found that their interior capacity increased on their magnetization.

Professor Henry replied briefly to the criticisms upon our lighthouse service, which appeared in the recent report of Major Elliott, an abstract of which has appeared in these columns. He said that lard oil made a brighter light in large lamps than kerosene; and that as most lighthouse keepers were appointed by politicians, they were ignorant of their business, and could not be trusted with gas-generating apparatus. There was often trouble in teaching them to manage the simple steam boilers used with fog whistles and sirens. An electrical light had been proposed instead of oil, but such light was deficient in the red ray. No light was strong enough to penetrate fog. A mile of cloud shut out the sun's rays, and we could not hope to get a light superior to the sun.

Professor Silliman described a method for the

REMOVAL OF AMMONIA FROM ILLUMINATING GAS,

and obtaining it in the form of a dry salt, adapted to the uses of agriculture. When nitric acid salt cake, a by-product of acid works and of small value, ground to powder, was placed in an apparatus similar to that used for lime purification, all the ammoniacal compounds were completely removed from the crude gas, while the salt was enriched by about 13 per cent of sulphate of ammonia, or 3½ per cent actual salt. It appeared on investigation that all the cyanogen compounds had been decomposed by the salts of iron in the nitric acid salt cake, derived from the action of the acid on the iron retorts, and excited a ferro- and ferri-cyanide of iron action in the mass, staining it distinctly.

The so-called commercial superphosphate of lime also effectually withdraws every trace of ammonia from gas. An acid salt of this sort is found in ammonia, which yields a soluble monobasic calcic phosphate of 6 76 per cent of phosphoric acid; when saturated with ammonia composed from gas, it yields 6·11 per cent of salts.

The ammonia may be completely withdrawn from coal gas in its crude state by acid salts, and presented in a dry and manageable form, without further labor or expense in solution, crystalization, or manufacture; and also it is easily deprived of the poisonous effects of cyanogen compounds by a proper use of salts of iron. Analytical chemists will be glad to know that, by using either sodic or potassic bisulphate in a U tube, it is quite easy to withdraw ammonia from a gaseous mixture containing ammoniacal compounds, and to obtain it in a condition to be weighed.

Professor W. B. Rogers, on

NEWPORT CONGLOMERATE,

said that there is nothing in the structure calling for further agency than the ordinary transporting and wearing actions under which such products have generally been accumulated.

Professor Rogers described a

SIMPLE METHOD OF GENERATING POSITIVE ELECTRICITY

wherever a steam boiler exists in the building.

He attached a pipe to an ordinary boiler used for heating purposes, and carried it through the window to the outer air. To the end of the pipe where the steam escaped he attached what are known as Faraday's nozzles—15 of them—with applewood apertures. In front of these nozzles he suspended, by a brass rod, a piece of brass foil, cut so as to present a bristle of points to the escaping steam. He had only to provide an insulating support for the rod, and carry a wire through a pane in the window to a long rod held by ribbon silk in the room where he desired to use the electricity, to have a strong positive current. A tube inserted in the steam pipe, with a valve opening inwardly, admitted air sufficient to produce a uniform condensation of the steam.

Professor Mayer's paper on the composite nature of electrical discharges, that of Professor Henry on the effect of wind on sound waves, and Dr. LeConte's address on the use of mineral poisons by farmers, we reserve for fuller consideration.

The meeting adjourned on November 5.

A NEW SOURCE OF COAL.—The English engineers sent by the Viceroy of Egypt to examine the carboniferous deposit of Dranesta have recently forwarded to England 300 tuns of the fuel to be experimented upon. Dranesta is situated 108 miles south of the city of Salonica, in the midst of the mountains which extend to the southward of Mount Olympus.

Character of Electric Discharges.

