increases by two degrees in six or seven hours. They are very marked when a door opening into the hallway is opened for four or five minutes, allowing warmer air to enter the room. The entrance door used when this work is being done is in an adjoining room. When a window is raised for a few minutes, allowing colder air to enter, a sudden decrease in the scale reading results. The convection effect increases as the rate of change of temperature increases.

When the suspended masses have been positively charged, and the large masses have been connected with the lightning rod marked effects have been observed on clear days when there was little or no wind. Sometimes the effect was to eliminate convection effects. In all cases there was an apparent decrease in gravitational attraction. The maximum decrease was usually in the afternoon at about three or four o'clock. The decrease varied from twenty-five to near two hundred per cent. In other words, gravitational attraction was apparently converted into a repulsion.

These results seem to indicate that there is a daily variation in the electrical potential of the earth. The atmosphere, ionized by solar radiation, acts inductively upon that part of the earth which is exposed to sunlight. Lightning flashes from cloud to cloud or from clouds to earth furnish abundant evidence that there are also local variations in the potential of the earth. There is no reason why we should not continue to assume the potential of the earth to be zero, as we assume the level of the ocean to be zero in altitude, but there is evidence that there is a condition of matter such that its electrical potential may be defined as zero absolute. It is the condition or potential of two masses having a like potential due to charges upon them when their gravitational attraction for each other is a maximum.

It seems very probable that the free terminal of a machine having the other terminal grounded in a pond of water, may be at times, nearer to a potential zero absolute, than the grounded terminal, when the machine is in active operation. This would fully account for different results obtained when the electrical machine is used in the electrification of the large masses. These results appear to furnish a complete explanation of the phenomenon known as St. Elmo's fire.

Francis E. Nipher
Washington University

THE BUFFALO MEETING OF THE AMERICAN CHEMICAL SOCIETY. IV

Division of Physical and Inorganic Chemistry

W. E. Henderson, *Chairman*
W. A. Patrick, *Secretary*

Action of perchloric acid on metals and non-metals: H. H. Willard and A. H. Huisken.

Perchloric acid as an oxidizing agent in the determination of chromium and vanadium: H. H. Willard and W. E. Cake.

Perchloric acid as a dehydrating agent in the determininination of silica: H. H. Willard and W. E. Cake.

The arrangement of electrons in atoms and molecules: Irving Langmuir. Starting from Rutherford's and Lewis' theory and from chemical data, a theory of atomic and molecular structure is developed in which the electrons are symmetrically arranged about the nucleus in concentric shells. From some simple postulates the broad features of the physical and chemical properties of all the elements (including eighth group and rare earths) are derived. There follows a new and rational theory of valency called the octet theory, identical with the ordinary theory for organic compounds and for inorganic compounds giving Werne's theory as a special case. The theory also explains the magnetic properties of the elements.

Preferential catalysis and the purification of hydrogen: H. S. Taylor.

New measurements on the direct synthesis of ammonia (lantern): L. H. Adams.

Application of the thermionic amplifier to conductivity measurements (lantern): L. H. Adams and R. E. Hall.

Electrometric titrations, with special reference to the determination of ferrous and ferric iron (lantern): J. C. Hostetter and H. S. Roberts. Conditions are given under which very small, as well as large, amounts of ferrous and ferric iron can be readily determined. Ferrous iron is titrated directly with potassium dichromate (0.002 N to 0.10 N) following the change in potential against

a calomel electrode; ferric iron is reduced with stannous chloride after which the excess of the reducing agent and the ferrous iron are titrated together, the curve of potential against quantity of dichromate showing two points of inflection between which is the amount of dichromate corresponding to the iron. Small amounts of ferrous iron can be determined directly in ferric salts and similarly ferric iron directly in ferrous salts: other applications of the method are given.

The effect of strain on solubility (lantern): J. C. HOSTETTER. It is possible that fluctuating temperature and, perhaps, some indirect effects brought about by pressure may account for the solidification of crystals compressed in contact with their solution by loosely fitting pistons—as found by James Thomson, Le Chatelier and Spring—without the necessity of postulating large increases in solubility due to non-uniform pressure. In preliminary experiments, individual crystals were subjected to stress at constant temperature by direct loading, and the effect on the concentration of the surrounding solution studied, by measuring the electrical conductivity. No change in concentration was found. The test was sufficiently sensitive to indicate that the effect of non-uniform pressure is much less than that produced by the same pressure acting uniformly. However, in another series of experiments in which an unloaded crystal was placed alongside a loaded crystal, the former grew at the expense of the latter, showing that a very slight increase of solubility was produced by the stress. The method of loading the crystals has a large influence on the effects found, thus indicating the importance of the stress distribution. The experiments of Becker and Day on the linear force of growing crystals are cited as indicating the stability of a crystal in its solution, even when subjected to pressure. In their experiments loaded crystals were found to lift the load during growth, although the pressures on the supporting edges of the crystals were finally of the order of magnitude of the crushing strength of the crystal. The evidence so far obtained indicates that the effect of strain on solubility is a second order effect.

A method of growing large perfect crystals from solution (lantern): ROY W. MOORE. This method consists briefly of placing or hanging a small seed crystal or several of them in a nearly-saturated solution, cooling the solution until it is very slightly supersaturated, and maintaining a state of slight supersaturation by slowly cooling the solution, with the temperature regulated within very narrow limits. Under these conditions, the seed crystals will build out to form perfectly developed, clear crystals, and these will continue to grow clear and perfect as long as a state of slight supersaturation is maintained. By this method, crystals of Rochelle Salt have been produced that are three inches or more long and two inches thick, perfectly clear and with all surfaces and angles perfectly developed. This method should be applicable to any substance which crystallizes from solution either in water or other solvents, provided the solubility varies considerably with the temperature.

