The PUGET SOUND CHEMIST

Bulletin of the Puget Sound Section of the American Chemical Society

VOLUME VII APRIL • 1946 NUMBER 8

April Meeting

Puget Sound Section of the American Chemical Society

Wednesday • April 24, 1946

6:30 P.M. • Dinner • The Chalet
15th Avenue N. E. and East 42nd Street

8:00 P.M. • Address • Bagley Hall • Room 140

SPEAKER

Dr. Albert L. Elder

Director of Research, Corn Products Refining Company
Head Chemical Adviser to the War Production Board
Co-ordinator of the Penicillin Program

SUBJECT

Chemicals from Agricultural Products

•

Phone your reservations for dinner to

DON REDFERN — MAin 3536

or

MRS. CURTISS — MElrose 0630, Local 439

Before 5:00 P.M., Tuesday, April 23, 1946

April Speaker

Topic of April Meeting Is Chemicals from Agricultural Products

Dr. Albert L. Elder

Dr. Alder on A.C.S. Tour 64 Will Address Section April 24

Albert L. Elder was born in Lexington, Illinois, June 19, 1901. He received the A.B., M.S., and Ph.D. degrees from the University of Illinois.

Dr. Elder was Charles M. Hall Research Director at Oberlin College from 1928 to 1930, and Professor of Chemistry at Syracuse University from 1930 to 1941. Since 1941 he has served as Head Chemical Adviser to the War Production Board and as Coordinator of the Penicillin Program. Since 1944 he has been Director of Research for the Corn Products Refining Company.

Dr. Elder is a member of the American Chemical Society, American Association for the Advancement of Science, American Institute of Chemists, Sigma Pi, Alpha Chi Sigma, Phi Lambda Upsilon, and Sigma Xi.

He has written a number of technical articles on penicillin, ozonides, butadiene and colloids. He is also the author of the following books: *General Chemistry*, 1941, *Laboratory Manual of General Chemistry*, 1941, *Lecture Demonstrations*, 1938.

Dr. Elder is chairman of the American Chemical Society Committee on Professional and Economic Status. In accepting the Society's invitation to tour, he expressed a willingness to meet informally with groups and discuss problems affecting the professional and economic status of the chemist and chemical engineer. If desired, he is also willing to speak before student groups on "What is a Chemist and a Chemical Engineer."

Following is a brief summary of the address which Dr. Elder will deliver April 24th.

Although the principal use of agricultural products is, and no doubt will remain to be, that of foods, the utilization of such products as raw materials for the manufacture of chemicals has received considerable attention during the past twenty-five years. Wartime research has resulted in the development of several chemicals from agricultural products and many others have been carried to the pilot plant.

Among the recent chemicals produced from steepwater are calcium phytate, iron phytate, and inositol. Steepwater contains many other chemicals which may be recovered. Carbohydrates have been converted into mannitol, sorbitol, citric acid, lactic acid, levulinic acid, itaconic acid, and butylene glycol; and from lactic acid has been prepared methacrylate resins and from butylene glycol, butadiene. The fractionation of starch results in two major fractions; anylose (a linear structure) and amylopectin (a ramified structure). Physical and chemical characteristics of these suggest interesting industrial uses.

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The PUGET SOUND CHEMIST

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Editorial: WHICH DEALS WITH AN ADMISSION OF AN OBLIGATION

"I hold every man a debtor to his profession; from the which as men of course do seek to receive countenance and profit, so ought they of duty to endeavor themselves by way of amends to be a help and ornament thereunto."

—FRANCIS BACON

From: Maxim of the Law. Preface.

* * *

The Puget Sound Section comes of age? Well, if that means being 37 years old and having 280 members, then we have arrived. But is that enough?

The American Chemical Society was established in 1876, "to encourage in the broadest and most liberal manner, the advancement of chemistry in all its branches; the promotion of research in chemical science and industry; the improvement of the qualifications and usefulness of chemists through high standards of professional ethics, education, and attainments; the increase and diffusion of chemical knowledge and by its meetings, professional contacts, reports, papers, discussions and publications, to promote scientific interests and inquiry, thereby fostering public welfare and education, aiding the development of our country's industries and adding to the material prosperity of our people."

In 1876 most chemists were trained in Europe and there were not very many of them. In fact ten years later in 1886 the American Chemical Society members numbered 241. As of January 1946, the Society members numbered 43,000. So the American Chemical Society has come of age but have we as individual members?

Chemists and chemical engineers are employed by all types of institutions, industries and enterprises in all sorts of capacities. It is obvious that they cannot all work in chemical laboratories and it is a good thing for the chemical profession that they do not so confine their activities. The true test of a chemist's professional status is not whether he works in a laboratory or not but how he feels about the importance of his role as a chemist or chemical engineer. Maybe this business of coming of age means that we should really admit our profession and establish in our own eyes and in those of the public just what that profession is. We have the world's best scientific journals. We have recorded a satisfying measure of accomplishment with regard to most of the above objectives. But have we really come of age in terms of "the improvements of the qualifications of usefulness of chemists through high standards of professional ethics, education and attainments?"

We need to raise our voice together in honest, united and emphatic protest in defense of our science when we see catastrophy threatening; as for example with regard to the present proposed military control of research on nuclear cleavage. We need to raise our voice in praise when we see a brother chemist or chemical engineer make an outstanding scientific contribution. You may say we assume *Chemical and Engineering News* takes care of this. But in how many of these praise and protest allocations have you yourself had a part? And how many of those praised or censored have you met or contacted personally?

Your new *Puget Sound Chemist* is *for* Puget Sound chemists and chemical engineers, *about* them and *by* them. The chemical industry and a host of others are our industries but the *Puget Sound Chemist* is concerned with these only in a secondary way. Yes, we are all for the development of Pacific Northwest industry and we will do our best to push it but our real interest is you. Pacific Northwest chemist and chemical engineer; your science and your profession. We shall get copy for *you*, not for the industries. We want copy expressing *your* ideas, *your* voice of praise and *your* cry of rage. When one of our members does a good job we shall try to bring this to your

(Continued on page 8)

OUR COVER PHOTO

Courtesy of

NORTHWESTERN MUTUAL FIRE ASSOCIATION

The beautiful photograph of an orchard in bloom which appears on the cover page is the first of a series obtained through the courtesy of the advertising department of the Northwestern Mutual Fire Association.

