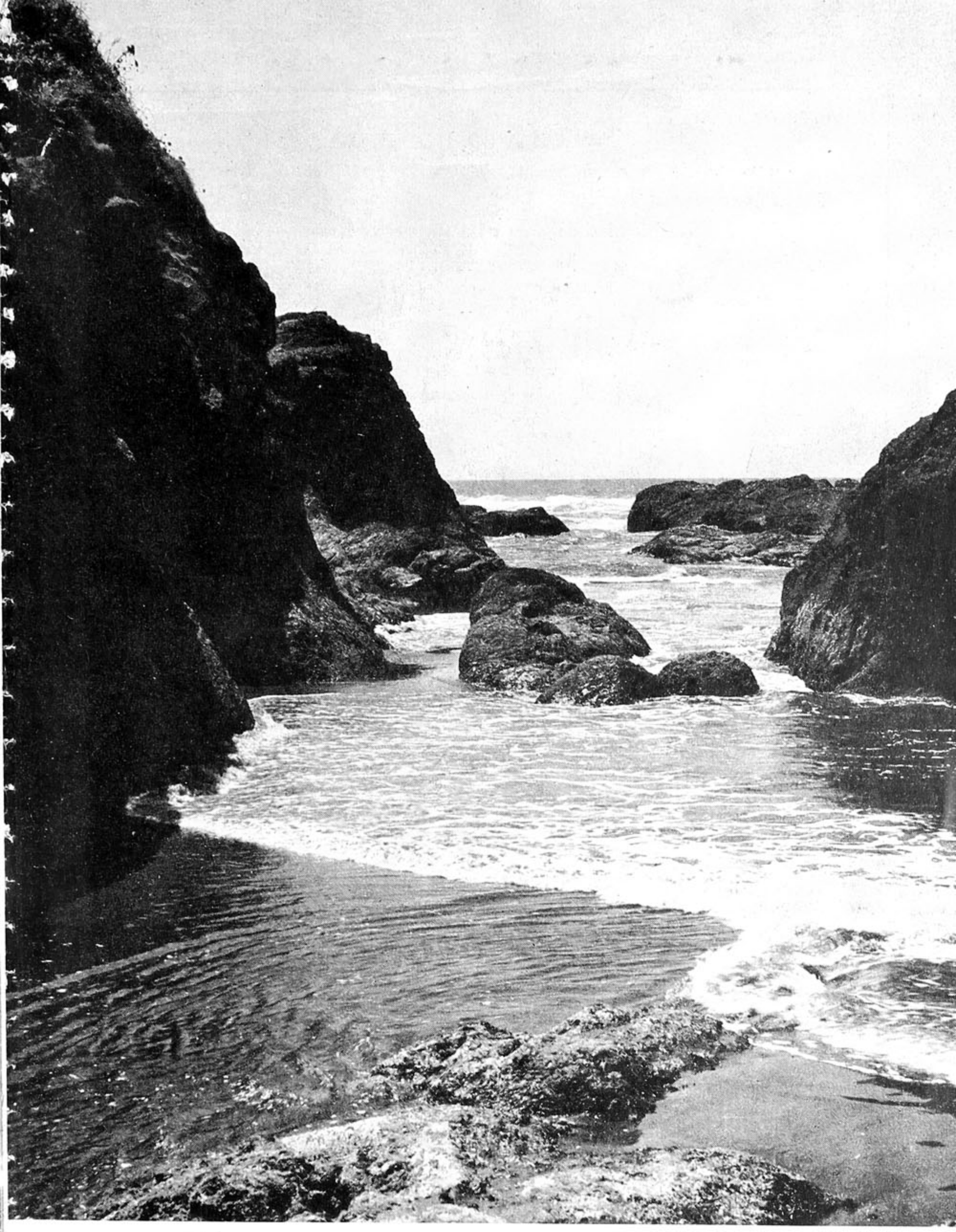

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Bulletin of the Puget Sound Section of the American Chemical Society

