experiments, this point was reached by the fourth subplant, in which latter the original inoculum was present in an estimated dilution of one to ten million.

If multiplication of the active agent be indicated by the capacity of the fourth and more remote subplants to induce mosaic disease in normal plants, then of 17 attempts to culture the active agent of tobacco and tomato mosaic, all must be considered as successful but one. It was found that normal tomato plants showed the disease on inoculation with early and remote subplants, up to the twelfth, which represented a diluted of the initial inoculum of one to 4×10^{-16}. Once the experimental disease gained a foothold, there was no difference in the severity of the affection following inoculation of the subplants from that induced by the original, undiluted active agent itself. All the characteristic signs regarded as criteria of the disease were present. The experimental mosaic disease induced by the cultural fluids could be transmitted from plant to plant in unlimited series both by direct application of the liquid of the affected plant to previously normal tomato leaves and by inoculation with the material from subplants of the liquid in the artificial medium.

In the course of the experiments a significant fact was noted, namely, that the agent present in remote subplants which can induce the disease was not readily filterable. The nature of the change thus indicated remains to be determined.

The conclusion seems justified that the incitant of mosaic disease of tobacco and tomatoes is a living, microbic body which can be cultivated in an artificial medium.

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THE AMERICAN CHEMICAL SOCIETY

DIVISION OF INORGANIC AND PHYSICAL CHEMISTRY

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A re-determination of the heats of oxidation of certain metals: S. W. PARR and J. E. MOOSE. (1) A direct method and apparatus have been perfected for the accurate determination of the heats of oxidation of certain metals. (2) Very pure aluminium, cadmium, cerium, lanthanum, magnesium, molybdenum, tantalum, tin, tungsten, and zinc have been completely oxidized inside a specially designed combustion crucible and the thermal effect of the oxidation measured. (3) Beryllium has been partially oxidized and the thermal effect measured. (4) Certain metals may be completely oxidized inside a Parr oxygen bomb when sized and arranged properly about a fuse wire within a combustion crucible and subjected to thirty atmospheres pressure of oxygen. (5) The values recorded for the same metal agree more closely than those that have been obtained by indirect methods.

The mechanism of acid catalysis of ester hydrolysis: JAMES KENDALL and CECIL V. KING. Freezing point determinations have been made upon dilute aqueous solutions of ethyl acetate; hydrochloric, trichloracetic, monochloracetic and acetic acids; and equimolecular mixtures of each of these acids with ethyl acetate, in concentrations up to the limit of solubility of ethyl acetate. Specific conductivities have been measured, at 0°, upon solutions of these acids and their equimolecular mixtures with ethyl acetate. The velocity of hydrolysis of ethyl acetate, at 0°, was measured, in the latter solutions. The approximate solubility of ethyl acetate, at 0°, in these solutions was noted. Experiments were carried out to determine the effect of the presence of ethyl acetate upon the velocity of inversion of cane sugar when catalyzed by hydrochloric acid. The collected data have been analyzed with the object of determining the state of molecular complexity in the acid-ester solutions, and the effect of water upon acid-ester compounds. The bearing of the results obtained upon the dual theory of acid catalysis and upon Rice's theory of catalysis by unhydrated hydrogen ion has also been considered.

A new energy relation governing liquids and vapors: J. E. MILLS. The author has previously shown in a long series of articles published mainly in the *Journal of Physical Chemistry* that molecular forces obey the law,

$$1. \qquad f = \frac{-m_1 E}{s^2}$$

where f is the force acting between two molecules, m_1 is the mass of a molecule, E is a constant

$$= 31414 \sqrt[3]{\frac{3}{4\pi}} \sqrt[3]{m_1 \mu^1}$$

and s is the distance through which the force acts.

It is now shown that under this law

2. $\mu^1 \sqrt[3]{d_o} - \left(\mu^1 \sqrt[3]{d} + \frac{Ej}{2} \right)$ = energy given out on changing from the density at the absolute zero to any other density d (liquid) or D (vapor) $= C\,R\,T \ln \frac{d^o}{d}$.

