THE JOURNAL OF INDUSTRIAL AND ENGINEERING CHEMISTRY

Vol. I. APRIL, 1909. No. 4

THE JOURNAL OF INDUSTRIAL AND ENGINEERING CHEMISTRY
PUBLISHED BY
THE AMERICAN CHEMICAL SOCIETY.

Published monthly. Subscription price to non-members of the American Chemical Society $6.00 yearly.

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EDITORIALS.

READJUSTMENT.

We are living in the days of the flying machine. Darius Green has been vindicated, and again we attempt to adjust our articles of faith so as to be more liberal. In chemistry the mental equilibrium which represents the balance between what we consider the possible and the impossible is disturbed by the apparent genesis of some of our sacred elements. This disturbance is counterbalanced by failures to confirm, but the thing is in the air. The machine has apparently operated, the faith has been adjusted, and this particular chemical guiding-star of specific individuality of the elements has become a comet receding along one of those hyperbolic paths which will continue to carry it away from us.

How much more readjustment must the chemist make? He has always been in the act of discovering or of being surprised. Yet he cannot discount the future to any extent. He knows that a microscopic cell contains in the chromosomes of its almost invisible nucleus something in material, or arrangement, which determines heredity. Development may make of it a polyp, an onion, or a man. The product will be further possessed of numberless characteristics which must have been dominant in the egg, and were determined by at least many of the ancestors of the new individual. Where was it? How fine is material? The theory of finite limits in fineness may be wearing out. A theory is a suit of clothes covering a nakedness. It is criminal to appear to be without it. It is foolish to change it too frequently, and it is slovenly to neglect it. We have used the atomic theory because it covered for a time the nakedness we recognized, but it must apparently be changed. Generally it is easier to patch than to renew, and he is a bold chemist who, knowing the style, dares renew entirely his theory. The atoms in some form will continue to be at least a covering below which other changes may be made, without an essential alteration of the previous outer design of the suit.

Are we not justified in believing that no limits of fineness are to be placed; that in fact all possible conceptions of finality are in us and not in Nature? If this were so, the continual change in our theories might be explained. As we develop we widen our horizon, and this is limitless. Is there any greater reason for assuming that the electron of conducting gases is the limit of their divisibility than that this was set by the chemist's atom of the recent past? The energy conceptions of matter which tend now to make us brush up our definition of matter, are as surely a transient state as were the elements earth, fire and water. What we always seem to gain by these pioneer efforts is a sort of trail-blazing which shows us a way to further co-ordination of facts, to simplifying mental processes and to prophesying. It has its great good for a certainty, not as an end, but as a means.

W. R. Whitney.

CHEMICAL SOCIETIES IN AMERICA.

The opinions of *Electrochemical and Metallurgical Industry* on National Chemical Societies were published in a recent editorial, in part as follows:

"The Baltimore meeting was exceedingly well attended. There was much rejoicing in the new spirit of activity manifested in the American Chemical Society. * * * .

"Any special brand of chemists may now find a certain limited degree of recognition and furtherance within the American Chemical Society under its new benevolent paternal policy. It is not fair to deride this new policy as a lucky afterthought and the new spirit of progressive activity as forced upon the Society by outside developments. * * * .

"In addition to the American Chemical Society and the American Institute of Chemical Engineers, there is the American Electrochemical Society, now seven years old and rapidly growing in membership and prestige. In all we have, therefore, now, three national chemical societies in this country. But the field is so broad that there is open for each of them a career of usefulness and activity, with glory enough for all. Though independent, they all could and should co-operate in a fine liberal spirit to promote the common interests of chemistry, each in its own sphere of influence. It is high time that narrow jealousy should cease. It should no longer be possible or practicable for a distinguished industrial chemist to rise in an important committee meeting with the complaint that electrochemical engineers and inventors get all the public recognition and the poor 'pure chemists' get nothing. Those over-zealous members of the American Chemical Society who even now, again and again, bring forward the suggestion of absorbing the Electrochemical Society, should finally learn that such a scheme is, to put it mildly, an anachronism. And the formation of the American Institute of Chemical Engineers should also be taken as an accomplished fact. The American Chemical Society can find no better friends than among the founders of the Institute. It is all very well to speak of the tendency of the times to form commercial combinations and trusts for manufacturing on a large scale. But science, pure and applied, is promoted not in such a way. What counts here is individuality, the man as man. Great advances are made by opposing individualities. For the promotion of science and engineering, even in a limited field like chemistry only, nothing could be worse than the combination of the various scientific and engineering societies into one unit, with one publication committee and an editor in charge who as a practical dictator would determine what is suitable for publication and what not. It is unnecessary to add another word."

After making allowance for the ambiguities of generalization, there remain among these statements several which may be fairly questioned. Not a few of the conservative members of the profession dissent from them. The Western Society of Technical Chemists and Metallurgists, national in everything but name and with a membership approximating that of the American Electrochemical Society and also the American Leather Chemists' Association with a larger membership than the American Institute of Chemical Engineers, may well be included in the list of American Chemical societies. Each of these publishes a monthly journal.

"Science pure and applied" is not promoted by combination or at least by large combinations. "What counts here is individuality, the man as man." We honor the individual who accomplishes great works unaided by organization or communion with his fellow workers, the Palissy whom nothing can defeat; but it is unwise to belittle the value and importance of scientific organization on the large scale. If we are progressing scientifically to-day, we are progressing because of far-reaching scientific combination. Although the factors of progress are various, our progress will advance or decline with the integrity and continuity of our organization.

The editor of *Electrochemical and Metallurgical Industry* seems to forget that combination for purposes of publication is especially necessary, and that whether this combination is secured by means of the subscription list of a journal privately conducted or by means of a society more or less national or international in its character and organization, is a matter of detail. The purpose of scientific publication must be to secure as wide a dissemination as possible of the results of scientific work. Two years ago some of the officers of the American Chemical Society attempted to secure a co-operation between that society and the American Electrochemical Society with a view to securing the circulation of papers published by either society throughout the membership of the other. The difficulties of securing such a co-operation appear to be insurmountable, but the members of the American Chemical Society certainly have no wish but for the best success of the Electrochemical Society. The success of that society is evidence that it has filled a useful place in the development of our scientific activities and there is no doubt that it will continue to do so. At the same time it seems unfortunate that many scientific papers published in America reach only a small fraction of the chemists to whom they would be most useful. It is because the American Chemical Society has, for the first time in the history of American science, succeeded in publishing chemical journals which have secured a very large circulation that the society has an especial right to ask for the support of all American chemists.

The picture of the combination of the various scientific and engineering societies of this country into one unit with an editor as "practical dictator" is a flight of fancy too great for us to take. Certainly the editors of the American Chemical Society are by no means "practical dictators." They are, in the first place, elected annually by a council of the society consisting of sixty or more representative chemists. Any attempt on the part of the editors to follow a course which was distasteful to a majority of the chemists of the country would be quickly followed by the appointment of other persons in their places. In addition to this, each editor has associated with him a number of associate editors, to some of whom every paper is submitted before publication and in case of any difference of opinion between the editor and associate editor to whom the paper is submitted, the question may be referred to the president of the society for decision. In some cases a doubtful paper has been submitted to nearly or quite the whole board of associate editors, and a practically unanimous opinion was secured before the paper was rejected. A democratic organization of the character of the American Chemical Society would seem to secure the rights of authors at least as well as they can be secured under the plan of a journal conducted as a private enterprise.

All the funds of the American Chemical Society go to the furtherance of chemistry in America. If the funds are increased as by an increase in membership or by advertising, all chemists will be the gainers. The work of its editors is largely a labor of love.

In the days when chemistry was little honored in this country, when chemists were few, salaries low, and support meagre, a few unselfish self-sacrificing men gave their time and money to the cause of the organization now known as the American Chemical Society, that all chemical research might be advanced and that the standing of all chemists in the community might be raised. In the days when there was no profit in publishing chemical journals, they published the *Journal of Analytical Chemistry* and later the *Journal of the American Chemical Society*. Their offense, if offense they committed, lay in publishing too much rather than too little; in printing the work of uncertain value rather than in excluding it.

The American Chemical Society favors and will always favor any movement among chemists which will advance the interests of chemistry and chemists in the best possible way. In the matter of publication, it believes the best interests of chemists are conserved by a large organization. This is not an hypothesis but a matter of simple calculation. The society supports all movements looking to the benefit of chemistry. Its friends are the friends of chemistry in America.

W. D. RICHARDSON.

ORIGINAL PAPERS.

THE RARE EARTHS—THEIR PRODUCTION AND APPLICATION.[1]

By H. S. MINER AND M. C. WHITAKER.

Received January 16, 1909.

The term "Rare Earths" was given originally to a group of earths of which but little was known and which we were accustomed to think was very sparsely appropriated throughout the mineral kingdom. At the present time, however, it is conceded that while not the most abundant of the elements which Nature has provided, yet they are of wide distribution; and when we consider that many of these elements are now dealt in by tons and the minerals containing them are dealt in by hundreds of tons, the term "Rare Earths" appears to be a misnomer. Instead, therefore, of conveying the original idea of scarcity, this term now conveys the idea of a fairly definite chemical classification, just as does the term the "Alkaline Earths" or the "Iron Group."

The late Prof. Mendeléeff has described this group of elements as one "which in their sesquioxides, present basic characteristics of a more energetic nature than those shown by alumina." The elements of this group as recognized by the International Committee on Atomic Weights, both by their chemical reactions, and by natural occurrence, fall into the following general classifications:

Cerite Group.—Cerium, Lanthanum, Neodymium, Praseodymium, Samarium, Gadolinium.

Ytterite Group.—Yttrium, Erbium, Terbium, Ytterbium, Scandium, Thulium, Dysprosium.

Thorium.

Zirconium.

The beginning of the study of this group of elements is traceable back about one hundred and twenty years and probably begins with the discovery of zirconium by Klaproth in 1788. He also

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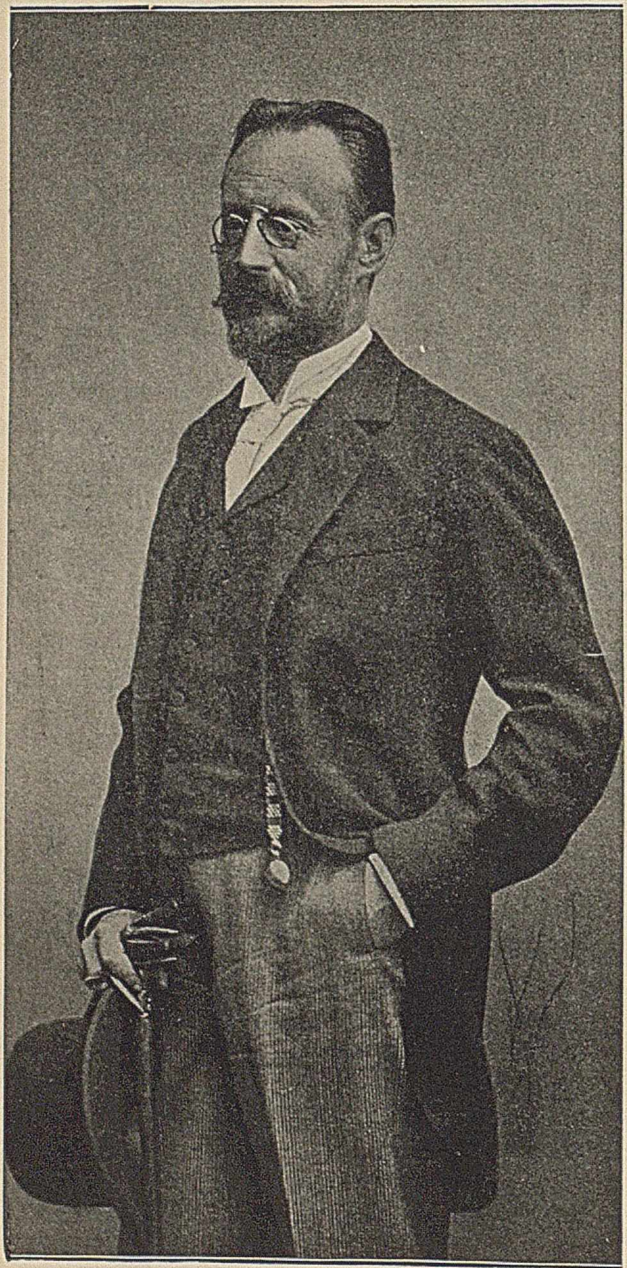
[1] A paper read before the New York Section of the American Chemical Society, Friday evening, December 11, 1908.

discovered cerium in 1803, while Berzelius just ninety years ago made the still more important discovery of the element thorium. From these beginnings the work was followed up all through the last century, and who shall say that the end of the chapter has been reached?



Dr. Carl Freiherr Auer von Welsbach.

Claims have been recently made that some of these supposed elements are not elementary in their character after all, but are mixtures of two or more elements. This claim is certainly supported by precedent, notably the work of Dr. Auer when, after forty-three years, from the didymium of Mosander he produced neodymium and praseodymium. In view of these results and other work of a similar nature, it is not too much to believe that others of these supposed elements, and not improbably even the two just mentioned, are complex in their nature.

I have alluded to the fact that the elements once noted for their rarity are very widely disseminated throughout the mineral world. It has been claimed that the fifteen elements which I would include in the classification of the "Rare Elements" are found in over one hundred different minerals. These minerals have been found scattered over the whole globe. Lines of several of these elements have also been found in the solar spectrum.

The wonderful discovery made by Dr. Auer transformed the group of elements which had been long known as the "Rare Earths" from scientific curiosities into materials having a very practical value. Minerals containing certain of these elements had been known to scientists for more than one hundred and fifty years; but beyond a very limited use in the preparation of a few medicinal compounds no practical value had been developed for any of them.

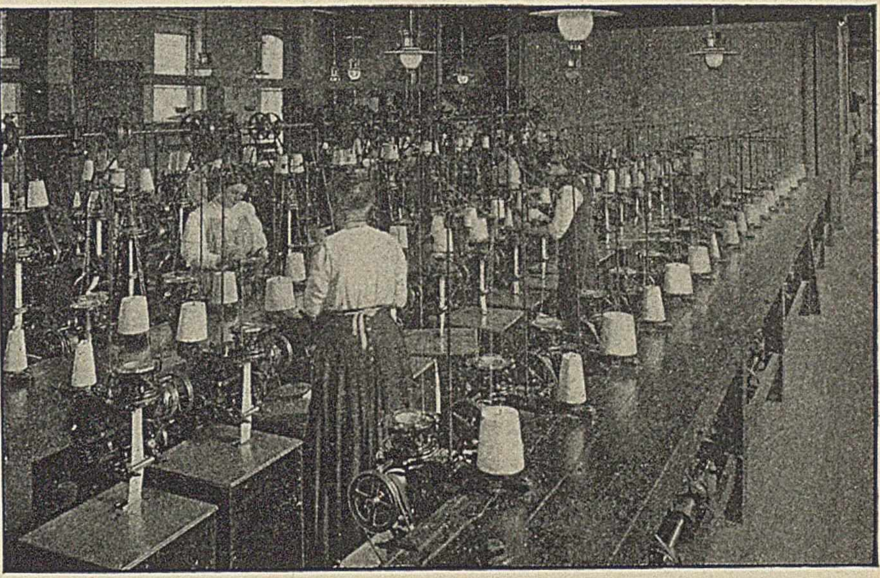
The first Welsbach mantles required principally lanthanum, cerium and zirconium, elements which existed in large quantities in the Swedish mineral cerite and in zircon. An ample supply of both of these minerals was found and large quantities of cerite were mined in Sweden, and soon sufficient zircon was produced in Norway and in North Carolina to meet the demands of the incandescent gas lighting industry. This type of Welsbach mantle also developed a demand for the mineral allanite and a large deposit of this rare earth mineral was discovered in Virginia.

The invention of the thoria-ceria mantle, composed of practically 99 per cent. of thoria, produced an immediate and urgent demand for minerals rich in that element. At that time the Norwegian mineral thorite, containing about 50 per cent. of thoria, seemed to be the most hopeful source of supply. Diligent search, however, failed to discover a sufficient quantity to supply more than a small fraction of the thoria needed. Many other minerals, of course, were known which contained thoria, most of them in much smaller percentages than thorite, but none of these, with the exception of monazite, had been found to exist in commercial quantities. Deposits of monazite sand had been discovered in North Carolina and in Brazil, and considerable quantities had been mined for use in the manufacture of the lanthanum-cerium-zirconium mantle. Lanthanum and cerium were the ingredients which had at first made the monazite of value and the thoria content had been practically overlooked and discarded. Finding that minerals rich in thoria were not commercially available more careful attention was directed towards the deposits of monazite already developed, with the result that large deposits were found in both of these localities. Though by no means an ideal mineral, yet being the only one found in paying quantities, it soon became recognized as the commercial source of thoria.

Monazite had been known since early in the nineteenth century and the fact that its name signifies "to be solitary" indicates that at the time of its discovery, at least, it was considered to be one of the very rare minerals. Since its first discovery monazite has been identified in the rocks over a large part of the earth's surface. Usually, however, it is found to compose but a minute portion of the rock and in many instances its presence can only be detected by the use of the microscope. The monazite deposits of commercial importance are those occurring in the placer sands of the streams and the adjoining bottom lands, and in certain beach sands along the seashore. Geologists tell us that such deposits can only be formed in countries which have not been subjected to the tremendous eroding influences of prehistoric glaciers during the ice age.

Monazite, in its original formation, occurs in rocks of the granite class and in many places these rocks have been decomposed by the action of weathe ing, and the grains or crystals of monazite thus liberated are collected in the stream-beds or bottom-lands below. As the monazite moves to its bed, by the action of running water, it undergoes a process of sorting and concentration, the lighter minerals being washed away, leaving the heavy monazite in a pocket with other heavy minerals, forming a "placer" deposit.

Monazite crystallizes in monoclinic crystals and has a hardness of from 5 to 5.5 and a specific gravity from 4.8 to 5.3. It is generally found in small grains or crystals; in fact, the grains are so fine that the mineral is commercially known as "monazite sand." Large masses and crystals have been found in Norway, though in this form the mineral is a very great rarity. Monazite is found in a variety of colors, such as light yellow, red, brown, green, buff and a great variety of intermediate shades. Chemically speaking, monazite is essentially a phosphate of the rare earths of the cerium group, and though its various components may vary considerably in different samples, a fairly typical analysis would be as follows:

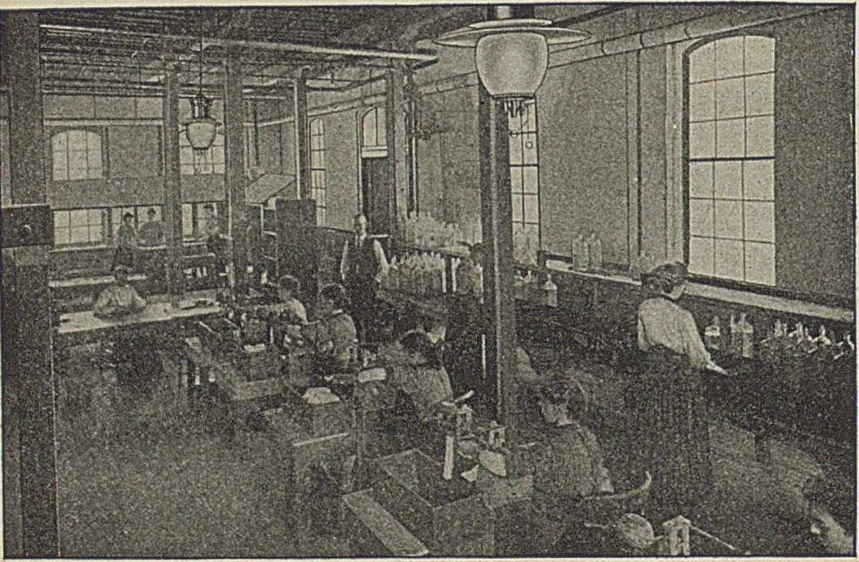


Knitting mantle fabric.

Phosphoric anhydride	28 per cent.
Cerium oxide	30 "
Lanthanum oxide	14 "
Neodymium oxide Praseodymium oxide	16 "
Thorium oxide	5 "
Yttrium oxide	2 "
Iron oxide Calcium oxide	5 "
Etc.	
	100 "

The discovery of the application of monazite to the incandescent gas lighting industry was a great incentive to the search for this mineral, but even after nearly twenty-five years, the only deposits of commercial importance are those originally known in the Carolinas and in Brazil. It is true that the borders of the deposits as originally known in both these localities have been very much extended, and far richer beds have been uncovered than were originally known to exist; yet until this date all the monazite sand used in the manufacture of incandescent gas mantles comes from either the Carolinas or from Brazil.

The monazite district in the Carolinas comprises approximately 3500 square miles of the border region of both North and South Carolina, and lies chiefly in Burke, McDowell, Rutherford, Cleveland and Polk Counties of North Carolina, and in Spartanburg and Greenville Counties of South Carolina, though many of the counties bordering on these mentioned contain deposits of this mineral. The monazite is found in the sand carried down by the rivers and "branches" of this district, and in the gravels underlying the "bottom" land bordering on these streams. Many of these streams and "branches" had been originally worked for gold, and the "tailings" of these placer operations were early found to contain monazite in paying quantities. The natural concentrates of the stream-beds were about the first deposits to be worked commercially in this region, the plan of operation being similar to that of gold placer-mining with the well-known "Long Tom" or rocker apparatus. By this process, the water from the "branches" is temporarily deflected from its channel, and is used to wash and concentrate these deposits in sluice-boxes before it returns to the original channel farther on. The sand and gravel are shoveled on to a perforated plate, and washed in the streams of water, allowing the lighter and finer impurities to float away, and permitting the heavier particles, principally monazite, to settle and remain in the bottom of the boxes.



Saturating mantle fabric with lighting fluid.

Stream beds are now so far exhausted that attention has to be paid to the adjoining "bottoms." The monazite is found in the gravel and there is usually a heavy "overburden" to be removed before this gravel can be reached. Here again the operation of placer gold mining is followed, except that in many cases the work has to be conducted methodically, since much of this bottom land has a value for tillage purposes. The purification of the washed sand is continued by various concentration devices, such as Wilfley tables or magnetic separators, by which most of the other impurities are removed, and the final product contains from 90 to 95 per cent. pure monazite, in which form it is ready for the market.

The largest known deposits of monazite sand are those which are found in Brazil, and these deposits supply practically all the monazite that is used in the European thorium factories. The principal Brazilian deposits are found on the coast of the provinces of Minas Geraes, Sao Paulo, Rio de Janeiro, Bahia and Espirito Santo. The monazite here is really a beach sand, being found either on the shore of the ocean, or in the lowlands immediately bordering the shore. The method of mining the Brazilian sand is very similar to that in vogue in North Carolina.

The annual production of monazite sand has very rapidly increased since the introduction of the Welsbach light. From the very small quantity of sand which was mined in the year 1888, the output has increased, until at present the annual transactions in this mineral are rated by the thousands of tons. Thus the day has passed when monazite sand can be spoken of as a "rare" mineral.

A new mineral was discovered a few years ago in the island of Ceylon, which has a composition rendering it an almost ideal source of supply for incandescent mantle chemicals, could it be procured in sufficient quantities. This mineral is thorianite and it is composed essentially of uranium and thorium, the latter comprising from 60 to 75 per cent. of its composition. As in this mineral the element sought is its essential constituent, it is to be regretted that as yet it has been found only in this one locality, and there only in small quantities.

As the chief use of the rare earths is found in the manufacture of incandescent gas lights, it might not be inappropriate for us to consider, at least, some of the salient points in the development of this system of illumination which has such a broad application.

Without any attempt to give a complete history of gas illumination,[1] or even to fully describe the very interesting development of incandescent gas lighting, I would say, that the discovery by Goldsworthy Gurney in 1826, that a lime cylinder could be raised to incandescence by the flame of an oxyhydrogen blowpipe first called attention to the fact, that certain refractory substances, when heated to a high temperature, possessed light-giving qualities. Thomas Drummond was supposed to be the first to make practical application of this discovery, which he did in the survey of Ireland, by the lamp which bears his name, which was used in connection with the heliostat for locating distant stations, and which has been in continuous use ever since as the "lime" or "calcium" light. Developments along this particular line have been confined to varying the size, shape and composition of the incandescent body, the lime being replaced by magnesia and later by zirconia.

Sewing and tying mantles.

In about 1830 we find that the municipality of Paris was attempting to light their streets by using little buttons of zirconia, heated to incandescence by the combustion of gas and oxygen conveyed to the burners in separate pipes. The excessive cost made the early abandonment of this system a foregone conclusion.

In 1839 Cruickshank took out a patent in England for a cage or mantle of fine woven platinum wire, which was of the proper shape and size to thoroughly envelop the outer portion of the flame, and be just enough smaller than the flame to be thoroughly immersed in it. Cruickshank soon realized that platinum was not the ideal material for light-giving purposes, for he says "although the light emitted by platina at a high temperature is very bright, it is inferior to that of lime and other earths at the same temperature." He tried to combine the strength of his platinum with the light-emitting properties of these earths, but found it was impossible to make his paste adhere to the surface of the platinum for any length of time.

The introduction of non-carburetted water-gas by Gillard in 1848, furnished a new incentive for invention, for though this gas which Gillard used in connection with his iron foundries at Narbonne, would be adapted for heating purposes it would have no application as a source of illumination. The inventor of this process of gas manufacture would naturally be expected to have the greatest interest in this development, and we are not surprised to find Gillard himself, devising a cap or mantle of fine platinum wire which he suspended in the flame of his "blue gas," and it is said that for some months this method of lighting was used at Passay and at Narbonne, but the rapid deterioration of the platinum mantle made this experiment very short-lived. The mantles not only lost their light-giving power, but finally became so brittle that they fell to pieces, and we are not surprised that Gillard's experiment should eventually fail as did that of his forerunner, Cruickshank, nine years before.

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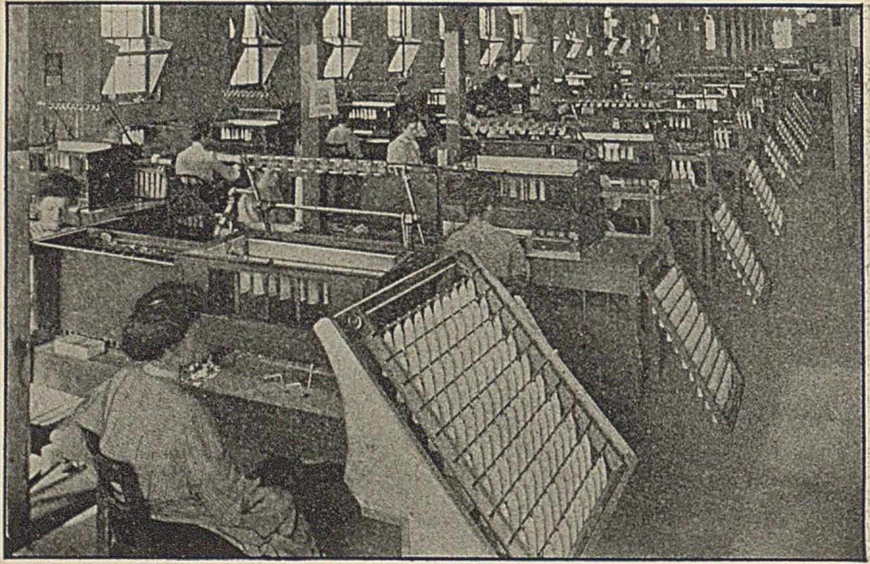
[1] See information given by Dr. Doremus in the discussion that follows.

Until the early 50's, the only non-luminous flames that could be produced were these of the spirit lamp and of uncarburetted water-gas, but at about this time Prof. Robert W. Bunsen, while planning and fitting out his great laboratories at Heidelberg, incidentally developed the burner that now bears his name, an invention which has done more for the gas industry than almost any other discovery or invention connected with it. While considering the methods of heating that should be adopted on the working benches of his new laboratory, it is said, that one of Bunsen's assistants pointed out to his chief that a non-luminous flame could be produced by passing coal-gas a short distance through the air, and then taking it through a piece of wire gauze. Seeing at once the importance of this suggestion, Bunsen brought his marvelous manipulative skill to bear on the problem, and in a few weeks produced the "Bunsen" burner. It is of interest to know that the assistant who made this suggestion, was later known as Sir Henry Roscoe.



Modeling and hardening mantles.

It is not the purpose of this article to describe in detail the work done by the multitude of investigators, who from time to time entered this new field of research, but only to mention some of the characteristic steps leading up to the incandescent gas light of to-day.

Notwithstanding the discouraging results obtained with platinum as an illuminant even as far back as 1839, we find that it was persistently tried for fully fifty years by a long line of inventors. Gillard, whom we noted as using a platinum mantle on the "blue" water-gas which he invented in 1848, continued to use it as late as 1865 in Paris and in Narbonne. He was followed by Lewis, Sellon, Moreau and others, but their lamps all met the same fate as did the first invention of Cruickshank.