In admiring the cover page you may have assumed as we did, that this depicted a scene of an orchard near Wenatchee with the Cascades in the background. However, with true scientific candor we must admit that the photograph actually portrays an almond orchard in California. We are happy that our brother chemists in the California Section have the pleasure of enjoying scenes which for sheer beauty are probably only surpassed in certain districts in Washington.

MAY MEETING

May 21, 1946

DR. H. I. BERNSTEIN

EMULSOL CORPORATION

Will address the Section on

Theory of Surface Active Agents

EDITORIAL . . .

(*Continued from page 7*)

attention, and when trouble threatens we shall try to lay the problem before you for your action.

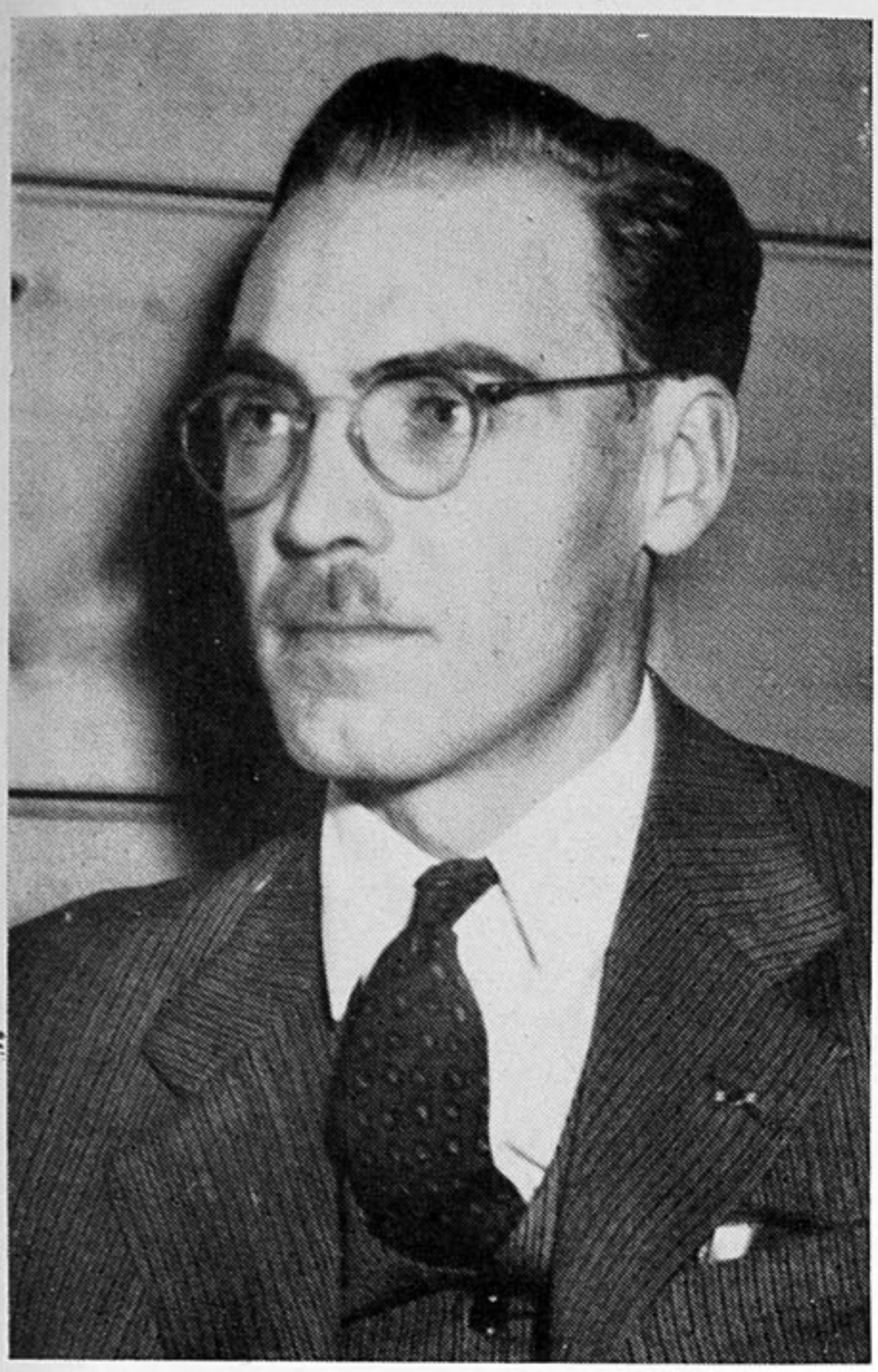
We shall try to publish some papers but we shall keep it in mind that the *Puget Sound Chemist* does not purport to be a journal for reports of research, nor for industrial developments, nor for chemical markets, nor for new products. From time to time a little of this may be of interest, but the papers we shall *wish* to use will usually be those written by our own members and dealing with Pacific Northwest situations or national situations with which we must be concerned.

Meeting notices and the doings of our section and its committees will be, of course, the regular monthly diet. We hope to go to press each month and to supply you with an annual issue containing membership directory, financial and other annual reports of committees.

Last year the expenditures for the mimeographed *Puget Sound Chemist* and maintenance of our address list ate up 70% (yes, seventy percent) of our income for the year from the National A. C. S. With this new slick *Puget Sound Chemist* we have included advertisements of laboratory and industrial chemicals, chemical products and laboratory supplies and services. These firms are giving us a vote of confidence. Let us buy from them. The income from these advertisers is carefully budgeted to finance the *Puget Sound Chemist* and its mailing list and these items only. To the advertisers this means a personal entry to the laboratory and office of every Pacific Northwest chemist and chemical engineer. To us it means that we shall obtain without charge a publication which will contribute in a unique way to every one of us. But bear in mind that what it does for us will be no more than the use we make of it.

Well, that's about it. The new *Puget Sound Chemist* will be what you want it to be and you can make it or break it. If we Pacific Northwest chemists and chemical engineers have really come of age, then this is our voice.

Chairman's Message



T. S. Hodgins

Fellow Chemists:

With this, the first issue of the new *Puget Sound Chemist*, your chairman is gratified to express to the members a few highlights on the goals which you have so aptly suggested to me during the short duration of my chairmanship.