Ej is the temperature energy of the molecules. C is the constant of Dieterici's equation for the internal heat of vaporization, namely, $\lambda = C\,R\,T \ln \frac{d_o}{d}$

$$3. \quad \mu^1 \sqrt[3]{d_o} = \mu^1 \sqrt[3]{d} + \frac{Ej}{2} + C\,R\,T \ln \frac{d_o}{d} \text{ for liquid}$$

$$= \mu^1 \sqrt[3]{D} + \frac{Ej}{2} + C\,R\,T \ln \frac{d_o}{D} \text{ for vapor.}$$

This equation has been tested for ethyl oxide, di-isopropyl, di-isobutyl, isopentane, normal pentane, normal hexane, normal heptane, normal octane, benzene, iodo-benzene, carbon tetrachloride and stannic chloride from 0° C. to the critical temperature of the substance. The results calculated from the liquid and from the vapor are in remarkable agreement and in all substances investigated the results agree with the values obtained at the absolute zero. The equation, therefore, confirms in the most striking manner the fact that the molecular attractive forces vary inversely as the square of the distance apart of the molecules. Also the equation gives a new energy relation apparently holding true for all non-associated substances from the absolute zero to the critical temperature of the substances.

A new method of studying electrode potentials: HOMER D. HOLLER. The usual methods of measuring electrode potentials during the flow of current are subject to error because of potential difference due to resistance. The new method distinguishes between electromotive force of polarization and potential difference due to resistance. A resistance-coupled electron tube amplifier is used with an oscillograph for photographically recording the variations in electrode potential without drawing any current from the electrode which is in the grid circuit. Also by superposing an alternating current upon the electrode, the potential difference due to resistance may be obtained by measuring the a. c. component in the plate current with a separately excited wattmeter.

An oscillographic study of electrolytic rectification: HOMER D. HOLLER and JOHN P. SCHRODT. The degree of rectification and the energy efficiency obtainable with the "valve" electrode depends upon the electrical characteristics of the circuit as well as the physical dimensions and condition of the electrode. The study of the effect of these factors upon electrolytic rectification resolved itself into an analysis of the wave-form of the rectified current under different conditions. The effects of inductance with and without an iron core, capacity, counter electromotive force and temperature were demonstrated theoretically and confirmed by oscillographic records.

The activation of hydrogen in the creepage corona: F. O. ANDEREGG and W. N. HERR. Glass wool, previously found active in promoting the oxidation of nitrogen in the creepage corona, has been shown to be more helpful in activating hydrogen than either flint or earthenware fragments or a bare platinum wire. However, the glass wool tube soon loses its efficiency. It may be restored by letting a little air in and then sweeping out or by passing a discharge through pure nitrogen for a few minutes. Traces of oxygen or nitrogen added to pure hydrogen had little effect on the poisoning. Probably an active form of hydrogen is adsorbed on the glass wool.

Some experiments on the self-corrosion of lead: F. O. ANDEREGG. A study has been made of the corrosion of the commercially pure lead, the 1 per cent. antimony-lead and the 3 per cent. tin-lead used for telephone cable sheath by burying samples in many kinds of soil at room and at incubator temperature, by observing the corrosive action of solutions of varying pH, by making c.m.f. measurements and by metallographic observations. Of the three, tin-lead is most and antimony-lead usually least resistant to corrosion. The self-corrosion increases with the organic content of the soil, with the presence of salts, with the poorness of the drainage and with the presence of mortar, cement, gypsum, etc. It is dangerous to place lead in contact with the soil. Asphalt, if continuous, should give good protection. The complete details are given in Bull. 18 of the Purdue University Engineering Experiment Station.

The solubility of ferrous hydroxide and its effect upon corrosion: W. G. WHITMAN, R. P. RUSSELL, G. H. B. DAVIS. (a) *Solubility of ferrous hydroxide.* Experiments are described in which the solubility of ferrous hydroxide has been determined in water and in solutions of varying concentrations of sodium sulfate, calcium chloride, sodium chloride, ammonium chloride, magnesium chloride, sodium dichromate, sodium chromate, sodium silicate and sodium hydroxide. These solutions of ferrous hydroxide were prepared by adding pure iron powder to the deoxygenated salt solutions, which were allowed to stand until saturated with ferrous hydroxide. The solutions were then filtered under hydrogen and analyzed for iron by a colorimetric method. Data are also given whereby the solubility of ferrous hydroxide may be calculated in non-oxidizing salt solutions. The dissociation constant for ferrous hydroxide is calculated as 6×10^{-10}, the ionization in saturated solutions as 30 per cent. at 25° C., and the free energy of formation as 57,200 calories. (b) *Comparison with corrosion data.* Data on the specific rates of corrosion of iron in various salt solutions have been obtained. The corrosion results parallel the solubilities of ferrous hydroxide in the same solutions. It is suggested that this is due to changes in the protectiveness of the rust film with the solubility of ferrous rust, and that decreased solubility causes a decrease in rate of corrosion.