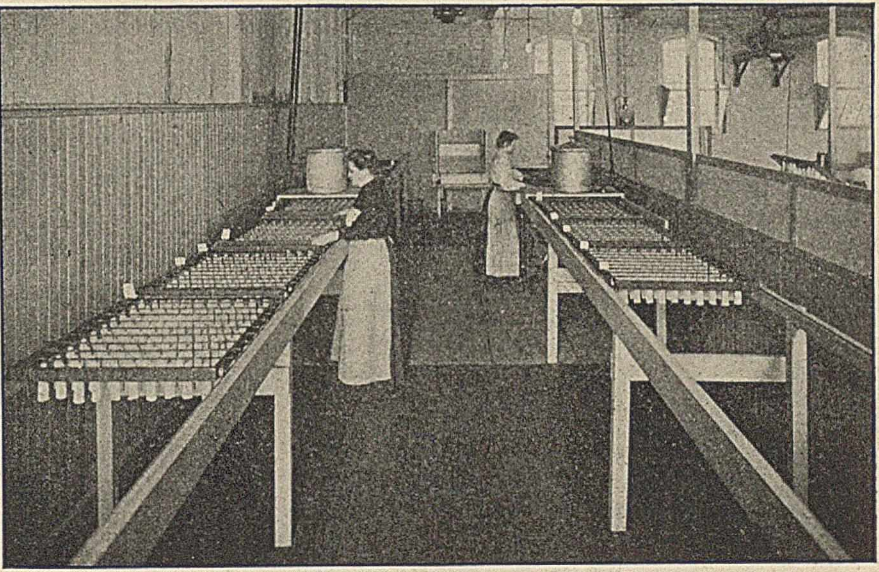
Clamond, who had been working on this problem for a number of years, brought out a lamp in the early 80's in which the illuminant consisted of an earthy basket. His first lamp was of the inverted type, and the basket was held in position by a platinum skeleton, but he soon changed this lamp to the erect type, and made his earthy basket of a conical shape. The Clamond basket was made from a pasty mixture of magnesia, the fibers being wrought into the desired form while in the flexible condition before ignition. Various modifications in the composition of the basket were made, in some of which zirconia was used, but the system was destined to be soon supplanted.

Other experimenters attempted to manufacture a mantle, by spreading an earthy paste in a thin layer over a form, and then perforating the dried sheet, which, after ignition, was suspended in any non-luminous flame, but this system was soon found to be impracticable.

The next form of an incandescent lamp to receive a practical test, especially in the fuel-gas plants of this country, was that designed by Fahnejelm, which may be described as a bundle of needles of refractory earthy material, arranged in the form of a comb, and suspended in the non-luminous flame of the bats-wing type. Fahnejelm preferred magnesia for his base material, though he mentions a number of other possible oxides. He forms these oxides into a paste and at the same time incorporates a small quantity of flux to make them stronger and more pliable when heated in the flame. These lamps were given a thorough test in connection with the fuel-gas plants in the Hyde Park Plants at Chicago, at Jackson, Mich., and at other places, but were soon discarded.

Stewart devised a type of burner, which embodies the Fahnejelm idea of pencils or needles of refractory earth. He reduced the mass in his pencils, however, by making them tubular in form so as to increase the lighting efficiency, and caused the gas to issue from a series of small orifices, so as to form a number of independent blue flames in close proximity to the incandescent tubes.

More than half a century has elapsed since the first incandescent gas light was invented, and during that time many interesting developments have been made, the most important of which we have attempted to enumerate. Important as these inventions were, however, none of them constituted a satisfactory incandescent gas light for the crux of the situation had so far eluded all investigators. It remained, therefore, for the young Austrian chemist, Dr. Karl Auer, to conceive the idea of impregnating a fabric with salts of the rare earths, burning out the organic material and so forming a skeleton or mantle of the rare earth oxides. About the year 1880, Dr. Auer was engaged in investigating the chemistry of the rare earths in Prof. Bunsen's laboratory in Heidelberg. In order to get the material in a more attenuated form, he says: "It just occurred to me, by chance, to impregnate a cotton webbing with a solution of these salts, and then to burn out the cotton. It was most probable that the experiment would fail, as the remaining earths were not liable to stick together after the cotton was burned out, but after all, the experiment was a success, and the earths retained the form of the webbing."



Coating mantles.

In his further experiments he found that lanthanum oxide not only formed a coherent body, but gave a very intense white light, and it was this fact that inspired him with the idea of using the rare earths for lighting purposes on a large scale. A mantle made from this material, however, soon decomposed and crumbled to a powder. Realizing the necessity of combining the lanthanum oxide, with its demonstrated light-emitting qualities, with some other substances that might not so easily absorb water vapor or carbonic acid, he first experimented with magnesia, but finally adopted zirconia as the substance best adapted for this work; and, based upon this composition, the commercial manufacture of incandescent mantles was begun. The mantles gave from 30–32 C. P., with a consumption of three cubic feet of gas per hour. Finding it necessary to improve this efficiency, Dr. Auer experimented with all possible material in nearly every conceivable combination, but with no essential improvement. Finally, in duplicating some of his earliest experiments, he noted that thorium oxide possessed desirable qualities.

In resuming these experiments with thorium it was necessary to prepare more material, and in doing so a very remarkable phenomenon appeared, the purer the thorium preparation, the less light emitted. Feeling convinced that his thorium had been increasing in purity as his candle-power had been diminishing, he began to experiment with the portions that had been removed, by successive purification processes. Here he found evidence of a special light-giving body, which was demonstrated to be cerium. With this information, and a few synthetic experiments by the addition of pure cerium to pure thorium, the brilliant light which we have to-day, was obtained. The incandescence of the new mantles exceeded that of the old threefold. The lasting qualities were also very much improved, and finally a satisfactory incandescent gas light was obtained.

The advent of the thorium-cerium mantle served to give the incandescent gas-lighting industry the greatest impetus that it had ever received throughout its history. The efficiency of the old lanthanum-zirconium-cerium mantle was increased by this invention to fully 22 candles per cubic foot of gas consumed. A pure thoria mantle, as has been stated, gave but very little light, but strange to say only about 1 per cent. of ceria was sufficient to produce this marvelous efficiency. The addition of more than this amount resulted in a lowering of the candle power, but within certain limits this loss in light was fully compensated for by an increase in the yellow color of the light.

Trimming and inspecting mantles.

While every conceivable substance has been experimented with, as an excitant upon a mantle with a thorium base, and many materials have been found that possess this quality to some degree, yet no substance equals that which was found to be the excitant in the original substance upon which Dr. Auer worked, cerium. The highest candle-power, on an average, is obtained with the addition of about 1 per cent. to 1.25 per cent. of ceria, though this amount is dependent upon the character of the fiber of the mantle itself. Manufacturers are often compelled, however, against their best judgment, very frequently, to supply mantles of very much lower percentage of ceria than those indicated as giving the maximum initial efficiency. The increase in the proportion of ceria increases the yellow rays in the spectrum of the mantle, producing a better quality of light, and making a mantle of superior quality and more permanent and uniform light-giving power.

Many attempts have been made to improve upon the thoria-ceria mixture of Welsbach, and I presume that the end of these attempts is not yet. But thus far, pure thoria and pure ceria are the mainstay of the incandescent mantle business.

There is no more important constituent entering into the manufacture of mantles than the thread which forms the base from which the mantle is started. Various fibers are used in the spinning of these threads, but the only ones of any commercial importance are cotton and ramie. Artificial silk might be mentioned as of experimental importance. Furthermore, there are a number of kinds of thread made from the various different materials. For example, a thread may be a single twisted cord, or it may be two cords twisted together, in which case it is known as a two-cord thread; or it may be three cords twisted together in which case it is known as a three-cord thread; or you may have four-cord threads or six-cord threads. Threads of more than six cords are not made in the sizes used for mantle-making. The cost of the thread varies with the quality of the material from which it is made, and also with the number of strands twisted together to form it.

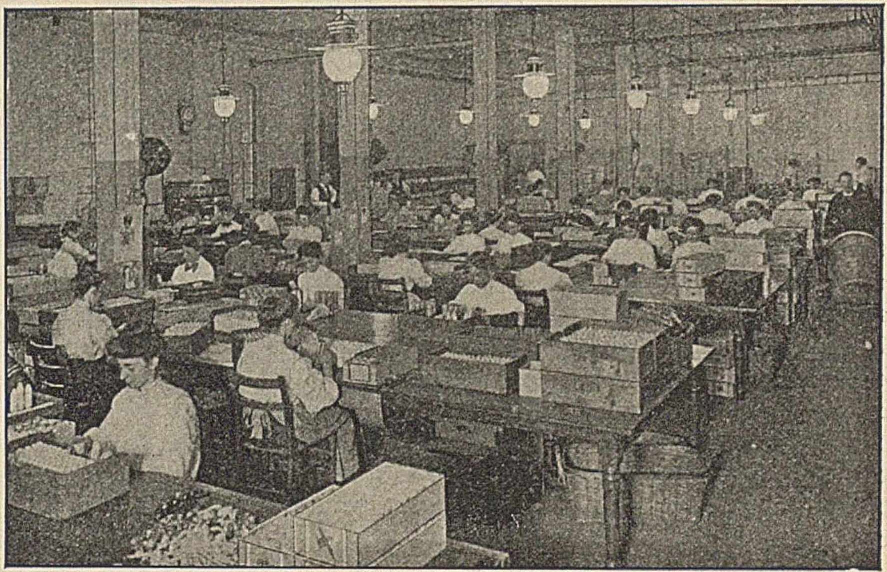
While extensive studies have been made of other fibers than those mentioned here, results have not been obtained which would justify their use in the manufacture of mantles. Of the three materials—cotton, ramie and artificial silk—cotton is used almost exclusively in the United States; both ramie and cotton are used abroad; artificial silk is only in the experimental stage. In view, therefore, of the importance of cotton as a base for the manufacture of the American mantles, we will confine the discussion to threads made from this substance.

Inasmuch as the texture of a finished mantle reflects every detail of the basic fabric from which it is made, the kind of a thread, the quality of the material used to make it up, and the uniformity of its size, have a direct bearing on the physical and candle-power life of the mantle. It is necessary to use a thread of uniform diameter with a maximum number of cords and made from a material with a long staple in order to produce a mantle of the highest quality. In the manufacture of mantles of different qualities to be sold at different prices, the distinction starts in with the quality and kind of thread used. In the cheap mantles the three-cord and four-cord and in some cases six-cord threads are used which are made from the lower grades of cotton. The highest grades of mantles require the use of a carefully made six-cord thread of uniform size made from the best quality cotton.

One of the most important operations in connection with the manufacture of mantles from cotton or any of the other basic fabrics is the washing process. It can be taken as an axiom in mantle-making that anything which tends to introduce the slightest chemical impurity into the finished mantle will work great injury to the product. Starting with the thread, therefore, we remove every possible trace of mineral impurity. The purest cellulose fiber which you have ever seen is absorbent cotton, such as that on the market for medicinal and surgical uses. On analysis, this absorbent cotton shows a mineral impurity of from 0.05 to 0.06 per cent. Ordinary cotton threads, such as are used in sewing, will show a mineral impurity of practically 0.5 per cent.

The washing process used to produce these results must necessarily be very efficient, as there is a marked difference between washing loose cotton, like absorbent cotton, and the tightly twisted threads in the knitted fabric used in the manufacture of mantles. The method of washing is a carefully designed combination of a chemical and mechanical process. The work is done in a room or building especially constructed with a view to carrying out an operation requiring exceptional cleanliness. The chemicals used are the purest substances obtainable; the solutions are all made in distilled water, and all of the mechanical appliances are constructed from materials especially chosen to resist the action of the various chemical agents employed. This equipment must be of such a character as to produce not only the highest attainable degree of purity in the fabric, but must produce it with absolute uniformity. It is obvious that perfect washing of some lots of fabric, with the imperfect washing of others, would materially affect the uniformity of the product.

Saturating is a comparatively simple process, where the thoroughly dried webbing is placed in a suitable vessel and covered with the lighting fluid. The fabric is allowed to remain in the lighting fluid until it is thoroughly saturated. The excess of fluid is then drawn off and the fabric is put through an equalizing machine piece by piece. The amount of substance to be used in the mantle is regulated at this point. In the inferior grades of mantles the quantity used is cut down to a minimum and is controlled only by the limit to which the manufacturer can go and produce a mantle which will hold together during the succeeding manufacturing operations. In the highest grades of mantles, the amount of lighting fluid used is based upon a careful consideration of the amount of material required to produce a mantle of the highest physical and candle-power life.



Packing mantles.

The next step in making a mantle is the formation of the head and loop. This operation is accomplished by folding-in one end of the tubular fabric and uniformly plaiting the folded portion and sewing an asbestos cord through the plaits. The asbestos cord used for this purpose must be made from a carefully selected long staple asbestos fiber, and must contain a minimum amount of cotton binder. In the manufacture, as well as in the use of the mantle, the asbestos cord is subjected to an intense heat, and unless it has been made from a long staple asbestos fiber with a minimum amount of cotton binder, it will disintegrate and render the mantle useless. The American manufacturers of this asbestos cord obtain their supply of raw material from Canada.

The method of branding mantles is very simple. The principle on which it is based is governed by the fact that the oxide of thorium and cerium is white, and in order to form an indelible brand on the mantle it is only necessary to place over this white oxide some chemical which has a colored oxide, as, for example, iron, which gives a reddish brown oxide, or didymium, which gives a dark brown oxide. Didymium gives the most permanent brand and is the substance most generally used. The brand is put on the saturated fabric by using a rubber stamp in conjunction with a stamping pad which has been saturated with the branding fluid.

The mantle is now suspended in a suitable hood and a torch applied for the purpose of burning out the cotton. The ignition is usually made at the top near the asbestos cord, so that the burning out will be gradual and not subject the remaining ash fabric to any undue strain. After the cotton is completely consumed the ash of thorium and cerium oxides hangs in a soft, shapeless, flabby condition, and presents a very remote resemblance to a mantle. It is a remarkable phenomenon that this ash should have sufficient cohesive power to hold together after every vestige of the original cotton fabric has been burned away.

When Dr. Auer first explained his idea for making a mantle to Prof. Bunsen, that famous teacher replied: "It is extremely doubtful if the ash can be made to hold together." This opinion was based upon Prof. Bunsen's knowledge of the general characteristics of metallic oxides, but the combination of metals with which Dr. Auer was working were exceptions to the rule. The Incandescent Gas Lighting Industry rests upon this remarkable exception.

The operation also has some remarkable features. After the cotton is completely burned out in the process just described, the soft, flabby ash is carefully adjusted over a blowpipe. The operator of this device controls levers which raise and lower the mantle and which adjust the gas supply and the air supply to the blowpipes. In some cases the gas issues under a pressure of several pounds to produce the intense flame required, but in either event the adjustment of the flame and the control of the position of the mantle is entirely in the hands of the operator. Under the influence of this intense blast flame, the flabby ash left when the cotton fabric was burned out is blown (by the proper control of the flame) into the shape of a finished mantle and is changed from its soft pliable state into a hard resilient form. This operation requires greater skill and experience than any other work connected with the manufacture of mantles.

The mantle is now "coated" to preserve the ash in the exact state in which it left the hardening operation while it is going through the inspecting, trimming, packing, transportation and installation stages. This coating or collodion, as it is usually called, is made from soluble cotton.

In the next step the mantles are taken out of the drying chambers and placed before inspectors, whose duty it is to trim them to uniform length and carefully inspect each individual mantle. This is an operation which is regarded as very important. It is an easy matter for people handling collodionized mantles to injure them, and yet the injury will not show until the coating is burned off. Furthermore, the inspection is not entrusted to irresponsible employees, and the greatest amount of care and supervision is devoted to this branch of the manufacture of mantles.

The mantles go to the Packing Department, where they are packed according to the desire of the consumer. The market is supplied with Loop mantles, Double Wire-Cap mantles, Centre-Support Cap mantles and Ring-Top mantles.

In summing up this superficial outline of the process for making mantles, it must be apparent that it is a process of great complication. These complications are divided into two distinct classes:

First.—The chemical problems which have to be solved and controlled.

Second.—The problem of supervising and controlling the work of the employees in the various different operations.

The first of these problems is under the control of a chief chemist and staff, who supervise the manufacture and use of each one of the chemical constituents entering into the make-up of these goods. Every operation involving a problem in chemistry or physics is carefully studied out and conducted under their supervision and direction.

There is no chemical manufacturing industry which requires such a large staff of trained experts as the manufacture of mantles and the raw materials for their production.

The second division of this subject is of no less importance than the first. There are many critical operations in the manufacture of a first-grade mantle. By a critical operation, I mean an operation which if not properly conducted will result in the production of an inferior piece of goods.

It is necessary, therefore, to have not only a carefully organized supervising staff of exceptionally efficient foremen, but also to have a high grade of intelligence in the working force and to teach them to appreciate the importance of the work entrusted to them.

The amount of skill required from the employees and the grade of intelligence demanded will exclude mantle-making from that class of manufacturing industries which use cheap and ignorant help. The proportion of pay-roll which goes to the supervising staff is greater in mantle-making than in any other manufacturing line. The greatest factors contributing to the success of the American mantle manufacturer are:

First.—A thorough study and understanding of the technical difficulties involved in the various different processes.

Second.—A carefully organized and intelligent suvervision of every process.

Third.—The high intelligence, integrity and skill of his employees.

Furthermore, I laid down in the beginning the axiom that any impurity introduced into the mantle in any of the processes would seriously affect the finished product. This makes it apparent that absolute cleanliness of the entire plant, of every operation and of every operator is imperative. In addition to this, the raw materials in the process must be made under the direct technical supervision and control of the mantle manufacturer.

Discussion by Dr. Charles A. Doremus: Dr. Miner has referred to Drummond as the first one to obtain an incandescent light. He will pardon my reading from a memoir by Prof. Robert Hare. It is entitled "On the Supply and Application of the Blowpipe," published by order of the Philadelphia Chemical Society, 1802.

Hare made a report to the Society on December 10, 1801, and exhibited experiments with his new apparatus which consisted not only of a blowpipe but also of a hydrostatic reservoir for holding the hydrogen and oxygen in separate compartments to be delivered as required.

On page 29 of this pamphlet the following description of some of his experiments occurs:

"The cock of the pipe communicating with the hydrogen gas was then turned until as much was emitted from the orifice of the cylinder as when lighted formed a flame smaller in size than that of a candle. Under this flame was placed the body to be acted on, supported either by charcoal, or by some more solid, and incombustible substance. The cock retaining the oxygen gas was then turned until the light and heat appeared to have attained the greatest intensity. When this took place, the eyes could scarcely sustain the one, nor could the most refractory substances resist the other." Hare has in many places in his subsequent writings made full claim to the "lime light."

Discussion by Dr. Morris Loeb: In addition to the hypotheses mentioned by the first speaker, it has, at times, been suggested that the oxide of thorium forms a complex with the other oxides, and that luminosity accompanies isomeric changes in this larger molecule. It has occurred to me that the conversion of heat into luminescence might be well explained on a hypothesis similar to that which was, I believe, first advanced by Huggins, for the explanation of fluorescence by the existence of very large molecular masses. We all know how the presence of phosphoric pentoxide enables tungstic acid to form much larger complexes. Is it not possible that pure thoria does not form large molecules, but that the presence of small quantities of some of the other oxides leads to the formation of the big complex molecule, which transforms the heat waves, rather than transmitting them?

GUAYULE RUBBER. I.

By Theodore Whittelsey.

Received January 22, 1909.

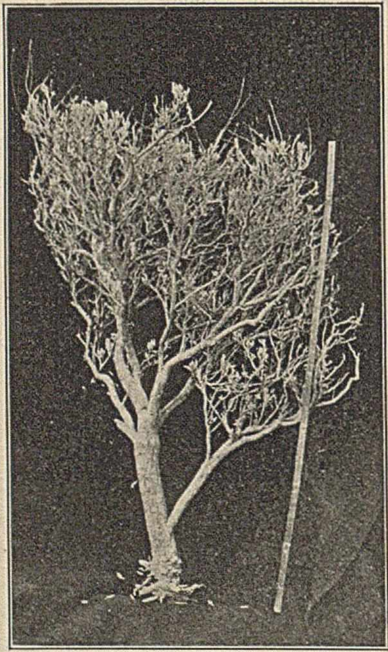
It as long been known that the natives of Mexico in some of their games use balls composed of an elastic substance which they obtain by chewing the bark of a shrub called Guayule. Attempts have been made from time to time to introduce this substance industrially, but without success until recently. The first practical experimentation on a commercial scale seems to have been made in 1903–4. In the following year the product, which has been found to be a true rubber, began to be put on the market. From this time on the industry developed with extraordinary rapidity, and the excitement in northern Mexico is said to have been comparable to that in Texas when the oil fields were discovered. By 1906 practically all the Guayule within reach of existing transportation facilities was contracted for.

The Guayule, *Parthenium argentatum,* is found on the semi-arid lands of the plateau of northern Mexico, growing in the dry, rocky soil of the foothills. It is not large; the dimensions of plants of factory size are approximately as follows:

Height.	Dry weight.	Diameter at base of trunk.
12 inches.	6 ounces.	7/8 inches.
20 "	12 "	1 1/8 "
36 "	32 "	2 1/4 "

The average weight of factory shrub is probably between 12 and 16 ounces. The plant shown in the cut is an exceptionally large one, weighing 5¾ lbs. It was 44½ inches high and 2¼ inches in diameter at the ground level.

The shrub is collected by pulling up the entire plant, and is pressed either in the field or at the railway station into bales weighing from 80 to 120 kilos. In 1904 these are said to have brought 7 pesos per ton; in 1905 the price had risen to 30 or 40 pesos and recently has been above 100 pesos (1 peso = $0.50 gold).



Guayule.[1]

Guayule in the field.

The Guayule contains in the neighborhood of 9 per cent. of pure rubber, calculated to the perfectly dry plant. The methods that may be used to extract the crude rubber are entirely different from those used with most rubber plants. These contain a milky juice or latex from which the rubber is obtained by coagulation, while in the Guayule the rubber exists as such preformed in the plant. The earlier processes were of three types: (1) the alkali process, in which the shrub was boiled with a solution of caustic alkali; (2) the solution processes in which the rubber was extracted by carbon bisulphide or some other solvent; and (3) the mechanical process. The first of these is still used in apparently only one factory. According to the patent specifications, the ground shrub is boiled with three times its weight of 6 per cent. caustic soda for six hours, after which the rubber is skimmed off and freed from alkali. Of the second class, the carbon bisulphide method has been abandoned, because of the expense and the belief that rubber when recovered from a solvent does not possess certain desirable physical qualities to the same degree as an undissolved rubber. A process that belongs to this type has been extensively experimented with in a new factory during the past two years. This process is said to be based on the extraction of the dried shrub with benzol. A solution of rubber and resin is obtained from which the former is precipitated by the addition of alcohol. It has been prophesied that this process will prove a failure for the same reasons that have led to the abandonment of the bisulphide extraction, but the product is now on the New York market and the outcome is awaited with interest. Rubber produced in this

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[1] These photographs are kindly furnished by Professor Francis E. Lloyd.

way should run lower in resin than that obtained directly by the other processes. The great bulk of the Guayule rubber now coming into the market is obtained by the third, the mechanical process. In this the shrub is crushed and then ground with water in pebble-mills. The rubber in the plant then becomes apparent as small particles 1/16 inch in diameter and from 1/16 to 1/8 inch long. The details of the succeeding operations to separate the rubber from the woody matter are for the most part kept secret and doubtless vary in different factories, but it may be said in a general way that the procedure is based on the fact that when soaked with water the woody fiber becomes water-logged and sinks while the rubber being lighter than water floats on the surface of the tanks and is skimmed off. It is then washed, sheeted on steel rolls, and either shipped moist or first dried by hanging the sheets in an airy room or by heating gently in a vacuum. If the mechanical process is properly conducted, a practically complete extraction of the rubber from the shrub is secured.

Guayule rubber obtained by the mechanical process is black on the surface when it reaches the market, but olive to light brown within. The dry crude rubber contains about 20 per cent. resin. Some factories also produce a brand from which the resin has been in great part extracted, but the demand for this seems comparatively small. Guayule rubber softens more quickly on the rolls than most other rubbers and therefore requires to be handled somewhat differently, but once this is understood, the working of Guayule rubber of good quality presents no difficulty. It can be substituted for many of the African rubbers, is used to advantage in boots and shoes and many other lines of manufacturing, and seems to be growing in favor. The Guayule rubber recently reported as received at the port of New York was, September 850,000 lbs., October 929,500 lbs., November 1,444,000 lbs.

NORTHWESTERN UNIVERSITY,
EVANSTON, ILL.

GUAYULE RUBBER. II.

DISTRIBUTION OF RUBBER IN DIFFERENT PARTS OF THE SHRUB.

By THEODORE WHITTELSEY.

Received January 24, 1909.

It is generally known to producers of Guayule rubber that more rubber is obtained from the bark of the shrub than from the wood. Apparently the only published statement on the point is in a paper by Endlich[1] in which he says that the ratio of the rubber found in the bark to that found in the wood is approximately 7 to 2. No analyses are given.

In connection with a study of the chemistry of Guayule, the question of the distribution of rubber in the different parts of the plant has been taken up. The results have turned out to be unexpectedly interesting, and to present problems of technical importance.

The material consisted of air-dried plants of different size, selected so as to represent approximately the ordinary run of factory shrub, *viz.*,

	Height.	Weight.	Trunk.	Root.	Branches and leaves.
1 Large plant...	3 ft.	944 g.	165 g.	125 g.	654 g.
2 Medium plants	2½ ft.	747 g.	165 g.	132 g.	450 g.
5 Small plants	2 ft.	2101 g.	637 g.	272 g.	1192 g.
Totals......		3792 g.	967 g.	529 g.	2296 g.

In the division of material the main stem up to the point where its diameter was that of its largest branch was called trunk. The largest branches were less than one-half inch in diameter. The plants had lost most of the leaves in shipment, as is usual, so that the value for "branches and leaves" is practically that of the branches. The trunks and roots were sawed into short pieces (the loss by sawdust amounted to 22 grams in the trunks, 29 grams in the roots) and then steamed until the bark could easily be removed from the wood. A small amount of water-soluble matter was undoubtedly removed in consequence of the steaming, but determinations of water-extractable matter in the whole trunk and in the steamed bark and wood showed that this was negligible. The separate parts were then crushed between steel rolls, dried in vacuum at low temperature, and ground as fine as possible in a coffee mill. The rubber in the bark renders it exceedingly difficult to obtain the material in sufficiently finely divided condition for proper sampling. Many of the particles of bark after the above treatment measured as much as 3 mm. across. This lack of homogeneity manifests itself in the analyses.

Material.	Dry weight.
Trunk bark..............................	349 g.
Root bark..............................	127 g.
Branches and leaves......................	1918 g.
Trunk wood.............................	404 g.
Root wood..............................	255 g.

The materials were reduced to convenient quantity by careful quartering. The portion taken for analysis was dried to constant weight in a steam-

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[1] *Der Tropenpflanzer*, **9**, 233 (1905); *India Rubber World*, **32**, 335 (1905).

oven, and then extracted by boiling successively with water and alcohol. It was dried again to constant weight, and the rubber extracted by boiling with carbon tetrachloride. An aliquot portion of this extract was heated on the steam-bath to remove the solvent, and from the dried residue remaining, the small amount of resin present was removed by boiling successively with acetone and alcohol. The residual rubber was then dried in the steam oven for one hour and a quarter and weighed.

Material.	Per cent. rubber.						
Trunk bark........	21.2	21.1	22.7	21.8	19.6	22.9	....
	22.2	19.7	21.4	20.3	22.4		Av. 21.4
Root bark.........	....	....	....	....	....	19.2	19.8
Branches and leaves	....	....	....	....	....	10.4	9.1
Trunk wood........	....	....	....	....	....	0.04	
Root wood.........	....	....	....	....	....	2.2	1.8

The duplicates vary more than is desirable but an extended series of analyses, made in different ways in the course of development of the method of analysis, showed that better agreement could not be expected from as coarsely divided material as this necessarily was.

These results are at variance with the prevailing belief based in part on Endlich's statement quoted above and in part on early analyses giving 11–15 per cent. rubber in the bark and 2–4 per cent. rubber in the wood. In the single determination of rubber in the trunk wood (0.04 per cent.), the sample, through an interruption of the work, was digested with alcohol for several days. Two other portions of the same material which had been boiled with alcohol for three hours only, as was done with the bark, gave rubber 4.7 per cent.; 4.8 per cent.; but in these the residue weighed as rubber was distinctly abnormal. While elastic, it was brownish red and could not be dissolved with carbon tetrachloride. It seemed probable that the wood contained a substance, not present in the bark, which was not extracted by ordinary treatment with alcohol. To ascertain whether this was the case, new material was prepared. A large plant was collected which consisted of eight branches, each about ¾ inch in diameter, springing almost directly from the root. The first five or six inches of these were steamed and the bark completely removed. Where the bark was ingrowing about knots, not only the bark, but the surrounding wood as well, was cut out. After drying, the wood was then sawed up and the sawdust passed through a 10-mesh sieve which held back only a few chips. The material proved to be of sufficient fineness to allow complete extraction of alcohol-soluble matter in three hours' boiling. After drying to constant weight the wood was then extracted with carbon tetrachloride as usual. Analyses:

Material.	Per cent. rubber.						
Trunk wood.......	0.06	0.00	0.06	0.13	0.12	0.07	0.07

The appearance of the slight residues here weighed as rubber showed that they were due merely to traces of unextracted wood-resin. This conclusively proved the trunk wood to contain no rubber. The work also showed how the erroneous statements to the contrary have arisen. When the alcoholic extract from the wood was dried, it bore no resemblance to the resinous matter similarly obtained from the bark. The wood-resin is a reddish-brown substance, not at all sticky, and distinctly elastic. After it has been dried in the steam oven it does not dissolve in alcohol, acetone or carbon tetrachloride. It can, however, be extracted from the shrub by tetrachloride. It has sometimes been the custom hitherto to determine the rubber in shrub by extracting directly with tetrachloride, evaporating the solution to dryness and then extracting the residue remaining with alcohol and acetone to remove resins, the undissolved portion being considered to be rubber. Such a procedure applied to the wood would cause this wood-resin to masquerade as rubber, and its elastic nature would contribute to the deception. A study of the resins of the wood and the bark has been begun and will be reported on in a subsequent paper.

The establishment of the fact that the trunk wood contains no rubber rendered it probable that the figures for rubber in the root wood were also due to incomplete extraction with alcohol. Five well-formed roots were therefore selected and the rootlets, ingrowing bark, and dead wood removed. The material remaining was dried and crushed on smooth steel rolls until it was finer than the sawdust used above. Analyses: Rubber, 2.6 per cent.; 2.9 per cent. Although the "rubber-residues" seemed normal, the presence of rubber in the root wood seems so remarkable, in view of its absence from the trunk wood, that the root wood will be further examined. It is possible that it contains a resin comparable in some of its physical properties to the remarkable resin of the trunk wood, but insoluble in alcohol. The root wood will be extracted with acetone in the hope of throwing some light on the question.