The Puget Sound Section, in common with many other institutions, felt the impact of the war. The rationing of gasoline, the long overtime work weeks and the calls of the armed forces on our members all tended to make it difficult to carry on a full and well-rounded program of activities. During this difficult time the task of carrying on the society was shouldered largely by staff members of the University of Washington. Not only were they successful in maintaining a working organization throughout the war, but with the help of other members climaxed last year's activities with a large and very successful regional meeting.

With the war now past and reconversion under way, we must continue to adapt the aims and services of our local section to our needs and potentialities. To augment and extend our program we have called upon many members to assume various responsibilities. A perusal of the directory page will indicate the scope of our present activities.

We have inaugurated the policy of having a meeting of the chairmen of the various committees together with the officers and councillors one week prior to each section meeting. By this means we coordinate the various section activities. In addition, since such a broad cross section of our membership is thus represented, it becomes a valuable means for the preliminary discussion of A. C. S. problems and policies. Thus, these problems can be studied more carefully and rationally to the end that they may be intelligently presented at the business meeting. In this manner decisions may be reached without an undue waste of meeting time which can be better utilized for the speaker of the evening.

One tangible evidence of the broadening scope of our activities is the issuing of our newly enlarged magazine. This will serve as a clearing house for our various activities, including not only notes regarding the regular programs, but also reports concerning the activities and members of the local section.

We are counting upon you to give us definite suggestions relating to the formulation of our programs and other activities. We are counting upon you to broaden the general scope of our activities by bringing qualified professional men into the "fold." In turn, you can count upon us to endeavor to serve you in such a manner as to make this a banner year for the Puget Sound Section of the American Chemical Society.

THE EARLY HISTORY OF THE PUGET SOUND SECTION

"Many of us are unacquainted with the details of the organization and early history of the section. Dr. Q. P. Peniston, Chairman of the Library Committee, has reviewed the early meeting minutes and prepared the following interesting story of our heritage. Dr. Peniston is indebted to Professor H. K. Benson for reminiscences regarding the early history of the section and for identification and characterization of persons mentioned."

The organization meeting of the Puget Sound Section of the American Chemical Society was held on Wednesday, January 27, 1909, with Dr. H. K. Benson as Temporary Secretary. The following regular officers were elected:

Chairman	DR. H. K. BENSON
Vice-Chairman	MR. M. J. FALKENBURG
Councilor	DR. C. W. JOHNSON
Treasurer	MR. F. F. FLANDERS
Secretary	MR. ALBERT JACOBSEN

It is noteworthy that a number of the original members of the Section were to assume roles of leadership in the development of the chemical profession and chemical industry in the Pacific Northwest. Several of these, Dr. Benson, Dr. Dehn, Dr. Johnson and Mr. I. F. Laucks have maintained this role throughout the thirty-seven years of existence of the Section and their activities will be familiar to all members.

Others who may not be recalled by newer members were:

DR. H. G. BYERS—Head of the Chemintry Department at the University of Washington from 1899 to 1919 and subsequently Chief of the Division of Soil Chemistry and Physics, Bureau of Chemistry and Soils.

MR. M. J. FALKENBURG—For many years a partner in the firm of Falkenburg and Laucks which was most prominent in the development of many Northwest Industries.

MR. ALBERT JACOBSEN—City Chemist, who after many years of efficient service remains in that official capacity.

MR. H. M. LOOMIS—In charge of the Food and Drug Laboratory of the U. S. Department of Agriculture in Seattle—subsequently transferred to Portland.

MR. J. H. LINTON—Owner and operator of the Pacific Testing Laboratories, now deceased.

MR. C. J. MORSE—City Engineer.

MR. F. S. BEALL—Northwest Creosote Co.

MR. C. E. BOGARDUS—Founder of one of the Northwest's first commercial testing laboratories which operated for many years under his name, now deceased.

MR. J. D. ROSS—Manager of the City Light Co., a nationally famous figure in the public utility field, now deceased.

MR. E. REX SMITH—Chief Chemist and Associated partner in the Crescent Manufacturing Co. with which our present active member Mr. E. R. Gailey is associated.

MR. RAYMOND CLOUGH—Chief Chemist for the National Canners Association.

Among out-of-town members were:

MR. F. S. STERNBERG—Manager of the British American Paint Co., Victoria, B. C.

MR. E. O. HEINRICHS—Operator of a testing laboratory in Tacoma; later head of a crime detection laboratory in Oakland, Calif.

The predominant interests of the Section in the early days, as now, centered around the development of chemical industry in the Pacific Northwest. To this end many of the meetings took the form of Symposia on particular industries. Thus on October 25, 1910, a meeting was devoted to the cement industry with I. F. Laucks, C. A. Newhall and L. H. Provine as speakers; on July 26, 1911, food and food materials were discussed by E. Rex Smith and H. K. Cameron, chemist at the U. S. Bureau of Soils, Washington. D. C., and on March 28, 1914, a lumbering symposium was held in Tacoma. with an inspection of the St. Paul and Tacoma Lumber Co. wood preserving plant and a dinner with Mr. Frank B. Cole as toastmaster and Dr. Benson, Dr. Byers, Mr. O. P. M. Goss of the timber testing laboratory, U. S. Forest Service. University of Washington; Mr. G. M. Winsloe from the U. S. Forest Products Laboratory, Madison, Wisconsin. and Dr. C. H. Shattuck, Dean of Forestry at the University of Idaho, as speakers.

Many of the early meetings were held in Tacoma, the boat trip, the development of the Tacoma Smelter and the Pa-

cific Brewing and Malting Co. with Mr. E. O. Heinrichs as host, figuring as attractions. Social affairs were numerous in the first years of the Section with many evening gatherings for dinner, dancing and card playing. Also several basket picnics were held in Cowen Park, at the home of Dr. Byers and in other localities.

From the outset an active interest was taken by the Section in civic, state and national affairs pertaining to chemistry and the chemical profession. Activities of this nature included the development of a code of ethics for practising chemists and in 1912 the formation of a Library Committee to foster improvement in the technical periodical coverage by libraries in the area. Also definite stands were taken by the Society on several occasions involving action by the state legislature in chemical matters.