The activity of hydrochloric acid in ethyl alcohol: PAUL A. ANDERSON. From the experimentally determined electromotive forces of cells of the type: H_2, HCl (alcoholic), HgCl, Hg measured at 25° C. over the concentration range 0.01 to 5.0 *M* are calculated the activities, and their coefficients, of hydrochloric acid in anhydrous ethyl alcohol. It is assumed with Danner, *J. Am. Chem. Soc.*, *44*, 2832, (1922), that $\gamma = \frac{\lambda}{\lambda o}$ as a first approximation in dilute solutions.

The conductivity of phosgene solutions. I. Solutions of aluminium chloride in phosgene: ALBERT F. O. GERMANN. Liquid phosgene forms conducting solutions with aluminium chloride, contrary to the prediction made by Beckmann, as a result of his study of the ebullioscopy of phosgene solutions. The gaseous products of electrolysis are carbon monoxide and chlorine, which in the type of cell used partially recombine in diffused light to form phosgene before they can be collected. The specific conductance of the phosgene used was of the order of 0.007×10^{-6} at 25°. Three series of conductivity measurements for solutions of aluminium chloride[1] used at 0° made the results at −45° appear of doubtful value, as the value of the cell constant can not be determined directly at this temperature. The value of the specific conductance at 25° rises progressively from the most dilute solutions to a value of 550×10^{-6} for the saturated solution, and increases in conductivity of the order of 10^5.

A preliminary paper on heats of adsorption from solution: D. C. LICHTENWALNER and NEIL E. GORDON. In previous papers, the adsorption of various salts by hydrous ferric and aluminum hydroxide has been reported. In this paper, the heats liberated when these salts are adsorbed by the iron and aluminum are measured, and an attempt is made to draw some conclusions between the heats of adsorption and the total amounts adsorbed. The salts used are potassium acid phosphate, magnesium acid phosphate and magnesium sulphate, with both iron and aluminum oxides.

The influence of hydrogen ion concentration on the adsorption of precipitating ions: HARRY B. WEISER and EVERETT E. PORTER. An investigation of adsorption during the precipitation of colloidal hydrous chromic oxide, at varying hydrogen ion concentrations. The adsorption of salt anions during the precipitation of gels stabilized by hydrogen ion is greater the greater the hydrogen ion concentration. However, the adsorption is appreciable even on the alkali side of the neutral point and is completely nullified only in the presence of an appreciable concentration of hydroxyl iron. The adsorption varies with different precipitating ions at the same hydrogen ion concentration and there is no indication of the formation of definite compounds. The most strongly adsorbed ion precipitates in lowest concentration, in accord with Freundlich's rule. It is probable that Loeb failed to observe the taking up of anions from neutral salts on the alkali side of the isoelectric point of gelatine because he worked with concentrations of salt anions which were too low relatively to that of hydroxyl.

The relation of pore size in silica gels to adsorption of gases and vapors: HARRY N. HOLMES and H. F. WEIDE. The authors found that in silica gels there is an optimum pore diameter corresponding to the maximum adsorption of a particular gas or vapor. A method was devised for preparing highly adsorbent gels with pores differing widely in average diameter. The adsorption of benzene, toluene, acetone, methyl alcohol, ethyl alcohol, acetic acid, methyl propionate and ethyl acetate at equal partial pressures was studied. With these substances molecular volume and critical temperature showed the greatest influence on adsorption.

Absolute unit of fluidity: EUGENE C. BINGHAM. The term *reciprocal poise* is not a satisfactory term for the absolute unit of fluidity. The term *rhe* is suggested. Since fluidities are referred to many different temperatures, it is desirable to take the fluidity of water at one temperature as standard. It is proposed that the fluidity of water at 20 degrees be taken for all calibration purposes at 100.5.

Colloid distribution and the capillary rise of sols: T. R. BRIGGS. The capillary rise of sols in filter paper has been studied from the point of view of the distribution of a suspended colloid between a liquid and a solid phase. Anything which peptizes the colloid acts against its adsorption by the paper and favors the capillary rise. Destabilizing agents favor adsorption by the paper and bring about a decrease in the capillary rise. The theory is general and applies to emulsification with finely divided solids and to the process of dyeing with the substantive or colloidal colors.