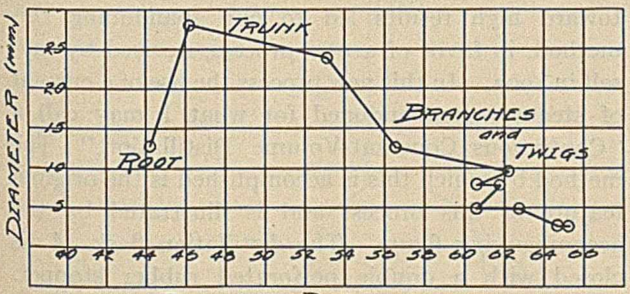
The results given above make it possible to calculate the amount of rubber contained in different parts of the Guayule.

	Dry weight. Gram.	Rubber. Per cent.	Weight of rubber. Gram.	Rubber, parts per 100.
Trunk bark........	349	21.4	74.7	25.7
Root bark.........	127	19.5	24.8	8.5
Branches and leaves	1918	9.7	186.0	64.0
Trunk wood........	404	0.0	0.0	0.0
Root wood.........	255	2.0	5.1	1.7
Totals.........	3053		290.6	99.9

The percentage of pure rubber in the whole trunk is 9.9, the whole root 7.8, the branches and leaves 9.7, and in the whole plant 9.5. These figures are based on perfectly dry material. If the "mill-weight" is taken as a basis (3792 grams — 51 grams (sawdust) = 3741 grams), the percentage of pure rubber in the whole plant is 7.8, which corresponds very closely to published figures[1] and to factory experience. When it is considered that these values for the whole plant are based on analyses of the different parts, varying in rubber content from zero to over 20 per cent., this furnishes substantial confirmation of their essential accuracy.

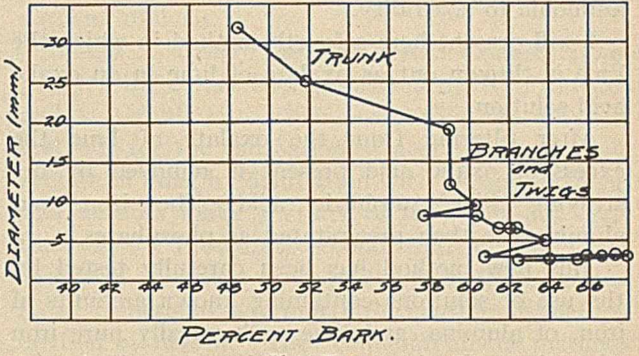
RATIO OF BARK TO WOOD IN GUAYULE.

Now that it has been definitely established that the trunk wood of Guayule contains no rubber the question of the ratio of bark to wood in the plant acquires importance. Inspection of the material prepared for analysis shows that the trunks of the shrub are made up of 46.4 per cent. bark and 53.6 per cent. wood. To ascertain the per cent. of bark in trunks, branches, and twigs of varying diameter, two-inch sections of such material were accordingly made, steamed, the bark removed from the wood and the bark and wood of each section dried and weighed. The plants used for this purpose, and the results plotted as curves, are as follows:



Plant No. 2.

No.	Height. cm.	Weight. Gram.	Circumference at base of trunk. cm.
2	53	350	11
7	42	342	10



Plant No. 7.

To determine the per cent. of bark in the plant as a whole, two plants, weighing 235 grams and 152 grams, were steamed, debarked separately and the parts dried and weighed. The plants contained 54.6 per cent. and 57.8 per cent. bark respectively. If the mechanical difficulties could be overcome, an efficient decorticating device, therefore, would make it possible to nearly cut in two the amount of raw material handled in the mechanical process without diminishing the yield of rubber.

NORTHWESTERN UNIVERSITY,
EVANSTON, ILL.

THE ESTIMATION OF IRON OXIDE AND ALUMINA IN PHOSPHATE ROCKS.

By THOS. S. GLADDING, A.M.

Received January 10, 1909.

There are at the present time three recognized methods for the estimation of iron oxide and alumina in phosphate rocks.

First and oldest is the acetate of ammonia process, where the iron oxide and alumina are precipitated as phosphates in an acetic acid solution by addition of acetate of ammonia. The great objection to this method is the unavoidable dragging down of calcium phosphate along with the iron and alumina phosphates, necessitating one, and even more, re-solutions and reprecipitations, in order to completely eliminate the lime.

Second is the Glaser method in which the lime is first removed by converting into calcium sulphate by means of sulphuric acid with addition of alcohol. After filtering, the alcohol is expelled by evaporation, and the iron and alumina precipitated as phosphates.

The third method, published by myself in 1896, throws out both lime and iron by digesting in hot

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[1] *India Rubber World*, **1906**, p. 219.

caustic potash solution. After filtering, the alumina is precipitated as phosphate of alumina either by acetate of ammonia or by addition of ammonia to neutrality.

I will present here a fourth method in which the lime is thrown out as oxalate of lime in an oxalic acid solution.

After filtering from the oxalate of lime the excess of oxalic acid present is removed by destroying with sulphuric acid. The iron and alumina are then precipitated as phosphates.

This new method has been carefully tested by the use of solutions containing known amounts of iron, of alumina, and lime. Chemically pure iron wire, sheet aluminum, and carbonate of lime were employed to make these solutions. Analyzing such solutions I obtained

	Taken. Gram.	Found. Gram.
Calcium oxide	0.008	0.008
Alumina	0.008	0.0083
Iron oxide	0.0094	0.0094
Calcium oxide	0.200	0.2005

The new method was also tested by analyzing a number of phosphate rocks in comparison with the caustic potash method with results as follows:

	Potash method. Per cent.	Oxalate method. Per cent.
Alumina	4.20	4.24
"	2.70	2.63
"	1.40	1.32
"	1.75	1.67
"	1.49	1.59
"	1.37	1.25
"	3.35	3.35
"	1.79	1.75
"	1.50	1.49
"	1.85	1.95

The new method is carried out in detail as follows: Boil 5 grams of the rock phosphate for one hour in 50 cc. HCl (1 : 1), filter into a 250 cc. flask, add a few cubic centimeters of peroxide of hydrogen solution, boil for a few minutes to oxidize iron and expel oxygen, cool, fill to mark and mix. Take 25 cc. (½ gram), heat to boiling, add ammonia to alkalinity, then HCl till just clear, then 1 gram of oxalate of ammonium in crystals, boil gently for a short time, let settle and filter from precipitated oxalate of lime into a 500 cc. Kjeldahl flask, add 5 cc. concentrated sulphuric acid, evaporate to white fumes to destroy excess of oxalic acid. (This boiling down and destruction of oxalic acid can be done in twenty minutes.) Cool, add 50 cc. water, 5 cc. strong HCl, and boil gently a few moments to dissolve any dehydrated sulphate of iron, boiling until solution is clear. Rinse into beaker, make up to about 150 cc. and precipitate the iron and alumina as phosphates either by adding ammonia to neutrality using methyl orange as an indicator, or by making the solution just alkaline with ammonia, just clearing with hydrochloric acid and then adding 25 cc. of acetate of ammonia solution (sp. gr. 1.04). Filter and wash the precipitated phosphates with a boiling hot nitrate of ammonia solution (2½ per cent.). Ignite and weigh, deduct the iron phosphate present and multiply the remainder by 0.418 to obtain the alumina.

The iron oxide is determined by taking 50 cc. (1 gram) of the rock phosphate solution and titrating by either bichromate of potash solution or permanganate of potash solution.

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THE ANALYSIS OF COMMERCIAL ACETATE OF LIME.

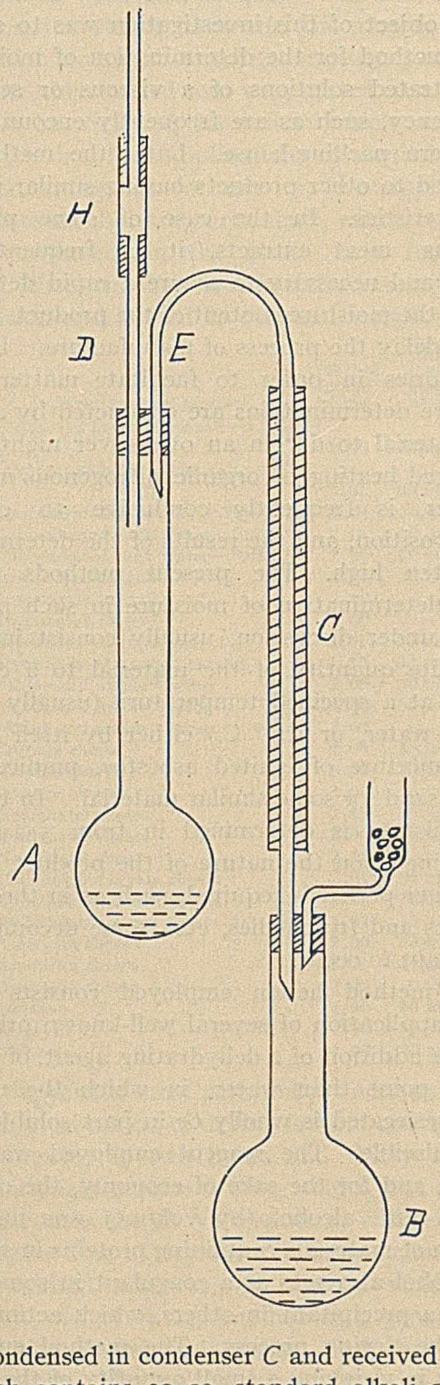
By THOMAS S. GLADDING, A.M.

Received January 29, 1909.

The exporting of commercial acetate of lime assumed noticeable proportions about the year 1890. In the early part of 1902 the exporters abandoned the so-called "English Commercial Test" and called for the estimation of acetic acid by distillation. For some time we used a process where the acetic acid was distilled with an excess of phosphoric acid, the distillation being assisted by a current of steam constantly blown through the body of the distilling liquor. This process was more complex than a simple distillation and great care had to be exercised against a dangerous tendency to carry over phosphoric acid. The constant tendency toward high results led to our abandoning this method, in favor of a new process, devised by myself in 1902. In this new process the use of a current of steam was abandoned for what I may call a "Continuous Constant-Volume Distillation." The method by which this is accomplished is the original feature of this process and is illustrated by the accompanying figure. The distillation flask *A* is closed with a double perforated rubber stopper. The tube *E* connects with the condenser *C*. The tube *D* connects with a reservoir, containing water free from carbonic acid. A screw pinch-cock at *H* regulates the flow of water, allowing it to enter drop by drop and maintaining the contents of the flask at a constant volume.

In this new process two grams of acetate of lime are introduced into a Kjeldahl flask *A* (about

300 cc. capacity) with 30 cc. water. Ten cc. phosphoric acid solution, sp. gr. 170, are added, the contents of the flask are boiled gently for about one and one-half hours while the volume is kept at 50 cc. The distillate passes over through tube E, is condensed in condenser C and received in flask B which contains 30 cc. standard alkali solution. At the end of one and one-half hours the contents of the flask B are titrated. The distillation is continued until the distillate comes over neutral. Phenolphthalein is used as an indicator. A blank experiment is run and the small amount of acidity obtained in this blank is deducted from each subsequent analysis.



In the *Zeitschrift für analytische Chemie*, 1908, p. 597, there has been published by W. Fresenius and L. Grünhut, a paper comparing the different methods for the estimation of acetic acid in crude acetate of lime, by distillation with phosphoric acid. The authors make a study of four methods, first that of R. Fresenius, second that of the Color Works of F. Bayer & Co., Elberfeld, third that of K. R. Haberland, and fourth the continuous method devised by myself. They condemn all the methods excepting the second, asserting that they give results too high. They attribute the excessive amount of volatile acid obtained, to a decomposition of the organic constituents of the acetate of lime and the formation of butyric acid. This decomposition they claim is due to too great a concentration of the distillant.[1]

This present paper will interest itself only in their criticism of my method. They speak of it in the following words: "We must reach the conclusion that the errors we find in the R. Fresenius method are not excluded." "We cannot recommend the working of this method." "The analyses show a tendency to go upward."

In answering these criticisms I call special attention to one important matter. The two novel features of my method are first the constant volume of the distillant, about 50 cc. when using 2 grams of acetate; and second the abandonment of a current of steam and the substitution therefor of the addition of water drop by drop. They state that in testing this method they maintained the volume at about 50 cc. but in one case they used 5 grams to 50 cc. and in another 2 grams to 50 cc. It is evident that when they used 5 grams to 50 cc. they were not using my method. Again, and far more important, they say that in both cases they employed a "current of steam," instead of adding water slowly to the distillant. It is evident therefore, that in none of their work did they really use my method and that their results have no value whatever as a criticism of the accuracy of my method.

The authors speak of testing the method by a "series" of tests. This "series" consists of four

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[1] A newly coined word, to express the contents of the distilling flask. It is derived from the present participle distillans (the thing distilling) as distillate is derived from the past perfect participle distillatus (the thing distilled).

analyses of a brown acetate of lime. They also fail to carefully follow the method in its most essential feature, namely, the slow addition of water as a substitute for a current of steam.

To ascertain whether the objections urged by the authors, are of any value as applied to my method, when correctly carried out, I have made a number of analyses, using widely varying degrees of concentration. Thus I have taken 5 grams of acetate of lime, added 25 cc. water and 25 cc. phosphoric acid solution sp. gr. 1.70, distilled to a volume of 30 cc. and continued the distillation for two hours, till no further volatile acid could be obtained. At the same time, 2 grams acetate plus 10 cc. phosphoric acid solution were distilled at a volume of 40 cc. for two hours, also 1 gram acetate plus 5 cc. phosphoric acid solution was distilled at a constant volume of 50 cc. for two hours, till all volatile acids were over. These three experiments were made with a brown acetate of lime, also with a gray acetate of lime. The results were as follows:

BROWN ACETATE OF LIME.

One g. + 5 cc. phos. acid sol. at constant vol. of 50 cc. gave 67.80%.
Two g. + 10 cc. phos. acid sol. at constant vol. of 40 cc. gave 67.75%.
Five g. + 25 cc. phos. acid sol. at constant vol. of 30 cc. gave 67.90%.

GRAY ACETATE OF LIME.

One g. + 5 cc. phos. acid sol. at constant vol. of 50 cc. gave 83.57%.
Two g. + 10 cc. phos. acid sol. at constant vol. of 40 cc. gave 83.41%.
Five g. + 25 cc. phos. acid sol. at constant vol. of 30 cc. gave 83.41%.

We notice in these experiments that although the concentration, when using 5 grams, is ten times that when using 1 gram, nevertheless, no more volatile acid is obtained from the greater degree of concentration.

I tested the question still more rigorously and conclusively, by taking the residue of the 5 grams distillant. After expelling all volatile acid, I added 50 cc. water and 1 gram C. P. acetate of soda. I obtained after exhaustive and continued distillation 100.1 per cent. of acetate of soda.

I consider that the above work completely vindicates the method as proposed by myself. I also express the opinion that the high results obtained by Fresenius and Grünhut are due to the use of a current of steam. The experience of Grosvenor is similar to my own. He says:[1] "Steam should never be used for distillation." As has been stated in an earlier part of this paper, I abandoned the use of a steam current because of its tendency to give results higher than the truth.

LABORATORY OF STILLWELL & GLADDING.

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[1] *Jour. Soc. Chem. Ind.*, **1904**, p. 535.

THE RAPID DETERMINATION OF MOISTURE IN COMMERCIAL PRODUCTS OF A VISCOUS OR SEMI-SOLID CONSISTENCY.[1]

By ARTHUR LOWENSTEIN.

Received January 16, 1909.

The object of this investigation was to secure a rapid method for the determination of moisture in concentrated solutions of a viscous or semi-solid consistency, such as are frequently encountered in a modern packing-house. Later the method was extended to other products having similar physical characteristics. In the case of some products, such as meat extracts, it is frequently desirable and necessary to secure a rapid determination of the moisture content of the product, in order not to delay the process of manufacture. In many laboratories in order to facilitate matters, such moisture determinations are conducted by allowing the material to dry in an oven over night. Such prolonged heating of organic nitrogenous material, however, is frequently conducive to chemical decomposition, and the results of the determination are often high. The present methods for the direct determination of moisture in such products as are under discussion, usually consist in drying a definite quantity of the material to a constant weight at a specified temperature (usually that of boiling water, or 105° C.) either by itself or with the admixture of ignited asbestos, pumice stone, quartz sand, or some similar material. In this way the moisture is determined in from 5–24 hours, depending upon the nature of the product. When the longer period is required, such as in the case of molasses and fruit jellies, etc., some decomposition is very apt to occur.

The method herein employed consists merely in the application of several well-known principles, *viz.*, the addition of a dehydrating agent, of a lower boiling point than water, in which the material to be desiccated is wholly or in part soluble, or at least miscible. The reagent employed was ethyl alcohol, and for the sake of economy, the ordinary 95 per cent. alcohol (by volume) was used. In the case of materials containing proteins in solution, the alcohol also acts as a coagulant in some cases, and as a precipitant in others, which action facilitates the drying process. The method employed consists in weighing a small quantity of the sample in a metal dish, 2½ inches in diameter (the metal

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[1] Read before the Division of Industrial Chemists and Chemical Engineers of the American Chemical Society at Baltimore, Dec. 29, 1908.

caps such as used on meat extract jars answer very well) together with a short glass stirring rod flattened at one end to facilitate spreading the material uniformly over the surface of the dish. About 15 cc. of the alcohol are added and thoroughly incorporated with the sample. The dish is then placed on the steam bath and the alcohol evaporated, with frequent stirring; another portion of 15 cc. are then added and evaporated in a similar manner. In case of materials which are very difficult to dry, four applications of alcohol will be found advantageous—or one or two applications of absolute alcohol are particularly effective. Drying is continued on the steam bath for thirty minutes, then the dish is transferred to a double-walled oven and heated to constant weight at 105° C. In the case of most substances under consideration, the total period of drying is from one hour and thirty minutes to two hours and thirty minutes. Some materials require a longer time, but in practically all cases the above treatment will materially shorten the time of drying. In some instances the use of ignited asbestos, or mineral wool as an absorbent was of value, but not as a general rule. With molasses and fruit jellies, lead shot proved to be quite effective in increasing the heating surface. The use of a good conductor of heat, such as the lead shot, has some advantage over poor conductors, like quartz sand.

Alcohol has been used for years in the determination of moisture in soap, which product is soluble in this solvent. The author, however, is not aware of its employment for this determination in food products, or others of the nature herein mentioned.

The appended table will give some idea as to the accuracy and usefulness of the method. Its use can no doubt be extended to many commercial products not mentioned herein. It is necessary to bear in mind that it is difficult to obtain uniform samples of some of these products and therefore the results in some cases can at best only be approximate. In all cases I think it is safe to assume that the shorter the period of drying, at moderate temperatures, the less likelihood there is of decomposition of the product.

Lab. No.	Description of samples.	Wt. of portn. Gms.	Dried on steam bath.	Dried in oven 105° C.	Dried to constant weight hrs.-min.	Per cent. H_2O.	Remarks.
38000	Extract of beef. Low salt—3.5% NaCl	2.00	30 min.	1 hr.	1–30	28.70	2 port. 15 cc. ea. alcohol
38001	Extract of beef. High salt—18% NaCl	2.01	30 min.	1 hr.	1–30	24.01	2 port. 15 cc. ea. alcohol
38002	Concentrated glue sol.—"Glue jelly"	2.04	30 min.	2 hrs.	2–30	61.35	2 port. 15 cc. ea. alcohol
38003	Concentrated tank water—"stick"	2.01	30 min.	1 hr.	1–30	50.25	2 port. 15 cc. ea. alcohol
38003	Concentrated tank water—"stick"	2.00	30 min.	2 hrs.	2–30	50.01	2 port. 15 alcohol, 1 gr. asbestos
38004	Inspissated ox gall	2.03	30 min.	1 hr.	1–30	38.29	2 port. 15 cc. alcohol
38004	Inspissated ox gall	2.00	....	6 hrs.	6	38.24	No alcohol used
38004	Inspissated ox gall	2.00	....	17 hrs.	17	38.55	Dried overnight
38005	Dyewoods—Fustic extract	2.01	30 min.	2 hrs.	2–30	48.42	2 port. 15 cc. alcohol
38005(*a*)	Dyewoods—Logwood extract	1.30	30 min.	3 hrs.	2–30	43.10	Heated 5 min. on steambath before adding alcohol
38006	"Cane and maple" syrup	2.09	30 min.	4 hrs.	4–30	35.00	2 port. 15 cc. alcohol
38006	"Cane and maple" syrup	1.03	30 min.	2 hrs.	2–30	35.13	2 port. 15 cc. alcohol
38006	"Cane and maple" syrup	2.09	....	17 hrs	17	35.44	Overnight no alcohol
38007	Cottage cheese	2.03	30 min.	2 hrs.	2–30	76.99	2 port. 15 cc. alcohol
38007	Cottage cheese	3.00	10 hrs.	...	10 hrs.	76.97	Official A. O. A. C. method
38007	Cottage cheese	2.04	....	17 hrs.	17	76.57	Overnight, no alcohol
38008	Neufchatel cheese	2.02	30 min.	2 hrs.	2–30	73.51	2 port. 15 cc. alcohol
38008	Neufchatel cheese	3.00	10 hrs.	...	10	73.36	Official A. O. A. C. method
38008	Neufchatel cheese	2.11	....	17 hrs.	17	74.07	Overnight, no alcohol
38009	Philadelphia cream cheese	2.01	30 min.	2 hrs.	2–30	35.62	2 port. of alcohol
38009	Philadelphia cream cheese	2.01	30 min.	2 hrs.	2–30	35.27	2 port. of alcohol, asbestos added
38009	Philadelphia cream cheese	3.01	10 hrs.	...	10	35.12	Official A. O. A. C. method
38010	American cheese	2.00	30 min.	2 hrs.	2–30	41.49	2 port. of alcohol
38010	American cheese	2.01	30 min.	2 hrs.	2–30	41.46	2 port. of alcohol, asbestos added
38010	American cheese	3.09	10 hrs.	...	10	41.58	Official A. O. A. C. method
38011	Molasses	1.00	30 min.	7 hrs.	7–30	30.01	No alcohol, 30 gr. quartz sand—Horne's method
38011	Molasses	1.00	30 min.	5 hrs.	5–30	29.86	Horne's method plus 2 port. alcohol
38011	Molasses	1.00	30 min.	6 hrs.	6–30	29.75	45 gr. lead shot, 2 port. alcohol

The author desires to express his appreciation of the assistance rendered in this work by Edward Moore and William P. Dunne.

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A NEW METHOD FOR THE CALCULATION OF THE PROTEINS IN MILK.

By GEO. A. OLSON.

In the year 1906 the formula (protein $= 0.368$ total solids $+ 0.33$ ash $- 0.383$ fat) for the calculation of protein in milk devised by the writer was published in the Proceedings A. O. A. C.[1] Since that time the writer has derived a simpler formula which will be discussed in this paper.

In studying the composition of milk from individuals of the same or different breeds of cows it has been found that the ratio of the fat to the protein or casein may vary.[2] A divergence in this respect, however, is generally accompanied by a variation in the specific gravity, since the specific gravity of a milk differs according to the relative amounts of the components present.

It frequently occurs that different milks contain the same amount of fat and yet the solids-not-fat of such milk may vary quite widely. With equal fat content, the milk containing the highest or lowest total solids or solids-not-fat will also have the highest or lowest specific gravity, respectively. Again milks having equal total solids will vary in their specific gravities according to the amount of fat present; the milk having the highest fat content will have the lowest specific gravity. A closer scrutiny of the composition of milk also reveals these facts: *First*, milk which has a high fat content also has a high protein content; *second*, milk which has a high specific gravity has also a high protein content and milk which has a low specific gravity has accordingly a low protein content, providing the fat content in such milks are equal. These facts are clearly brought out in the following table.

TABLE I.—INFLUENCE OF SPECIFIC GRAVITY ON PROTEIN CONTENT OF MILK.

No.	Specific gravity.	Total solids. Per cent.	Fat. Per cent.	Protein. Per cent.
1	1.0361	14.08	4.40	3.69
2	1.0288	12.56	4.40	3.11
3	1.0394	13.91	3.30	3.84
4	1.0300	11.23	3.30	2.99
5	1.0352	15.15	5.28	4.12
6	1.0311	15.16	6.25	3.69

The first two samples of milk given in Table I have equal fat content but differ in their specific gravities, total solids and protein contents. Likewise the same is true for numbers 3 and 4. Number 3, however, was an abnormal milk and is given in order to show how a milk of high specific gravity can also have a high protein content. Numbers 5 and 6 have equal total solids, but differ in their specific gravities, fat and protein contents.

Instead of taking into account milk of average composition, we may consider the composition of milk from cows of any breed. The milk from a Holstein cow tested 3.3 per cent. fat, the total solids was 11.8 per cent. and contained 3.12 per cent. protein, the milk from a Jersey cow tested 4.55 per cent. of fat with a total solids of 13.5 per cent. and contained 3.28 per cent. protein. The ratio of fat to protein in the former case is 1:0.95 while in the latter it is found to be 1:0.72. In this illustration the proteins are practically the same while the fat content of the two milks differs by 1.25 per cent. Considering, however, the total solids of the two milks in the above illustration and determining the ratio of solids-not-protein to the total solids gives a ratio for the Holstein cow of 1:1.358 and 1:1.320 for the Jersey. In other examples the ratio of solids-not-protein to total solids varies for the above types and other breeds, indicating that this ratio is independent of breed characteristics. Instead of taking the average ratio of a large number of analyses the writer chose 1.34 as the number, because this figure represents the specific gravity of milk protein.

By the use of the number 1.34 the protein can be readily calculated for average purposes, particularly where herd milk is considered and even in the case of individuals in normal health, when the total solids of the milk are known. To illustrate, the total solids are divided by 1.34 and the quotient thus found, representing the solids-not-protein, is subtracted from the total solids, the difference representing the per cent. of protein in a given milk.

The extreme variations of the ratio of solids-not-protein to total solids found in all normal milks analyzed by the writer did not vary more than 0.084, and this variation was regardless of breed or individual characteristics. The following table shows the extreme variations of the solids-not-protein to total solids of milk comprising four different breeds in the Wisconsin University Dairy Herd. A comparison of the calculated to the actual protein content of these milks is also given.

In Table II it will be noted that there is an extreme variation in the ratio of the solids-not-protien to total solids of 0.084, and the variations are independent of breed; the ratio of fat to protein, on the other hand, ranges from 1:0.59 to 1:0.99, or a difference of 0.40.

The accuracy of a formula for the estimation of protein can best be determined when compared with actual analyses of the protein in milk from individuals of different breeds at different periods of lactation.

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[1] *Bull.* **99**, Bur. of Chem., U. S. Dept. of Agri., p. 106.

[2] L. L. Van Slyke, *Jour. Amer. Chem. Soc.*, **30** (1908), No. 7, pp. 1166–1186.

TABLE II.—VARIATIONS OF SOLIDS-NOT-PROTEIN TO TOTAL SOLIDS OF MILK FROM DIFFERENT BREEDS.

Breed.	Solids-not-protein to total solids.	Total solids. Per cent.	Fat. Per cent.	Protein found. Per cent.	Protein calculated. Per cent.	Ratio of fat to protein.
Ayrshire..........	1: 1.370	13.42	4.40	3.63	3.40	1: 0.83
"	1: 1.297	12.72	4.03	2.91	3.22	1: 0.72
"	1: 1.340	12.56	3.50	3.21	3.19	1: 0.92
Jersey	1: 1.378	13.67	4.60	3.75	3.47	1:0.82
"	1: 1.314	13.29	4.38	3.18	3.38	1: 0.72
"	1: 1.342	15.03	5.85	3.83	3.82	1: 0.65
Guernsey..........	1: 1.369	14.32	5.10	3.86	3.63	1: 0.76
"	1: 1.294	14.35	5.53	3.26	3.64	1: 0.59
"	1: 1.344	14.28	5.20	3.66	3.63	1: 0.76
Holstein	1: 1.386	11.32	3.20	3.15	2.87	1: 0.99
"	1: 1.301	10.40	2.75	2.41	2.64	1: 0.88
"	1: 1.342	12.73	4.03	3.25	3.23	1: 0.81

From the data given in Table III it will be noted that the proteins determined by calculation are fairly concordant with those obtained by the Kjeldahl method. The ratio of fat to protein ranged from 1:0.65 to 1:0.91.

TABLE III.—ACTUAL AND CALCULATED PROTEIN CONTENT OF MILK FROM DIFFERENT BREEDS AT DIFFERENT PERIODS OF LACTATION.

Breed.	Specific gravity.	Total solids. Per cent.	Fat. Per cent.	Protein found. Per cent.	Protein calculated. Per cent.	Ratio of fat to protein.
Holstein, No. 1.....	1.0311	11.25	3.14	2.84	2.86	1: 0.90
" " 2.....	1.0322	12.39	3.50	3.35	3.15	1: 0.91
" " 3.....	1.0303	10.61	2.90	2.53	2.69	1: 0.87
Ayrshire, " 1.....	1.0330	12.77	3.88	3.29	3.24	1: 0.85
" " 2.....	1.0323	12.52	3.90	3.05	3.18	1: 0.80
" " 3.....	1.0339	13.10	3.93	3.45	3.32	1: 0.88
Jersey, " 1.....	1.0341	14.98	5.68	3.72	3.80	1: 0.65
" " 2.....	1.0334	13.23	4.36	3.19	3.36	1: 0.73
" " 3.....	1.0348	15.54	6.03	3.96	3.94	1: 0.65
Guernsey, No. 1....	1.0336	14.29	5.13	3.64	3.63	1: 0.71
" " 2....	1.0340	13.37	4.33	3.30	3.39	1: 0.76
" " 3....	1.0331	15.29	5.91	3.87	3.88	1: 0.67

The ratio 1 : 1.34 as stated in the preceding pages has been taken as representing the relation of the solids-not-protein to total solids. Exceptions to this ratio have been found in the case of milk from cows affected with tuberculosis of the udder, mammitis (garget), freshened (colostrum) or strippings, etc. Some of the exceptions to this ratio and the cause for the variations are given in the following table:

TABLE IV.—EXCEPTIONS TO THE RATIO 1 : 1.34.

