ing tendency to confine themselves to detailed directions for the performance of a number of more or less well selected but highly specialized electrical measurements. Such methods provide an easy introduction to the technique of the electrical laboratory and they are frequently useful in dealing with elementary students provided the underlying principles and their interrelations are clearly emphasized. But, when they become crystallized in book form, the several experiments are apt to occupy watertight compartments, between which the student sees very little relation. He performs the specified manipulations and draws the specified conclusions without obtaining the slightest inkling of their significance in electrical science, because he has been relieved of the study necessary for understanding. Moreover, owing to variations in equipment, even the best of such books are of little use except in the laboratories for which they were written.

Professor Laws's book is a welcome departure from these methods and can not fail to be greatly appreciated by serious students of electrical science. It is a clear and comprehensive treatise on modern methods of electrical measurement and includes sufficient discussion of typical instruments to guide the student in their practical application whatever may be the type of the instruments with which he has to deal. A few methods of purely historical interest are described, but for the most part the methods and instruments discussed are so thoroughly up to date that many of the more recent developments can be found elsewhere only in the original publications of their authors. Numerous references to original sources direct the student to first-hand discussions of the topics treated and to special methods and details beyond the scope of the present work.

The following list of chapter headings gives an idea of the field covered by the book: Measurement of Current; The Ballistic Galvanometer; Resistance Devices; Measurement of Resistance; Measurement of Potential Difference and Electromotive Force; Power Measurement; Measurement of Inductance and Capacity; Induction Instruments; Electricity Meters; Phase Meters; Power-factor Indicators; Synchroscopes and Frequency Meters; Graphic Recording and Curve Drawing Instruments; Instrument Transformers; Calibration of Instruments; Determination of Wave Form; Cable Testing.

The theory of methods and instruments is logically developed from fundamental principles and the conditions necessary for accuracy are discussed at some length in connection with practical applications. Galvanometers of various types are treated with the fulness merited by their general use as indicating and measuring instruments. The equation of motion of the suspended system is developed and integrated in its general form. Special cases are then derived by suitable choice of initial conditions and dynamical constants. The results thus obtained are utilized throughout the book in discussing the proper adjustment of resistance, control torque, period, damping factors, deflecting couple and sensitiveness to meet the requirements of the various uses of the galvanometer.

The typography of the book is clear and well arranged. The few misprints, inevitable in a first edition, are apparent and easily corrected. Most of the diagrams and illustrations are clear and well executed but a few of the halftones do not give a very clear idea of the instruments represented. The reader is assumed to be familiar with the fundamental principles of direct and alternating current systems of distribution and with the methods of differential and integral calculus. With this equipment he should find no difficulty in following the author's clear and concise discussions. The book is well adapted for use in senior college laboratories and it should also find a place in the working library of every electrical engineer.

A. deForest Palmer

SPECIAL ARTICLES

A NEW AND IMPROVED METHOD FOR OBTAINING PECTIN FROM FRUITS AND VEGETABLES

For more than two years past the writers have been engaged in the study of methods for

the isolation and purification of pectin. The studies, which were for the most part carried on at the Washington Agricultural Experiment Station, were at first concerned with the preparation and concentration of pectin for household use.[1] This work led to attempts to develop practical and inexpensive methods for the isolation of pectin in a pure state which should be equally available for the household or for commercial use. Such a method was developed and perfected in the autumn of 1917, but the transfer of the authors from the Washington Station to this office has delayed the preparation of a detailed report of the results for publication. The purpose of this preliminary note is to make the method immediately available pending the publication of a detailed paper now in the hands of the editor of the *Journal of Agricultural Research.*

The method is available for use with any pectin-containing material, since the objectionable flavoring substances of such materials as carrots are entirely removed.

The pectin is extracted from the material by the usual method of pulping, boiling with water and draining, this process being repeated until the pulp is exhausted. The watery extracts are combined, cooled, and a small quantity of a saturated solution of commercial alum, the exact amount being determined by the viscosity of the liquid, is slowly added and thoroughly mixed with the solution. Ammonia is now added in an amount slightly greater than that necessary to neutralize the acidity of the solution or until no further precipitate is formed. Precipitation will not occur if the solution is a concentrated, viscous one, and in all cases warming, or preferably diluting with hot water, hastens the coagulation of the precipitate and the clarification of the liquid. The voluminous insoluble precipitate of aluminum hydrate holds and carries out with it suspended solids and a considerable portion of the coloring matter.

As soon as the clarification is completed the solution is filtered and the residue upon the filter paper is preserved and dried for subsequent recovery of the aluminum. An ordinary laboratory grade of filter paper permits rapid filtration and retains the precipitate perfectly.