VOLUME VII SEPTEMBER • 1946 NUMBER 12

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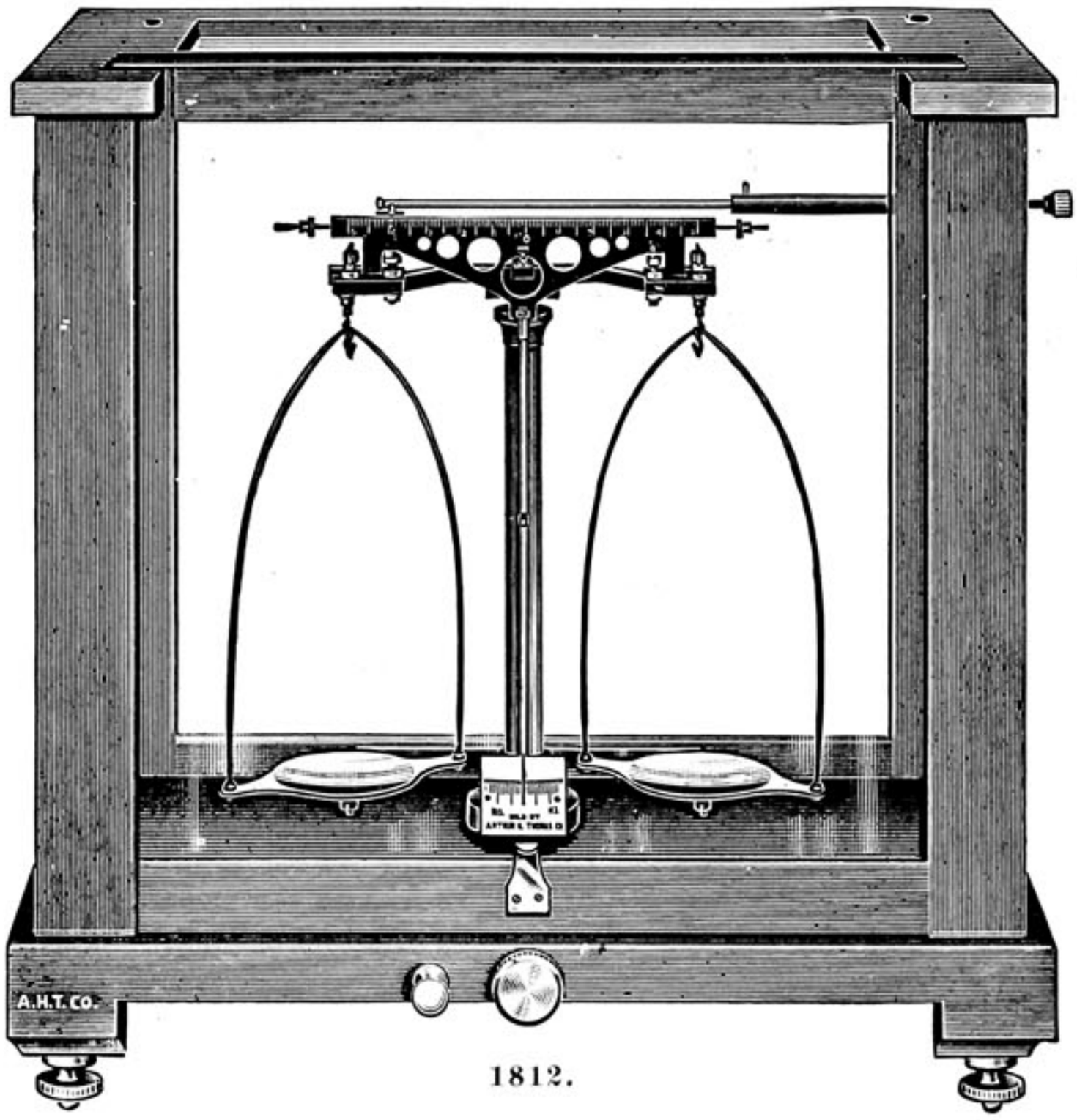

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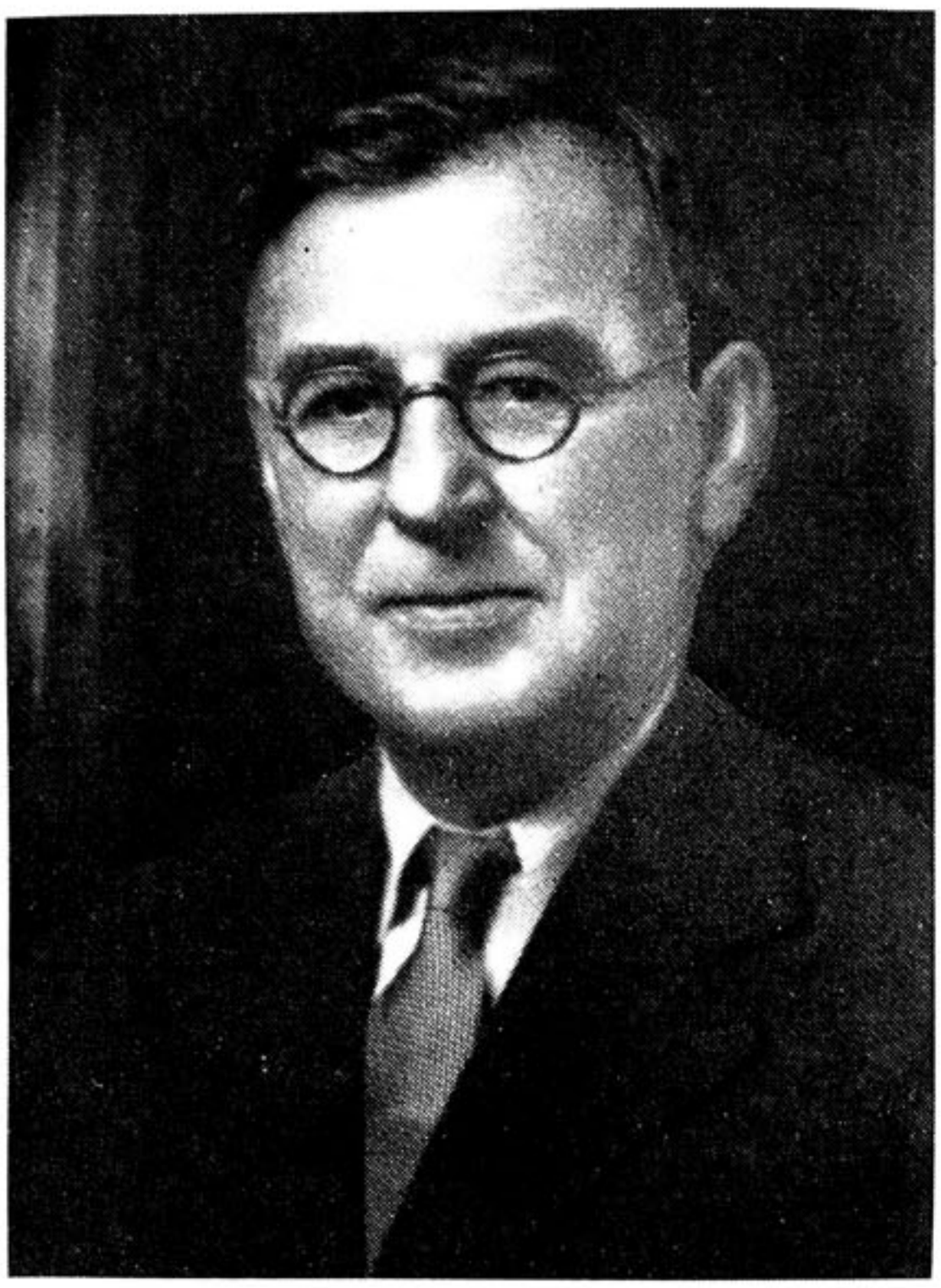
IRVING F. LAUCKS — ANALYTICAL CHEMIST