Breed.	Specific gravity.	Total solids. Per cent.	Fat. Per cent.	Protein found. Per cent.	Protein calculated. Per cent.	Cause for abnormality. 0.8 lb. milk per milking.
Brown Swiss.	1.0366	16.83	6.10	5.53	4.26	
Guernsey....	1.0330	14.26	5.20	3.09	3.62	Garget
Holstein.....	1.0350	14.50	4.30	4.26	3.68	Rheumatism
"	1.0304	11.19	3.00	3.30	2.84	Garget
"	1.0400	14.06	3.30	5.52	3.57	Colostrum
Ayrshire.....	1.0334	13.89	4.38	4.00	3.53	Garget
"	1.0332	13.75	4.48	4.19	3.50	Colostrum
"	1.0333	13.35	4.00	3.99	3.39	Milk fever
Jersey.......	1.0378	16.02	5.20	5.06	4.06	Garget

The tendency for the composition of milk from individuals to vary is far greater than where the herd milk is considered as a whole. Any abnormality (Table IV) in the composition of milk from a few cows would be reduced by the number of cows in a herd producing normal milk.

It has been shown that the relation of the solids-not-protein to the total solids is very nearly constant in normal milks, therefore the protein must be in direct relation to the total solids. From this it would follow that the sugar plus fat and ash should be in relation to the total solids. Since the ash is practically constant in milk (0.75 per cent.) we may consider only the sugar and fat. The writer found that the ratio of solids-not-fat or solids-not-sugar to the total solids varied within rather wide limits; it follows from this that the sugar and fat do not necessarily stand in a definite relation to one another and consequently the two must be considered together. Accordingly it was found that the sum of these two constituents (fat and sugar) stand in a definite relation to the total solids, and several formulae have been constructed, depending upon whether or not the ash should be considered independent from the other solids. From any one of the formulae given below the protein or sugar can be obtained, and if we consider the ash constant in all milk we have therefore, a method of estimating the amount of protein and sugar in all normal milks when the specific gravity and the fat are known.

1. $(TS) - TS/1.34 = P$.
2. $(TS-A) - TS-A/1.365 = P$.
3. $(TS) - TS/3.25 = F + S + A$, or $(TS)/3.25 - A = P$.
4. $(TS-A)TS-A/3.694 = F + S$, or $TS-A/3.694 = P$.

where TS = total solids; P = protein; A = ash; F = fat; and S = sugar.

TABLE V.—THE CORRESPONDING PROTEIN OR CASEIN CONTENT OF MILKS CONTAINING FROM 10.00 TO 16.50 PER CENT. TOTAL. SOLIDS.

Total solids. Per cent.	Protein. Per cent.	Casein. Per cent.
10.00	2.54	2.03
0.50	2.66	2.13
11.00	2.79	2.24
0.50	2.92	2.34
12.00	3.04	2.43
0.50	3.17	2.54
13.00	3.30	2.64
0.50	3.42	2.74
14.00	3.55	2.84
0.50	3.68	2.94
15.00	3.80	3.04
0.50	3.93	3.14
16.00	4.06	3.25
0.50	4.19	3.35

The preceding table has been constructed from the formula (TS) — TS/1.34 = P and contains the total solids of milk from 10.00 to 16.50 and its equivalent in protein which runs from 2.54 to 4.19. The casein has been calculated on the assumption that 80 per cent. of the protein is casein.

In the preceding paragraph it was assumed that eighty per cent. of the total protein of milk is casein. Analytical data show the casein to range from 78 to 82 per cent. of the total protein, hence the casein can be calculated by multiplying the per cent. of protein by 0.8. Dr. Van Slyke's figures[1] for protein have been multiplied by 0.8 and compared with the actual results of casein as determined by him. The maximum, minimum and average results of fifty-eight analyses are as follows:

Table VI.—Comparison of Actual and Calculated Casein Content.

	Casein found. Per cent.	Casein calculated. Per cent.	Difference.
Maximum	3.55	3.50	+0.12 to —0.25
Minimum	2.11	2.07	0.00
Average	2.70	2.69	—0.01

The results obtained by calculation and summarized in Table VI are within the limits of error. From this it appears unnecessary to make casein determinations in milk.

CONCLUSIONS.

1. The relation of the solids-not-protein to total solids in different samples of milk is practically constant and may be considered on the average, equal to 1:1.34.

2. The protein content of normal milk can be calculated with a fair degree of accuracy when the total solids are known by the formula (TS) — TS/1.34 = P. The per cent. of casein can be found by multiplying the per cent. of protein by 0.8.

(Contribution from the Bureau of Chemistry, U. S. Department of Agriculture.)

THE DETERMINATION OF BENZALDEHYDE IN ALMOND FLAVORING EXTRACT.

By W. Denis and P. B. Dunbar.

Received February 1, 1909.

The methods proposed for the determination of benzaldehyde in flavoring extracts may be divided into three classes:

(1) Methods based on the formation of the addition product with acid sodium sulphite.[2]

(2) Colorimetric methods.[1]

(3) Methods involving the precipitation of the oil of bitter almonds.[2]

In the examination of almond extracts of known composition by these methods, we have found that the sodium hydrogen sulphite method invariably gives results far below the truth, with the colorimetric method we have not been successful, while Howard's precipitation method is apt to give figures much too high, due probably to the difficulty of removing the last traces of chloroform.

We have found that we are able to obtain results within 97 to 99 per cent. of the theory by precipitation of the benzaldehyde in almond extract, and in bitter almond oil, as the phenylhydrazone[3] according to the equation

$$C_6H_5.CHO + NH_2.NH.C_6H_5 \rightleftarrows C_6H_5.CH = N.NHC_6H_5 + H_2O.$$

This method has already been proposed by Denner[4] for the quantitative determination of benzaldehyde in bitter almond water; by Rocques[5] for its determination in kirsch; and by Herissey[6] for the determination of the benzaldehyde resulting from the hydrolysis of amygdalin.

The reagents used by us are:

Reagent (1):	Phenyl hydrazine hydrochloride	2 grams
	Crystals of sodium acetate	3 "
	Water	20 cc.

Dissolve the sodium acetate in the water, add the phenyl hydrazine hydrochloride, shake for five or six minutes, and filter, or

Reagent (2):	Phenyl hydrazine	1 cc.
	Glacial acetic acid	1.5 cc.
	Water	20 cc.

Mix the acetic acid and water, then pour in the phenyl hydrazine.

Reagent (2) we find to be much more convenient on account of the rapidity with which it may be prepared. Whether reagents (1) or (2) be used, the solution should be made up immediately before use, and solutions more than an hour old should be discarded. The method of precipitation is as follows:

Two 10 cc. portions of almond extract are measured into 300 cc. Erlenmeyer flasks; to one portion is added 10 cc., to the other 15 cc. of either reagent; shake, stopper tightly, and allow to stand over night in a dark place. The next day add 200 cc.

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[1] *Jour. Amer. Chem. Soc.*, **30** (1908), No. 7, pp. 1169–1174.

[2] U. S. Pharmacopoeia, VIII, p. 68. Leach, Food Inspection and Analysis, p. 750.

[1] Woodman and Lyford, *Jour. Amer. Chem. Soc.*, **30**, 1607.

[2] Howard, *Ibid.*, **30**, 610.

[3] Fischer, *Liebig's Ann. d. Chem.*, **190**, 134.

[4] Denner, *Zeit. für analyt. Chem.*, **29**, 228. *Pharm. Centralhalle*, **28**, 527.

[5] Rocques, *Rev. Internat. des Falsifications*, **1907**, p. 66.

[6] *Journ. de Pharm. et de Chim.*, **1901**, p. 60.

of cold water to each flask, and filter on tared Gooch crucibles provided with thin mats of asbestos. Wash with cold water and finally with 10 cc. of 10 per cent. alcohol. Dry for three hours in a vacuum oven at 70–80° C. If a vacuum oven is not available, the drying may be accomplished in a vacuum desiccator over sulphuric acid, but will of course take much longer than when a higher temperature is employed. The weight of the precipitate, multiplied by 5.408, gives the number of grams of benzaldehyde in 100 cc. of the solution.

Our reason for using 10 and 15 cc. of reagent on different portions of the same extract is based on the fact, that we have found in the examination of a large number of commercial extracts, that while the large majority conform to the official standards,[1] and contain in the neighborhood of 1 per cent. by volume of oil of bitter almonds, occasionally extracts are met with containing as much as 6 per cent. of benzaldehyde; in such preparations it is obvious, that, while the use of 10 cc. of the reagent may give good duplicates the results would be far below the truth.

The following results have been obtained on almond extracts made in this laboratory, and containing known amounts of benzaldehyde or oil of bitter almonds.

Analyst.	Gr. benzaldehyde per 100 cc. in sol.	Gr. bitter almond oil per 100 cc. in sol.	Gr. benz. aldehyde per 100 cc. found.	Per cent. benzaldehyde recovered.	Grs. bitter almond oil per 100 cc. found.[2]
E. H. G........	0.995	...	0.989	99.5	...
W. E. H.......	0.995	...	0.973	97.8	...
W. D..........	1.659	...	1.600	97.0	...
W. D..........	0.995	...	0.966	97.0	...
W. D..........	...	1.086	0.949	...	1.090
W. D..........	...	0.947	0.787	...	0.905
P. B. D........	1.00	...	0.980	98.0	...
P. B. D........	...	1.00	0.890	...	1.02

The presence of benzoic acid, which in varying amounts must always be present in almond extracts, does not affect the accuracy of the results.

(*a*) In a solution containing 1.6598 grams of benzaldehyde and 0.610 gram benzoic acid per 100 cc. there was found, on analysis, 1.638 grams benzaldehyde, which is equal to 98 per cent. theory.

(*b*) In a solution containing 1.6598 grams benzaldehyde and 1.220 grams benzoic acid per 100 cc. there was found, on analysis, 1.628 grams benzaldehyde per 100 cc. which is equal to 97 per cent. theory.

In the same way it was found that nitrobenzol, which is sometimes placed in almond extracts, has no effect on the precipitation.

(*a*) A solution containing 0.9950 gram benzaldehyde and 0.8676 gram nitrobenzol per 100 cc. gave 0.9756 gram benzaldehyde per 100 cc., which is equal to 98 per cent. of theory.

(*b*) A solution containing 0.5 gram benzaldehyde and 0.5 gram nitrobenzol per 100 cc. gave 0.498 gram benzaldehyde per 100 cc., which is equal to 99.6 per cent. theory.

REVIEW.

PHARMACEUTICAL CHEMISTRY DURING 1908.

Upon comparing the broad and rapid progress made during the last year along the lines of synthetic organic chemistry, with what has been accomplished among the medicinal synthetics, we regret to note that nothing original has appeared. No new fields have been opened; what progress has been made was along the well beaten paths with duplication of old ideas in other forms. The inevitable result of continuing such a multiplication along old lines is to increase confusion and finally compel the medical profession to fall back to their old standard remedies.

Local Anesthetics.

The study of the structure of cocaine, demonstrated that its local anesthetic action resided in two nuclei, namely, a substituted pyridin ring and an esterified benzoic acid. As chief synthetic representatives of the former class were the "Eucaines," along this line, nothing new has developed. Among the older and successful representatives of the latter class, esters of aromatic amino and oxyamino acids, are the ortho forms (oxybenzoic methyl esters) and anesthesin (*p*-amino-benzoic ethyl ester). They are non-toxic and serve especially for anesthesia of the nerve terminals. The objectionable insolubility was overcome through the introduction of an amino-alcohol in place of H of the COOH group as in novocain, a *p*-amino-benzoyl-diethyl-amino ethanol [$C_6H_4(NH_2)COO.C_2H_4N(C_2H_5)_2.HCl$]. The amino-cinnamic alkaline esters (D. R. P. 187,593) are still more powerful local anesthetics. New among this class is Propaesin, the propyl ester of *p*-amino-benzoic acid, m. p. 73 to 74° C. ($NH_2C_6H_4COOC_3H_7$) which, like others of this class, serves as a mild anesthetic adapted to diseases of the esophagus and inflamed mucous surfaces. Dipropaesin, a condensation-product of the former, which splits up into propaesin when in contact with alkalies, serves as a local anesthetic in gastro-intestinal affections. The esterifying group has, of recent years, grown to such proportions and pharmacologic importance, securing thereby more profound anesthesia, that such derivatives may be considered as substituted tertiary alcohols. As prototypes of this class are stovaine, the hydrochloride of dimethyl-amino-benzoyl-dimethyl carbinol [$(C_6H_5CO.O)C(CH_3)(C_2H_5)(CH_2.N(CH_3)_2.HCl$] and alypin, the hydrochloride of benzoyl 1,3-tetramethyl-diamino-2-ethyl-isopropyl alcohol [$(C_6H_5CO.O)C(C_2H_5)(CH_2.N(CH_3)_2)_2HCl$]. The success attending the introduction of these led to a number of recent patents along similar

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[1] Circular 19, Office of the Secretary, U. S. Department of Agriculture.

[2] Oil of bitter almonds calculated from the benzaldehyde by use of the U. S. P. Standard, *i. e.*, that oil of bitter almonds shall contain at least 85 per cent. benzaldehyde.

lines. Among such are benzoyl derivatives of alkyl amino-ethanols and alkyl amino-pentanols, E. Schering, D. R. P. 175,080, 181,287; alkamin esters of benzoic and salicylic acids, Hoechst Co., D. R. P. 187,209, 188,571; benzoyl derivatives of tertiary amino alcohols in which acid radicals enter into the amino and hydroxyl groups, J. D. Riedel Co., D. R. P. 189,481, 183,361; amino-ethers of primary alcohols through interaction between halogen derivatives of alkyl ethers of the hydrocarbons ($CH_2X.OR$) and amines, D. R. P. 184,968, also products of action of chlorin derivatives of the general formula $RRN.CH_2.CH_2Cl$ on *p*-amino-benzoates, D. R. P. 189,335, E. Merck.

The allied field of suprarenal active principles, which are largely employed in conjunction with local anesthetics, has become one of the most important in modern medicine. Nowhere in the domain of medicinal synthetics has organic chemistry exhibited greater triumphs in duplicating Nature's products. Among the older preparations are adrenalin, adnephrin, suprarenalin, adrenal, epinephrin, hemisine, etc., which represent active extracts of the glands or synthetic products. New additions are suprarenin, methyl-amino-ethanol-pyrocatechin [$(OH_2).C_6H_3.CHOH.CH_2.NH(CH_3).HCl$]; Homorenon, amino-ethyl-amino-aceto-pyrocatechin [$(OH)_2 C_6H_3.CO.CH_2.NH.C_2H_5.HCl$] and Arterenol, amino-ethanol-pyrocatechin [$C_6H(OH)_2.CHOH.CH_2.NH_2.HCl$].

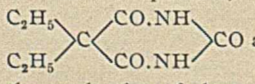
Antiseptics and Disinfectants.

This field has been so thoroughly worked over during the last decade that the market has become flooded and physicians bewildered by the immense number and variety of products. No new fields have been opened, hence progress in this direction has been in amplifying old ideas. *Formaldehyde Preparations:* Dr. M. Goldschmidt (D. R. P. 183,856) offers a new method for preparing formaldehyde from metallic formates through the action of CO of furnace gases on oxides. For the disinfection of rooms, autan has not been surpassed, The only addition to the almost innumerable condensation products of formaldehyde (used as dry antiseptics) is Decilan, a formaldehyde potassium oleate. The valuable antiseptic *Silver Combinations* which can scarcely be improved upon, is enriched by Argoferment, a soluble colloidal silver, similar to v. Heyden's Collargol. More important among the miscellaneous antiseptics are Paralysol, a solid cresol ($C_6H_4CH_3OK.3C_6H_4(CH_3)OH$, m. p. 146°); Boryl, ethyl borosalicylate; Nizin, a zinc sulfanilate; Chrysyl, a zinc boropicrate; Griserin New, claimed to be an isomer of loretin (iodo-oxyquinolin-sulphonic acid, D. R. P. 187,869). Aminosol, a pure oxyquinolin sulphate (D. R. P. 187,943), 25% more active than the older impure product, has appeared. Noteworthy is the increase in the use of colloidal sulphur, introduced by v. Heyden under the name of Sulfoid (D. R. P. 164,664) prepared by precipitating sulphur in presence of such colloids as albumin in acid solution.

Intestinal and Urinary Antiseptics.

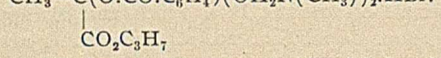
The ever-increasing number of organic combinations of bismuth, which aim to serve as local antiseptic desiccants or intestinal antiseptics, has received the largest number of additions. Among these are Neoforma, a basic triodo-phenol bismuth ($C_6H_2I_3O.BiO$); Helkomen, a basic dibrom-β-oxy-naphthoate ($C_8H_6Br_2.COO.BiO.CO.BiO$); Biscinoid, a bismuth cinchonin iodide; Gastrosan, bismuth bisalicylate; Iodomenin, iodo bismuth albuminate, and Radiovis, a radio-active bismuth subnitrate, specially intended as an intestinal disinfectant. Investigations have demonstrated that thorough intestinal asepsis is not attainable; theoretical possibilities have not been borne out in practice. Substances which possess, in general, superior antiseptic properties and have shown themselves to be useful in disinfection of the stomach, utterly fail to stop fermentation in the intestinal canal. This is due to the alkalinity of the intestinal secretions, which in many cases renders the antiseptic useless. One class of chemicals best adapted for this purpose, are such condensation-products which, because of their insolubility, reach the lower intestines, then slowly break up with liberation of their medicinal constituents. To this class belong such condensation-products of formaldehyde and tannin as Tannopin, Tannocasum and Tannoform and various esters of tannin, Tannosal, Tannogen, Tannochrom, etc. New are Tannothymal (D. R. P. 188,318), a condensation-product of formaldehyde, thymol and tannin; Tannyl, a tannin compound of oxychlor-casein; Tannin Silver Albuminate, a combination of albumin, tannin and silver; Fixin, an aluminum lactate. There are but few additions to the many and useful derivatives of hexamethylene tetramine which serve as disinfectants in treatment of diseases of the urinary organs and tract. Prominent among these are Silin, a hexamethylene citrosalicylate and Dorovertin (D. R. P. 188,815), a borate of urotropin.

Hypnotics and Sedatives.

The various hypnotics that belong to the different classes of organic compounds, exemplified by chloral, urethane, paraldehyde, amylene hydrate, sulfonal, trional, chloral formamid, dormiol and hedonal (methyl-propyl carbinol urethane), owe their hypnotic effect to different atomic groups. Chloral and its derivatives owe their action to trichlor-ethyl alcohol into which they are decomposed in the blood. The next class represented by amylene hydrate, dormiol and isopral, are secondary and tertiary alcohols, in which an alcohol group is linked with alkyls to a tertiary carbon. The urethanes and hedonal represent the third class, being carbamic acid esters which, because of their very mild action, were soon displaced by a fourth class, the sulphones, sulphonal and trional, which contain four alkyl groups linked to carbon. These possess certain similarities in common with amylene hydrate, since the nucleus of the molecule is a carbon linked to alkyl groups, the resulting hypnotic action being intensified through ethyl groups. These latter compounds serving as models, other nuclei were sought which should contain a tertiary or quaternary carbon linked to the sedative ethyl groups. The ideal groupings which seemed most favorable for these purposes were the substituted urea derivatives, namely, those derived from diethyl-acetyl urea, 1, $(C_2H_5)_2C(H)(CO.NH.CO.NH_2)$ and derivatives of diethyl malonic acid with cyclic structure of the *n* position, as diethyl malonyl urea, 2,  $(C_2H_5)_2C(CO.NH)_2CO$ and 3, dipropyl malonyl urea. For the production of sleep, the urea group bears an important part, but essential is its linkage with several aliphatic alkyls, rich in carbon, increasing in hypnotic action with molecular weight, reaching a maximum in the dipropyl derivative. Toxic is *N*-methyl malonyl urea, which differs from diethyl malonyl urea (Veronal) in that a methyl group is linked to a

N, like unto the distinction between acetanilid and its methyl compound exalgin. Of these groups, No. 1 possesses a hypnotic action similar to the well-known sulfonal, while No. 3 is about 4 times as active. As a medium between these two, No. 2, Veronal, has merited an unrivaled position among hypnotics. To this class belongs Medinal (Schering), the mono-sodium salt of diethyl barbituric acid, a hypnotic adapted for rectal application.

The search for other fields among the substituted tertiary or quaternary carbon derivatives has led to the old and well-tried valerian; the sedative effect of this on reflex excitability was found to exist largely in the isovaleric acid ester of borneol present in the root. The Riedel Co. introduced this compound under the title of Bornyval; recently a bromin (25%) derivative of this has appeared, namely Brovalol (Valison). To this class belongs the neurasthenic sedative Quietol, claimed to be a propyl valeryl-dimethyl-amino-oxyisobuteryl hydrobromide,



$$CH_3-\underset{\displaystyle CO_2C_3H_7}{\underset{|}{C}}(O.CO.C_6H_4)(OH_2N(CH_3))_2.HBr.$$

Related to the phenetidin nucleus is Nevalthein, the sodium salt of *p*-ethoxyphenylaminometa sulfonate. As succedaneum for the alkali bromides, substances free from secondary action peculiar to large doses of these, is Sabromin, a calcium dibrom-behenate (D. R. P. 186,740) analogous to Sagodin, the corresponding iodine compound.

Antipyretics.

The general satisfaction attending the use of phenacetin and other derivatives of the phenetidin nucleus also antipyrin and the various acetanilid combinations has apparently discouraged any further research in this thoroughly explored field. The recent introduction of a Phenetidin Amidoacetate (Voswinkel) presents nothing new over phenocoll (glycocoll phenetidin).

Alkali Iodid Succedaneums.

When it is necessary to subject the system for periods, to the action of this halogen and to avoid the undesirable secondary effects, such as usually accompany the profuse administration of iodides, recourse is had to the organic compounds of iodin which are slowly eliminated, exercising thereby a prolonged iodine effect. Most successful among such derivatives are the insoluble alkali earth salts of iodized aliphatic acids of high molecular weight, which liberate their iodine in the organism without the production of the quickly diffusible alkali iodides. Sajodin, the calcium salt of mono-iodobehenic acid, $(C_{22}H_{42}IO_2)_2Ca$ (28% iodine), and Iodthion, a diiodo-hydroxypropanol, $CI_2OH.CH_2CH_3$ (80% iodine), D. R. P. 180,622, 187,822, are representatives of this class. These were followed by Iodival, an α-mono-iodo-isovaleryl urea (47% iodine), $(CH_3)_2CH.CHI.CO.NaN.CO.NH_2$. This, like others of this group, is unaffected by the gastric juice, but in the intestines, it readily dissolves (Knoll Co., D. R. P. 197,648). Iodomenin (an iodobismuth albumin), Iodopeptide (a product of the action of nascent iodine on peptonized albumen, adapted for subcutaneous use), Guaiadol (Fr. Pat. 371,982, a para iodoguaiacol), and Iodomercuric albumin (D. R. P. 177,109) are new.

Synthetic Purgatives.

These are derivatives of either anthraquinone or phenolphthalein. Among the former are Exodin, a mixture of diacetyl rufigallic acid tetra-methyl ether and acetyl rufigallic pentamethyl ether, and Purgatol, a diacetyl anthrapurpurin, bodies built after the emodin (of rhubarb) type, namely, methyl anthraquinone. To the second class belongs the popular non-toxic Purgen or phenolphthalein which is eliminated from the system in practically an unchanged state. New are Aperitol, a valeryl acetyl-phenolphthalein and Sodophthalyl, a disodio quinone phenolphthalein. The esterification of the phenolphthalein serves to render these preparations still more resistive against decomposition in the system. Eulaxans is the sodium salt of phenolphthalein.

Diuretics.

With the discovery of methods for the synthesis of Theophyllin (Theocin) and the introduction of their double alkali acetates and citrates, ideal diuretics seem to have been reached. Of more recent origin are Euphyllin, a combination of theophyllin and ethylene diamine, and Eustenin, the double salt of theobromine sodium and sodium iodide. The latter is employed in arteriosclerosis, aortal aneurism and angina pectoris.

Antirheumatics, Salicylic Acid Derivatives.

The unprecedented success attending the introduction of Aspirin (acetyl salicylic acid) and Mesotan (salicylic methoxy-methyl ester), followed by Spirosal (salicylic monoglycollic ester, U. S. P. 173,776) and Novaspirin (methylene citric acid ester of salicylic acid, Pat. 185,800) has brought out several products built along similar lines. Burroughs, Wellcome & Co. have patented a cinnamyl salicylic acid, Boehringer & Sohn, a salicylo-salicylic ester called Diplosal and Kalle & Co., an acetyl salicylic amide called Arthrisin (D. R. P. 177,054). Diaspirin is a salicylic succinate.

Organic Arsenicals.

Therapeutically valuable arsenicals, especially adapted for subcutaneous use, are obtained through the replacement of the OH groups of arsenic acid by methyl groups, as sodium-methyl arsenate or Arrhenal, $AsO(CH_3)(ONa)_2$, cacodylic acid and its salts. Because of its special value in treatment of the African sleeping sickness (trypanasmiasis), atoxyl has attracted much attention of recent years; this is the monosodium salt of para-amino-phenyl arsenic acid, $H_2N.C_6H_4.AsO(OH)ONa.4H_2O$. In this class of compounds, the arsenic is so finely linked that but very small quantities are taken up in the system. For example, doses of 1 gm. of sodium cacodylate may be taken, although 2/3 of its weight consists of arsenious oxide. Through atoxyl, 40 to 50 times as much arsenic can be administered as in the form of Fowler's solution. Claimed to be an improvement over atoxyl is Acetatoxyl, less toxic and admits ready sterilization. Arsacetin is a sodium para-aceto-amino-phenyl-arsenate, $CH_3CO.NH.C_6H.OH(AsO)ONa$, also proposed as an atoxyl succedaneum. Other arsenicals of minor importance are Thiarsol, a colloidal arsenic-trisulfid; Arsen Triferrol, an arsenic iron preparation of para nucleinic acid; Arsenogen, of like origin; and Sodium Arsenyl tartrate, $NaAsO.C_4H_4O_6.2\frac{1}{2}H_2O$.

Organic Mercurials.

The value of mercurials in syphilitic diseases and also as antiseptics has brought forward a large variety of combinations, some of which, because of ready solubility, freedom from irritation and slow elimination from the system, are especially adapted for subcutaneous and intramuscular injection; others aim to excel mercuric chloride for local use in being more penetrative (not coagulating albumin) and less irritating. New additions are few. Asquirrol is a stable mercurial, a dimethylate, reacting much like the well-known diphenyl mercury; the greatest care must be exercised in administering this, since through cumulative action, serious symptoms of mercurial poisoning are liable to appear without warning. Asiphyl is mercury paranilide arsenate; Iodargyre and Hydrarsyl are organic mercurials of unknown origin. Mergandol is a mercury sodium glycerate and Antiperiostin a mercuri-iodocantharidate, both being solutions. A colloidal mercurous oxide, prepared by the reduction of mercury salts by the alkali salts of lysalbinic or protalbinic acids or other albuminoids and subsequent dialysis (D. R. P. 185,599–600), has been added to our list of colloidal mercury compounds (U. S. Pat. 740,855). These patents are not unlike those of the Kalle Co. (D. R. P. 179,980), wherein the alkali salts of decomposition-products of albumin are used for preparing colloidal silver and mercury.

Sandalwood Oil Derivatives.

The East Indian sandalwood oil is an old and excellent remedy for gonorrhea, objectionable, however, because of the presence of the terpene, santalen (10%), which causes irritation of the mucous surfaces of the duodenum, the kidneys and also disturbances of the digestion. Semmler[1] found that the chief constituent of this oil was a tricyclic alcohol called α-santalol. Under this title (santalol and gonorol), Mess Heine & Co., of Leipzig, introduced the alcohol into the market. Later, Semmler, through oxidation of this alcohol, obtained the tricyclic aldehyde, $C_{11}H_{16}O$, eksantal and eksantalic acid, $C_{11}H_{16}O_2$. In order to still further avoid any possible irritant action, the OH group of the alcohol was esterified through the salicylic acid radical and the product introduced by the Knoll Co. (D. R. P. 173,240) under the title Santyl. This was followed by the carbonic acid ester Blenyl (v. Heyden, Pat. 182,627). With these as prototypes, the following have been introduced during the past year. Camphosal, the neutral camphoric acid ester of santalol, $C_8H_{14}(CO_2.C_{15}H_{23})_2$, especially adapted for urethral fever and vesical catarrh. Thyresol is a santyl methyl ether of $C_{15}H_{32}OCH_3$, b. p. 149–156° C. (16 mm.). Allosan is the allophanate of santalol. Camphosan, a 15 % solution of camphosal in santalol.

(To be continued.)

NOTES.

A WOOD PRESERVATIVE.

Recently a fence which was built forty years ago on a farm near Mechanicsville, Iowa, was taken down, and the oak posts were found to be remarkably well preserved below ground surface line, where decay of the wood so easily takes place. Four or five inches below the surface there had been inserted in each post at the time the fence was built a wooden plug closing an augur hole cavity that enclosed a reddish, powdery substance. After most of the posts were burned, a section containing the filled cavity was secured. This when split open yielded quite a quantity of the red preservative. The wood surrounding the cavity was perfectly sound, and the augur hole surface was as sharply defined as if made only a few weeks before. The plug was pine, but it had become so hardened that it was whittled with difficulty. The preservative seemed to be only white arsenic, colored by long contact with the wood.

NICHOLAS KNIGHT.

THE BUREAU OF STANDARDS ANALYZED SAMPLES.

The Bureau of Standards is now able to supply an acid open-hearth steel with 0.4 carbon, in addition to the samples listed in the January number of THIS JOURNAL (p. 41). An acid open-hearth sample with 0.6 carbon will probably be ready by the time this notice appears in print.