Action of nitrogen and hydrogen mixture on steel at high pressure and temperature (lantern): R. O. E. DAVIS. When subjected to an atmosphere of nitrogen and hydrogen at high pressure and temperature of 500° C. for some weeks carbon steel shows a marked change in physical characteristics; it is probable that a compound is formed between the iron and the gases.

Comparative tests of palau and rhotanium ware as substitutes for platinum laboratory utensils (lantern): L. J. GUREVICH and E. WICHERS. A series of tests has been carried out at the bureau to determine the suitability of the palau and rhotanium alloys as substitutes for platinum laboratory ware. The tests were of two types, the aim being to determine the resistance of the materials to chemical reagents, and their behavior on heating. These tests indicate that rhotanium "A" ware is superior to platinum ware both of high (2.4 per cent.) and low (0.6 per cent.) iridium content in respect to its resistance to loss on heating. The losses on treatment with acid, after heating, are about equal. Grade "A" ware compares favorably with platinum in resistance to boiling hydrochloric and hydrofluoric acids, to boiling 20 per cent. sodium hydroxide, and to fusion with sodium carbonate in a muffle, and with potassium pyrosulphate. It is superior to platinum in resistance to the action of boiling sulphuric acid, and inferior in its resistance towards boiling concentrated and dilute nitric acids, boiling 10 per cent. ferric chloride solution, and for fusions with sodium hydroxide. The only objection that may be raised to its use is the rather low melting point of the alloy, which makes it impossible to blast or strongly heat the ware without melting it. As far as resistance to loss in weight on heating to 1,200° C. is concerned, rhotanium "C" and palau wares are about equal, if not slightly superior, to platinum ware containing 0.6 per cent. iridium. They are surely superior to

platinum ware containing 2.4 per cent. iridium. Palau and rhotanium "C" behave towards reagents in about the same way as rhotanium "A," except that they are not suitable for potassium pyrosulphate fusions and are inferior to grade "A" for sodium hydroxide fusions. The only striking distinction between rhotanium "C" and palau is the latter's slight superiority in the case of the potassium pyrosulphate fusions. Palau and both grades of rhotanium may all be used to advantage in the electrolysis of chemical solutions, but only as cathodes. As anodes the alloys are worthless. It is believed that in order that the above tests may indicate the true merit of the alloys, information should be available as to the behavior of these wares in actual laboratory service. Unfortunately the authors have very little of such information at their disposal, and suggest that any further available information of this nature, both favorable and unfavorable, be communicated to the Bureau of Standards.

Hydrogen overvoltage; applications to reduction, metal corrosion and deposition (lantern): D. A. MacInnes and A. W. Contieri. MacInnes and Adler have advanced a theory in which hydrogen overvoltage is related to the surface energy necessary to form the evolved bubbles. The theory requires that the overvoltage increase with a decrease of the external pressure, and *vice versa*, a prediction verified in some unpublished work by Goodwin and Wilson. In this paper it is shown that, in acid solutions, reduction by metals is accelerated, corrosion of metals is decreased, and the electrolytic deposition of metals is made more efficient, by reducing the external pressure.

The ternary system CaO-MgO-SiO_2 (lantern): John B. Ferguson and H. E. Merwin. A brief discussion of the experimental methods, followed by a general survey of the liquidus-solidus relations. Several new compounds will be described; the solid solutions of different types which occur will be touched upon and the effect of solid solutions upon inversion temperature will be mentioned.

The influence of chemical composition on the birefringence in strained glass (lantern): Erskine D. Williamson. All glasses to be used for optical instruments must be tested for the presence of internal strains. The only convenient method of accomplishing this is to measure birefringence as observed between crossed nicols. It is therefore necessary to know how the observed birefringence for a given amount of strain depends upon the composition of the glass which is being used. Figures are presented for the eight types of optical glass made by the Pittsburgh Plate Glass Company during the war.

The determination of oxygen by the copper-ammonia-ammonium chloride reagent: W. L. Badger.

Fluidity and hydration (lantern): Eugene C. Bingham.

The preparation of cyanogen chloride: W. L. Jennings and W. B. Scott. Nearly quantitative yields (98 per cent.) of cyanogen chloride may be obtained conveniently by passing chlorine into finely powdered sodium cyanide, containing 2 per cent. of water, suspended in carbon tetrachloride and kept cooled to $-3°$ C. At the end of the operation the product is distilled off and by redistillation over mercury is obtained pure. This method appears to be an improvement on the earlier methods in which mercuric cyanide was used as initial material, and on the later methods in which chlorine was passed into aqueous solutions of hydrocyanic acid or alkaline cyanides.

Electrolytic preparation of permanganates: Charles Hecker.

A study of the constant-boiling mixture of hydrochloric acid and water: Marion Hollingsworth.

A holder for spools of iron wire for standardization: Marion Hollingsworth. The holder is made from sheet metal and carries the spool supported in a stoppered bottle. The construction is such that the wire may be conveniently drawn out as desired without exposing that which is left to the corroding atmosphere of the laboratory.

A new buret support: Marion Hollingsworth. This support is designed to carry a buret attached to a supply bottle. It has the advantage that the buret's height may be varied without any of the graduations being obscured.

Charles L. Parsons,
Secretary

(*To be concluded*)

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