Irving F. Laucks

"This is the first of two articles briefly biographing the life and work of the Pacific Northwest's most successful industrial chemist. In this, the first part, Mr. Laucks' career as an analytical chemist and head of a laboratory is presented. The second article, to appear in the October issue, will deal with Mr. Laucks, the chemist, as business head of a rapidly growing manufacturing concern."

When Morris Laucks, foundry man and machinist of Akron, Ohio, first saw his infant son Irving on July 3, 1882, albeit proud, little did he realize his boy was to become one of the nation's leading chemists.

Irving F. Laucks graduated from Case School of Applied Science in 1904 with the degree of Bachelor of Science. Young Laucks crowded as much chemistry and mining engineering into his curriculum as time and credits would permit. His interest in chemistry developed under the influence of his high school chemistry teacher, a Case graduate. The writings of Richard Harding Davis filled him with the romance of mining engineering.

Upon graduation from Case, Irving Laucks was first employed as a control chemist by Schoellkopft, Hartford and Hanna in Buffalo, N. Y., at a salary of $40 a month. At that time this dye producing concern (later to become a part of National Aniline) had what was for those times a fair sized research staff consisting of half a dozen Ph. D graduates from Germany, particularly Heidelberg.

The accepted method of research at Schoellkopft, Hartford and Hanna was for each chemist to carry on his experimentation in his own private little cage replete with hood, bench space and equipment. Each of the German doctors would start the day by setting up his own experiment in his little cubicle. Then he would hie to the library to hide behind a pile of Beilstein. When these gentlemen were all assembled in the library in an apparent state of preoccupation, they sent out for beer.

These learned doctors were of the opinion that all good chemists stayed in Germany and only the unfavored ones came to America. It was some time before the young American chemist was accepted by these Heidelberg chemists. This came about through their interest in self defense.

In Germany at that time self defense and the righting of wrong was accomplished through the medium of sabres. Many of the researchers of Schoellkopft, Hartford and Hanna proudly bore the marks of this form of competition. They learned that this type of combat was frowned upon in America and that they must resort to the more primitive method of pugilism to express their manhood. When they found that the young American was adept at the art of boxing they adopted him as their tutor. Soon he too was repairing to the library to quaff the malty beverage behind an array of scientific tomes.

However, young Laucks soon appreciated that there was little future in this employment. In 1905 he was control

(Continued on page 6)

IRVING F. LAUCKS . . .

(*Continued from page 5*)

chemist with Graselli Chemical Company in East Chicago, where sulfuric, nitric and hydrochloric acid and zinc chloride were produced. He stayed there less than one year, when he joined the Diamond Rubber Company as research chemist. Mr. Marks of that company had a patent for reclaiming rubber and decided he needed a research department. As Mr. Laucks expresses it, everything would have turned out fine except for two difficulties; Mr. Marks did not know what he wanted researched, and young Irving Laucks was at a loss as to how to start researching.

In 1906, imbued with a sense of the romance and adventure of the West and as though in response to Horace Greeley's plea to the youth of America, Irving Laucks journeyed to San Francisco. He was accompanied by his former schoolmate at Case, M. J. Falkenburg.

These two classmates, later to become associated in business, arrived in San Francisco in April, 1906, three days after the earthquake had reduced the city to ruins. They realized it would be some time before San Francisco would offer opportunity for chemists, so they traveled to Seattle. The young men had a list of prospective employers in the mining chemical line. Mr. Falkenburg went to Alaska and Mr. Laucks to eastern Washington and Montana. Irving Laucks spent the summer of 1906 with Facet in Spokane in assay work relieving men for vacations. Between 1906 and 1908 he worked at Great Falls, Montana, and for Anaconda Mining Company at Butte, and also returned to Ohio for a short visit. At Great Falls Mr. Laucks served as assistant city engineer, largely because he was one of the few men in the vicinity who could run a transit. After going East, he returned to Butte and, being short of funds, worked as "mucker" for Anaconda.