Soon after March 1st a change in the fee schedule for the iron and steel samples will go into effect, allowing but a single discount rate as follows:

Single sample of 150 grams, each sample $2.00.

In lots of 3 or more, each sample $1.70.

The sample of zinc ore D of which analysis appeared in the *Jour. Am. Chem. Soc.*, 29, 269, containing about 31.41 Zn, is in charge of the Bureau and is available for free distribution in approximately 50-gram samples.

W. F. HILLEBRAND.

[CONTRIBUTION FROM THE DIVISION OF FOODS, BUREAU OF CHEMISTRY, U. S. DEPT. OF AGR., WASHINGTON, D. C.]

A SIMPLE RAPID PROCESS VINEGAR GENERATOR FOR GENERATOR USE.[1]

In making vinegar on a laboratory scale in which a few gallons only of finished product are required, the existing forms of wooden rapid process generators are unsatisfactory for many reasons. Among these may be mentioned, contamination with the larvae of the vinegar fly, excessive evaporation, and loss by seepage. The essential features of a rapid process generator are, a suitable substratum, usually beech-wood shavings, where the vinegar ferment may develop, a supply of air, and an arrangement whereby the liquor being acetified, is periodically or continuously brought in contact with the shavings. The generator here described consists practically of two glass bottles filled with shavings and suitably connected by glass tubing. The liquor is gradually forced from one bottle to the other and back, using a simple siphon device and a very slow stream of water by which a third bottle is alternately filled and emptied. Contamination from the outside is entirely avoided by filtering all air admitted through a cotton plug. There is probably little evaporation as excessive heating does not occur, and there is no loss possible by seepage. Three five-gallon bottles, *A*, *B*, and *C*, are connected as shown. The heights indicated of the various tubes are essential to the proper operation of the apparatus and cannot be materially lessened. The use of a siphon to secure the periodic wetting of the shavings was suggested by Dr. C. S. Hudson. Its down-coming arm is made of copper tubing to lessen the danger of breaking. The bend shown in this arm appears to be necessary in order that the siphon shall not start promptly when the water overflows. A slow drip of water is run in through the curved tube in the stopper of bottle *A* at such a rate that several hours are required for *A* to fill. The volume of *A* is larger than that of *B* or *C* by the volume of shavings in

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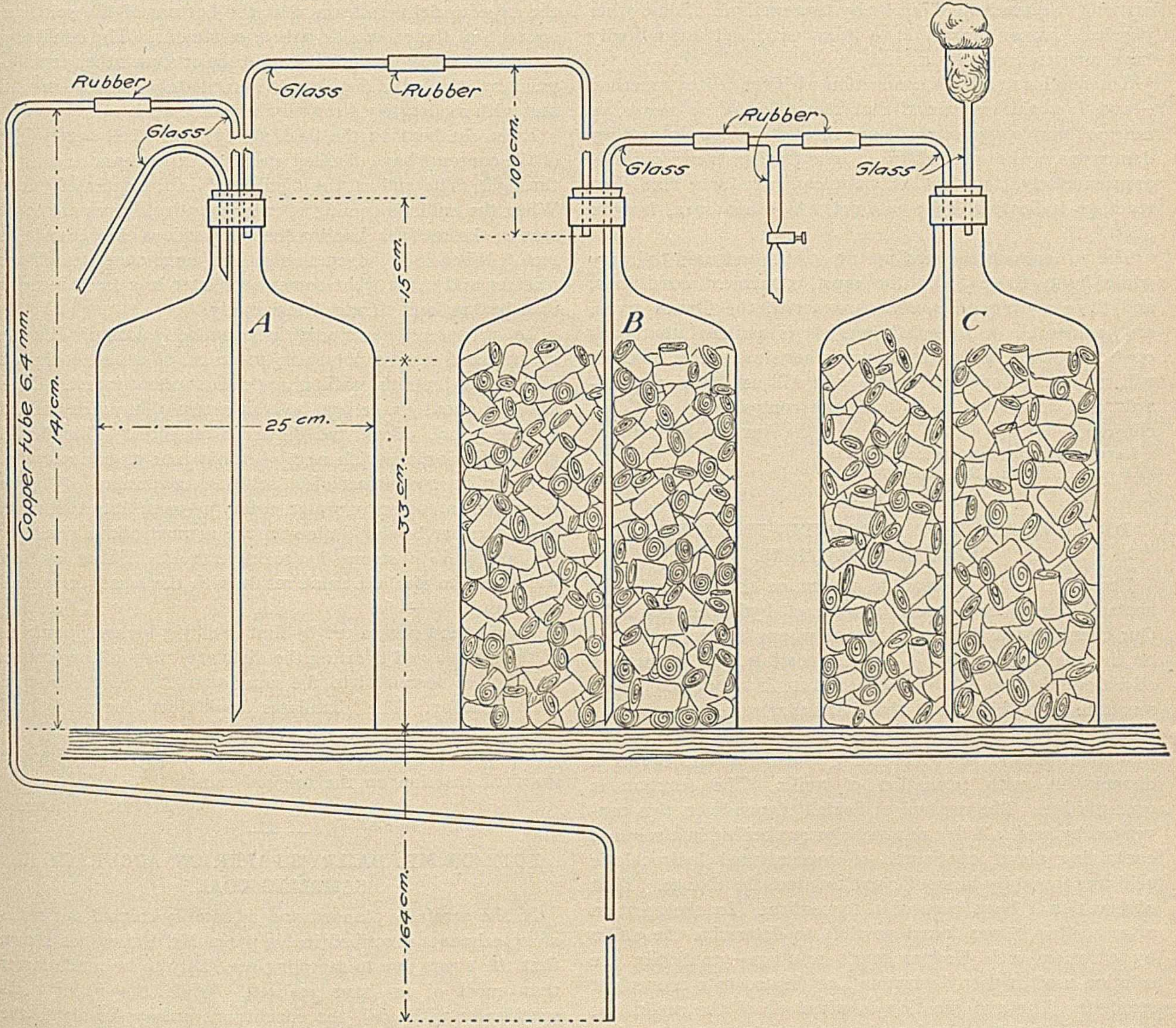
[1] *Ber. d. chem. Ges.*, **40**, 1120.

[1] Published by permission of the Secretary of Agriculture.

B or *C*, and as *A* fills, not only is practically all of the liquor forced from *B* to *C*, but considerable quantities of air pass up through *C* and out. As *A* empties, the liquor passes back from *C* to *B*, and considerable air is drawn from *C* through *B* into *A*. In this way the air of the generator is continually being partly replaced by fresh air. When once started, the generator requires no further attention, and acetification is usually complete in a few weeks, working at room temperature. The shavings have a clarifying effect on the liquor so that when the finished vinegar is withdrawn it is brilliant. The generator is filled and emptied through the T tube between bottles *B* and *C*. When not in use these bottles should be kept full of vinegar. It is evident that the device can be operated on a smaller or larger scale than the one shown. The present size will produce about three gallons of vinegar at one charge.



H. C. Gore.

NOTE ON TURPENTINE.

Replying to Mr. R. H. Acott's statement in the February number of This Journal, as well as to several inquiries from other readers, the writer wishes to state that in his article, in the January number, on "Turpentine and Its Adulterants," the terms "very light naphtha" and "exceedingly light petroleum products" were *NOT* intended to include ordinary gasoline, but merely such *unusual* products as "hexane" petroleum ether, etc.

Inasmuch as the writer's statement that his method gives low results with such products, if understood according to Mr. Acott's interpretation, and coupled with his statement as to the use of gasoline for adulteration, would greatly reduce the general applicability and utility of the method, the writer desires to say that he too, has frequently found samples of turpentine adulterated with petroleum products resembling gasoline, and that the method described, gives excellent results (90 per cent. on known mixtures) in such cases.

The writer has also received a number of inquiries concerning the conditions of observation of the butyro-refractometer readings.

The reasons for employing these readings rather than any other physical constant, were ease of application and smallness of amount required, the time consumed being but a few moments, and a drop or two of material being amply sufficient for the determination.

The readings given in connection with the fractionation results are supplied merely to show the impracticability of arriving at quantitative results by that method. Some other physical constant might have been used, and undoubtedly have answered equally as well.

The readings given in connection with the writer's method —and I would emphasize that these *are by no means an essential part of the method*—are interesting merely as they demonstrate the possibility of recognizing, very quickly, approximately, the *kind* of petroleum products used, low readings indicating light products, high readings, heavier ones.

The writer took the readings at 25° C., and used ordinary white light, those being the most convenient conditions; and these having been used throughout, the figures given, are comparable with each other. It is assumed that each operator, before using this or any other similar new method, will try it on known substances, and will use his own standards and constants, as a basis for comparisons and conclusions.

ARTHUR E. PAUL.

LABORATORY OF MARINER AND HOSKINS,
CHICAGO, ILL., Feb. 13, 1909.

DETERMINATION OF ACETANILID IN HYDROGEN PEROXIDE SOLUTIONS.

Recently I had occasion to determine the proportion of acetanilid in a commercial sample of hydrogen peroxide. Our client stated that one chemist whom he had consulted on the subject, declared it to be impossible, and it must be admitted, that so far as the literature is concerned, there seems to be nothing to fit that particular case.

It is a matter of record that boiling acetanilid with strong hydrochloric acid or with strong caustic alkali, causes a dissociation, with formation of anilin. The reaction is quantitative. The method of Seidell[1] depends on this conversion by acid. A five minute vigorous boiling in a solution containing about one-fourth of concentrated hydrochloric acid was found by him sufficient to effect the change. That observation I have been able to confirm. In the solution after cooling it was found possible to determine the anilin by titration with Koppeschaar's solution—practically the solution used in urea determinations diluted to a convenient strength. The end reaction is when all of the anilin has been precipitated as the bromine substitution product, when the excess of bromine imparts a yellow tinge to the solution. For standardizing or for determining acetanilid in many pharmaceutical preparations, his process serves very well, but in the presence of the peroxide, the preliminary boiling completely destroys the acetanilid, affording a yellowish solution in which bromine gives no precipitate.

It was found that the desired result could be obtained by boiling with strong caustic alkali in presence of granulated zinc, and distilling over the anilin formed, by the aid of a current of steam. After some experimenting, the following plan was worked out: In a side-neck flask of 200 cc. capacity, place about half a stick of caustic potash or soda (6–7 grams). Add about 20 cc. of water to dissolve, and then 25–30 grams of granulated metallic zinc (the zinc had best be in as fine particles as can be obtained in "granulated" form. There is reason, however, to believe that "zinc dust" is too finely divided for this purpose). Then add a measured amount (not over 50 cc.) of the solution to be tested. Connect the flask on the one side with a flask to supply steam, arranging the tube to deliver steam near the bottom of the solution; connect on the other side with a condenser. The condenser should deliver into a Peligot bulb tube or some other arrangement by which the distillate is immediately brought in contact with moderately strong hydrochloric acid.

Raise the heat on the flask slowly, and when nearly half of the contents have distilled over, start the steam to passing through. The end of the distillation is a matter of guess. When the anilin is coming over in quantity, fumes are to be seen in the receiver, but for the last portions they cannot be seen. When it is judged that all has come over, detach the receiver and catch what comes over later in a fresh receiver or a beaker, and titrate it separately.

To prepare the volumetric bromine solution, dissolve 25 grams of caustic potash in 20–40 cc. of water, cool, and add liquid bromine until it appears supersaturated. Then dilute to about 200 cc. and boil out excess of bromine (judged by the color). Cool, and dilute to one liter. This should give a solution of which 1 cc. = nearly 0.01 gram acetanilid. Standardize by means of a solution containing 0.5 gram acetanilid in 200 cc. of water, using 30–50 cc. lots at a time, treated either by distillation on the manner above given, or by boiling with strong hydrochloric acid. Either method was found to give the same result with the same amount of acetanilid.

The method was tested by first distilling known quantities of the sample and titrating the distillate, then adding known amounts of acetanilid to the same quantities of the sample, and distilling. The distillates took just the additional amount required by the acetanilid added.

The presence of acetanilid was indicated by obtaining the iso-nitril reaction on the original sample.

ELWYN WALLER.

NOTE ON MR. BAILEY'S PAPER ON ACCURACY IN SAMPLING COAL.[1]

In the carefully planned and admirably carried out series of experiments described in his paper Mr. Bailey has shown that the errors due to sampling are likely to be much larger than most of us have realized. While the paper deals specifically with coal, the conclusions are applicable to the sampling of all mixtures of solids. It is the first attempt that has been made to measure quantitatively the errors due to too small an initial sample and to insufficient crushing before quartering. No one realizes more fully than Mr. Bailey that there are other parts of sampling than those he has investigated, in which serious errors may occur. The U. S. Steel Corporation have studied some of these and formulated rules for taking samples of their principal raw materials.

This society and others have done much to insure the introduction of more accurate methods of analysis, but no one has done anything to insure that the samples represented the material correctly. To insist on the use of methods that

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[1] *J. Am. Chem. Soc.*, **29**, 1091.

[1] THIS JOURNAL, March, 1909.

are accurate to a few hundredths of a per cent. and accept samples that have an error of several per cent. is absurd; but it is what most of us have done.

Many of the complaints that are made of inaccurate analyses are due to inaccurate sampling. We have "strained at a gnat and swallowed a camel." Now that attention has been drawn to this matter it is to be hoped that the American Chemical Society will take it up energetically, study the question thoroughly and formulate rules for sampling, and, as far as possible, insist that its members follow these rules, or, at least, that all certificates of analysis state how the samples were taken. GEORGE C. STONE.

DISCUSSION ON "ACCURACY OF SAMPLING COAL" BY E. G. BAILEY.[1]

Mr. Bailey's paper is so interesting, instructive and comprehensive that it will require a great deal of study, before one can discuss it intelligently.

Mathematics that have lain dormant for years must be reviewed and some parts carefully studied before the full value of Mr. Bailey's paper can be realized and appreciated.

The application of the mathematical principle of least squares, a principle based on the theory of probabilities and the general law of deviations, to the sampling of materials, in order to test the accuracy of different methods, is unique and is worthy of much praise.

The maximum errors are here shown, and probable and possible errors are calculated to a mathematical certainty, thereby throwing additional light on a very important subject that needs illumination.

The proper sampling of non-uniform material under the varying conditions in which it must be sampled, is so difficult that in many cases it seems almost impossible to obtain a representative sample. Duplicate sampling by the same method or by different methods at times give very consistent results; at other times, results obtained indicate that no method of sampling, so far devised, will properly represent the material.

By applying the principle of least squares to the different methods, that method that gives least variation (if applicable to the varying condition of sampling), may be selected and in so doing material progress may be made.

Reference is made to publication of U. S. Geol. Survey, in which heavier pieces—such as slate and pyrites—settle to the bottom of the car in transit. Experiments made on Illinois and Indiana coals transported about 150 miles, prove that a settling of heavier particles does occur. Results in the main corroborate those of the U. S. Geol. Survey. For this reason sampling from the surface of cars has been discontinued.

The importance of total weight of sample, the relation of size, weight of pieces taken to the total weight of sample, and the limit beyond which sample should be divided when crushed, is especially instructive. A statement showing relative weight of sample taken to total weight of material sampled, would be very interesting.

The amount of experimental data given, shows the thoroughness of Mr. Bailey's work, and the paper as a whole is a valuable addition to the literature of sampling materials.

W. BRADY.

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[1] See March Number, THIS JOURNAL.

SOIL FERTILITY.

The following correspondence on the subject of soil fertility is self-explanatory. The first letter, dated January 21st, was sent to a number of agricultural experts by Dr. A. M. Peter, chief chemist and head of the Chemistry Division, Kentucky Agricultural Experiment Station, at Lexington. The second letter is a letter of transmittal by Dr. Frank K. Cameron, Bureau of Soils, Department of Agriculture, and joint author of Bulletin No. 22 of that Bureau. The third letter dated January 28th, is Dr. Cameron's letter expressing his position and views. The fourth letter, dated February 18th, summarizes the replies up to that time by Dr. Peter, in answer to his first letter of January 21st.

KENTUCKY AGRICULTURAL EXPERIMENT STATION,
STATE UNIVERSITY.
M. A. Scovell, *Director*. *Chemical Division.*
A. M. Peter, *Chief Chemist, Head of Division.*
S. D. Averitt, *Chemist.*
O. M. Shedd, *Chemist.*

January 21, 1908.

DEAR SIR:

In a "Hearing before the Committee on Agriculture of the House of Representatives," 1908, Drs. Whitney and Cameron, of the Bureau of Soils, have made statements to the effect that the recent teachings of the Bureau in regard to soil fertility are generally accepted throughout this country and Europe and that they are being widely taught in the Agricultural Colleges of this country. The teachings referred to, with which you are, no doubt, familiar, may be summarized in the following statements:

(1) That all soils contain enough mineral plant food in available form for maximum crops and that this supply will be indefinitely maintained.

(2) That the real cause of infertility is the accumulation in the soil of poisonous excreta from plant roots.

(3) That it is not ever necessary to add fertilizers for the purpose of increasing the plant food in the soil, the good effect of fertilizers being due to their power of neutralizing or destroying these toxic substances or their activity.

(4) That soil fertility can be maintained indefinitely by practicing a system of rotation by which a crop is grown each year that is not injured by the excreta of the preceding crop.

In order to ascertain just how extensively these views are accepted and taught in our Agricultural Colleges and Experiment Stations, the writer is sending this letter to professors of agriculture, agronomists and agricultural chemists in all such institutions on the "Organization Lists." It is proposed to publish a summary of the data obtained, without giving names of institutions or individuals. Will you kindly assist by telling me whether or not these views are accepted and taught by you or your institution, or by referring this letter to some one who will give me an authoritative answer? Yours very truly, ALFRED M. PETER.

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS, WASHINGTON, D. C.

February 5, 1909.

DEAR SIR:

I have been advised by Dr. A. M. Peter that recently a circular letter had been sent out by him, in which are summarized certain views regarding soils, and these views are attributed to me. I deem it proper that a copy of my reply to Dr. Peter should be in the hands of every one reached by his letter. I may say that in a letter dated February 3rd, Dr. Peter concurs in this opinion. I am therefore enclosing for your consideration a copy of this reply.

Very truly yours,

Frank K. Cameron, in charge.

Dr. A. M. Peter,
Ky. Agr. Expt. Station,
Lexington, Ky.

United States Department of Agriculture,
Bureau of Soils,
Washington, D. C.

Physical and Chemical Investigations.

January 28, 1909.

Dr. Alfred M. Peter,
Ky. Agr. Expt. Station,
Lexington, Ky.

My Dear Doctor Peter:

I have received your letter of the 22nd, enclosing a circular letter, and I have also seen your letter to Professor Whitney. I recognize, of course, that you disbelieve my statements or seriously doubt them, and ordinarily I should be disposed to give the matter no further consideration than an acknowledgment of your courtesy in advising me of your intentions. My high respect for you personally and our past pleasant relations have induced me, however, to treat the matter differently. Assuming that you desire to undertake your investigations in a disinterested spirit, I wish to submit some criticisms to your consideration. You summarize my teachings under four heads, which I will consider seriatim:

"1. That all soils contain enough mineral plant food in available form for maximum crops and that this supply will be indefinitely maintained."

I do not teach this doctrine, nor have I ever taught it. From Bulletin No. 22, Bureau of Soils, of which I was a joint author, I quote those passages which seem to me to bear upon this point:

Page 49. "It will be seen from the results obtained by this Bureau that these large annual applications of stable manure, or of high-grade fertilizers, do not apparently change permanently the chemical composition of the soil as determined by chemical analysis of the aqueous extracts; that is to say, immediately after the application the influence of the fertilizer can be seen in the increase in the soluble salt content of the soil; but not only is this comparatively slight, but fields that have been annually treated in this way for a number of years do not show on the average appreciably more water-soluble plant food than adjoining soils upon which no such applications have ever been made.

"These observations indicate obviously that fertilizers do sometimes increase the yield of crops and maintain a larger average yield over a period of years. But it is not obvious, as has been claimed, that such results indicate in the unfertilized soil an amount of available plant food actually insufficient for the need of crops."

Page 50. "If fertilizers have any influence upon the texture of the soil, or upon the movement of soil moisture, they will not only influence the supply of water which will be delivered to the plant, but also the supply of nutrient materials normally contained in this water. The problem would then come into the domain of soil physics rather than into that of soil chemistry. The important practical inference, if this is so, is that fertilizers have to a certain extent the same effect as cultivation and cropping; but in a majority of cases it is undoubtedly better to depend upon efficient methods of cultivation and cropping than to rely upon fertilizers while at the same time neglecting to give proper attention to the physical condition of the soil. The effect due to cultivation is also more permanent than the effect due to fertilizers. Furthermore, the influence of fertilizers on the yield of crops is not proportional to the amount of fertilizer added, as it frequently happens that a small application is quite as efficient as a larger application."

Page 53. "The texture of the soil is the principal basis for the classification of soils in the soil survey, and taken in connection with the character of vegetation and the experience of farmers is undoubtedly a safe and reliable one for the estimation of the relative value of soils for certain crops and for determining the most efficient methods of cultivation. It is realized that the controlling effect of the physical properties of soils on crop distribution and production does not depend wholly upon the texture of the soil, as shown by the mechanical analysis, but that there are two other very important properties, the organic matter content and the structure of the soil, or the arrangement of the soil grains. Unfortunately no satisfactory methods have been devised to determine this structure or its consequent effects. Not only is the character and yield of a crop adapted to a soil dependent upon the texture and structure, but upon the moisture which the soil can deliver to the plant to supply its needs."

Page 55. "It is becoming increasingly evident that this capacity of a soil to deliver water is a very important and probably the most important factor in crop production, and this is a point which will receive consideration in the future work of the Bureau. The delivery of water from the soil to the plant must receive more consideration in future chemical studies of soil for the reason that it is the mechanism by which the mineral nutrients are supplied to the plant, and it is evident that if the delivery be small, the plant will suffer not only for water itself but also for the mineral food which the water supplies, even though ample quantities may be present in the soil solution, and in what would usually be regarded as readily available form. This point of view aids in understanding many of the discrepancies between chemical indications and actual crop returns in past work, and conclusively shows that a chemical study of a soil, which does not include as well a physical study along the lines here suggested, can not be expected to yield definite results."

Page 58. "There is no question that in certain cases, and in many cases, the application of commercial fertilizers is beneficial to the crop. The experience of farmers, the enormous sums expended for commercial fertilizers, and the many experiments carried on at the experiment stations prove that under certain conditions fertilizers are very beneficial in increasing the yield of crops. The fundamental idea under all of this work, however, has been that of supplying plant food in an available form; that is, adding to the supply existing in the soil. It is significant that other conditions of growth have so much influence on the yield that in but very few instances, even after long-continued experiment, has it been demonstrated that any particular fertilizing ingredient or ingredients are required for any particular soil, and that even then the effect of the fertilizer varies so greatly from year to year that no specific law has been worked out, even for a particular soil, from which the fertilizing requirements could be deduced in any exact manner.

"It is also significant that, in general farming, fertilizers are most useful in the early stages of the growth of plants, and the common practice is either to put the fertilizer in with the plant or to put it in at some time before the seed is planted. Very little effect is obtained in field culture in attempts to increase the value of a crop showing signs of inferior growth, by the application of fertilizers. This would indicate that the effect is early and immediate. In opposition to this may be cited the special cases of the application of nitrates to increase leaf development, potash salts to increase starch, and many similar cases, particularly in greenhouse culture, to hasten the maturity, to prolong the growth, or to produce artificial stimulation of certain plant processes. But the use of fertilizers in such cases is recognized as producing artificial and abnormal conditions."

Page 60. "One possible explanation of the effect of fertilizers, which would be in entire accord with the hypothesis that has been formulated, is that the fertilizer is needed during the early period of growth when the root system is beginning to develop, that is, as the plant germinates and begins to feed upon the soil the root system has to be artificially nourished by a temporary increase in concentration as regards one or more constituents, whereas, when the root system is developed into a considerable volume of soil the plant will be quite capable of collecting all of these materials it may require. It is a fact, admitting of no argument, that fertilizers rarely take the place of efficient methods of cultivation and of cropping in increasing or maintaining crop yields."

Page 6. "We have examined a few cases, such as certain samples of the Galveston sand, which showed practically none of the several necessary mineral plant foods to be present and soluble, but neither will these samples in their natural state support any crop, being nearly pure silica, and as such can scarcely be regarded as soils. Practically, all soils were found to give a solution with a composition varying little from a normal, but even the exceptional soils showing extremely small quantities of one or more soluble plant food constituents would still yield a fair crop if brought into good mechanical condition.

"The idea now held by the Bureau as a result of these investigations is that the ratio of the nutrient elements in normal soils does not play a very important part in the yield of crops, or, to be more explicit, low yields are usually related to the physical condition and characteristics of the soil, and that it is only after these major controlling factors are changed and the yields thereby increased, that it would be necessary or profitable to consider this question of the ratio of plant foods. In other words, that it is only where all other conditions of plant nutrition and growth are satisfactorily controlled that the nutritive ratio can be considered an important factor and that the influence of this would be mainly seen in the quality of the crop rather than in the yield."

Pages 63 and 64. "The exhaustive investigation of many types of soil by very accurate methods of analysis, under many conditions of cultivation and of cropping, in areas yielding large crops and in adjoining areas yielding small crops, has shown that there is no obvious relation between the amount of the several nutritive elements in the soil and the yield of crops; that is to say, that no essential chemical difference has been found between the solution produced in a soil yielding a large crop of wheat and that in a soil of the same character in adjoining fields giving much smaller yields. The conclusion logically follows that on the average farm the great controlling factor in the yield of crops is not the amount of plant food in the soil, but is a physical factor, the exact nature of which is yet to be determined.

"It is not to be deduced from this that fertilizers do not frequently increase the yield of crops, but whether this increase is due to an actual increase of the plant food in the soil, to an early stimulation of the plant to enable it to get its roots out into a sufficient volume of soil, or to some physiological or physical effect is not altogether clear. As above stated, the effect of fertilizers on the quality of the crop is not specifically considered in this bulletin.

"The results of these investigations also seem to indicate that the actual quantity of water a soil can furnish the plant, irrespective of the percentage of water actually present in the soil, has probably a very important influence on the yield. When the supply of water is inadequate to the need of the plant, as the water is a medium for the conveyance of nutritive solutions to the plant, it may well indicate not only a deficiency in the supply of moisture, but also of nutrient material contained in the water. It may be, moreover, that with an insufficient water supply, and consequently an insufficient food supply, fertilizers, by temporarily increasing the concentration of the solution, may increase the food supply of the plant; but as in this case also the obstructive factor is the purely mechanical function of delivering water from the soil to the plant, the problem is one to be handled by physical methods, and can not, in the nature of the case, be solved by chemical methods alone.

"Again, while some variations occur in the composition and concentration of the soil solution, in the case of the great majority of cultivable soils these variations are within comparatively narrow limits. The nature of the solution is but seldom permanently affected by the addition of ordinary mineral fertilizers, and it seems safe to say, therefore, that the concentration with respect to the mineral plant food constituents per unit of solution is approximately constant. Considering the wide variations in the percentages of water present in different soils, however, the amounts of dissolved plant foods in them may be quite different.

"The conclusion seems justified that, although differences in the dissolved salt content, or in the concentration and composition of the soil moisture, may be a factor in the yield as well as quality of a crop, it does not appear to be a major one in determining or controlling the wide variations observed in crop yields on different soils. It appears further that practically all soils contain sufficient plant food for good crop yield, that this supply will be indefinitely maintained, and that this actual yield of plants adapted to the soil depends mainly, under favorable climatic conditions, upon the cultural methods and suitable crop rotation, a conclusion strictly in accord with the experience of good farm practice in all countries."

Neither from these passages, nor any others in the bulletin, nor any others that I have ever written so far as I can recall can the conclusion be fairly drawn that I teach that *maximum* crops can be grown without the use of fertilizers. I have never taught that in the case of any given soil and crop a larger yield could not be obtained if larger amounts of soluble mineral nutrients were present. I have taught that cases may exist where there is not sufficient "available" plant food in the soil (see specifically citation above, p. 62, Bulletin No. 22); and also that cases may exist where the rate of supply of moisture containing mineral plant food from soil to plant is insufficient, as cited above. These cases, however, are to be considered as abnormal. I have taught, however, that the "plant food" explanation of fertilizers is insufficient in itself to account for the known facts. That (speaking generally and with consideration of exceptional cases) the soil solution in all soils tends towards a normal concentration which is the same for all soils, as regards the constituents derived from the soil minerals, and this concentration is, normally, sufficient to give good (not the maximum possible) crop yields. These conclusions follow from *a priori* considerations and experimental evidence advanced in Bulletins Nos. 22, 30, and 50.

To sum the matter up, I believe and teach that mineral fertilizers are useful as one of the three general methods of soil control, but that they have other and probably more important functions than supplying plant food.

I wish to say here, that on re-reading carefully Bulletin No. 22, I feel that there are but two material points on which just criticism may be made: The tables are badly arranged and do not bring out in themselves that the same fields were examined at intervals. And, secondly, the nitrate determinations are probably valueless, for subsequent investigations have shown the analytical method to be doubtful; nitrates are now known to vary very widely within a few hours, and more especially because nitrates are not derived from the soil minerals, and should not be regarded as mineral components of the soil solution.

"2. That the real cause of infertility is the accumulation in the soil of poisonous excreta from plant roots."

To represent correctly my views and teachings, this statement would have to be materially changed. So far as I can recall I have never ascribed infertility to any one cause. Definite organic compounds injurious to certain plants have been extracted from the soils. Experimental evidence has been obtained which indicates strongly, if not positively proving, that such substances are excreted by plant roots. To correctly represent what I have taught your statement should be amended to read: One of the causes of infertility is the accumulation in the soil of injurious organic matter, possibly excreted from plant roots.

"3. That it is not ever necessary to add fertilizers for the purpose of increasing the plant food in the soil, the good effects of fertilizers being due to their power of neutralizing or destroying these toxic substances or their activity."