A flash of the duration of $\frac{1}{1000000}$ of a second is instantly recognized by the retina, but the effect on the eye lasts fully $\frac{1}{8}$ of a second. The duration of the flashes recently examined by Professor A. M. Mayer, of the Stevens Institute, varied from 0·124 to 0·0416 of a second. An idea of the length of this last mentioned interval may be obtained by recalling the fact that a rapid involuntary wink takes place in nearly the same time. That the Leyden jar discharge is multiple was discovered by Professor Henry, and this has been subsequently confirmed by Cazin, Tedderson, and Rood. Professor Mayer, however, has sought more definite results, and the object of his investigations has been a permanent record of the character of the discharge, of its duration, and of the intervals separating its constituent flashes and sparks. To this end he prepared disks of thin printing paper, blackened over burning camphor, and of a diameter of 5·8 inches. When one of these was revolved very rapidly, it became quite flat by centrifugal action, and in this position the discharge between points or balls perforated it, leaving the required record. By presenting momentarily to the rotating disk the delicate point attached to a vibrating tuning fork, the number of vibrations per second of the fork was determined to the last degree of precision by means of a break-circuit clock, which at each second sent a spark from an inductorium through the fork. The result was traces on the blackened disk; and by tracing the axis of the sinuous line with a needle point, and then drawing radii through symmetrical intersections of the axis on the line, the disk was divided off into known fractions of time. These marks were then rendered permanent, the disk centered on a dividing circle, and the indications read by a low power microscope, determining with accuracy intervals and durations to one 50,000th of a second.

The results thus far obtained we summarize below, and we understand that others have been reached which the investigator withholds until he has subjected them to more careful examination.

The first discharge was between large inductorium points, 0 39 inches apart, the striking distance of the coil being 17·7 inches. Thirty-three clear round holes were made in the disk by a portion of the discharge lasting $\frac{1}{23}$ of a second. The average interval between the perforations at the beginning was $\frac{1}{459}$ of a second; then followed a period of quiescence of $\frac{1}{1500}$ of a second, and then a shower of 30 minute sparks, lasting $\frac{1}{330}$ of a second. The average interval separating these was $\frac{1}{3500}$ of a second. The second discharge was between platinum points, 0·39 inches apart, of a large inductorium, with a Leyden jar of square inches, connected with the terminals of the secondary coil. The discharge on its path around the disk dissipated 91 little circles of carbon, each perforated by from 1 to 4 holes. The discharge lasted 0·124 second, and the intervals were $\frac{1}{556}$ of a second up to the tenth flash. For four fifths of the discharge they were separated by $\frac{1}{5882}$ of a second, and at the last by $\frac{1}{1000}$ of a second.

We understand that Professor Mayer is examining the discharges of the frictional and Holtz machines, as well as of the Leyden jar and inductorium, so that results of considerable scientific interest and importance may be expected.

Rubber Thermometers.

M. Kohlrausch, having several times noticed that glass flasks, closed by stoppers of hard rubber, burst, concluded that this substance must be very dilatable. This hypothesis was fully verified by experiment, for the expansion of this body was found to be about three times that of zinc. From his measures, the coefficient of dilatation for 1° between 16 7° and 25·3° = 0·0000770, and between 25·3° and 35·4° = 0·0000842. Thus, not only has hard rubber a very great coefficient of dilatation, but the latter increases very rapidly with the temperature.

This remarkable property can be applied to the construction of very delicate thermometers. Thus, with a small instrument, consisting of two strips of rubber and ivory, 8 inches long, glued together and fastened at one end, we obtain, at the other extremity, a considerable movement for a change of temperature of one degree. The coefficient of hard rubber is equal, at zero, to that of mercury; above, it is greater. We can, then, as a curiosity, construct a mercury thermometer with a reservoir of this substance, whose changes will be the opposite of those of a common thermometer, and which will fall with an increase of temperature.

The Pennsylvania Railway Company's Figures.

The Pennsylvania Railway Company owns about 16,000 eight-wheeled freight cars, valued at $512 each; 1,800 four-wheeled freight cars, worth $170 each; 521 passenger cars of all grades, worth $3,550 each, and 879 locomotive engines, worth $11,000 each. Total valuation of the rolling stock, twenty millions of dollars. The length of the company's tracks, or those controlled by the company, is 5,934 miles.

MUSCARINE is a new alkaloid obtained from poisonous mushrooms, and especially from the *agaricus muscarius*. Dr. Provost, of Geneva, has shown that, when muscarine is injected into the veins of an animal, the heart is arrested in its diastole. The action of this poison is so much the more remarkable, since in such a case the heart is not dead, nor even paralyzed, and its contractions can be aroused after several hours' silence.

ACCORDING to Képesy, the surgeon to the Austrian Polar Expedition, chocolate, as a beverage, proved most valuable of all; the preserved meat and vegetables in tins being also of the greatest service in sustaining the strength and spirits