Mr. Laucks returned to Seattle in 1908 and was soon joined by Mr. Falkenburg, who had been doing assay work for Sam Silverman at the Hedley Smelter on Prince of Wales Island.

At that time one Phillip Holdsworth had an assay laboratory back of the old Opera House and Mr. Holdsworth was not doing so well.

Falkenburg and Laucks had decided to open a chemical testing laboratory and so they bought out Phil Holdsworth. They wanted to hold onto his assay work as a start, but they had firm convictions that a real analytical chemical laboratory could be developed through problems and testing in the area.

A part of the space for this lab was sublet from a shoemaker. The quarters were not exactly ideal for the establishment of a laboratory. In fact there were times in the first few months of this venture when the two young chemists were as busy catching rats and mice as they were doing analytical work. Nevertheless, it was in this same year that Irving Laucks by work in absentia obtained his Master's degree from Case School of Applied Science.

Mr. Falkenburg, besides being associated with Mr. Laucks, was also chemist for Frye Packing Company for the first six months of their partnership. However, they made some progress in this first half year and decided to move to Pioneer Square into what seemed by comparison really luxurious quarters.

In 1908 three of the four corners of Pioneer Square were occupied by banks; the First National, Dexter Horton and the State Bank. Falkenburg and Laucks obtained space on the second floor over the State Bank with all the financial houses about and beneath them.

Nevertheless, the two chemists did not feel very much a part of this financial kingdom of the Pacific Northwest, for after signing for the new lab space they found they lacked sufficient funds to make the move.

Irving Laucks went to Theodore Haller and mortgaged all of their equipment for a loan of $1000. The inventory of their equipment indicated that this was a good loan for Mr. Haller. However, had Falkenburg and Laucks had to dispose of this equipment they would have been hard put to raise the requisite "grand."

The two chemists were associated together from 1908 to 1918. From 1908 to

1914 their business increased gradually. By 1914 they had taken on three assistants and were doing work in assay, industrial analysis, clays, packing house chemistry and cement testing. A cement testing lab was started in 1912. A. H. Albertson was their first client and for this engineer they did most of the cement testing involved in the construction of the White, Henry, Cobb and other Metropolitan buildings.

Between 1914 and 1918 their staff increased to about 30 men for two reasons; they obtained all the inspection work for the Alaska Railway; and natural oils began coming into west coast ports from India and the Orient. The first of these involved all the inspection on any commodities which the Alaska Railway purchased, whether ties, cheese, or typewriters. The second led indirectly to the later success of I. F. Laucks Inc.

Prior to 1914 practically all of the Oriental and Indian natural oils that reached the U. S. arrived through European markets and channels. World War I changed this and these oils began coming into Pacific Coast ports. These oils were received, accepted and resold on the basis of certified chemical analysis. This analysis was usually attached to the bank draft covering the shipment or sale. Falkenburg and Laucks soon found they had their hands full taking care of this analytical work.

During this period Mr. Laucks learned considerable about natural oils. He is the author of "Commercial Oils" and the knowledge he obtained for this work started in this period.

I. F. Laucks Incorporated was established in 1918. The services of this concern should not be confused with those of I. F. Laucks Inc. after 1926 which was a manufacturing enterprise. From 1918 to 1926 I. F. Laucks Inc. was an analytical and research service laboratory.

About 1920, due to the analytical work which Mr. Laucks' organization had done on soya bean oils, he became interested in soya bean meal (Oriental press cake and cart wheel cake). In slack periods

(*Continued on page 8*)

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OCTOBER MEETING

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Will address the Section on

"The Low Temperature Carbonization of Sub-Bituminous and Lignite Coal"

IRVING F. LAUCKS . . .

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a part of the staff worked on possible uses of this potential raw material.

There had been occasional trouble around this time with casein adhesives for plywood. Realizing that soya bean meal was approximately 45% protein, Mr. Laucks was interested in trying to develop a plywood adhesive from it.

To illustrate the desire on the part of the plywood industry to increase plywood's water resistance, Mr. Laucks tells an interesting incident of this period. His organization found that by adding 1½ to 2 per cent of Portland cement to a soya bean adhesive, they were able to produce plywood with considerably increased water resistance. Sufficient of such a glue was supplied for a mill run of one day's duration at one of the plants. Everyone concerned was greatly pleased with the way the test run went both from the standpoint of production and increased water resistance of the plywood. They were still rejoicing the next day when the saw filers marched into the office in an advanced stage of agitation. They were through! Every saw in the plant was duller than a stone age ax. It was some time before the righteous rage of these irate gentlemen could be appeased and then only after firm promises that no more Portland cement would ever be used in an adhesive.

After 3 years work on soya bean adhesives the Laucks organization began to have some success. The first ton was supplied to Ed Westman, then manager of Olympia Veneer in August, 1923.

Roger Chase of Tacoma was serving as jobbing salesman at that time for this experimental production. One day Mr. Chase was scanning the Patent Gazette and came across an abstract of a patent on soya bean glues issued to one Otis Johnson of San Francisco. A letter to Mr. Laucks resulted in his men scurrying to the library, to find to their chagrin that a patent had been issued to Johnson on July 3, 1923. This was Irving Laucks' forty-first birthday.

(*Continued in October Issue*)

Speaker . . .