This statement does not represent my views or teachings. It should be amended and restated as two separate and distinct propositions. First, the increase in mineral plant nutrients due to an ordinary fertilizer treatment is insufficient to explain the improved plant growth. Second, one of the possible functions of a fertilizer treatment of the soil is to affect the organic matter in the soil in a way advantageous to plant growth.

It has been conclusively shown that the presence of mineral salts affects the rate of oxidation of organic matter by root growth. Other effects on the organic substances of the soil have been strongly indicated if not conclusively proven.

"4. That soil fertility can be maintained indefinitely by practicing a system of rotation by which a crop is grown each year that is not injured by the excreta of the preceding crop."

While I do not recall teaching the doctrine as stated above I think that a soil may be maintained permanently in a more or less good condition for plant growth without the use of fertilizers, by adopting a suitable crop rotation. But I have always taught that it was better and more economical to use fertilizers as an additional method of controlling the soil and soil conditions.

I have, of course, taught that one of the purposes of using a crop rotation was to overcome the harmful influences of the preceding crops, among which influences is the organic débris from the preceding plant life. Some of this débris, in some cases very probably, is material excreted by roots during growth. That rotations are practiced for other purposes, such as for instance the elimination of parasitic growths, injurious insects, etc., is accepted by every one so far as I know, and certainly has been an integral part of my teachings, although I have never made any special investigations in this direction and consequently have had no occasion to dwell upon it in my writings.

I am not aware that the views you attribute to me are being taught anywhere. Certainly I would never teach them myself. But the views which I do hold are being taught in whole or in part at a large number of our American institutions, and some of my more important publications have been translated into foreign languages. I see no reason to alter or modify the testimony I gave to the House Committee on Agriculture.

Finally, I submit that it is unfortunate that you take the attitude expressed in your letter towards the physical chemists, etc., for it has been the applications of the principles and methods of physical chemistry and physiology that have made my work possible. It would seem obvious that the commendation of specialists in these lines would have at least as much weight as the opinions of agriculturists and agronomists who have not had any training or experience in these methods of modern chemistry.

I feel that in view of the action you have taken, a copy of this letter should be placed in the hands of each and every one to whom your circular letter was addressed. I must therefore request that you furnish me at your earliest convenience such a list as will enable me to do this. For your convenience I am enclosing an extra copy of the "organization lists" and a franked envelope.

Very truly yours,

FRANK K. CAMERON, in charge.

KENTUCKY AGRICULTURAL EXPERIMENT STATION,
STATE UNIVERSITY.
M. A. Scovell, *Director*. *Chemical Division.*
A. M. Peter, *Chief Chemist, Head of Division.*
S. D. Averitt, *Chemist.*
O. M. Shedd, *Chemist.*

LEXINGTON, KY., February 18, 1909.

DEAR SIR:

Replies to my letter of January 21st have now been received from 104 individuals in the United States and Canada, including 35 Agricultural Chemists, 25 Agronomists, 21 Professors of Agriculture, 9 Soil Specialists, both chemists and physicists, 8 Experiment Station Directors, not otherwise classified, 3 Directors of Farmers Institutes, 1 Professor of Vegetable Pathology, 1 of Horticulture and 1 of Natural Science. Out of these only two endorse the Bureau's views without qualification and say they are taught in their institutions as established facts. These two are from minor or branch institutions, however, not one of the Land-Grant Colleges or State Experiment Stations being willing to accept or teach them in the sense in which they have been put forward by the Bureau. About half recognize more or less truth in the doctrines and present and discuss them in advanced teaching. Most of these recognize the value of the Bureau's work on toxic substances and consider them a possible factor in soil fertility, though not the most important one. The rest either say they do not accept and teach the Bureau's views on these subjects, or oppose them. The Agricultural Colleges and Experiment Stations in 47 states and territories of the United States are represented in these answers, showing a very general interest in the subject of the inquiry. It is apparent that, while the Bureau's views on soil fertility are not being accepted and taught as established, in these institutions, they are being generally presented and discussed in advanced teaching of agriculture.

In a letter to me dated January 28th, a copy of which has been sent to you, Dr. Cameron takes exception to my presentation of the Bureau's teachings and explains his position in this matter. Dr. Whitney in a letter to me approves Dr. Cameron's letter, so it may be taken as an authoritative expression of the Bureau's views. If, after reading it, you desire to modify your opinion already expressed to me, I will be glad to hear from you before making my final publication.

Yours very truly,
ALFRED M. PETER.

INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY.

The following letter and minutes on this subject are self-explanatory.

NEW YORK, February 10, 1909.

DEAR SIR:

The International Congress of Applied Chemistry will meet in London in the week of May 27 to June 2, 1909. In the past Paris, Berlin, Vienna and Rome have enjoyed the honor of entertaining this most distinguished body of scientists. It is now proposed to issue an invitation to the London Congress to hold its next meeting (Spring, 1912) in New York City.

As the U. S. Government does not coöperate in such meetings nor does it help to defray expenses, it is left to the American chemists, and especially to those connected with chemical industries, to take the initiative and responsibility.

A temporary committee has therefore been formed to consider, first, whether it will be practicable and wise to issue such invitation; and second, if decided in the affirmative, what steps shall be taken to issue it and make it effective; and it has been decided to request all those who might be interested and who might assist in the matter to attend a meeting to be held on Saturday, February 20th, at 8.15 P.M., at the Chemists' Club. You are earnestly requested to be present.

THE TEMPORARY COMMITTEE.

Wm. H. Nichols, *Chairman*; Albert Plaut, *Treasurer*; H. Schweitzer, *Secretary*; Charles Baskerville, *First Vice-Chairman*; Marston T. Bogert, *Second Vice-Chairman*; L. H. Baekeland, Charles F. Chandler, John Hays Hammond, J. Hasslacher, Alex. C. Humphreys, W. R. Ingalls, Adolf Kuttroff, Morris Loeb, W. J. Matheson, H. A. Metz, William McMurtrie, T. J. Parker, Cl. Richardson, Wm. J. Schieffelin, I. F. Stone, Maximilian Toch.

Minutes of meeting, called by the Temporary Committee to discuss advisability of holding the Eighth International Congress of Applied Chemistry in New York City and held in the Chemists' Club on February 20, 1909.

Present, W. H. Nichols, Chas. Doremus, Walker Bowman, Chas. Baskerville, Wm. H. Erhart, J. Hasslacher, M. T. Bogert, L. Baekeland, J. W. Richards, E. Schill, E. G. Love, T. J. Parker, I. F. Stone, L. Briggs, E. F. Roeber, W. J. Evans, H. Schweitzer, Wm. H. Nichols in the chair.

After a few introductory remarks by the chairman, H. Schweitzer read the minutes of the first meeting and many letters which were received favoring the plan of inviting the Eighth Congress of Applied Chemistry to New York.

The question, whether it is practical and wise to issue such an invitation was first discussed and finally a motion brought by Mr. Bogert, seconded by Mr. Parker, that it is the sense of this meeting that such steps should be taken as appear necessary or desirable to extend an invitation to hold the Eighth Congress of Applied Chemistry in New York, was unanimously carried.

It was then discussed what steps should be taken to make the invitation effective, and upon a motion by Mr. Hasslacher, seconded by Mr. Doremus, it was decided to authorize the secretary to correspond with such scientific organizations, educational institutions, manufacturing corporations, etc., likely to be interested in the Congress, to designate official delegates and alternates to meet at the Chemists' Club on Saturday, April 3rd, at 8.15 P.M. If distances should forbid the attendance of delegates, communications on the part of the addressed should be solicited.

As it was considered essential to issue the formal invitation to the London Congress through the U. S. Government, a committee was selected to take appropriate steps to accomplish this object.

The committee consists of Wm. H. Nichols, Chas. F. Chandler, Ira Remsen, J. Hasslacher, W. R. Whitney, A. Plaut, L. Baekeland, M. T. Bogert, D. T. Day, J. A. Holmes, C. D. Walcott, H. W. Wiley, Chas. Doremus, H. Schweitzer, and Chas. Baskerville, *chairman*.

The committee was given power to add to its number.

The secretary was requested to notify the English Congress officials about the progress made by this committee.

Adjourned to April 3rd at 8.15 at the Chemists' Club.

H. SCHWEITZER, *Secretary.*

COMMITTEE ON ANALYSIS OF FATS, SOAPS AND GLYCERINE.

The following letter has been issued by the Special Committee on Glycerine:

American Chemical Society Committee on Uniform Tests of Glycerine: A. C. Langmuir, *Chairman*, B. T. B. Hyde, R. E. Divine. Office of the Chairman: 9 Van Brunt Street, Brooklyn, N. Y., U. S. A.

GENTLEMEN:

The Committee on Uniformity of Technical Analysis of the American Chemical Society has appointed a sub-committee to study the merits of the various methods in use for the sampling, analysis, and valuation of crude and dynamite glycerine.

At present there are often radical differences between analyses of the same glycerine by different chemists. The chief reason is undoubtedly due to the use of a number of methods and individual modifications of these methods.

It is the purpose of this committee to correspond with buyers and sellers of glycerine, manufacturers and chemists, to compare the methods in use, note their defects, if any, and point out improvements, if possible. Finally a method will be recommended which is believed to be the best for the purpose of obtaining correctness of results, giving due consideration to present general practice.

With this end in view we invite the coöperation of manufacturers, works chemists and commercial analysts. It is only by free discussion and criticism that the end can be obtained.

As a beginning the committee outlines below some points brought out by their own experience and indicates some of the problems to be solved, as follows:

ANALYSIS OF CRUDE GLYCERINE AND WASTE SOAP LYES.

One of us favors in his own work the Hehner method as modified by Richardson and Jaffe. Another uses the Hehner method, and the third has used chiefly the acetine method.

Acetine Method.—This method has been criticized as giving results below the truth. Geitel (*J. prakt. Chem.* (N. F.), 55.429) found only 97–8 per cent. on testing anhydrous glycerine, sp. gr. 1.2654. Filsinger (*Ztschr. angew. Chem.*, 1889.3) found on C. P. glycerine 86 per cent. only 83.7 to 84.2 per cent. One of us has verified the above.

On the other hand, Lewkowitsch prefers the acetine to the bichromate method. It is no doubt far superior to the bichromate in the analysis of foods and very low-grade glycerines.

The acetic anhydride is variable and should be tested. The end-point in the titration is sometimes troublesome to decide.

Bichromate Method.—The oxidation of glycerine to carbon dioxide by acidified bichromate is probably incomplete. Traces of formic acid or formaldehyde and carbon monoxide may be formed. One of us has identified the latter in the gas evolved. If the error due to the above is to be constant, conditions as to temperature, concentration and time should be definitely stated. Under the conditions of the Richardson and Jaffe method[1] one of us obtained 99.4 to 99.6 per cent. glycerine on C. P. anhydrous glycerine.

This loss is probably offset by oxidizable impurities not removable by silver oxide or basic lead acetate such as glycol, polyglycerols and certain albuminoids. The lower fatty acids, contrary to the general belief, have some reducing action on bichromate.

Silver oxide is omitted in the Richardson and Jaffe method as superfluous, lead acetate alone being used. As this does not remove all chlorine, it is well to add to the filtrate a little silver acetate. It is better to remove any excess lead before oxidation.

If silver oxide is used slightly higher results are obtained.

The use of a stock solution of bichromate is open to objections. It is better to weigh than to measure. One of us prefers to weigh out the dry bichromate for each test.

The bichromate is probably the most reliable basis. It is better to take it as pure rather than to standardize against iron. In reference to its equivalent weight with respect to glycerine the one in general use, *i. e.*, 7.486 = 1 gram glycerine is not in harmony with recent atomic weight tables.

If Mohr's salt (ferrous ammonium sulphate) is used in the regular analysis it should not be assumed to be pure, as it is variable in strength and should be tested against bichromate.

The analysis should be carried through promptly. An aqueous solution of glycerine may ferment. The oxidation mixture will change in bichromate strength unless dust is excluded. All apparatus must be scrupulously clean and should be used for no other work. It is well to run a blank occasionally with the reagents and distilled water.

The degree of basicity of the lead acetate has been said to exert an influence on the results, an excessively basic acetate throwing down some glycerine as glycerate. This has been noted by some of us when using a large excess of acetate in the analysis of spent lyes.

In the valuation of crude glycerine, a knowledge of the amount of impurities in addition to the per cent. of glycerine is very desirable as these increase the difficulty of refining. A definition of the term "organic impurities" is advisable. The committee has not yet found any reliable method, particularly on soap lye crudes.

DYNAMITE GLYCERINE.

With respect to testing dynamite glycerine the problems are simpler.

Salt is generally determined by titration after burning off glycerine or by testing the diluted sample. The latter is more convenient and seems to give equally accurate results.

Specific gravity is found by the pycnometer, Westphal balance, or refractometer. Their respective accuracies are in the order named. In this connection the specific gravity of anhydrous glycerine should be established, and a reliable table determined or recommended. Of those published, Skalweits and Gerlachs are probably the best.

Organic impurities can be readily determined by igniting a 25-gram portion in a porcelain dish and allowing this to quietly burn off. This is probably as accurate as any method involving heating to a constant weight.

SAMPLING.

The method of sampling is important, particularly on drums containing soap lye and separated salt.

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[1] *J. Soc. Chem. Ind.*, 1898, p. 330.

IN GENERAL.

The committee is in no way bound to the opinions above expressed, and invites the fullest criticism. Even if you are unable to comment on the above problems we should be very glad to receive a simple description in detail of the methods you are using in the analysis and sampling of crude glycerines and dynamite glycerine. Full credit will be given in the committee's report to any suggestions or improvements adopted, unless otherwise desired.

SODIUM FOR DRYING TRANSFORMER OILS.

The Roessler & Hasslacher Chemical Company, selling agents for The Niagara Electro-Chemical Co., manufacturers of metallic sodium, communicated the following information on the drying of transformer oils:

Sodium for Drying Transformer Oils.—Recent experience in connection with the drying of transformer oils has convinced us that by the use of metallic sodium, moisture may be completely removed from oils which are to be used for insulating purposes. This means, of course, that the insulating qualities of the oil will be raised in a very marked degree.

The method of using sodium for drying hydrocarbon oils is one that is familiar to every chemist who has ever measured the dielectric constants of these oils where the sodium is usually added in the final operation to remove the very last traces of moisture. In the fear that the caustic formed by the reaction of the moisture on the sodium might be left as a liquid or a solid in the hydrocarbon, the chemist has usually thought it necessary to distil off from the sodium. In working on a very large scale this fear has been found to be groundless, and it is absolutely unnecessary to distil the oil.

Properties of Sodium.—Sodium has a density of about 0.97 at 15° C. (39° F.) and melts at 97° C. (207° F.). In transformer oil it will sink unless dragged to the surface by hydrogen gas. With water it reacts to form caustic soda and hydrogen. If very much water is present the caustic soda dissolves and in the presence of oil forms a second layer. If very little water is present the caustic soda is formed on the surface of the metallic sodium and may be removed when removing the sodium. When the sodium surface becomes covered with caustic, it is advisable to remelt under oil, not letting the temperature rise above 120° C. (248° F). After cooling and getting in the shape desired, it is again ready for use for drying more oil. Sodium should always be kept under a good transformer oil.

Method of Use of the Sodium.—One method which we have used with our own transformer oils has been the following:

The oil on the granulated sodium is poured off and a good transformer oil poured over the metal. To the oil which is to be treated, and which is put into an open tank or barrel, the sodium is added at first very carefully, about one ounce to the barrel. If much hydrogen is evolved, this will be conclusive proof that there is much water in the oil, and the balance of the sodium should be added carefully and in small amounts. The amount which is to be added depends upon the oil, but as a rule one pound to the barrel is usually much more than is required. The oil is then stirred up three or four times a day for a minute at a time. After several days the oil may be removed and tested, but the longer it remains over the sodium the better the oil becomes.

Another method used is to put the sodium in the form of sticks in a cylinder of iron wire of about 28 mesh and hang the cylinder in the oil. This method may be used directly with the static which is in use, the only precautions required being those familiar to all electricians in the avoidance of short circuits.

Results.—We have repeatedly taken oils which broke down at 3,000 volts and by letting them stand over the sodium for two days have brought their breaking points up to 20,000 volts or higher. Results as good as this had been obtained on a large scale by one of the largest power companies.

STANDARDIZED SAMPLES.

THE SOLVAY PROCESS COMPANY,
SYRACUSE, N. Y., February 17, 1909.

Mr. W. D. Richardson, Editor,
Journal of Industrial and Engineering Chemistry,
4306 Forrestville Ave., Chicago, Ill.

DEAR SIR: The editorial in your last number by W. C. Ebaugh upon Standardized Samples appeals to me strongly. It appears that standardized samples of many important materials are already obtainable, but if this work is undertaken by a committee of industrial chemists, I would like to suggest that standardized samples of Bituminous Coal and Coke be the first to be considered. The coal samples might represent perhaps four types, *viz.*, Pocahontas, Pittsburg Gas, Clearfield and an Illinois or Indiana Coal. These coal samples should be ground to pass a 100-mesh sieve and be standardized particularly as regards volatile matter, sulphur, phosphorus and calorific value. Two coke samples perhaps representing a good by-product and Bee Hive coke should be standardized as regards sulphur and phosphorus content.

It may be urged that coal samples change but if care is taken in keeping the samples the change is almost inconsiderable even as regards calorific value and volatile matter in samples which have been stored several years and absolutely uninfluenced as regards sulphur and phosphorus in either coal or coke. It is, however, the two last constituents mentioned which cause the greatest number of controversies,

Yours truly,
L. C. JONES,
Laboratory Manager,
The Solvay Process Co. and Semet-Solvay Co.

ILLINOIS FUEL CONFERENCE.

The Fuel Conference held at the University of Illinois, March 11th to 13th at Champaign-Urbana, had for its main purpose the bringing together of mine operators, inspectors, bosses and others directly interested in the coal mining industry, for the purpose of inaugurating the work of the Mine Explosion and Mine Rescue station just established at the University. This station is intended to serve the contiguous states of Indiana, Kentucky, Iowa, Missouri and Michigan, by giving instruction to those who may be detailed from the various mining centers, in the use of the oxygen helmets and other devices used in rescue work. This is the first substation to be established after the main one at Pittsburg, which has recently been put in operation.

The success of the Conference was indicated by the very large attendance, about 150 men being present. The program covered a much wider scope than the mere presentation of the work and plans of the Rescue Station, about half the time being devoted to topics of more especial interest to the operators and mine inspectors. The other half of the sessions took up the more technical subjects of conservation, the technical and smokeless use of fuel and the methods employed in analytical work.

One immediate result of the Conference was a sudden realization of the fact on the part of the mining men especially, that Illinois, with her very extensive mining interests, had no medium for training experts in this line which more than ever is calling for expert knowledge and technical skill. As a result, a strong memorial was adopted for presentation to the Legislature now in session, praying for the establishment of a department or school of mining engineering at the State University.

The program of the Conference was as follows:

THURSDAY, MARCH 11

First Session—Dr. W. F. M. Goss presiding.

Mechanical Engineering Laboratory.

Formal opening of the United States Geological Survey's Urbana Laboratory for Mine Accident and Mine Rescue Work.

2:00 P.M.—Address of welcome on behalf of the University, President Edmund J. James, University of Illinois. Responses, J. A. Holmes, representing United States Geological Survey; G. W. Traer, representing Illinois Coal Operators; John H. Walker, representing United Mine Workers.

3:30 P.M.—Demonstration in use of the oxygen helmets and in resuscitation work, R. Y. Williams, Mining Engineer, United States Geological Survey.

Second Session—Mr. G. W. Traer presiding.

Physics Lecture Room, Engineering Building.

8:00 P.M.—Address—"Mine Explosions: What the United States Geological Survey Is Doing to Prevent Them." J. A. Holmes, Chief of Technologic Branch, United States Geological Survey.

Address—"The Work of Foreign Mine Explosion Stations." G. S. Rice, Mining Engineer, United States Geological Survey.

Address—"Coal Mining in the United States." E. W. Parker, Statistician, U. S. Geological Survey.

Reception.—At the conclusion of this session the Faculty of the College of Engineering will give an informal reception to the visiting members of the conference.

FRIDAY, MARCH 12.

Third Session—Mr. Richard Newsam presiding.

Lecture Room, Chemistry Building.

9:30 A.M.—Address—"The Origin of Coal." (Illustrated.) W. S. Bayley, Associated Professor of Geology.

Address—"The Chemistry of Explosives." C. W. Balke, Associate in Chemistry.

Conference—"Mine Explosions and Their Causes." James Taylor, State Mine Inspector, Illinois; James Epperson, Chief Mine Inspector, Indiana; Joan Verner, State Mine Inspector, Iowa; Carl Scholz, President Coal Valley Mining Co.

12:45 P.M.—Complimentary Buffet Lunch at University Club House.

Fourth Session—Professor L. P. Breckenridge presiding.

Assemble—Mechanical Engineering Laboratory.

2:00 P.M.—General inspection of the laboratories of the University.

Physics Lecture Room, Engineering Building.

3:00 P.M.—Conference—"Smoke Suppression." Paul P. Bird, Chief Smoke Inspector, Chicago; W. A. Evans, Commissioner of Health, Chicago; H. W. Weeks, Fuel Engineer; A. Bement, Consulting Engineer, Chicago; L. P. Breckenridge, Director Engineer Experiment Station.

Fifth Session—Professor S. W. Parr presiding.

Physics Lecture Room, Engineering Building.

8:00 P.M.—Address—"First Aid Work in the Anthracite Mines" H. H. Stoek, Editor, *Mines and Minerals.*

Address—"The College of Engineering and the Mining Interests." W. F. M. Goss, Dean of the College of Engineering.

Address—"The Work of the University of Illinois Engineering Experiment Station." L. P. Breckenridge, Director of the Engineering Experiment Station.

Conference—"Economy in the Use of Fuel for Industrial and Domestic Use." A. Bement, Consulting Engineer, Chicago; D. T. Randall, Engineer, Technologic Branch U. S. G. S.; R. H. Kuss, Assistant Smoke Inspector, Chicago; Edward H. Taylor, Fuel Engineer, Chicago; J. M. Snodgrass, in charge Fuel Investigations, Engineering Experiment Station.

SATURDAY, MARCH 13.

Sixth and Closing Session—Dr. U. S. Grant presiding.

Lecture Room, Chemistry Building.

9:30 A.M.—Address—"The United States Geological Survey and the Fuel Resources of the Country." George Otis Smith, Director United States Geological Survey.

Address—"The Illinois State Geological Survey and the Fuel Interests of the State." H. F. Bain, Director State Geological Survey.

Address—"Coal Analysis." N. W. Lord, Director of the School of Mines, Ohio State University.

For the benefit of those who are unable to attend Thursday, demonstrations of the rescue apparatus will be given each day by Mr. R. Y. Williams.

The United States Geological Survey acting in coöperation with the Illinois State Geological Survey and the University of Illinois has established a Mine Explosion and Mine Rescue Station at Urbana, Illinois. The purpose of the Station is to interest some mine operators and inspectors in the economic value of such modern appliances as the oxygen helmets and resuscitation apparatus as adjuncts to the normal equipment of mines. The Station also will concern itself with the training of mine bosses and others in the use of such apparatus. Its service is to be rendered gratuitously, and so far as possible to all in Illinois, Indiana, Michigan, West Kentucky, Iowa and Missouri, who may desire the benefits thereof.

BOOK REVIEWS AND NOTICES.

Wood Products, Distillates and Extracts. By P. DUMESNY and J. NOYER. Translated from the French by Donald Grant. Introduction, xvi pages. Body, 320 pages. London: Scott, Greenwood and Son. New York: D. Van Nostrand Company. Price, $4.50 (net).

Few books have been written giving definite information as to the methods employed in the recovery of technical products from wood, most of such material being scattered, and largely in periodical literature. This book, though giving an account of foreign practice, will nevertheless be welcomed by chemists and others interested in the industries built about the various products of wood distillation, or materials produced from it by other chemical means.

The book is divided into two distinct parts, the first relating essentially to distillates, and the second essentially to extracts.

Part I consists of 127 pages, and it, in turn, is divided into five chapters and an appendix, and is principally confined to a description of products obtained during the destructive distillation of wood, methods for obtaining them, descriptions of apparatus, and the analytical methods employed in determining their purity.

It is interesting to note the absence of any reference to turpentine, or any similar product, as resulting from the destructive distillation, except as inserted by the translator from Circular No. 36, of the United States Department of Agriculture. It would seem, therefore, that this growing industry has received little attention, thus far, abroad. Much space is given to the description of processes for the recovery of pyroligneous acid, to the manufacture and refinement of acetic acid from the crude acetates, and to the making of various acetates. The recovery and purification of wood alcohol also is fully treated. Several pages are devoted to the secondary products, such as oxalic acid, acetone, tar and creosote, and to the manufacture of briquettes from charcoal is touched upon. The recovery of potash from ashes is also dealt with briefly. Some fifteen pages are devoted to a description of the analysis of raw materials and finished products.

An interesting description of processes suggested and attempts to recover products from olive oil residue, especially in Spain, is given in the appendix.

The method and apparatus described for the distillation of wood, and the refinement of products are those ordinarily employed for the harder woods, and do not vary materially from the American practice, but the authors are evidently not familiar with the practice of distillation applied to "fat" wood, as carried out in this country.

Part II, 179 pages, deals with the manufacture and testing of tan-wood extracts, and the utilization of their products in modern tanneries. Some space is given to the general discussion of the effects of deforestation and the importance to industry in the maintenance of the supply of trees capable of yielding tanning material. In view of the recent congress for the discussion of the conservation of our American natural resources, it is interesting to note the warning: "The chestnut tree will disappear from France, if the tannic acid industry continues to fire upon it with red hot bullets." And take heed. The statistics in this book are worthy of careful study.

The description of plant and equipment for treating chestnut wood, the chemical control of the process, commercial details, connected with the operation of the factory and the conduction of the business of manufacturing chestnut extract is exhaustive.

A short chapter of five pages is devoted to the use of chestnut extracts in tanning. Chapter VI describes the manufacture and use of oak extract. Eleven pages, Chapter VII, treat with the same treatment of quebracho extract: Khaki as a substitute for quebracho is also described. Some twenty pages are given to a description of the manufacture and uses of various other tanning substances, dividivi, valonia, Chinese galls, etc. The manufacture of logwood extracts follows.

The last chapter describes the official methods of the International Association of Leather Chemists for the analysis of tanning substances.

The work is well indexed and well illustrated. The printing is clear, on good paper, and the text is amplified by means of useful tables of analyses and other data.

WILLIAM HOSKINS.

Rapid Methods for the Chemical Analysis of Special Steels, Steel-making Alloys, and Graphite. By CHARLES MORRIS JOHNSON, Chief Chemist of the Park Steel Works of the Crucible Steel Company of America. First edition, pages vi+217. New York: John Wiley & Sons. 1909. Price, $3.00.

For contents, "List of Papers" is given. The book is divided into chapters as follows: I. Qualitative Tests for Chromium, Vanadium, Copper, Titanium, Nickel, Molybdenum and Tungsten in Steel, 3 pages. II. Analyses of Vanadium Steel and Ferro-Vanadium, 34 pages. III. Analysis of Titanium Steel and Ferro-Titanium, 16 pages. IV. Analysis of Tungsten Powders. Analysis of Tungsten Steel and Chrome Tungsten Steel. Analysis of Low Per Cent. Tungsten Steel, 13 pages. V. Analyses of Molybdenum Powders. Analysis of Tungsten-Molybdenum Steels, 19 pages. VI. Analysis of Ferro-Chrome, Chrome Ore and Carbonless Chrome, 7 pages. VII. Determination of Aluminium in Steel, 3 pages. VIII. Determination of Copper in Steel and Pig Iron. Separation of Nickel and Copper from Iron and Vanadium by Potassium Ferricyanide. Determination of Copper in Metallic Copper, 15 pages. IX. Rapid Determination of Nickel in the Presence of Chromium, Iron and Manganese, 12 pages. X. Analysis of Ferro-Manganese. Rapid Volumetric Method for Manganese in the Presence of Iron, Calcium and Magnesium, 16 pages. XI. Determination of Carbon in Iron and Steel by Direct Ignition with Red Lead or Litharge. Determination of Carbon in Steel, Ferro-Alloys, and Plumbago by Means of an Electric Combustion Furnace. Also by Gas and Blast, 27 pages. XII. Carbon in Steel by Color. Phosphorus in Steel, Pig Iron, Bar Iron and Wash Metal. Sulphur in Steel, Bar Iron, Pig Iron and Wash Metal. Manganese in Special Steels, Bar Iron and Wash Metal. Silicon in Iron and Steel, 26 pages. XIII. Analysis of Graphite and Graphite Crucibles, 11 pages. XIV. The Annealing of Plain and Special Steels, 9 pages. XV. Percentage Reduction of Acids, 6 pages. XVI. A Practical Automatic Steam Water Still. A Simple Laboratory Method for Making Clay Combustion Boats, 6 pages.

This work is a collection of analytical methods for the detection and estimation of the metals used in making special steels and steel alloys. Methods are also given for the determination of carbon in iron, steel and graphite. The methods given are those used by the author in actual control work of operations, and are based on results obtained from a large amount of experimental data covering years of experience. They are practical in their nature, and the directions for manipulations are clear, concise and well detailed.

The chapters on the determination of carbon in iron and steel by direct ignition and use of the electric furnace are worthy of special mention. The author's opinion of color carbon is given in the first sentence of the chapter of that title, which states: "The determination of carbon by color methods should be indulged in as little as possible." This statement, coming from such authority, may be a surprise to many; but, to the initiated, it is a corroboration of his own ideas, perhaps never expressed publicly.

The preface calls attention to 15 new features and the reader is not disappointed when he reads them in the subject-matter. The book is written by a technical man, and is designed for technical chemists who are called upon to make rapid analyses of such materials as the title embodies. To such chemists the book will prove of inestimable value, since the scientific and technical literature on these subjects is limited and not always easily accessible.

WILLIAM BRADY.

A Short Handbook of Oil Analysis. By AUGUSTUS H. GILL, S.B., Ph.D. Fifth edition, revised and enlarged. pp. 179. Philadelphia and London: J. B. Lippincott Co. 1909. Price, $2.00 net.