Colloid distribution and the theory of dyeing with substantive colors: T. R. BRIGGS. From a consideration of the general process of colloid distribution, a special theory of substantive dyeing has been formulated and tested by experiment. A substance which destabilizes the suspension of the dye will act as an assistant in the dyebath up to the point of actual flocculation. A substance which stabilizes the suspension of the dye will act as a restrainer, providing it does not act as a mordant toward fiber and dye. A stabilizing substance and a destabilizing substance may each exert their special effect in the same dyebath. Transition dyes undoubtedly exist which combine with their properties of acid or basic dyes the characteristics of substantive dyes.

The conductivity of suspensions: HUGO FRICKE and STERNE MORSE. One of us has developed the following formula for the conductivity of suspensions of spheroids in terms of the conductivities of the suspending liquid, suspended particles and the shape of the latter, on the assumption that the arrangement of the particles is fortuitous:

$$\frac{K - K_1}{K - K_2}\left(1 - \frac{K_2}{K_1}\right) = \beta\frac{\rho}{1-\rho}$$

where

K = conductivity of suspension

K_1 = conductivity of suspending liquid

K_2 = conductivity of suspended particles

ρ = volume concentration of suspended particles

$$\beta = \frac{1}{3}\left[\frac{2}{1 + \left(\frac{K_2}{K_1} - 1\right)}\sigma + \frac{1}{1 + \left(\frac{K_2}{K_1} - 1\right)(1 - \sigma)}\right]$$

$$\left(\frac{K_2}{K_1} - 1\right)$$

$$\sigma = \int_0^\infty \frac{d\lambda}{\left(1 + \frac{b^2}{a^2}\lambda\right) \tfrac{1}{2} \left(1 + \lambda\right)^2}$$

a = axis of rotation of spheroid

b = conjugate axis of spheroid.

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[1] At — 45°, 0°, and 25°. Anomalous behavior of the cell.

Graphs for β are given for various values of $\frac{K_1}{K_2}$ and $\frac{a}{b}$. The formula has been tested by comparison with Stewart's values for the conductivity of suspensions of red blood corpuscles $\left(\frac{a}{b} = \frac{1}{4.25}\ K_2 = 0\right)$ with agreement to 1 per cent. or less, within the experimental error and with our own experimental data for cream $\left(\frac{a}{b} = 1, K_2 = 0\right)$ with about the same good agreement. The actual size of the particle does not enter in. The value of the shape appears only in the constant β which is not greatly changed by most combinations of $\frac{K_1}{K_2}$ and $\frac{a}{b}$. Graphs for β for various values of $\frac{K_1}{K_2}$ and $\frac{a}{b}$ are given.

The effect of hydrophilic colloids on the size and distribution of particles in electrolytic precipitation. III Macroscopic crystals from evaporation: DORMAN MCBURNEY and WESLEY G. FRANCE. The size of macroscopic crystals formed by evaporation in both the presence and absence of addition agents was studied with basic lead carbonate, using gelatin, tannin, agar-agar and egg albumen, in concentrations from 0 per cent. to 1 per cent. The addition of gelatin or egg albumen was accompanied by the formation of smaller crystals, and by an increase in the number of crystal groups. The samples to which agar-agar had been added showed clumps of crystals branching from a central nucleus. The presence of tannin seemed to inhibit the formation of well-defined crystals. (By title).

A new method for the separation of elements of the rare earths: JAMES KENDALL and BEVERLY L. CLARK. The ionic migration method previously proposed for the separation of isotopes (Proc. Nat. Acad. Sci., *9*, 75 (1923)) has been successfully extended to the fractionation of certain rare earth mixtures. A gel containing the given mixture is placed in a long glass tube, between a section of KCl gel (nearer the anode) and a section of chromic sulphate gel (nearer the cathode). On electrolysis, since the K^+ moves more rapidly than the rare earth ions, and the Cr^{+++} moves more slowly, the two boundaries of the central section remain quite sharp, even after it has travelled a long distance. If the rare earth ions themselves have appreciably different mobilities, the faster ion should accumulate in the front portion and the slower in the rear portion of this section so that a complete separation should readily be obtained. Short runs have been carried out with three mixtures: yttrium-erbium, gadolinium-samarium and neodymium-praseodymium. In the first two cases a 400 cm run gave practically perfect separation, in the last the separation was only partial.