Dr. Emil Heuser

Dr. Heuser received his early training at the Technical Universities of Munich and Karlsruhe, where he studied under such well-known chemists as Bunte, Engler, Haber, and Le Blanc. After completing the work for his doctoral dissertation at the University of Graz in Austria, under Scholl, the successor of Skraup, he returned to the University of Karlsruhe to obtain his doctor's degree in 1909.

After spending three to four years gaining practical experience in various paper and pulp mills in Germany and Austria, the Technical University of Darmstadt offered Dr. Heuser the Chair of Cellulose Chemistry, which had been made vacant by the appointment of Professor Schwalbe, then the leading exponent of cellulose chemistry in Germany, to the Forest Academy at Eberswalde. At Darmstadt Dr. Heuser lectured on organic chemistry, the chemistry of cellulose, and the chemical technology of pulp, paper, dyes, and textiles. In co-operation with his graduate students, he carried on many original investigations both on the theoretical and practical aspects of problems relating to cellulose, lignin, non-cellulosic carbohydrates, and wood, as well as on those dealing with pulping, bleaching, and other phases of paper manufacture. His activities at Darmstadt were interrupted from 1916 to 1918 by his appointment to the Government Central Organization for the Utilization of Cellulose Waste. During this period he was engaged in studying the fermentation of sulfite waste liquor, the production of ethyl alcohol from wood waste, of methyl alcohol, acetone, and other products from alkaline pulping spent liquors by the Rinman Process, and the manufacture of furfural from wood waste and straw. In 1923 he left Darmstadt to become director of research of the Vereignigte Glanzstoff-Fabriken, manufacturers of rayon and photographic film. At the same time he served as honorary professor of cellulose chemistry at the Technical University of Berlin at Charlottenburg. In 1926, when the manufacture of rayon pulp became a pressing problem in North America, he left Germany and accepted the position as director of research of the Canadian International Paper Company at Hawkesbury, Ontario, Canada. In 1938 he was appointed to his present position as research associate and instructor in cellulose chemistry at The Institute of Paper Chemistry, a graduate educational and research institution affiliated with Lawrence College at Appleton, Wisconsin.

Dr. Heuser is well known as contributor to, and author of a number of books on cellulose and related fields. Of more recent contributions, we may mention his chapter on cellulose in Gilman's "Advanced Treatise on Organic Chemistry" (1938 and 1943). His "Textbook of Cellulose Chemistry" (1924) was translated from the German second edition by West and Esselsen and appeared in new form under the title, "The Chemistry of Cellulose" in 1944 (John Wiley and Sons, Inc., New York).

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THE ESTIMATION OF VITAMIN A

R. W. HARRISON
Lyle Branchflower Company

In estimating Vitamin A, the evaluation is made in terms of biological activity or potency rather than as a measure of a physical quantity of the vitamin. Thus a product is said to contain or have a potency of so many U.S.P. or International units per gram. This practice was logical and necessary in the years immediately following the discovery of Vitamin A because its utility is due to its essential role in the biochemical machinery of man and animals and pure Vitamin A was not available for reference.

Vitamin A was first identified about twenty-five years ago as a constituent of cod liver oil. The rat was used in these nutritional experiments and has continued as a test animal for the bioassay of the vitamin. Until the early 1930's, no uniform standard of reference was known for evaluating Vitamin A and as a result a variety of arbitrary units were recommended. In many instances it was the practice to take cod liver oil as a gross reference and the product being tested was reported as being equal to or some degree less or more potent than cod liver oil. Under these conditions early trade in Vitamin A materials such as fish liver oils could be based only on rough approximation of Vitamin A content.

During the late 1920's, investigators discovered that certain pigmented cereal and vegetable products possessed Vitamin A activity. This activity was shown to be due to beta-carotene and certain related carotenoid pigments. Demonstration that these materials were provitamins or precursors of Vitamin A suggested the availability of a reference standard because beta-carotene could be isolated in relatively pure form—a situation that did not pertain with respect to Vitamin A. In 1934 the Permanent Commission on Biological Standardization of the Health Organization of the League of Nations selected a well defined sample of carotene as the international reference. The international unit of Vitamin A was then specified as being equivalent to the biological activity of 0.6 gamma of the standard beta-carotene.

Biochemists in the United States were reluctant to accept the international standard as practical reference material and accordingly arranged for the preparation of a standardized reference cod liver oil sample. This oil was evaluated against the International carotene sample and was determined on the basis of the average of numerous collaborative assays to have a Vitamin A content of 3,000 units per gram. The unit, however, was designated as a U.S.P. unit rather than an International unit. Subsequent U.S.P. reference samples have been prepared to replace exhausted supply of the preceding samples.

Although the beta-carotene standard and the U.S.P. reference oils ostensibly have permitted establishment of a standard of measurement for estimating Vitamin A, both standards possess serious limitations. With respect to beta-carotene, additional lots of standard material may be of dissimilar purity and there is a wide variation in the ability of various types of animals to convert provitamins to Vitamin A. Furthermore, the physical and chemical properties of beta-carotene are dissimilar from those of Vitamin A, and therefore the material cannot be used as a standard of reference in physiochemical methods. Cod liver oil is unsatisfactory as a standard because of the lack of stability of the vitamin and the fact that although it can be used in connection with physico-chemical methods it contains interfering materials. Nevertheless, the biological assay using these standards still constitutes a final official answer in the estimation of Vitamin A.