Professor Gill's excellent and well-known handbook of oil analysis has reached a fifth edition, which testifies to its general usefulness. In this edition, the changes include a description of the now universal viscosimeter, improved method for antifluorescents and of applying the spontaneous combustion test. Those parts of the book on the detection of animal and vegetable oils, and the treatment of unsaponifiable matter have been entirely rewritten. A new chapter on waste fats and oils has been added, also a description of the titer test, another method for determining sulphur in burning oils and some new tables. For a well-condensed work on the analysis of oils, the present volume can be heartily recommended.

W. D. RICHARDSON.

Heat, Energy and Fuels. By HANNS V. JÜPTNER. Translated by Oskar Nagel, Ph.D. 8vo. pp. 306. New York: McGraw Pub. Co. Price, $3.00 net.

This work is a translation of the well-known volume by Hanns v. Jüptner and is well adapted to the needs of Universities and Engineering Schools, as well as to those of practicing engineers. The subject is treated not only theoretically and practically but details of the latest practice are given. In particular, the measurement of high temperatures, incomplete combustion, combustion temperatures, combustion at constant volume and constant pressure are ably discussed from the theoretical and practical standpoint. Recent data on the melting points of various substances and on solid, liquid and gaseous fuels and their production, and on the gasification of fuels is given. The volume is made up of twenty-five chapters. The work of the translator is well done.

W. D. RICHARDSON.

The Semi-annual Scientific and Industrial Bulletin of Roure-Bertrand Fils, of Grasse, for the fall 1908 has just been issued, on account of delays in preparing special matter for the volume. Under the head of scientific work is given an interesting article on the Essential Oils at the International Congress for the Suppression of Adulterations, Geneva, 1908, by M. Em. Perrott. Under Contributions to the Study of Essentials Oil are detailed six studies of different oils, giving the various constants. The review of recent work on the essential oils occupies 100 pages, or two-thirds of the volume.

NEW BOOKS.

Practical Sheet and Metal Plate Work. By EVAN A. ATKINS. New York: Macmillan Co. 491 pp., over 100 ill., cl. Price, $2 net.

Laboratoriumstechnik. Bibliothek der gesamten Technik. By O. BENDER. 108 Band. Verlag Dr. Max Jänecke, Hanover. Price, Brosch., M., 2.60; geb., M. 3.

Methods for the Analysis of Maple Products and the Detection of Adulterants, Together with the Interpretation of the Results Obtained. By ALBERT HUGHES BRYAN. Wash., D. C., U. S., Office Sup. of Documents 1908 (1909). 13 pp., 8°. (U. S. Dept. Agr., Bureau Chem., Circular). pap. Price, 5c.

The Gases in Rocks. By ROLLIN T. CHAMBERLAIN. Washington, D. C.: Carnegie Inst. 80 pp. Price, 50c.

Die technische Entwickelung der Schwefelsäurefabrikation und ihre volkswirtschaftliche Bedeutung. By E. DROSSER. Verlag von W. Klinkhardt. Leipzig. 1908. 220 Ss., M. 450. Preis, Brosch., M. 12.

Untersuchung und Nachweise Organischer Farbstoffe auf spectroskopischem Wege. By JAROSLAV FORMANEK. Zweite aufl. Erster Theil. Mit 19 Textfiguren und 2 lithogr. Tafl. Berlin: Springer, 1908. viii + 258 Ss.

A Short Hand-book of Oil Analysis. By HERMAN A. GILL. Phila.: Lippincott. 1909. 5th ed., rev. and enl. 179 pp., figs., tabs., cl. Price, $2 net.

Das Ammoniak und seine Verbindung. By Dr. J. GROSSMAN. Helle a. d Saale: Verlag v. Wilhelm Knapp, 1908. Preis, geh., M. 3.60

Metallic Alloys: their Structure and Constitution. By G. H. GULLIVER. London: Charles Griffin & Co., Ltd. 1908.

Natural Sources of Water. By ROB. S. HALL. New York: D. Van Nostrand Co. Cloth. Price, $2 net.

Seifenindustrie-kalender 1909. By O. HELLER. 2 Teile. Leipzig: Verlag Eisenschmidt & Schulze.

Elementary Agricultural Chemistry. By HERBERT INGLE. A Handbook for Junior Agricultural Students and Farmers. Chas. Griffin & Co., Ltd., Exeter St., Strand, London. 1908. Price, 4s. 6d.

Rapid Method for the Chemical Analysis of Special Steels, Steel-making, Alloys and Graphite. By C. MORRIS JOHNSON.

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Mineral Resources of the U. S.: Pt. I, Metallic Products. Pt. II, Non-metallic Products. 1600 pp., maps. Statistics for 1907, and a résumé of the conditions under which the mineral industries were conducted.

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PERSONAL NOTES.

Mr. Paul N. Clancy, of Syracuse, N. Y., Chemist and Engineer of Tests, was last month elected by the Board of Directors of the Clancy Hardward Iron and Steel Co. of the same city to the position of Vice-president of the above-named Company.

Past President Marston Taylor Bogert delivered an address before the American Philosophical Society at Philadelphia, March 19th.

Dr. Edward Ellery, professor of chemistry in Union College, was married on February 20th, to Miss Adelaide F. True, of Waterville, Maine. Dr. Ellery expects to pursue research work in chemistry in the University of Berlin during a five months' leave of absence. Mrs. Ellery will accompany him.

Mr. Henry Bausch, Vice-president of the Bausch and Lomb Optical Company, died at Augusta, Ga., on March 2nd, after a long and painful illness, at the age of fifty years.

After an illness of only a few days' duration, Mr. Geo. J. Seabury, president of the firm of Messrs. Seabury and Johnson, of New York, died Feb. 13th. Born in New York, Nov. 10, 1844, he served one year in the Army of the Potomac; returning to New York he entered the employment of the firm of Hallett, Seaver and Burbank, wholesale druggists. In 1873 he founded the firm of Seabury and Johnson, branching out into the manufacture of rubber adhesive medicinal plasters, extending this to medicated gauzes, cottons and various other pharmaceutical specialties. In 1885 Mr. Johnson retired from the firm and since this time, Mr. Seabury has managed the business alone. His activities in pharmaceutical interests were varied and influential. He was also a voluminous writer on economics, trade, political and public questions. The funeral services took place Feb. 16th, at Orange, N. J.

Dr. R. D. Hall has resigned as Instructor in Analytical Chemistry in the University of Wisconsin to take charge of the analytical and research work of the Westinghouse Lamp Co., of Bloomfield, New Jersey.

INDUSTRIAL AND TRADE NOTES.

It was announced on February 24th that President Roosevelt had denied the petition of the rectifiers which asked for a modification of the internal revenue branding regulations on the misbranding of neutral spirits mixed with whiskey and colored with caramel. He also declined to approve the recommendation of a commission appointed by himself which reported to him in favor of the rectifiers' request. The President endorsed and made public an opinion of Attorney-general Bonaparte, which declares the position of the rectifiers and the conclusions of the commission to be an error. Dr. Wiley's views on whiskey thus are upheld. The attorney-general in declaring that "imitation whiskey" is the only proper name, and in deciding that the terms suggested by Dr. Dunlap are not legal, says:

"I cannot fail to recognize in Dr. Dunlap's recommendation a challenge of the correctness of my conclusions." Mr. Bonaparte declares that the terms suggested by Dr. Dunlap and the rectifiers are not only at variance with the opinions of the Department of Justice, but are also at variance with the decision of the courts."

A bill has been introduced into Congress by Hon. James R. Mann, of Illinois, which requires all packages of foods, drugs, medicines and liquors shipped in interstate commerce to be plainly marked with the net quantity of the contents of the package in terms of weight, measure or numerical count. The measure is in the form of an amendment to the pure-food and drugs act and provides for rules and regulations governing changes from natural causes.

The American Institute of Mining Engineers met in New Haven, Conn., February 23rd and succeeding days. The conservation of natural resources was one of the principal topics discussed.

On March 10th, the Standard Oil Company of Indiana was acquitted of the charges against it by the jury in the second trial on Judge A. B. Anderson's instructions.

Guayule Factory Concession in Mexico.—Consul T. W. Voetter, of Saltillo, advises that an issue of the *Periodice Oficial* of the Mexican State of Coahuila, states that a concession has been granted to Robert L. Bonnet and Eric Notholt by which $10,000 gold is to be invested in a factory for the extraction of rubber from the guayule plant at Nadadores, Coahuila, and which will be exempted from the payment of state and municipal taxes for the period of five years. The concessionaires are obligated to continue the operation of the factory for a further period of five years after the free term, and must deposit a sum of $750 gold in the state treasury as a guaranty fund.

Héroult Furnaces for the United States Steel Corporation.—A most significant point in the development of the steel industry is the adoption of the Héroult furnace by the United States Steel Corporation. Present plans contemplate the construction of two 3 electrode, 15-ton furnaces, one to be installed at the Illinois Steel Company's Works at South Chicago, and the other at the Washburn and Moen Plant at Worcester of the American Steel & Wire Company.

At South Chicago negotiations have been closed with Mr. R. Turnbull, of St. Catherine's, Ontario, Canada, representative for the Héroult Processes for the furnaces, and work is being pushed on their construction. They will be built by the engineering force of the Steel Corporation at the respective plants, and will be ready for operation by July 1st.

The South Chicago furnace will be used for refining liquid Bessemer steel taken from the converters, in order to make a high-grade rail steel and also car wheels and steel axles.

On the other hand, at the Worcester plant the Héroult furnace will be used for refining open-hearth steel for high-grade wire manufacture.

These 15-ton furnaces adopted by the United States Steel Corporation are the largest which have been constructed up to the present time, previous furnaces of this type having reached a capacity of 8 tons only. If the 15-ton furnaces are successful, the Steel Corporation contemplates building others of larger size.

The Hoskins Manufacturing Company, formerly the Hoskins Company, of Chicago, has opened its new plant and general offices at 453 to 471 Lawton Ave., Detroit, Michigan. Here the Company has an extensive factory, new equipment, and enlarged facilities for making and distributing its established line of Electric Furnaces, Pyrometers and Heating Appliances.

With the reorganization and increase of capital to $500,000.00, the management remains the same as before. The officers of the Company are: Mr. Hoyt Post, *President*; Mr. W. W. Talman, *Vice-president and Sales Manager*; Mr. E. F. Hoskins, *General Manager and Treasurer*; and Mr. Jonathon Palmer, Jr., *Secretary*. Mr. A. L. Marsh will continue in the capacity of Electrical Engineer for the Company.

Water Power Wanted for Air-nitrate Factories.—Representatives of European interests manufacturing air nitrates by hydro-electric power for fertilizers are in the United States to see what can be done in the way of securing large water powers for establishing such factories in this country. An industry of this kind is needed as the imports of Chilean nitrate of soda now amount to $14,000,000 a year. Difficulty is being experienced, however, in securing suitable water powers at reasonable cost. Governments of other countries are said to be offering inducements for the location of the extensive nitrate mills which the company proposes to erect.

Extensive Chemical School Planned in Germany.—Consul-General Richard Guenther, of Frankfort, advises that an association has been formed in Germany for the purpose of establishing a national chemical laboratory. A fund of 1,000,000 marks ($238,000) is to be raised for erecting a suitable building with the requisite equipment. The board of directors of the association is requesting the Federal Government to support the new institution by an annual subvention of 100,000 marks ($23,800). The state Government of Prussia has tendered a site for the building free of cost.

The following statement regarding conditions in the American Portland cement industry during the year 1908 has been prepared by Mr. Edwin C. Eckel for the United States Geological Survey:

Although detailed figures are not yet obtainable, an estimate based on the information available indicates that the production of Portland cement in the United States was somewhat less than 40,000,000 barrels. This compares as follows with the output of recent years:

	Barrels.
1905	35.246,812
1906	46 463,424
1907	48,785,390
1908 (estimated)	40,000,000

The falling off from the 1907 output was heavy, and is particularly notable because it is the first decrease shown in any year by the American cement industry since its inception. The decrease was not uniformly distributed throughout the country, for New York, Pennsylvania, and New Jersey will probably show the highest percentages of loss, while in some portions of the West and the Middle West the decrease was relatively slight.

The year 1909 opens with heavy stocks of cement on hand at most mills, but with good prospects for a steady, though slow, revival in the cement trade. It is unlikely that this revival will be sufficiently rapid to push mills to their capacity during the year, and it is therefore possible that the high record for output made in 1907 will remain unbroken for another year at least. The total maximum capacity of existing plants is now about 60,000,000 barrels a year.

Despite the business depression, or perhaps partly because of it, there have been a number of important technical and industrial developments in the cement industry during 1908, and others are still pending. These will be discussed in the Survey's final report on cement production, which will be issued early in the spring.

American Patents in England.—Consul Albert Halstead, of Birmingham, has made a number of inquiries as to the effect upon Birmingham industries of the new British patents and designs act of 1907, which requires foreign patents, if they are to be protected by British patent laws, to be worked wholly or adequately in the United Kingdom. The consul writes:

I have heard it said that many foreign manufacturers, including Americans, were establishing factories in the United Kingdom, or licensing British manufacturers to manufacture patents for them under their patent rights, but have not learned of any Americans locating in this consular district. From inquiries made of me by owners of factory property it would seem that there were plenty of factories that British owners wished to sell or lease to American manufacturers at a good round price.

While there appears to have been no establishment of American factories in this section of England since the act became effective, I learn that a number of British firms are working American patents under royalties. One Birmingham jewelry firm is busy making an American specialty that requires electroplating, whereas most of the Birmingham jewelers are complaining of slack times, and another firm has laid down a special plant to manufacture a certain galvanized-iron article that has not previously been made in England, but is in general use in the United States.

I am also told that other Birmingham firms are profiting through working American patents for American manufacturers, but British manufacturers benefiting from the new British law, and making American patented articles under license, are not disposed to discuss the matter or to advertise their success.

Birmingham manufacturers themselves are not encouraging the establishment of new factories by Americans or other foreigners, because such factories would ultimately compete in other lines as well as in those for which they were especially established, but are encouraging Americans to sell them their patent rights, or to authorize their manufacture under royalties.

Taking the United Kingdom as an entirety, it would seem that the number of American manufacturers who have protected themselves by complying with the provisions of the law is very considerable, and represents a large amount of work taken from American workmen; but there must be a far greater number who have overlooked the importance of so doing, and who are thus risking the forfeiture of their patents and the manufacture of their articles in the United Kingdom by British firms and without compensation, even though their articles have not as yet been introduced into this market, because the British manufacturers are very well contented with the new law and are watching keenly for all such opportunities.

—*U. S. Consular Report*, Feb. 19, 1909.

Tin Plant in Transvaal.—There has just been completed at Groenfontein, near Potgietersrust, in the Transvaal, a plant for dressing tin ore, which Consul Edwin N Gunsaulus, of Johannesburg, describes:

The coarse crushing takes place in a Blake-Marsden rock breaker of the ordinary pattern. From this the ore passes direct to the mill bins, whence it is fed into the mortar boxes of the 10 stamps, each weighing 1,050 pounds and dropping 97 times per minute. The crushed ore passes to a conical hydraulic separator, where the fine stuff passes off at the top through a launder on to a Wilfley table, and the coarser stuff is delivered to two other Wilfley tables. These separate out three grades of stuff, namely, concentrates, middlings, and waste. The Wilfley table separates the heavy and the light grains into layers by agitation, and then by the jerking action throws them toward the head end, and while at the same time the lighter grains are washed down the slope toward the tail side by the surface water, which flows at right angles to the direction of the jerk.

The concentrates are almost entirely of pure cassiterite, and do not require any further treatment. The middlings, which consist largely of particles of tinstone attached to gangue matter, are reground in an auxiliary pulverizing mill. The waste sands pass to two spitzkasten. The coarser stuff from the bottom of the first spitzkasten is treated on a fourth Wilfley table, the finer stuff passing over into the second spitzkasten, the coarser stuff from which is delivered onto two Frue-vanners, while the finer slimes, together with the residues from the fourth Wilfley table and the Frue-vanners, are led away and stored in a dam for future treatment.

The Frue-vanner is essentially a traveling endless belt, which is slightly inclined from the horizontal and receives a rapid shake in the plane of the belt, while at the same time it has a continuous slow motion up the slope. The agitation makes the ore bed so loose that minerals of higher specific gravity can settle to the lower layer, while those of lower specific gravity rise to the upper layer. The travel of the belt carries the heavy minerals to the upper end, and the surface water washes down the light mineral to the lower or tail end. The whole plant is being run by a 60-horse power Tangye suction gas engine and has a capacity of 1,000 tons per month.—*U. S. Consular Report*, Feb. 23, 1909.

Canadian Iron Ore.—Consul-General William Harrison Bradley, of Montreal, furnished the following information concerning a combination of Canadian companies for the working of iron ores, especially New Brunswick ores, heretofore considered practically worthless:

"The consolidated company is known as The Canada Iron Corporation (Limited), and is formed of four companies formerly owned and operated by Montreal interests. The corporation has an authorized bond issue of $3,000,000, of which $2,500,000 is to be issued. Its authorized capital is $8,000,000, of which $3,000,000 is 6 per cent. preference cumulative and $5,000,000 common. Its total assets are about $11,000,000, according to its own valuation. The company is now negotiating for a short railway line to help them market their ores.

"The head office of the corporation is in Montreal. The location of its foundries and their daily outputs are, in tons: Fort William, Ontario, 150; St. Thomas, Ontario, 100; Hamilton, Ontario, 80; Quebec, 50; Three Rivers, Quebec, 70; Londonderry, Nova Scotia, 50; total finished product, 500 tons. Furnace and daily output in tons: Midland, Ontario, coke iron blast furnace, 125; Radnor, Quebec, charcoal iron, 30; Drummondville, Quebec, charcoal iron, 20; Londonderry, Nova Scotia, coke iron blast furnace, 125; total, 300 tons. Iron ore mines and output per day in tons: Eganville, Ontario, 200; Bessemer, Ontario, 1,000; Annapolis, Nova Scotia, 2,000; Bathurst, New Brunswick, 3,000; total, 6,200 tons."

The following is taken from the report of an American expert, who investigated the mines:

"I consider this mine the most valuable one I have examined in Canada. It is the largest body of iron ore known to me to exist in the Dominion to-day. There are three principal ore-bearing areas that I estimate contain, in the aggregate, 20,000,000 tons of merchantable iron ore (hematite) carrying 53 to 55 per cent. of metallic iron, this estimate being arrived at after rejecting all ore running below this standard.

"If a valuation is made on a royalty basis of one dollar per ton, which is the common price in the United States, and in my opinion a very moderate one in the present instance, on account of the proximity of the mine to the seaboard, the Bathurst property will show at least $20,000,000.

"The following analysis from No. 1 area (estimated to yield 10,000,000 tons), made by a government analyst, demonstrates the quality of the ore, in percentages: Iron, 62.83; insoluble, 10.39; manganese, 0.624; sulphur, 0.109; phosphorus, 0.735; titanium, none."—*U. S. Consular Report*, March 3, 1909.

German Peat-gas Plants.—Consul-General A. M. Thackara, of Berlin, forwards a translation by Consular Agent W. B. Murphy, in which is discussed the utilization of the extensive peat deposits in Germany for the production of electric power, and, as a side product, of nitrogen fertilizer. The following extract will be of interest:

"A peat-gas plant is being erected near Svedala, Sweden, which will transform power won from peat into electricity, and this electric power will be conducted to neighboring towns for consumption by municipalities and industrial plants. Of the peat used in experiments, 100 kilos (220 pounds) produced about 327 cubic yards of gas at 0° and 760. Peat-gas machines require less than half as much fuel as steam machines for the production of a given amount of power.

"Calculations show that from central stations located on the banks of the Ems River, where there are extensive peat deposits, electric power can be produced and conducted to surrounding towns, not only as cheaply as that furnished by the south German water-power plants in Rheinfelden, but at prices that will compete with those charged for power in Scandinavia, Switzerland, and by the Niagara Falls company.

"In order that Germany may not become dependent on foreign countries for manures containing nitrogen, the latent resources existing in the moors of Germany should be developed.

"With a plant of 10,000 horsepower 40 tons of carbide can be produced in twenty-four hours, and 100 parts of carbide with 25 specific parts of nitrogen give 125 parts of manure containing 20 per cent. of nitrogen. It hardly needs to be pointed out that the yearly maximum production of 15,000 tons of manure containing nitrogen, by means of an electric central station of 10,000 horse power, would give German agriculture, which now uses 500,000 tons of Chile saltpeter and 150,000 tons of sulphuric ammonia, a very welcome addition to its by no means sufficient supply of manures.

"Taking as a basis the agricultural-chemical experiments carried out since the year 1901, it can already be considered as indisputable that calcium cyanamide, which is obtained from calcium carbide by admittance of atmospheric nitrogen, constitutes in many cases a useful substitute for the manures containing nitrogen imported from abroad, particularly Chile saltpeter and sulphuric ammonia."—*U. S. Consular Report*, March 8, 1909.

South Sea Phosphate.—Consul Julius D. Dreher, of Tahiti, furnishes the following information concerning the discovery of phosphate on an uninhabited British possession in the South Seas:

"Henderson Island is about 150 miles northeast of Pitcairn Island, and 300 miles east of Gambier Islands, which are in the Tahiti consular district. According to one of the two men who discovered the phosphate, Henderson is an elevated island, several times as large as Makatea, which has an area of some 10 square miles. The preliminary investigations made on various parts of the island show that there are large deposits of phosphate thereon. It outcrops on the land and was found at several places to extend to a depth of 6 feet, which was as low as the examination was made. Specimens analyzed show that some of the phosphate at least is of a high grade. Of the other two islands, Ducie is elevated and it is quite probable that deposits of phosphate will be discovered on it.

"My informant has sent his report and many specimens of the phosphate to London. He informs me that a thorough survey and examination of Henderson will soon be made."—*U. S. Consular Report*, March 12, 1909.

German Viticultural Legislation.—Consul Thomas H. Norton, of Chemnitz, advises that the protection accorded by existing German laws to grape-growing interests is confined chiefly to statutes designed to safeguard the purity of wine. Mr. Norton discusses their provisions and contemplated changes as follows:

The present law came into force on May 24, 1901. Its chief provisions are as follows:

In the law of 1879 regarding foodstuffs, etc., certain forms of adulterated or imitation wines are forbidden. Exception is made in the following cases, where the products of the operation are not to be considered as falsified wines:

"(1) The recognized cellar treatment of wine, including preservative methods, even when alcohol or small quantities of albumen, gelatin, isinglass, etc., tannin, carbonic acid, sulphurous acid, or sulphuric acid formed therefrom, are added for the purpose; however, the amount of alcohol added, in as far as foreign southern or sweet wines are not concerned, should not amount to more than 1 per cent. of the volume.

"(2) Mixing of wine with wine.

"(3) The lessening of acidity by means of pure precipitated calcium carbonate.

"(4) Addition of technically pure cane, beet, or invert sugar, technically pure starch sugar, likewise in aqueous solution, in as far as such additions are made merely for the purpose of improving the wine without materially increasing its amount; further, in character and composition, and especially in the percentage of extractive substances and mineral matter, such sugared wine shall not be inferior to the average grade of the unsugared wine of the vineyard territory to which the wine, according to the designation given it, should correspond."

The industrial production of so-called wines by the following processes is totally forbidden:

"(1) An addition of sugar solution or ordinary water to grapes, grape mash, grapes wholly or partly expressed, mixed with yeast (producing grape wine and yeast wine).

"(2) The use of dried fruits (also their extracts by solvents or by boiling) or concentrated fruit sirups, even though their use is permitted in making beverages which occur in trade as foreign dessert wines.

"(3) Artificial sweetening matters.

"(4) Tartar, tartaric acid, etc., aromatic matters.

"(5) Artificial fruit sirups or essences, even though the use of aromatic and medicinal substances is permitted in making wines which appear on the market in the form of the ordinary root beverages or medicines.

"(6) Cider and fruit wine.

"(7) Gums or other substances by means of which the extractive substance would be increased."

Further it is forbidden to have for sale or to sell wine, to which sugar has been added, so labeled as to give the impression that such addition had not been made. The designations prescribed by the imperial federal council must be given on price lists, wine lists, and other forms of advertisements. The addition of the following to wines, and to beverages resembling wine is forbidden:

Soluble aluminum salts (alum and the like), barium salts, boric acid, glycerin, foxglove, magnesium compounds, salicylic acid, oxalic beginning with the opening of the vintage and ending on January 31st of the following year. During this period wines of earlier vintages may also be treated. The addition of sugar can take place only in the region where the wine is produced. The intention to make use of this permission must be announced to the proper authorities. The addition of sugar to a deteriorated wine to produce a new fermentation requires a special permission of the authorities. Wine growers and wine merchants are required to inform purchasers, if the demand is made, whether the wines in question have received an addition of sugar, and to be thoroughly familiar with the facts in the case. In the labeling of "sugared" wine the character of the grapes used and the year of vintage may be indicated, but it is forbidden to add the name of the wine grower or the region of production.

Geographical designations in the commerce with wines are limited to indicating their origin. The present practice, however, of using such designations for the purpose of distinguishing between similar products of the same region is allowed.

It is totally forbidden to make imitation wines for other than household use, or to import the same. The distinction is drawn between beverages which may replace wine, such as fruit or vegetable juices, malt extracts, etc. (which are permissible), and liquids intended to so closely resemble wine that they may deceptively be sold as such. The imperial council possesses the right to limit the choice of materials from which such beverages may be prepared.

Champagne must be labeled with the name of the land in which the bottles were filled. If the fermentation did not take place in bottles the fact must be indicated on the label. The term "cognac" can be applied only to brandies, the alcohol of which is obtained from grape juice. The land of origin must be placed upon the label.

Each wine grower is required to keep a very complete set of books, showing how much grape juice and how much wine he has produced directly, how much has been purchased from others; the quantity of sugar used and how employed; what liquids similar to wine he has produced or purchased. Dates and names are to accompany all transactions of sale or purchase. Such books must be retained for five years after the last date of entry.

Official experts are to be appointed in each wine district with full powers for inspecting cellars, books, etc. Absolute silence is required in regard to all trade secrets learned during inspection. The execution of the law is entrusted to the various Federal States and their officials. The maximum punishment prescribed is two years' imprisonment and a fine of $4,000.

The whole tenor of the proposed law is in harmony with the dominating principle of the American pure-food law, *i. e.*, the preventing of the sale of wares without full knowledge on the part of the purchaser of just how the food or beverage has been manufactured, and what are its constituents. *U. S. Consular Report*, February 27, 1909.

The second annual Cement Show at the Coliseum, Chicago, February 18 to 24, 1909, was most successful in the number of exhibitors and the variety of exhibits, and the great interest shown by the general public in cement as a structural material. All of the standard makes of cement were represented, as well as the makers of cement machinery. The key-note of the show was the fireproof qualities of cement. Several exhibits of water-proofing processes were to be seen, but there was no great novelty in this direction. One of the most interesting exhibits was that of Robert W. Hunt & Company, engineers of Chicago, of a model testing laboratory. This exhibit contained tensile testing machines of the lever and shot type, a glass top testing table, with a complete layout of apparatus for the various tests made in connection with the inspection of cement. With their operators in white uniforms and with demonstrations of the various tests, together with informal explanations of their methods of handling the work, their exhibit was valuable and interesting to those directly interested as users of cement, and pleasingly enlightening to those not familiar with the service.

It will probably be interesting to our readers to know that their work is done entirely for the users of cement or for those who specify the use of cement. They test under the standard specifications for cement recommended by the American Society of Civil Engineers. These are embodied in a small pamphlet, which, in addition, contains some very valuable comments on the significance of the different tests. Space does not allow our printing this data here but Robert W. Hunt & Co. state that they will be pleased to send same to any of our readers on request to their main office, 1121 The Rookery, Chicago.

Work was resumed in full March 15th at Mills Nos. 3 and 4 of the Alpha Portland Cement Company at Martin's Creek. Mill No. 3 had been shut down since Christmas and Mill No. 4 since February 13th. Operations were resumed at Mill No. 2 at Alpha, N. J., on March 22nd.

OFFICIAL REGULATIONS AND RULINGS.

FOOD INSPECTION DECISION 104.

Amendment to Food Inspection Decisions No. 76 and No. 89, Relating to the use in Foods of Benzoate of Soda.—The Referee Board of Consulting Scientific Experts, composed of Dr. Ira Remsen, Dr. Russell H. Chittenden, Dr. John H. Long, Dr. Alonzo E. Taylor, and Dr. C. A. Herter, have reported upon the use of benzoate of soda in foods. The Board reports, as a result of three extensive and exhaustive investigations, that benzoate of soda mixed with food is not deleterious or poisonous and is not injurious to health. The summary of the report of the Referee Board is published herewith.

It having been determined that benzoate of soda mixed with food is not deleterious or poisonous and is not injurious to health, no objection will be raised under the Food and Drugs Act to the use in food of benzoate of soda, provided that each container or package of such food is plainly labeled to show the presence and amount of benzoate of soda.

Food Inspection Decisions 76 and 89 are amended accordingly.

GEORGE B. CORTELYOU,
Secretary of the Treasury.
JAMES WILSON,
Secretary of Agriculture.
OSCAR S. STRAUS,
Secretary of Commerce and Labor.

THE INFLUENCE OF SODIUM BENZOATE ON THE NUTRITION AND HEALTH OF MAN.

Of the questions referred to this Board[1] the first to engage our attention have been the following:

(1) "Does a food to which there has been added benzoic acid, or any of its salts, contain any added poisonous or other added deleterious ingredient which may render the said food injurious to health? (*a*) In large quantities? (*b*) In small quantities?"

(2) "If benzoic acid or any of its salts be mixed or packed with a food, is the quality or strength of said food thereby reduced, lowered, or injuriously affected? (*a*) In large quantities? (*b*) In small quantities?"