The practice of obtaining nationally and internationally prominent speakers to address meetings of the Section was also adopted in the first years of its history. Meetings of this nature were generally spaced at intervals between others of a more local character in which ceramics. mining, fertilizer, lumber and wood waste utilization, fisheries and chemurgic problems were discussed. Several meetings were devoted to reporting of research results by students at the University.

Some highlights in the early history of the Section which deserve special mention were:

1. The San Francisco meeting of the National Society in July, 1910. Many of the delegates to this meeting were entertained in Seattle by the local Section, then only six months old.

2. A joint meeting of the San Francisco, Portland, Intermountain and Puget Sound Sections of the American Chemical Society held in Seattle May 21 to 23, 1914.

The program for this meeting indicated the wide interests of the Sections represented at this time. Some of the subjects and speakers were:

WOOD PROCESSING—C. H. Shattuck

DEVELOPMENTS IN WOOD PRESERVATION—B. L. Grondal

THE BIOCHEMISTRY OF WAXES WITH SPECIAL REFERENCE TO THE WAX Or THE TUBERCLE BACILLUS—Benj. Paschall

ARSENATES OF LEAD AND THEIR INSECTICIDAL PROPERTIES – H. V. Tartar and R. H. Robinson

RATE OF DECOMPOSITION OF HYPOCHLORITES—O. F. Stafford

CARAMEL—Harper F. Xoller

THE USE OF DIATOMACEOUS EARTH AS A REFRACTORY—H. K. Benson

CAPITALIZATION OF TRAINING AS A BASIS OF COMPENSATION – E. O. Heinrichs

THE SMOKE PROBLEM – F. G. Cottrell

ELECTROLYTIC ENDOSMOSIS – H. G. Byers

3. During the week of August 30, 1915, the Puget Sound Section acted as host to the National Society for its 51st meeting. An address of welcome was given by Dr. Henry Suzzallo, president of the University of Washington, and a response by Dr. Charles H. Herty, president of the Society. Also given at the opening meeting were addresses by Leo H. Baekland on "Chemical Industry" and by H. K. Benson on "Industrial Resources and Opportunities of the Pacific Northwest."

In general sessions open to the public two symposia were held on:

"THE CHEMISTS CONTRIBUTION TO INDUSTRY" (12 papers) and

"THE CHEMISTRY OF WOOD DISTILLATION" (17 papers).

In addition to these general sessions the regular divisional meetings with papers in special fields were held throughout the week.

Socially the meeting was eminently successful as a result of zealous effort by members and friends of the local Section. Funds for entertainment were raised by subscription from members of the Science Faculty at the University and by contribution from members and friends of the Section. Affairs included a complimentary smoker given by the Seattle Commercial Club featuring an illustrated lecture on Mt. Rainier by Professor Edmund S. Meany, a Japanese sword contest and a Chinese cartoonist. A ladies reception and tea was held at the University and an organ recital was provided at the Liberty Theatre. Also

(*Continued on page 22*)

First Chairman—Puget Sound Section

Dr. H. K. Benson

Dr. H. K. Benson was responsible for calling together the organizational meeting of the Puget Sound Section in 1909. At this first meeting he was elected Chairman. Since then he has given of his time and effort in augmenting the Section and its activities. We are all aware to some extent of the many contributions that Dr. Benson has made to the chemical profession. The following biographical sketch is presented to you to better acquaint you with his life and work.

It was sixty-eight years ago on January 3, 1877, when Henry Kreitzer Benson was born in Lebanon, Pennsylvania. He grew up in Pennsylvania and in 1899 was granted the degree of A.B. from Franklin and Marshall College in Lancaster, Pa. During the next year he came to the Pacific Northwest, where he served from 1900 to 1903 as principal of the high school at Kent, Washington. During the summers of these years he continued graduate work and in 1902 received the degree of A.M. from Franklin and Marshall College. In 1903-04 he entered Johns Hopkins University to study chemistry under Remsen and associates. In 1904 Dr. H. K. Benson was appointed assistant Professor of Chemistry at the University of Washington, thus beginning an association of now forty-two years' standing. In 1906 and 1907, he was granted leave to accept a fellowship at Columbia University in New York City and in the latter year he was granted the degree of Doctor of Philosophy from this university. During the ensuing years he continued his work in teaching and research at the University of Washington, being advanced in 1919 to the office of Professor and Head of the Department of Chemistry and Chemical Engineering.

During the summer vacation periods, Dr. Benson rendered many services to the state and national governments. In 1909 he was Assistant in Soil Survey in the Washington Geological Survey and Bureau of Soils, U. S. Department of Agriculture. During the same year he was a commercial agent for the U. S. Department of Agriculture in land clearing studies. In 1912 he acted as agent for the U. S. Forest Service and at this time became interested in the possibilities of wood utilization by destructive distillation and charcoal production. In 1914 he was commercial agent for the U. S. Department of Commerce, publishing the results of his studies in a bulletin: "By-Products of Lumber Industry." From 1915 to 1919 he was Director of the Bureau of Industrial Research at the University of Washington. In 1916 he was State Director of the U. S. Naval Consulting Board. From 1917 to 1920 he acted as consulting chemist for the American Nitrogen Products Company. During World War I, he served as a captain in the Nitrate Division of the Ordnance Department of the U. S. Army.

In 1926 his old Alma Mater, Franklin and Marshall, bestowed upon him the

degree of Doctor of Science. Dr. Benson served as chairman of the Division of Chemistry and Chemical Technology of the National Research Council in 1931-32, and it was during this year that he wrote his valuable booklet, "Chemical Utilization of Wood."

During the depression years, Dr. Benson directed the work of a small staff of chemists, engineers, and librarians in compilation of two useful volumes concerned with the potential chemical industries of Washington and of the Columbia Basin. About the same time there was prepared a bulletin on "Wood Chemical Industries of Washington."

In 1938 Dr. Benson was a delegate to the International Conference of Chemistry in Rome, Italy, and visited cellulose and lignin research laboratories in Italy, France, Germany, Finland, and Scandinavia.

Dr. Benson has been a leader in many organizations, being a member of the American Institute of Chemical Engineers, the Technical Association of the Pulp and Paper Industry, and others. He is a member of the Board of Governors of the National Farm Chemurgic Council and has also organized and is now chairman of the Washington State Chemurgic Committee. Dr. Benson, along with Mr. W. E. Breitenbach and Mr. D. B. Davies, was instrumental in bringing about the organization of the technical men of the west coast pulp and paper industry; at the solicitation of these three gentlemen, the first meeting of the technical men of the pulp and paper industry took place on the University of Washington Campus in 1928, and it was at this meeting that the Pacific Section of TAPPI was organized.