The ammonium carbamate equilibrium: T. R. BRIGGS and V. MIGRDICHIAN. The system solid ammonium carbamate, ammonia and carbon dioxide has been reinvestigated from the point of view of the Mass Law, at temperatures between 10° and 45°, and in the presence of an excess of either one of the gaseous components. The dissociation pressure of ammonium carbamate has also been redetermined between these temperatures. The equilibrium has been found to conform very closely to the requirements of the Mass Law.

The detection of azeotropic mixtures: T. R. BRIGGS. A simple laboratory method of distinguishing between a chemical individual and an azeotropic or constant-boiling mixture has been devised and applied to the systems: hydrochloric acid-water and methyl alcohol-benzene. The method is based on the familiar principle that the azeotropic composition is displaced by a change of pressure. A complete cycle of distillation, reversible with respect of either the residue or the distillate, is described. The method is especially available as a simple and instructive experiment in a course in physical chemistry (By title).

The binary system, silver perchlorate-pyridine, and the ternary system, silver perchlorate-pyridine-water: RUDOLPH MACY. A phase rule study of the binary system has been made from the eutectic to temperatures above 100°, and the solubility curves of 3 molecular compounds determined. The compositions of these compounds were obtained from a study of the ternary system at 25°. They are $AgClO_4.4C_5H_5N$, $4AgClO_4.9C_5H_5N$, and $AgClO_4.2C_5H_5N$. Of these only the first compound was obtained in pure enough form for the composition to be checked by a direct analysis. A complete study of the ternary system was made at 25°.

Germanium tetraethyl: L. M. DENNIS and F. E. HANCE. Germanium tetraethyl was prepared by the interaction of zinc diethyl and germanium tetrachloride in an atmosphere of carbon dioxide, using an apparatus of special design. The compound was shown by analysis to correspond with the formula $Ge(C_2H_5)_4$. It is a colorless, oily liquid boiling at 163.5°, freezing at $-90° \pm 0.2°$, having a specific gravity of $0.9912\ \frac{24.5°}{24.5°}$ and a refractive index at 20° of 1.4000. It is insoluble in water, miscible in all proportions with ethyl alcohol, diethyl ether, benzene and some other organic solvents. It is not easily attacked by oxidizing agents and is stable in the air under ordinary conditions. It burns with a smoky flame, leaving a residue of the normal and lower oxides of germanium.

The physical properties of monogermane: ROBERT B. COREY. Monogermane, GeH_4, prepared as described in a previous investigation, was carefully purified. The density as gas, the density as liquid, the melting point and the boiling point of the compound were determined, and the tension-temperature curve was plotted. Vapor tension values quite different from those previously published by Schenck were obtained.

The behavior of anhydrous hydronitric acid toward various inorganic salts: A. E. MCKINNEY. A qualitative study of the behavior of anhydrous liquid hydrogen trinitride at 0° toward about 250 solid substances, chiefly inorganic salts, has been made. It has been shown that this liquid acts as a dissociating solvent toward a large number of inorganic solutes, but shows little or no tendency to form solvates. In the case of certain inorganic salts solvolysis has been found to take place. Qualitative observations have been made on the behavior of the various salts during electrolysis.

Heavy metal azido-dithiocarbonates: G. B. L. Smith and Paul Wartman. Aqueous solutions of $HSCSN_3$ form insoluble precipitates with $AgNO_3$, $Hg_2(NO_3)_2$, $HgCl_2$, $AuCl_3$, $CuSO_4$, $ZnSO_4$, $Cd(C_2H_3O_2)_2$, Tl_2SO_4, $Pb(C_2H_3O_2)_2$, and $Bi(NO_3)_3$. Of these substances, the following have been identified by analysis, and their chemical and crystallographic properties studied: $AgSCSN_3$, $Cd(SCSN_3)_2.2H_2O$, $Hg(SCSN_3)_2$, $Hg_2(SCSN_3)_2$, $TlSCSN_3$ and $Pb(SCSN_3)_2$. The heavy metals of the first group of the periodic system as well as univalent mercury form amorphous or cheesy precipitates, which are probably highly hydrated. The heavy metals of the second, third and fourth groups form crystalline precipitates of well-defined structure. All these salts in the dry state are sensitive both to shock and heat. The crystalline substances are more or less sensitive to shock, not only in the dry state, but also in contact with the mother liquor. The violence of the explosion appears to be a function of the atomic weight of the basic ion, increasing with rising atomic weight.