The official U.S.P. bioassay for Vitamin A is based upon growth. Rats raised on a controlled diet and ranging between 39 and 50 grams body weight at not more than 28 days age and not showing evidence of Vitamin A deficiency are divided into comparable groups and placed on a Vitamin A deficient diet for a period of 20 to 45 days until character-

istic evidence of Vitamin A deficiency occurs. Varying amounts of both the reference cod liver oil and the unknown product are included in the diets of the control groups and the test groups and after a period of approximately 28 days the vitamin content of the unknown is estimated on the basis of the relative increases in weight between the control and the test groups at the various levels of Vitamin A intake.

The bioassay is both time consuming and costly and reproducibility of results between different laboratories is seldom within plus or minus 5% and more likely is in the neighborhood of plus and minus 10 or more per cent. Such a test, while permitting a means of substantiating the estimation of Vitamin A, is entirely unsatisfactory and impractical where frequent assays or prompt results are required.

Shortly after Vitamin A was discovered investigators noted that the addition of a chloroform solution of arsenic trichloride or antimony trichloride to a dilution of cod liver oil in chloroform caused the formation of a blue color, the intensity of which was approximately proportional to the Vitamin A content of the oil as indicated by the biological test. Investigators also observed that materials containing Vitamin A exhibited an absorption maxima in the ultra violet and the degree of absorption likewise proportional to the Vitamin A activity of the material. These fundamental observations, particularly the latter, provided the basis for the development of the physicochemical methods now so widely used in the estimation of Vitamin A.

The antimony trichloride reaction, popularly known as the Carr-Price test, was used extensively during the late 20's and early 30's. Although now largely replaced by the spectrophotometric test, it still has wide application in both control and field work and within the past few years has regained favor as a supplemental test to be used in conjunction with the spectrophotometric estimation.

Progress in the development of the Carr-Price test has been principally in

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Estimation of Vitamin A

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instrumentation. In applying the test to the assay of oils a known concentration of oil in chloroform is prepared. A measured volume, usually from 0.2 to 1 cc., depending on cell size, is placed in a glass cell of standard internal measurement and the cell is placed in the color measuring instrument. A volume of saturated antimony trichloride—chloroform solution, usually ten times that of the oil chloroform mixture, is added so that the two solutions mix. The blue color develops rapidly and then fades. Readings are taken at the point of maximum color intensity. Initially the color was matched against colored glass standards in an instrument such as the Rosenheim-Schuster or Lovibond Tentometer. The results were reported as "blue units" and an approximate estimation of Vitamin A made by multiplying by some predetermined conversion factor. The test was quite laborious because the rapidly fading color made necessary repeated observations in order to obtain a measure of the color at maximum intensity. The readings also were influenced by the variable ability of individuals to match color.

The accuracy of the color test has been enhanced greatly by the application of photoelectric colorimetry. The blue color given by the antimony trichloride reaction has an absorption maxima at approximately 618 to 620 mu. Thus by measuring photoelectrically the intensity of the incident and the emergent light of that wave length it is possible to obtain increased accuracy in the color measurement. Each laboratory generally calibrates the instrument against a standard of known biological potency and since the relation between color and Vitamin A concentration essentially follows Beer's law, the readings of the unknown can be converted directly to apparent biological value.

Within the past six or seven years the spectrophotometric method of assay has been adopted almost universally, particularly in the United States, as the standard method for estimating Vitamin A. This test, as indicated previously, is based upon Vitamin A having a specific and characteristic absorption curve with a definite maxima in the region 325 to 328 mu. Through improvements in instrumentation and increasing knowledge of the chemistry of Vitamin A, the test has reached a relatively high degree of precision and may soon receive the same official status as the bioassay.

Application of the spectrographic test was at first limited to laboratories having expensive spectrographic equipment of the conventional type. The possibilities of the method led to development of special abridged instruments specifically designed for estimation of Vitamin A. Of the earlier instruments the Hilger Vitameter and the Bills-Wallenmeyer Instrument were manufactured commercially while others were developed and used privately or were custom built.

Development of new types of instruments for general spectrophotometric work has provided the Vitamin A industry and investigators in this field with an extremely useful tool. Of these the Beckman Quartz Spectrophotometer and the Coleman Universal Spectrophotometer are most widely used. The Beckman Spectrophotometer might rightly be considered the official assay instrument of the Vitamin A industry.

The estimation in the Beckman instrument is made using either a tungsten light source and corex absorption cells or a hydrogen discharge lamp in conjunction with quartz absorption cells. An accurately weighed sample of the unknown is made up to volume with a suitable solvent, either isopropanol, cyclohexane or

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Estimation of Vitamin A

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ethyl alcohol. A portion of the dilution is placed in one of a pair of matched absorption cells and the solvent alone in the other. The instrument is designed to take up to four cells and permit their interchange in the light beam. The instrument is then balanced to read 100% transmission with the solvent in the light source of desired wave length. The cell containing the unknown is brought into the beam of light and the instrument again balanced. A dial indicates the percent transmission.