Since Dr. Benson completed his doctorate dissertation at Columbia University in 1907 on "Fused Salts Containing Water of Crystalization as Solvents for Determination of Molecular Weights," he has been active in publication and has published more than one hundred papers in the field of wood chemistry and chemical engineering. Some of these papers may be of interest to exemplify Dr. Ben-

(Continued on following page)

A.I.C.H.E. MEETING APRIL 23

American Institute of Chemical Engineers [Chemical Engineering Society of Washington]

The April meeting of the Chemical Engineering Society of Washington will be held on Tuesday, April 23rd. The speaker for this meeting will be Mr. E. O. Ericsson of the Puget Sound Pulp and Timber Company. Mr. Ericsson will speak on the subject "Alcohol from Waste Sulfite Liquor."

Dinner will be at the Edmond Meany Hotel at 6:30 P.M. The meeting will be at 8:00 P.M. in Room 140, Bagley Hall on the University of Washington campus. Please make reservations for the dinner not later than noon on April 22nd. Write R. W. Moulton, Department of Chemistry, University of Washington, or call Melrose 0630, Local 439.

U. of W. Student Chemical Society Activities

PHI LAMBDA UPSILON & AMMONII SOCII

Both Phi Lambda Upsilon and Ammonii Socii will hold their Spring election of new members during April. Although inactive during the war. both groups have resumed activities and a full calendar is being outlined by the officers of each group. —*D. L. Pastell*

A.I.C.H.E. — STUDENT CHAPTER

Harry F. Yancey of the U. S. Bureau of Mines spoke to the student chapter of the AICHE on the "German Coal Industry During the War." The meeting was held March 27 at 8 P.M. in Bagley Hall.

Mr. Yancey has just returned from Germany where he was a member of a technical commission sent there to inspect the coal industry and the effect of allied bombing upon it. Mr. Yancey's talk was accompanied with colored slides.

A short business meeting at 7:30 preceded the talk. Inactive during the war, the group began activities in November. This was the third in a series of business and technical meetings being presented by the chapter. The next meeting is scheduled for April 17 but the program has not yet been announced. —*D. L. Pastell*

(*Continued on page 22*)

FIRST CHAIRMAN . . .

son's continuing enthusiasm for his profession and for the Pacific Northwest over a period of more than forty years. Note the following papers and years: "Chemical Utilization of Underbrush," Pacific Building Engineer, 1908; "Conservation and Utilization in the Pacific Northwest," Journal of Engineering Chemistry, 1910; "Oil of Douglas Fir," Journal of Industrial and Engineering Chemistry, 1911; "Fractional Distillation of Wood Tar by Electrical Heat," Metallurgical and Chemical Engineering, 1912; "Design and Equipment of the Chemical Engineering Laboratory at the University of Washington," Industrial and Engineering Chemistry, 1912; "Chemical Treatment of Waste Wood," Eighth International Congress of Applied Chemistry, 1912.

In 1914 Dr. Benson was the author of a text book, "Industrial Chemistry for Engineering Students," published by MacMillan. During the following years his publications continued in these and related fields.

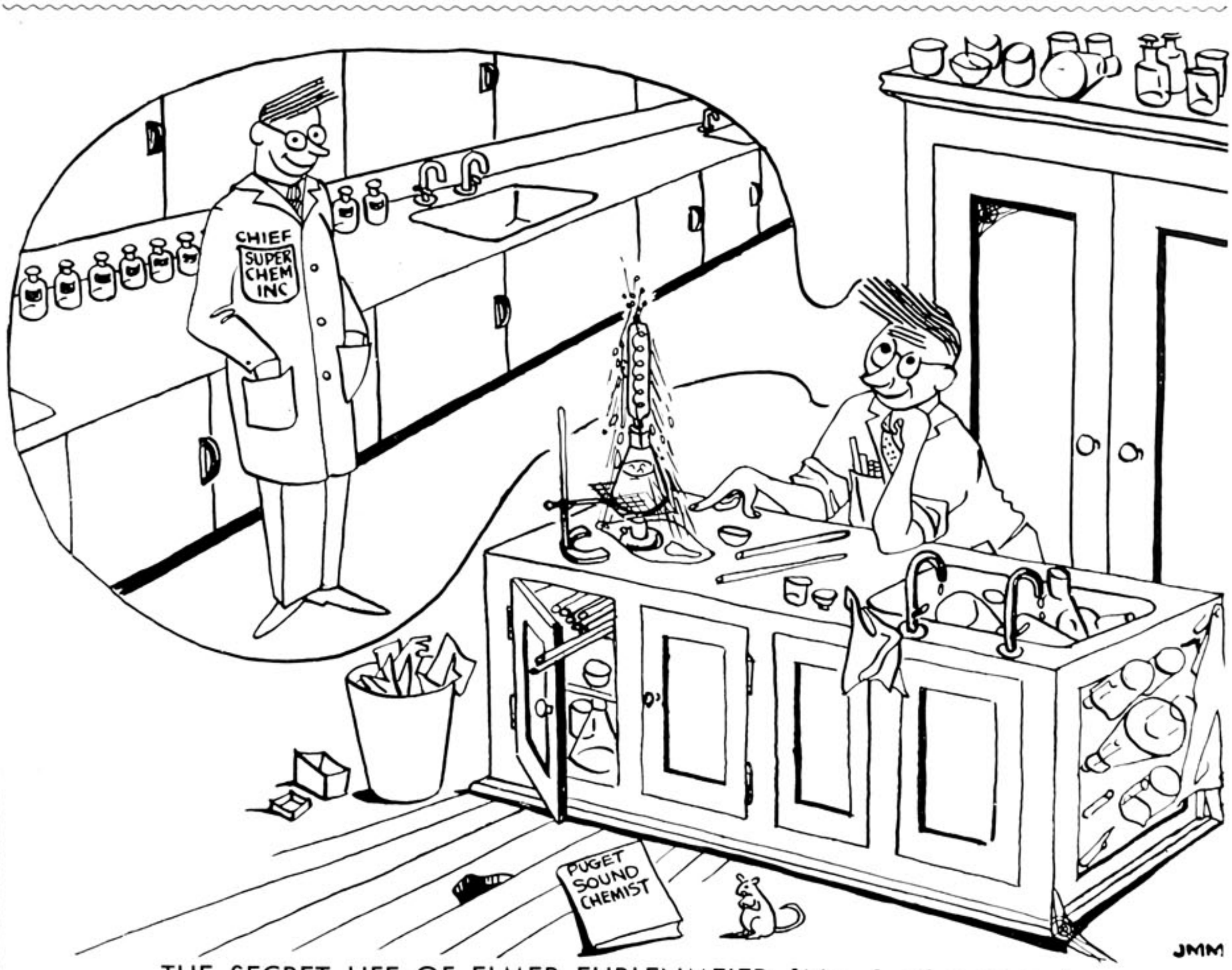
The problems of local industry have long been of concern to Dr. Benson. In 1930 he published "The Story of Paper, Production of Pulp in the Pacific Northwest," and "Measurement of Pollution of Sea Water." In 1931 he reported on "Production of Sulfite Pulp from Douglas Fir" and similar woods, on the oxygen consumption method for determination of sea water pollution, and on the detection of sulfite liquor in sea water. In 1933 further reports were rendered on sulfite waste liquor pollution of sea water and on the utilization of sulfite waste liquor. During the period 1935-1937, working under grants by the National Research Council and a group of Washington Pulp Mills, reports were rendered with Dr. A. M. Partansky on the anaerobic decomposition of sulfite waste liquor in the presence of both salt water and fresh water muds. A comprehensive paper on the analysis of sulfite waste liquor, and two papers on sulfite waste liquor were published.