Azido-dithiocarbonates of the alkali and alkaline earth metals: L. F. Audrieth. Aqueous solutions of alkali and alkaline earth trinitrides react with CS_2 to form the respective azido-dithiocarbonates. The following salts have been isolated, analyzed and identified, and their chemical and crystallographic properties have been studied: $LiSCSN_3.H_2O$, $NaCSN_3$, $NaSCSN_3.2H_2O$, $NaSCSN_3.4H_2O$, $KSCSN_3$, $RbSCSN_3$, $Ca(SCSN_3)_2.5H_2O$, $Sr(SCSN_3)_2.5H_2O$, $Ba(SCSN_3)_2.5H_2O$. Evidence has also been obtained of the existence of the compound $CsSCSN_3$. The K, Rb and probably Cs salts crystallize from aqueous solution in the anhydrous state, while the salts of the alkaline earth metals and of the two ansition elements of Group I, Na and Li come out as rates. All these salts in the dry state are sensitive to shock and heat. The violence of the explosion ars to be a function of the atomic weight of the basic ion increasing with rising atomic weight.

Standardization of sodium thiosulfate solution: Stephen Popoff and J. L. Whitman. The study of equilibrium conditions between sodium thiosulfate and iodine was made the basis for the determination of the best conditions for the standardization of sodium thiosulfate by iodine, $KMnO_4$, $K_2Cr_2O_7$, $KBrO_3$ and Cu. The normalities of the thiosulfate checked to within 0.05 per cent., regardless of the standard used, except in the case of Cu. Maximum variation among the results was not more than 0.06 per cent. as compared with 0.3 per cent. by other investigators. This accuracy was made possible by the study of the equilibrium conditions, by employing the electrometric method in all titrations even in the standardization of $KMnO_4$ by $Na_2C_2O_4$ (in spite of the common statement that the latter was not possible) and by using a special form of apparatus for weighing the iodine.

Electrometric titrations in acidimetry and alkalimetry without the use of the hydrogen electrode: Stephen Popoff and John McHenry. Since the hydrogen electrode requires time to come to equilibrium with any solution, and since it is poisoned or influenced by some substances, platinum wire, especially treated, was made the basis of a study of both titrations in acidimetry and alkalimetry and actual determination of hydrogen ion. The results obtained are good and promising.

The determination of iron: Stephen Popoff, Cecil Powell and John McHenry. The order of the addition of iron and ammonia solutions and the number of reprecipitations in the determination of iron in the presence of sulfates was studied. If double precipitation is used, the order of the addition of iron and ammonia makes no appreciable variation; if single precipitation only is resorted to, the results are low regardless of the order of the addition of reagents (By title).

A sensitive test for copper: Stephen Popoff and Carl W. Tucker. The use of potassium ferrocyanide as a test for copper in the electrolytic determination of that metal is hardly justifiable even in ordinary work. By substituting haemotoxylin and by using copper gauzes as cathodes and a special form of platinum anode, the accuracy is increased and the cost reduced to a minimum (By title).

A new design circuit breaker for laboratory thermostats: G. Frederick Smith and C. E. Hollister. A modified telegraphic relay presents difficulties as a working part of electrically heated laboratory thermostats. This article describes a deviee designed with the aim of eliminating these difficulties and fulfils the following qualifications: (1) The power contacts will continuously open and close a 100 watt heating load at 110 volts. (2) The use of condensers has been found unnecessary on voltages up to 110. (3) Springs are eliminated. (4) The magnetizing winding operates at low voltage with low current in order to minimize arching at the mercury contact of the toluene regulator. All dimensions and details of design together with photos and cross-section drawing of the device are given for the purposes of duplication. The apparatus has been thoroughly and favorably tested (By title).

Formation of mother of pearl: F. G. Donnan. By allowing an aqueous solution of calcium bicarbonate containing gelatin to slowly evaporate, it is possible under suitable conditions to produce a deposition of calcium carbonate in a close Liesegang ring formation, which exhibits diffraction colors nad pearly luster, closely resembling natural mother of pearl in these respects.