It is accepted practice in estimating Vitamin A spectrophotometrically to determine the coefficient of absorption on the basis of a 1% solution of one centimeter depth. The results are expressed as $E^{1\%}_{1cm}$ @ 328 mu where E represents the optical factor $\text{Log } \frac{Io}{I} \times \frac{1}{cx}$ in which Io and I are the intensities of the incident and emergent light respectively and c = concentration and x = width of absorption cell. The above determination can be made within a few minutes and a high degree of reproducibility is attained —there seldom being more than ± 1% variation between experienced laboratories. The physical advantages of this method over the bioassay are obvious.

The reproducibility of the spectrophotometric test, however, does not assure that the result is an accurate estimation of Vitamin A. All materials that absorb light in the approximate range 325 to 328 mu are not Vitamin A. In the case of most fish liver oils the quantity of non-vitamin A material giving extraneous absorption is not apt to be large, yet it is sufficient to warrant serious consideration. As a result the interpretation of the spectrophotometric measurement has always been and still is a primary problem of the Vitamin A chemist.

At the present time a factor of 2,000 is used in converting the E value to apparent U.S.P. Vitamin A units. In England a factor of 1,600 is used to convert to International units, yet the two units evolve from the original beta-carotene standard. The 2000 conversion factor was selected as an average result of a series of collaborative data involving bio-assays and spectrophotometric determinations. In some instances conversion factors have been found to range between as low as 1600 to 1700 to as high as 2300 to 2500. This variation, however, does not mean that the lack of uniform conversion is due entirely to lack of reliability of the spectrophotometric test. The bioassay is subject to quite wide variation and research indicates that further improvements are advisable.

Vitamin A has a characteristic and rather symmetrical absorption curve. The ratios E300/E328 and E350/E328 are about 0.5 and 0.6. Since very few materials have a similar absorption curve, none of which occur normally in Vitamin A oils, any foreign material having absorption at 328 would tend to distort the curve of the unknown. In view of this, it has become relatively standard practice to determine the absorption at several wave lengths between 300 mu and 350 mu in addition to the 328 mu reading. Experimental evidence suggests that if the ratios E300/E328 and E350/E328 are less than about 0.73 and 0.65 respectively, there is good assurance that the E-328 value is a measure of Vitamin A and the conversion factor of 2000 can apply. The ratios given by some whole oils are improved by making the determination on the unsaponifiable fraction, in which case the lower value usually obtained is considered a more reliable estimation of Vitamin A. Where poor curve characteristics persist it is reasonably certain that the spectrophotometric result will give an erroneously high estimated Vitamin A content if the 2000 conversion factor is applied. The degree of distortion, however, is only indicative and not a direct measure of the error. When this condition occurs the antimony trichloride test is helpful as a supplementary source of data.

The writer trusts that the above discussion, although very general in nature, will give chemists of the Puget Sound Section not concerned with the Vitamin A industry a rough picture of why some of their colleagues either turn grey or lose their hair—and not for lack of Vitamin A.

KJELDAHL

DIGESTIONS

and

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a

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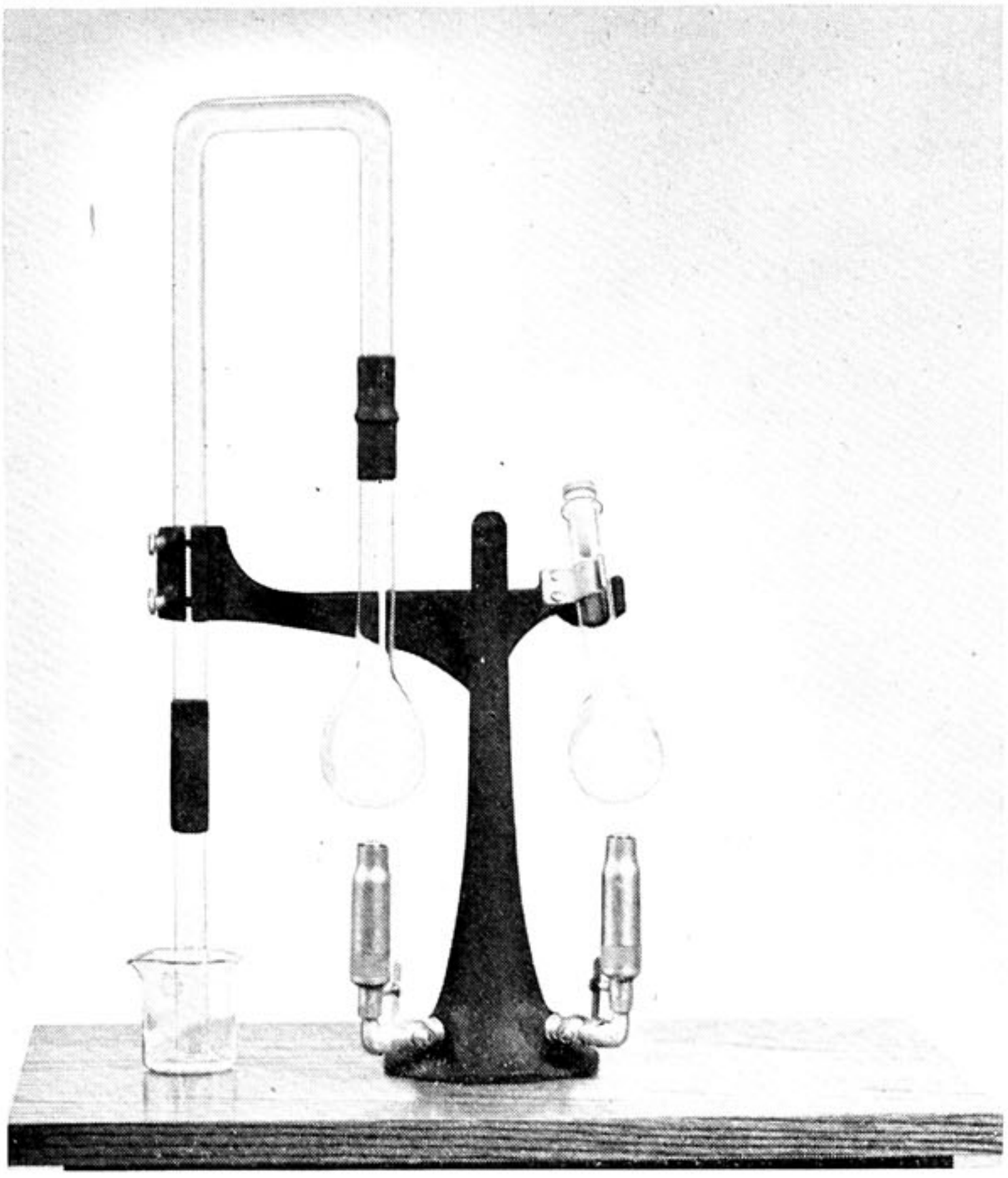