In the last few years Dr. Benson and his collaborators have carried on studies

on the pulping of Douglas Fir with ammonium bisulfite and with nitric acid and on such chemical derivatives of lignin as chlorolignin and also nitrolignin. Among many other investigations, Dr. Benson and his co-workers have studied the production of oxalic acid from sulfite waste liquor, and the desulfonation of calcium lignosulfonate (two papers), the pollution of sea water by sulfite waste liquor, and the detection of sulfite waste liquor in sea water by a colorimetric method, and the catalytic oxidation of sulfite waste liquor by atmospheric oxygen.

In 1906 Dr. Benson was married to Eva Ronald, the daughter of the distinguished Judge J. T. Ronald of the King County Superior Court. The Benson's have had four children. Ronald (Mr. W. R. Benson), now living in Seattle with his wife and two children, has followed his father's interest in chemistry and in the pulp and paper industry, and is associated with the Carl F. Miller Company, Inc. Another son, Henry (Lt. Col. H. K. Benson, Jr.), now in Europe with the U. S. Army Occupation Troops, is married and has one child. A daughter, Margaret, is the wife of Major A. V. Martin, Credit Manager for the Caminol Oil Co., Los Angeles, and has two children. Dr. Benson's youngest daughter, Betty, married Harold J. Runstad, a Boeing engineer, and she and her husband and their two children live in Seattle.

Of more recent interest, Dr. Benson visited New York City the latter part of February to attend the Chemical Engineering Award Dinner, the National Chemical Exposition and TAPPI. He has been a member of the Award Committee for Chemical Engineering Achievement for 12 years. Dr. Benson also attended the National TAPPI Convention while in New York, reporting on the "Colorimetric Test for Determination of Waste Sulfite Liquor in Sea Water" before the TAPPI Chemical Methods Committee of which he is a member.



THE SECRET LIFE OF ELMER EHRLENMEIER [No. 1 of a series]

DEVELOPMENT of *Laminates*

A Paper Presented Before the Puget Sound Section March 19, 1946

HARRY KLINE

Manager and Technical Director, Phenolic Plastics Division

The laminating industry had its inception about 1910, when Dr. Baekeland first introduced phenol-formaldehyde plastics commercially. There was a great unfilled demand, at that time, for a material having good electrical insulating properties, as well as lightness, and good water and chemical resistance. The electrical industry was quick to use these phenolic resins to impregnate paper for the production of solid boards which could be employed to solve insulation problems. Applications for laminates have increased continually, year after year. and World War II, of course, was a tremendous stimulus to the laminating industry. These products have served well in almost every mechanism of offense or defense produced for the war effort.

LAMINATING PROCESS

The process of making laminates appears simple, theoretically, though it can be quite complicated. Fibrous materials, such as paper or canvas, are impregnated with a resin resolution. (The resin solution usually contains alcohol as the solvent, although water and other liquids are sometimes employed.) The treated, or impregnated, material is then passed through an oven in order to remove the solvent and to further advance the resin, so that it has the correct flow properties when heat and pressure are applied. This drying process is very critical as the resin is thermosetting and if advanced, or dried, too much, it will not flow sufficiently. If it is not dried enough, it will flow excessively and produce a poor laminate. After passing through the drying oven, the impregnated material is wound on a mandrel to be cut into sheets. The sheets are then cured with heat and pressure between stainless steel plates.

DEVELOPMENT OF IMPREGNATING EQUIPMENT

The early treating machines had a means of saturating the fibrous material in the varnish, which was then dried by passing through a closed oven heated by steam coils. The amount of impregnation was controlled mainly by thinning the varnish to the proper consistency. The next ovens developed provided heat by means of ducts through which heated air was blown throughout the entire length of the machine. The paper passed through the center of the oven, and heated air was blown both on the top and bottom of it. This gave a

much more uniform product. In the still later machines, heated air through the ducts were combined with a better and more economical means of controlling resin pick-up. This was accomplished by very accurately machined squeeze rolls. The paper, after passing through the varnish, was subjected to the squeeze rolls, and the resin pick-up was controlled by opening the rolls to the proper point. This resulted in a saving of solvent, as well as, perhaps, a more uniform impregnation from side to side.

DEVELOPMENT OF PRESSES

The early hydraulic presses were much smaller than current models and had one opening. The modern presses may have as many as ten openings and are loaded by elevators placed along side them. The platens may be as large as 6 ft. by 8 ft. or larger. A pressure of 1000 p.s.i. (pounds per square inch) can be developed over the entire platen area. A machine of this type represents a large investment. One reason for the interest in low-pressure molding is the very much lower cost of press equipment.