The water-clear filtrate, which contains only pectin, sugars, and traces of coloring matter, is heated to boiling, and magnesium-sulphate crystals are added, with constant stirring, until the formation of the flaky, grayish precipitate of pectin has ceased. The solution is then passed through filter-paper, preserving the filtrate, and the precipitate is freed from magnesium sulphate by washing with cold water and dried. The dry preparation may be readily reduced to a grayish powder, insoluble in cold water but readily soluble in warm acid solutions. It is entirely free from the coloring and flavoring matters of the material from which prepared. It may consequently be employed in making jellies from even the most delicately flavored fruit juices without danger of introducing foreign flavors. This makes possible the use not only of fruits but also of such pectin-rich but hitherto unavailable materials as the carrot as sources of pectin for jelly-making purposes. By reason of the purity of the product made by this method, it may be kept for prolonged periods in the dry condition without deterioration. In comparison with the ordinary commercial concentrated pectin there is an enormous reduction in volume and in cost of storage and transportation, a considerably decreased cost of production with a wider variety of raw materials available as sources, and a greatly increased range of usefulness.

An especially valuable feature of the process is that the chemicals employed may be almost completely recovered, thus reducing the cost of the process to a minimum. The aluminum salt is recovered as aluminum oxide by incinerating the residue from the first filtration. The magnesium sulphate is recovered as such from the final filtrate by concentration and the addition of a small quantity of alcohol, which causes the prompt crystallization of the salt, leaving coloring matters and sugars in solution in the dilute alcoholic liquid. Purifica-

[1] Caldwell, J. S., "A New Method for the Preparation of Pectin," *Wash. Agric. Expt. Sta. Bull.*, 147: 1–14, April, 1917.

tion of the magnesium sulphate is completed by washing the crystals with very dilute alcohol, after which they may be immediately used for further precipitation.

In the complete paper the authors will discuss in some detail the application of this method to the quantitative determination of pectin in the laboratory or in commercial jelly-making establishments. It is considered especially desirable at this time to point out that precipitation by magnesium sulphate may advantageously supplant the use of alcohol in the household test for pectin. While alcohol is not ordinarily available to the housewife, Epsom salts are to be found in every home and in almost every grocery store. By heating a small quantity of the aqueous extract of fruit, dissolving Epsom salts therein, and observing the amount of pectin thrown out of solution, one obtains an accurate measure of the pectin content of the fruit and is thereby enabled to form a judgment as to the amount of sugar necessary to form a jelly.

Discussion of many details of technique and of certain applications of the method here presented in outline are necessarily reserved for presentation in the full paper immediately forthcoming in the journal already named.

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THE CARE AND BREEDING OF ALBINO RATS

At this time when the government is using great numbers of albino rats and mice for inoculation purposes, numerous letters have been received from various sources asking for information regarding a source of supply and the care and breeding of these animals. This demand is so widespread that it is deemed most expedient to give this information in a simple form and to disseminate it to the greatest number of people by publishing it in this journal. In so doing those persons who are anxious to do their bit in this present crisis and who reside sufficiently near base hospitals and cantonments may be able to rear and supply these animals.

Albino rats and mice are exceedingly easy to raise. Their care and feed are practically the same and the cages in which they are kept can be identical. The cages for mice can, however, be much smaller. Our colony at the present time consists wholly of rats and the following applies strictly to them. It in general applies to mice also. These animals can ordinarily be handled by the bare hands without any danger of being bitten. Occasionally, however, a mother with young may be less docile if her young are disturbed. In such cases the use of a pair of heavy gloves is advisable. The oftener the rats are handled and petted the less likely they are to bite.

The cages in which our rats are kept and which we have found most satisfactory are made of one-fourth-inch galvanized wire netting with all the corners, edges and doors bound, or reënforced by galvanized iron (Fig. 1). They are made 12 inches high, 18 inches wide and 24 inches long. A partition of woven galvanized wire, provided with a sliding door (D 4 in. $\times$ 4 in.), divides this into two compartments 12 in. $\times$ 12 in. $\times$ 18 in. Each of these compartments is provided with a woven wire door (D, 6 in. $\times$ 6 in.) which slides up in runners made of galvanized iron (Rn). These doors are of ample dimensions to enable one to easily reach into all parts of the cage.

The bottom is separate and composed of galvanized iron 20 in. $\times$ 25 in. with three of the sides turned up 1 in. The front side is left flat to facilitate cleaning. The cage thus sits in this bottom and can be readily lifted off when cleaned. This process, which should be attended to at least once in two weeks, can be accomplished without handling the rats or without danger of their leaving the compartments to which they belong. This is done by placing the whole cage on a broad table, lifting the top about one half an inch and carrying it along to the bare table. The rats are thus forced along with the cage and the bottom left free. The old sawdust and excelsior used for bedding are now scraped out and a fresh supply added. The cage containing the rats in