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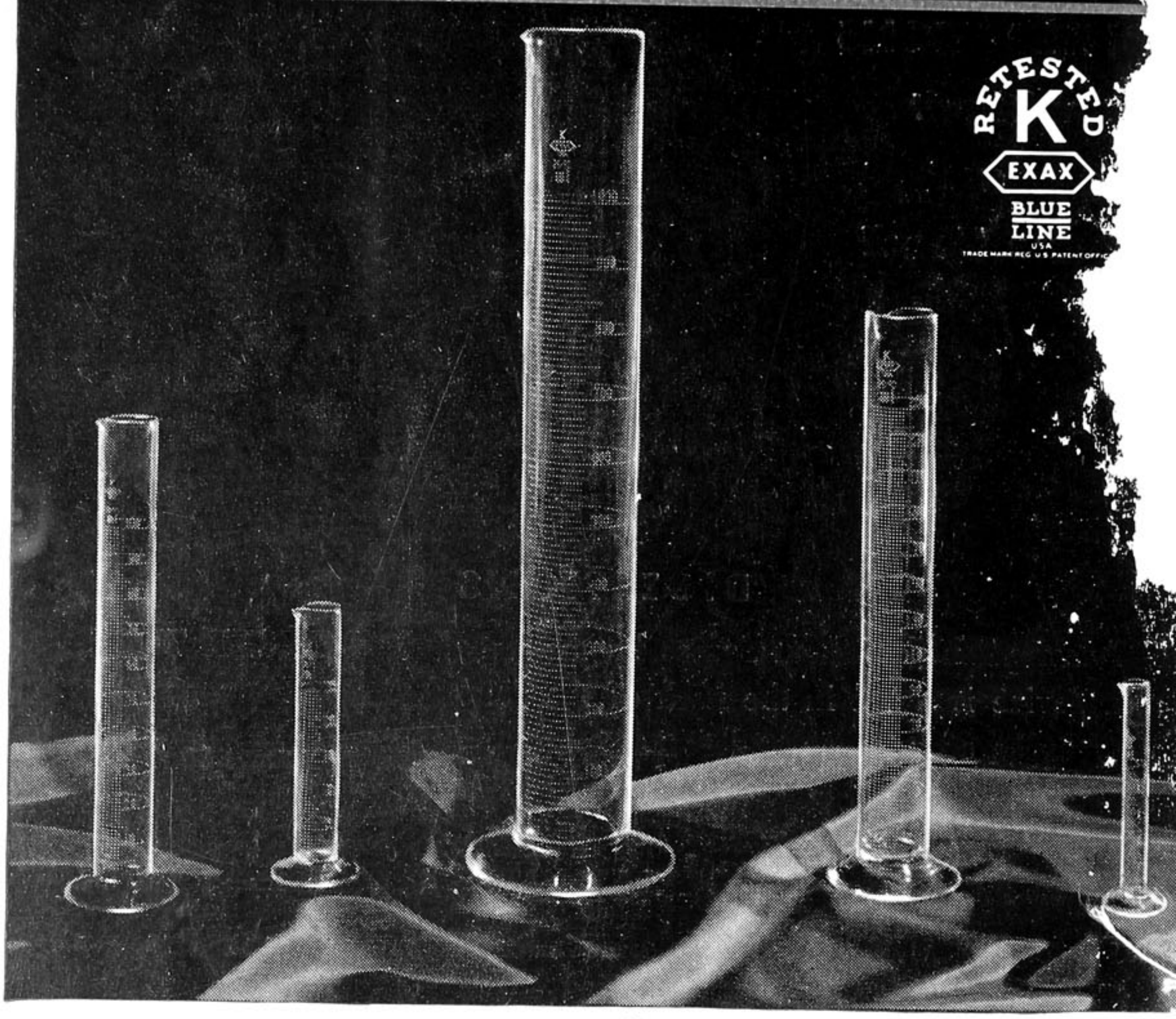

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