DEVELOPMENT OF RESINS

In the early days of the industry, one resin was sufficient to produce the products made at that time. However, as the industry grew, demands required resins having special properties. For example, it was found that laminates were hard to punch with steel dies to produce the intricate shapes desired for insulation. To satisfy this requirement, flexible resins were developed which overcame this manufacturing problem. For cold punching, still greater flexibility is needed. There are various types of varnishes available for laminates which are to be hot or cold punched. Other varnishes have been developed to provide special mechanical properties suitable for the production of molded automotive timing gears and similar applications.

When the refrigerator industry began using laminated breaker strips, about 1930, they found the odor objectionable. As a result, odorless varnishes were formulated. The need for greater chemi-

cal and water resistance also created a demand for special laminating resins. The speed at which certain laminates must be cured caused the development of fast curing varnishes.

RAW MATERIALS FOR RESINS

The raw materials most commonly used for phenolic resins are phenol, cresols, xylenols and formaldehyde. By varying the type of phenolic body, the kind of catalyst, method of reaction and amount of formaldehyde, thousands of modifications can be made, each of which may be employed in some special way.

In addition to phenolic resins, the laminating industry has used some urea-formaldehyde products where light colors and light proofness is desired. The ureas have now been replaced by melamine-formaldehyde resins for these purposes. The melamine-formaldehyde materials also produce laminates which have greatly improved arc-resistance, and were employed in large volume during the war, along with fiberglass, to produce panel boards for Navy ships.

Phenolic resins, made with furfural, have been used only to a limited extent for the production of laminates, but further developments may be expected in the postwar period.

Resorcinol materials will, undoubtedly, become more widely used. They served very well, during the war, in the production of resins for the low-temperature bonding of heavy timbers. Their use for laminates is still very limited.

FILLERS FOR LAMINATES

The strength of laminates is due mainly to the fillers employed. The most generally used fillers are paper, cotton fabrics, asbestos paper, asbestos fabric and recently, glass fabric.

The papers most commonly incorporated as fillers are kraft, alpha cellulose, and rag.

Various types and weights of cotton duck are used: the coarse materials for high impact strength laminates. Where greater water resistance and better insulating properties are desired, the cloth is more thoroughly impregnated.

Where heat resistance is important, asbestos paper is used.

Paper laminates have the highest tensile strengths. Those made of kraft paper reaching 20,000 p.s.i., while some produced with the newer high strength papers have tested 35,000 p.s.i. Laminates made of paper, however, do not have as good impact strength, especially in the edgewise direction, as those produced with canvas. Canvas laminates are five times as strong in impact strength in the edgewise direction.

Laminates made of paper have the best electrical insulating properties, and are not only vastly superior in this respect, but also cost considerably less than those made of canvas. If greater impact strength could be imparted to paper laminates by some property in the paper pulp or the resin, this would be an outstanding improvement. This has been done, but only at the sacrifice of other advantages, such as water resistance.

PAPER-PLYWOOD COMBINATIONS

The properties of paper laminates and plywood complement each other. Paper laminates have smooth surfaces, are good in water and wear resistance and tensile strength, though poor in impact strength, while plywood is poor in water resistance, but is good in impact strength. By combining these materials, laminators have created a new product which has the water and wear resistance, tensile strength and excellent surfaces of paper laminates, as well as satisfactory impact strength imparted by plywood. Another development along this line, which has proved successful, is the overlaying of plywood surfaces with impregnated paper of from .005 to .010 inch thick, to increase its water and wear resistance, eliminate surface defects of plywood and provide a good coating surface. This material is used for box cars, ammunition boxes, etc.

This type of plywood, overlaid with impregnated paper, may be produced with various surface designs and colors, and will, undoubtedly, be made available for many applications in the building industry.

RECENT DEVELOPMENTS LOW-PRESSURE MOLDING

Most laminates are molded at pressures of 1,000 p.s.i. and higher. The use of much lower pressures, such as 100 p.s.i. and even less, is not a new idea. It has, however, only recently been commercialized.

The introduction of Mitscherlich high strength papers and the war gave great impetus to the use of low pressures. Laminates made of these special papers and cured at 100 p.s.i. to 250 p.s.i. have exceptionally high tensile strengths and excellent water resistance. With the advent of war, and the consequent greater demand for laminates, low-pressure presses came into wider usage. This was because they were easier to obtain, as they required less critical materials than the large presses.

Special phenolic resins, of a lower molecular structure, have been developed which will flow at pressures as low as 50 p.s.i. These resins make it possible to use fluid pressures, as is done in bag molding, and have opened up a host of new possibilities for molded laminates.

MOLDED LAMINATES

Low-pressure laminating has stimulated the search for new techniques of molding laminates in various shapes besides flat sheets. During the war, some outstanding achievements were made in this field, employing fluid pressures.

Laminates were, of course, molded into various shapes long before the war. Items such as automotive timing gears have been molded of canvas laminates for a great many years and large objects, for example, refrigerator door liners, were also molded of laminates just before the war. These products were produced by high pressures which is still the best method for the mass production of molded laminants. High-pressure molding produces laminates which have definite superiorities such as: better surfaces, more water resistance and somewhat greater strength. The cost of molds and large hydraulic presses required for high-pressure molding must, of course, be considered. However, where the article is to be produced in large quantities, the initial cost of a mold can easily be absorbed. For instance, where a laminator produces 2,000 refrigerator door liners in a day, the cost of the mold becomes a very small part of the price of each door liner.

During the war, there was a demand for many new and novel molded parts. In some cases, the sizes desired were too large for available presses, as for example, boat hull sections. Other requests covered quantities which were not large enough to warrant the cost of high-pressure molding. Applications of this type can be handled economically by low-pressure molding and especially fluid-pressure molding. Where dies are used in a hydraulic press, the chief advantage of low-pressure molding is in the lower cost of making the dies, as these can be made of Kirksite or other such alloys. Most low-pressure molding is accomplished, however, by means of some form of the bag molding process.

One method is to use a certain type of hot press. Here the mold is set on a container which can be heated by means of steam or gas. When this container is raised against the press, a rubber diaphragm, a bag which is actuated by water pressure, exerts the fluid-pressure against the mold.

There are two other procedures commonly employed, and these involve the use of autoclaves. In one method, a female mold made of steel or other material is used, and the impregnated material is placed in the mold. Next, a sheet of cellophane is inserted to prevent sticking. A rubber blanket is then clamped around the mold and vacuum is applied which presses the blanket against the impregnated material. The entire assembly is then placed in an autoclave and steam, or air pressure and steam, are applied to the extent of about 50 lbs. to 100 lbs. When the vacuum is released, the volatile matter escapes.

In the other method, a male mold is prepared from wood or other material. The impregnated material is then laid over the male mold and the entire assembly is enclosed in a rubber bag which has an opening for the application of a

vacuum. The entire bag is then placed in an autoclave and heat and pressure applied as explained in the previous process.

These newer methods are used primarily for large pieces or where only a small number of products are desired.

POST-FORMING LAMINATES

We have been told for many years that, as regards thermosetting phenolic resins, "heat softens them and further heat hardens them, after which still more heat will not soften them." Were this absolutely true, post-forming of laminates would not be possible. This is not entirely true. Mr. W. I. Beach of North American Aviation, Inc., found that when he took a standard piece of fully cured canvas laminate and reheated it and applied a pressure, the piece could be formed or stretched just like metal.

The usual procedure, in post-forming, is to obtain canvas laminate made with a standard phenolic resin or one modified to work best in this process. This is then heated in a gas or infrared oven, or sometimes on a hot plate, to a temperature slightly above that used in curing the laminate. (Temperatures of 350°F. to 400°F. are commonly employed.) The sheet must not be heated too high or it will blister and if not heated sufficiently, optimum forming properties will not be obtained. (A little experience determines the correct heating time.) The heated sheet is then quickly placed over the forming die and pressures of 10 p.s.i. to 100 p.s.i. applied. The mold can be made of inexpensive material, such as hardwood, Masonite, plastics or metal. The mold cost is not high, and the process has great possibilities of being adapted for many applications. It may, however, encounter certain limitations due to the greater cost of cloth laminates. Paper laminates, so far, have not proven successful for post-forming. There is a possibility that some of the two-way stretch papers may prove suitable to some extent.

DEVELOPMENTS IN RESINS

In manufacturing phenolic resins, the tendency has been to develop materials which cure rapidly. Resins of this type,

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EARLY HISTORY . . .

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featured were automobile trips through Seattle's parks and boulevards provided by local members and friends and an afternoon excursion on Puget Sound with refreshments aboard a specially chartered steamer. The meeting was closed with a banquet at the Frye Hotel. On Friday many of the delegates were taken to Tacoma on private yachts to inspect industrial plants in that locality and a number visited Mt. Rainier by automobile. 106 members and 119 guests attended the meeting.

The subsequent history of the Puget Sound Section has been one of continued expansion in membership and in the scope of activity of its members. Interest in the chemical development of the Pacific Northwest has been maintained throughout the life of the Section and the functions and policies of the National Society have been served by the local section in this area. It may be expected that future years will see further development of the Section in the above fields with continued service to the advancement of the chemical profession, the interests of the community and of the nation.

Q. P. PENISTON

CHEMICAL SOCIETIES . . .

(*Continued from page 14*)

IOTA SIGMA PI

Oxygen Chapter of Iota Sigma Pi recently held its annual formal banquet and initiation at the Seattle Tennis Club. Active members, alumnae, and faculty wives were present. Those initiated were Betty Armour, Catherine Cooper, Carol Greene, and Shirley Rigg. Entertainment was provided by the new initiates who told their autobiographies in chemical terms.

Climaxing the winter's activities, Iota Sigma Pi held a joint ski trip with Ammonii Socii on March 10, at Paradise, Mt. Rainier. Everyone had a grand time.

New officers for this semester were elected recently. They are Marian Boehr, President; Betty Cehrs, Vice-President; Margaret Gano, recording secretary-treasurer, and Nellie Wasson, corresponding secretary. Joan Doe, president during the first semester, completed her course and is now on vacation before going to Massachusetts Institute of Technology.

—Marian Boehr, President

APRIL SPEAKER . . .

(*Continued from page 5*)

Production of zein, an alcoyol-soluble protein, has developed rapidly during the past years. The recovery of other proteins and amino acids from them are promising developments.

Wartime corn shortages have speeded investigation and utilization of other starch-bearing grains. Sorghum and wheat are notable in this respect. Comparative properties of the starch and protein fractions offer interesting industrial possibilities.

Kodachrome slides will be used to illustrate some of the basic processes involved in the separation of fiber, starches, oils and proteins from corn which is a major agricultural product.

In many instances practical applications in the agricultural industry have surpassed fundamental research. Some of the fundamental problems in this field will be discussed.

LAMINATES . . .

(*Continued from page 21*)

used during the war, cured articles such as helmet liners in two to three minutes. These fast-curing resins are of importance where molded articles are made in large volume, as any reduction in curing cycle results in less molds being needed to attain a given output.

Resins of this kind are now being used for large molded objects like refrigerator door liners, the curing time being three minutes. Resins which not only cure fast, but which impart good water resistance to laminates, made with only 25% to 35% resin, and which are also odorless, are now being commercially used.

Another important development has been the improvement of low-pressure phenolic resins.

Resorcinol resins, while made extensively for wood bonding, have. as yet. not been used to any extent for laminates. Melamine resins for arc-resistant laminates and decorative laminates have also been improved. Alkyd-styrene types of resins, combined with glass fiber as well as cloth, etc., have also attained some importance lately.

DOW

BEGINNING WITH BROMINE . . .

Start your story with a prehistoric salt sea imprisoned below the earth's surface and it sounds like the beginning of a romantic adventure tale. But the sea 5,000 feet below Midland, Michigan, suggested something very practical to the late Dr. Herbert H. Dow.

As a young chemist, Herbert Dow journeyed, in 1890, to Midland to tap the underground water and see what he could make of it. He first made bromine, extracting this pharmaceutical chemical from the brine and producing it in commercial quantities by his own low-cost process. This was the beginning of The Dow Chemical Company.

Thus bromine, chlorine, likewise sodium, calcium and magnesium — all recovered from the same brine — led Dow step by step into an endless parade of chemicals, now more than 500, all stemming from the original pioneering effort.

The growth of Dow, like the origin of Dow, has largely come about through the chemist and his profession. Dow is honored to be an advertiser in this, the first issue of a publication whose chief aim is to enhance this profession and to serve the chemist in this area.

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