To obtain satisfactory answers to these questions the Board has felt it necessary to carry through a careful investigation of the effect of benzoic acid or some one of its salts on the nutrition and general health of man. A thorough study of the literature giving the results of work done by various investigators on the physiological effects of benzoic acid and its salts, together with a study of reported clinical and medical observations, therapeutic usage, etc., have made it apparent that additional work was needed to render possible a conclusive answer to the above questions.

With a view to limiting the scope of the work, while at the same time meeting all practical requirements, our investigation, with the consent of the Secretary of Agriculture, has been confined to a study of the effect of the sodium salt of benzoic acid, *viz.*, sodium benzoate.

To make this experimental inquiry as thorough as possible, and to minimize the personal equation, three independent investigations have been carried out—one at the medical school of Northwestern University, in Chicago, under the charge of Prof. John H. Long, of that institution; a second at the private laboratory of Prof. Christian A. Herter, of Columbia University, New York City; and the third at the Sheffield Scientific School of Yale University, in charge of Prof. Russell H. Chittenden.

The same general plan of procedure was followed in all three experiments. A certain number of healthy young men were selected as subjects, and during a period of four months these men, under definite conditions of diet, etc., with and without sodium benzoate, were subjected to thorough clinical and medical observation, while the daily food and the excretions were carefully analyzed, and otherwise studied, and comparison made of the clinical, chemical, bacteriological, and other data collected. (For details, see the individual reports.) In this manner material has been brought together which makes possible conclusions regarding the effect of small and large doses of sodium benzoate upon the human system.

In fixing upon the amount of sodium benzoate that should constitute a "small dose," we have adopted 0.3 gram of the salt per day. Manufacturers of food products, which in their view require the use of a preservative, are in general content with 0.1 per cent. of sodium benzoate. This would mean that in the eating of such a preserved food the consumer would need to take 300 grams per day, or nearly two-thirds of a pound of preserved food to ingest an amount of benzoate equal to our minimal daily dosage. Looked at from this point of view, our dosage of 0.3 gram per day seemed a fair amount for a "small dose," one that would clearly suffice to show any effect that small doses of the salt might exert, especially if continued for a considerable length of time. In all these four experiments this daily dosage was continued for a period of about two months. Under "large dose" was included quantities of sodium benzoate

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[1] Dr. Alonzo E. Taylor, Professor in the University of California, a member of this Board, owing to absence in Europe, has not been able to participate in the investigations embodied in this report.

ranging from 0.6 gram to 4 grams per day. Such a daily dosage was continued for a period of one month. In a few instances somewhat larger doses were employed.

As the amount and character of the daily diet exert a well-known influence upon many of the metabolic or nutritive changes of the body, as well as upon the bacterial flora of the intestines, attention is called to the fact that the three investigations differed from each other in the amount of protein food consumed daily, thereby introducing a feature which tends to broaden the conditions under which the experiments were conducted.

The conclusions reached as a result of the individual investigations are given at length in the separate reports herewith presented, together with all of the data upon which these conclusions are based.

The fact should be emphasized that the results obtained from the three separate investigations are in close agreement in all essential features.

The main general conclusions reached by the Referee Board are as follows:

First.—Sodium benzoate in small doses (under 0.5 gram per day) mixed with the food is without deleterious or poisonous action and is not injurious to health.

Second.—Sodium benzoate in large doses (up to 4 grams per day) mixed with the food has not been found to exert any deleterious effect on the general health, nor to act as a poison in the general acceptation of the term. In some directions there were slight modifications in certain physiological processes, the exact significance of which modifications is not known.

Third.—The admixture of sodium benzoate with food in small or large doses has not been found to injuriously affect or impair the quality or nutritive value of such food.

IRA REMSEN, *Chairman,*
RUSSELL H. CHITTENDEN,
JOHN H. LONG,
CHRISTIAN A. HERTER,
Referee Board of Consulting Scientific Experts.

FOOD INSPECTION DECISION 105.

The Labeling of Canned Salmon and White Fish.—Many inquiries have been made of the Department regarding the nomenclature commonly employed in designating canned salmon. It is stated that inferior species of salmon are frequently canned and labeled with some name which is understood by the trade to indicate the presence of fish of an inferior variety but which is not so understood by the consumer; as, for instance, "Alaska Salmon." The Department is informed by the Bureau of Fisheries that the species of salmon in the United States are as follows:

"1. *Oncorhynchus nerka.* Sockeye or sockey salmon, blueback salmon, red salmon, redfish, or nerka salmon.

"2. *Oncorhynchus tschawytscha.* Chinook salmon, king salmon, quinnat salmon, tyee salmon, or spring salmon.

"3. *Oncorhynchus gorbuscha.* Humpback salmon, pink salmon, or gorbuscha salmon.

"4. *Oncorhynchus kitsutch.* Coho salmon, silver salmon, or medium red.

"5. *Oncorhynchus keta.* Calico salmon, keta salmon, dog salmon or chum salmon.

"6. *Salmo gairdneri.* Steelhead salmon, steelhead, hardhead winter salmon, salmon trout, or square-tailed trout.

"7. *Salmo salar.* Atlantic salmon."

Two additional species of landlocked salmon exist in certain New England and Canadian lakes. Neither of these nor the Atlantic salmon is ever canned. Considering this fact, and the further fact that many packers put up humpback and dog salmon under fancy names and thus sell them to consumers who may believe them to be of superior varieties, it is held that canned salmon should be labeled with one of the common names mentioned above as belonging to the species of fish canned.

A similar question has frequently been raised regarding whitefish. A fish designated as *Argyrosomus artedi,* usually called lake herring or cisco, is put on the market at times as "family whitefish." The following is quoted from a communication from the Bureau of Fisheries:

"The whitefish tribe in America has numerous representatives, and at least 12 species are regularly caught for market, and others will doubtless in time acquire economic importance. Those now taken are:

"Common whitefish of Lake Ontario and Lake Erie, *Coregonus albus*; common whitefish of Lake Huron, Lake Michigan, Lake Superior, Lake of the Woods, Lake Winnipeg, etc., *Coregonus clupeiformis*; Rocky Mountain whitefish, *Coregonus williamsoni*; broad whitefish or Alaska whitefish, *Coregonus kennicotti;* Menominee whitefish or round whitefish, *Coregonus quadrilateralis*; Lake herring, or cisco, *Argyrosomus artedi*; jumbo herring, or Erie cisco, *Argyrosomus eriensis*; Huron cisco or herring, *Argyrosomus huronius*; moon-eye, or chub, *Argyrosomus hoyi*; longjaw whitefish, or bloater, *Argyrosomus prognathus*; longjaw, of Lake Superior, *Argyrosomus zenithicus*; blackfin or bluefin whitefish, *Argyrosomus nigripinnis*; tullibee whitefish, *Argyrosomus tullibee.*

"To most of these species the name 'whitefish,' with a qualifying word, is strictly applicable; but there is a wide range in food value, and to permit the sale of most of them as plain 'whitefish' would be unjust to the public. The Bureau does not know that this general question has come before your Board, or that you wish to consider it at this time, but sooner or later it will be necessary to render a decision, and at any time it may be brought to your attention because of cases arising in the Washington (D. C.) market, where one of the commonest and best of the fish food is 'smoked whitefish'—consisting of any one of three or four species of *Coregonus* and *Argyrosomus*, none of them *clupeiformis* or *albus*. Under these circumstances it would appear to this Bureau to be proper and feasible to require the different kinds of preserved whitefish to be designated by their qualifying names. The most appropriate name for 'family whitefish' is lake herring or cisco; but whitefish as here used would mean, or would be intended to mean, the common whitefish, the best of the tribe."

In harmony with the opinion of the Bureau of Fisheries, the Board holds that the term "whitefish" should be applied only to the common whitefishes, *Coregonus albus* and *Coregonus clupeiformis,* unless prefaced by the name of the particular species of whitefish employed. The fishes commonly known to the fisherman and the trade as "lake herring" and "cisco" should be so called, with or without qualifying names, but should not be designated "whitefish."

H. W. Wiley,
F. L. Dunlap,
Geo. P. McCabe,
Board of Food and Drug Inspection.

Approved:
James Wilson,
Secretary of Agriculture,
Washington, D. C., February 17, 1909.

(T. D. 29546) *Adeps lanae.*—Zinkeisen *v.* United States.—U. S. Circuit Court of Appeals, Second Circuit. January 12, 1909. No. 119 (suit 4920).

Adeps Lanae—Medicinal Preparation—Wool Grease

"Adeps lanae anhydrous and adeps lanae cum aqua, which are worth from 10 to 15 cents per pound, are used principally in therapeutics and generally sold to the drug trade, though used to some extent in medicinal soaps and salves, are not 'wool grease' within the meaning of paragraph 279, tariff act of 1897, but 'medicinal preparations' under paragraph 68."

Appeal from the circuit court of the United States for the southern district of New York.

(Decision in favor of the Government.)

The decision below (T. D. 29000) affirmed a decision by the Board of United States General Appraisers, Abstract 15013 (T. D. 28074), which had overruled protests of Zinkeisen & Co. against the assessment of duty by the collector of customs at the port of New York. The article in controversy was invoiced as "adeps lanae anhydrous," "adeps lanae cum aqua," and "wool grease."

Walden & Webster (*Howard T. Walden* of counsel), for the importers.

J. Osgood Nichols, Assistant United States Attorney, for the United States.

Before Lacombe, Coxe, and Noyes, Circuit Judges.

On appeal from a decision of the circuit court for the southern district of New York, which affirmed the decision of the Board of General Appraisers sustaining the action of the collector in assessing the merchandise in controversy as medicinal preparations under paragraph 68 of the tariff act of 1897.

Coxe, *Circuit Judge*: The collector classified the appellants' importations under paragraph 68 of the act of 1897, which reads as follows:

"Medicinal preparations not containing alcohol or in the preparation of which alcohol is not used, not specifically provided for in this Act, twenty-five per centum ad valorem; calomel and other mercurial medicinal preparations, thirty-five per centum ad valorem. (30 Stat., 154)."

The appellants insist that their merchandise should have been assessed as "wool grease" under paragraph 279 of the same act, which is as follows:

"Tallow, three-fourths of one cent per pound; wool grease, including that known commercially as degras or brown wool grease, one-half of one cent per pound. (30 Stat., 172)."

The Board and the circuit court, after a careful review of the facts, reached the conclusion that the merchandise was not wool grease. If not wool grease, the appellants must fail.

In February, 1895, two years prior to the passage of the act in question, the circuit court, in Movius *v.* United States (66 Fed. Rep., 734), had before it a case in all essential particulars similar upon the facts to the case at bar. The paragraph (316) of the act of 1890 was identical in language with the paragraph now in question. The court there described wool grease as follows:

"Wool grease is of a brown color and viscous consistency. It is extracted from wool washings, and consists of cholesterin and other fats and volatile fatty acids. It contains from 15 to 30 per cent. of potash. It emits a rank, disagreeable odor, it resembles molasses and tar mixed together, it is imported in returned petroleum barrels, it is worth from 2½ to 3 cents a pound, and its chief use is for stuffing leather."

The merchandise in question here is a highly finished product, used principally in therapeutics, and is sold generally to the drug trade, but a portion thereof (represented by Sample 3 and 4) is used for medicinal and very high-class soap and for salves, imparting thereto certain curative properties. It is worth from 10 to 15 cents per pound. It is not wool grease chemically, is used for entirely different purposes, and has never been known commercially as wool grease or degras.

We think that the importations are medicinal preparations as that term has been defined by the courts, and that there is no satisfactory testimony that it is possible to use them otherwise. Dodge *v.* United States (130 Fed. Rep., 624; T. D. 25240); Park *v.* United States (66 Fed. Rep., 731).

The case is stronger for the Government than the Movius case, for the reason that the court prior to the passage of the present act had construed "wool grease" to include only the crude raw material and not the refined and expensive products derived therefrom. With this construction presumably in mind, Congress reenacted the paragraph in identical language. This would hardly have been done if Congress had intended that the refined and expensive "lanolin" should enter as wool grease and pay duty at the rate of only one-half of 1 cent per pound.

The decision is affirmed.

(T. D. 29547) *Zinc Ores.*—United States *v.* Brewster.—U. S. Circuit Court of Appeals, Fifth Circuit. January 18, 1909. No. 1811 (suit 1961).

Zinc Ores—Calamine—Crude Minerals—Carbonate, Silicate and Sulphide of Zinc—Lead-Bearing Ores.

"The zinc ores known as carbonate, silicate, and sulphide of zinc are free of duty under the tariff act of 1897, the carbonate and silicate as 'calamine' under paragraph 514, and the sulphide as 'minerals, crude,' under paragraph 614, except that when containing lead the lead contents are subject to the duty provided in paragraph 181 on 'lead-bearing ore of all kinds.'"

Appeal from the circuit court of the United States for the southern district of New York.

(Decision adverse to the Government.)

The decision below (T. D. 29006) affirmed decisions by the Board of United States General Appraisers, Abstracts 14438-9 (T. D. 27937), which, on the authority of *In re* Cockerill Zinc Company, G. A. 6540 (T. D. 27891), reversed the assessment of duty by the collector of customs at the port of Laredo.

The case involves the following paragraphs of the tariff act of 1897:

"PAR. 181. Lead-bearing ore of all kinds, one and one-half cents per pound on the lead contained therein. * * *

"PAR. 183. Metallic mineral substances in a crude state, and metals unwrought, not specially provided for in this Act, twenty per centum ad valorem. * * *

"PAR. 514. Calamine. (Free).

"PAR. 614. Minerals, crude, or not advanced in value or condition by refining or grinding, or by process of manufacture, not specially provided for in this Act. (Free)."

The character of the materials in controversy is stated as follows in the Government's brief:

"The imported ores, broadly described, were:

"(*a*) Concentrated sulphides containing 28 per cent. zinc and 2 per cent. lead.

"(*b*) Carbonates crushed and hand-picked, containing 28 per cent. zinc and 7 per cent. lead.

"(*c*) Carbonates and silicates combined, crushed and hand-picked (21 to 35 per cent. carbonate, 2 to 26 per cent. silicate), in some less than 1 per cent. of lead, and in others no lead."

In some instances duty was assessed under said paragraph 183, tariff act of 1897; in other instances duty was assessed on the lead contents under said paragraph 181, and on the zinc contents under paragraph 183; and in one case duty was assessed only on the lead contents.

The Board of General Appraisers held, as claimed by the importer, that the merchandise was free of duty, the carbonates and silicates under paragraph 514, as "calamine," and the sulphides under paragraph 614, as "minerals, crude." This conclusion was affirmed by the circuit court.

Lodowick McDaniel and *Rufus E. Foster*, United States attorneys (*James C. McReynolds*, special assistant to the Attorney-General, of counsel; *Charles E. McNabb* on the brief), for the United States.

Baker, Botts, Parker & Garwood (*W. Wickham Smith* of counsel; *Henry S. Wardner* and *Howard T. Walden* on the brief), for the importer.

Before PARDEE, MCCORMICK, and SHELBY, Circuit Judges.

PER CURIAM: Under the facts in this case it is not necessary to decide whether the provision for lead-bearing ores in paragraph 181, tariff act of 1897, is exclusive. On the merits the Board of General Appraisers and the circuit court ruled correctly.

The judgment of the circuit court is affirmed.

(T. D. 29552). Drawback on pig iron manufactured from iron ore, and steel billets, blooms, ingots, bars, structural material, guns, machinery, etc., manufactured from pig iron produced from imported iron ore and imported ferromanganese and ferrosilicon by the Bethlehem Steel Company, of Bethlehem, Pa.—T. D. 29365 of November 25, 1908, revoked.

TREASURY DEPARTMENT, *February 10, 1909.*

SIR: On the exportation of pig iron manufactured from imported iron ore, and steel ingots, blooms, billets, bars, rails, plates, structural material, castings, forgings, guns, gun mountings, projectiles, or machinery manufactured from pig iron produced from imported iron ore and imported ferromanganese and ferrosilicon by the Bethlehem Steel Company, of South Bethlehem, Pa., by the basic open-hearth process, a drawback will be allowed equal in amount to the duty paid on the imported materials consumed, less the legal deduction of 1 per cent.

The peliminary entry must show the marks and numbers of the shipping packages and the quantity and weight of each kind of product contained in each package and in the entire shipment.

The drawback entry shall show the quantity of each kind of exported article or material and the quantity of imported iron ore used in the manufacure thereof on which drawback is claimed. There shall be filed with each entry and made a part thereof a sworn abstract from the special manufacturing record hereinafter provided for. Said entry must further show, in addition to the usual averments, that the exported products were manufactured of the material and in the manner set forth in the manufacturers' sworn statement, dated December, 2, 1908, transmitted herewith for filing in your office.

A special manufacturing record shall be kept showing the quantity of pig iron manufactured, the quantity of imported ore used in the manufacture thereof, the analysis of and weight of metallic iron contained in each kind of ore used, the total quantity of metallic iron contained in the ores used and the average analysis thereof, the quantities of steel products manufactured, the quantities of pig iron produced from imported iron ore used in the manufacture thereof, and the quantities of imported ferromanganese and ferrosilicon used.

In liquidation, the quantity of imported iron ore which may be taken as the basis for allowance of drawback may equal that shown in the entry and abstract of the manufacturing record, after official verification of exported quantities, provided it shall not exceed 1.8 tons of imported ore for each ton of pig iron exported or used in the manufacture of steel products. The maximum quantity of pig iron produced from imported ore which may be taken as the basis for allowance of drawback on the steel products shall not exceed 1.0595 tons for each ton of steel products. The figures stated above are based on ore having the average metallic contents of 55.55 per cent. If the metallic contents of the ore is in excess of this percentage, the quantity of ore allowed for each ton of pig iron would be reduced accordingly.

The quantities of imported ferromanganese and ferrosilicon allowed for each ton of steel products exported shall not exceed 0.0082 of a ton of ferromanganese and 0.004 of a ton of ferrosilicon.

T. D. 29365 of November 25, 1908, providing for the allowance of drawback on steel products manufactured by the Bethlehem Steel Company, is hereby revoked.

Respectfully,
JAMES B. REYNOLDS,
Assistant Secretary.

(58807).
Collector of Customs, Philadelphia, Pa.

(T. D. 1463). *Denatured Alcohol.*—Authorizing Formula 1 for use in the cleansing of filled gelatin capsules.

TREASURY DEPARTMENT,
OFFICE OF COMMISSIONER OF INTERNAL REVENUE,
Washington, D. C., February 16, 1909.

SIR: You are informed that Formula 1 (to 100 gallons of alcohol add 5 gallons of approved wood alcohol) is hereby authorized for use in the cleansing of filled gelatin capsules.

You will please inform ———, Brooklyn, N. Y., of this authorization, in compliance with their application of the 6th instant.

Respectfully,
JOHN G. CAPERS,
Commissioner.

Mr. E. B. JORDAN, *Collector First District*, Brooklyn, N. Y.

(T. D. 29563).—*Zinc Ores—Calamine.*—Decision of the United States circuit court of appeals, fifth circuit (suit 1961), United States *v.* Brewster (T. D. 29547), acquiesced in

TREASURY DEPARTMENT, *February 20, 1909.*

SIR: The Department is in receipt of a letter from the Attorney-General, in which he states that no steps will be taken looking to a review of the decision of the United States circuit court of appeals for the fifth circuit in suit 1961, United States *v.* Brewster (T. D. 29547), involving the classification of zinc ore known as carbonate, silicate, and sulphide of zinc.

The carbonates and sulphides were assessed with duty under paragraph 183 of the tariff act as crude metallic mineral substances, and the court affirms the decision of the Board and circuit court that the carbonates are free of duty under paragraph 514 as "calamine" and the sulphides are free of duty as minerals crude under paragraph 14.

You are therefore, hereby authorized to forward a certified statement for the refund of the duties collected in excess in this case.

While the circuit court of appeals affirms the decision of the Board and circuit court that the ores are free of duty, it sustained your assessment of duty under paragraph 181 upon the lead contents without regard to the percentage of lead contained therein, and you are hereby instructed to assess duty upon the actual lead contents in future importations of such ores.

Respectfully,
JAMES B. REYNOLDS,
(23706). *Assistant Secretary.*

Collector of Customs, Corpus Christi, Tex.

(T. D. 29601).—*Chemical Flasks.*—EIMER *v.* UNITED STATES.—U. S. circuit court of appeals, second circuit. February 16, 1909. No. 138 (suit 4963).

1. CHEMICAL FLASKS—BLOWN GLASSWARE—"BOTTLES."

"Thin blown-glass flasks designed for use in chemical laboratories are dutiable under paragraph 100, tariff act of 1897, as 'blown glassware,' rather than under paragraph 99 as 'bottles.'

2. STATUTORY CONSTRUCTION—HISTORY OF LEGISLATION.

"The bottle paragraph (No. 88) of the tariff act of 1894 contained a provision for 'bottle glassware' which was held to cover bottle-shaped receptacles, such as blown-glass chemical flasks, but which was omitted from the tariff act of 1897, while a provision (par. 100) for 'blown glassware' was inserted in the latter act. *Held* that it was intended that blown-glass flasks should no longer be grouped with bottles, but should be included in the larger group of 'blown glassware.'"

APPEAL from the circuit court of the United States for the southern district of New York.

(Decision in favor of the Government.)

The decision below (T. D. 29162) affirmed, without written opinion, a decision by the Board of United States General Appraisers, Abstract 15582 (T. D. 28223), which had affirmed the assessment of duty by the collector of customs at the port of New York on importations of Eimer & Amend.

Walden & Webster (*Henry J. Webster* of counsel), for the importers.

D. Frank Lloyd, Assistant United States Attorney, for the United States.

Before LACOMBE, COXE, and WARD, Circuit Judges.

This cause comes here upon appeal from a decision of the circuit court, southern district of New York, affirming a decision of the Board of General Appraisers which sustained the action of the collector in classifying for duty certain importations under the tariff act of 1897.

LACOMBE, *Circuit Judge:* The articles imported are chemical glassware, consisting of thin blown-glass vessels, such as Joliet's flasks, CO_2 flasks, etc., designed for use in chemical laboratories. The collector classified them for duty under

"PAR. 100. Glass bottles, decanters, or other vessels or articles of glass, cut, engraved, painted, colored, stained, silvered, gilded, etched, frosted, printed in any manner or otherwise ornamented, decorated, or ground (except such grinding as is necessary for fitting stoppers), and any articles of which such glass is the component material of chief value, and porcelain, opal and other blown glassware; all of the foregoing, filled or unfilled, and whether their contents be dutiable or free, sixty per centum ad valorem."

The importer contends that they should be classified under

"PAR. 99. Plain green or colored, molded or pressed, and flint, lime, or lead glass bottles, vials, jars and covered or uncovered demijohns and carboys, any of the foregoing, filled or unfilled, not otherwise specifically provided for, and whether their contents be dutiable or free (except such as contain merchandise subject to an ad valorem rate of duty, or to a rate of duty based in whole or in part upon the value thereof, which shall be dutiable at the rate applicable to their contents) shall pay duty as follows: If holding more than one pint, one cent per pound; if holding not more than one pint, and not less than one-fourth of a pint, one and one-half cents per pound; if holding less than one-fourth of a pint, fifty cents per gross: *Provided*, That none of the above articles shall pay a less rate of duty than forty per centum ad valorem."

The articles are in fact blown glassware. The importers put in some evidence, which is vague and unpersuasive, to the effect that they were blown in a mold. We do not decide this case, however, on any insufficiency of proof; if it were conclusively shown that each one of these variously shaped flasks had been blown in a mold, it would not follow that they were "bottles, vials, jars, demijohns or carboys" and thus entitled to classification under paragraph 99. The word "bottle" has a tariff meaning which does not include these articles. "Chemical glassware" was provided for *eo nomine* in the tariff act of 1883, paragraph 143, and in the tariff act of 1890, paragraph 107. In the act of 1894 there was no provision for chemical glassware, but paragraph 88 provided not only for glass bottles, but also for "molded or pressed green and colored and flint or lime *bottle glassware.*" This last phrase is descriptive of the articles in question; they were held dutiable under that paragraph in Eimer *v.* United States (99 Fed. Rep., 423), where the court said:

"The expression, 'bottle glassware,' is broader than glass bottles and seems to cover something different from mere bottles used as containers. These bottle-shaped receptacles come within that description and seem to be included by it."

In the act of 1894 there was no provision for blown glassware. In the present act "blown glassware" is included in paragraph 100, and the "molded * * * bottle glassware" of 1894 is omitted from the new section 99. It would seem to be the natural conclusion that Congress intended that these articles should no longer be grouped with "bottles," but should be included in the larger group, "other blown glassware."

The decision is affirmed.

(T. D. 29614–G. A. 6880). *Microscope Slides with Specimens.*—Microscope slides of glass, containing specimens that are of greater value than the glass, are not dutiable under paragraph 100, tariff act of 1897, relating to articles of glass, ground, etc., but under Section 6 as unenumerated manufactured articles.—G. A. 1394 (T. D. 12798) followed.

United States General Appraisers, New York, March 9, 1909.

In the matter of protests 312302, etc., of American Express Company against the assessment of duty by the collector of customs at the port of Boston.

Before Board 1 (SHARRETTS, MCCLELLAND, and CHAMBERLAIN, General Appraisers; MCCLELLAND, G. A., absent).

SHARRETTS, *General Appraiser:* The merchandise in question is microscope slides composed of strips of glass 3 inches in length by 1 inch in width, with beveled edges and with a slight concavity in the center of each piece, in which concavity a microscopical subject—in the present case either physiological, botanical, or zoological—is mounted, a thin, flat, circular piece of glass being cemented to the edges of the concavity in the strip of glass to preserve the specimen enclosed therein. Duty was assessed on the disputed articles at the rate of 60 per cent. ad valorem under paragraph 100, tariff act of 1897, the importers alternatively claiming the same to be properly dutiable at the rate of 20 per cent. ad valorem as unenumerated manufactured articles under Section 6.

In G. A. 5794 (T. D. 25598) this Board held that pieces of crown glass identical with those used in the fabrication of the slides here in question were dutiable at 60 per cent. ad valorem under paragraph 100 as articles of glass ground. But in the case at bar the merchandise is not merely strips of ground glass. By reason of the fact that the specimens for microscopic investigation have to be prepared and mounted with consummate skill by scientific men the value of the microscopic slides is approximately eighteen times greater than that of the mere ground glass strips, and we so find.

An issue absolutely identical with that now before us was passed upon by the Board in G. A. 1394 (T. D. 12798), wherein it was held that the specimen was the essential feature of the article and that the glass was merely incidental to the display and protection thereof.

Based on our finding and following G. A. 1394 (*supra*), we sustain the protests and reverse the decision of the collector in each case.

(T. D. 29617–G. A. 6883). *Zinc Ores.*—Zinc ores—Calamine—Crude minerals—Lead-bearing ores. The zinc ores in the form of carbonates, silicocarbonates, and sulphides or concentrates are free of duty under paragraphs 514 (calamine) and 614 (crude minerals), tariff act of 1897, except that when containing lead, the lead content is subject to duty under paragraph 181.—United States *v.* Brewster (T. D. 29547) followed.

United States General Appraisers, New York, March 9, 1909.

In the matter of protests 221325, etc., of Prime Western Spelter Company against the assessment of duty by the surveyor of customs at the port of Kansas City.

Before Board 2 (FISCHER, HOWELL, and DE VRIES, General Appraisers).

FISCHER, *General Appraiser:* These protests are against the assessment of duty on certain zinc ores imported from Mexico. The ores are in the form of (1) carbonates or silicocarbonates and (2) sulphides or concentrates. The importers concede that if lead is present in these ores the importations should pay duty on the lead content at 1.5 cents per pound under paragraph 181, tariff act of 1897. They contest, however, the assessment of a 20 per cent. duty on the value of the zinc content, claiming that it is error to classify said ores as "metallic mineral substances in a crude state" under paragraph 183 of said act. The carbonates of zinc are claimed free under paragraph 514 as "calamine," or under paragraph 614 as crude minerals not otherwise specially provided for. The sulphides, ores known as zinc-blende, are claimed free of duty under paragraph 614.

These ores of zinc are in a crude state. The carbonates have been crushed and hand-picked; the sulphides have been subjected to a crude process of concentration. The object of such processes is to discard useless and foreign matter from the ore. To concentrate, as that term is used in mining, is to "separate (ore or metal) from its containing rock or earth." What the Government endeavored to prove in these cases may be briefly summarized as follows: That the ores, having been either crushed and hand-picked, or concentrated, are excluded by reason thereof from the provisions of paragraph 614, having been advanced in value or condition by refining or grinding, or by other process of manufacture; that the provision for metallic mineral substances covers the said ores, and that the merchandise should be classified under paragraph 183 rather than under paragraph 614, because the provision in the former paragraph is more specific than the latter; and that paragraph 514, which provides for the free entry of "calamine," applies only to the hydrous silicate of zinc, and does not embrace ores in the form of carbonates or silicocarbonates of zinc.

The issues thus raised were passed upon by the Board in G. A. 6540 (T. D. 27891). The testimony in that case was voluminous and exhaustive. The Board held that the construction given to the phrase "metallic mineral substances" in the case of Hempstead *v.* Thomas (122 Fed. Rep., 538) precluded the application of that provision to zinc ores in which the zinc did not appear as a free metal;

that the removal of foreign matter from the ore did not operate so as to take such ore out of paragraph 614; and that the term "calamine" included both carbonates and silicates of zinc, and was not to be confined to the hydrous silicate of zinc. The last clause in that decision of the Board may be here cited:

"Our conclusion is that the carbonates and silicates of zinc are included within the meaning of the term calamine as used in paragraph 514, and that they are free of duty under said paragraph and also under paragraph 614, and that the sulphide of zinc is free under the paragraph last named as crude minerals, etc., subject, however, to the qualification that when lead is found in these ores duty shall be taken on the amount of lead contained therein as described in paragraph 181."

Rulings of the Board, following G. A. 6540 (*supra*), on precisely similar ores, were appealed by the Government, with the result that the Board was affirmed in the case of United States *v.* Brewster (T. D. 29547, affirming T. D. 29006). The Treasury Department has announced its acquiescence (T. D. 29563), and, in accordance with these authorities, we sustain the claim in these protests that the zinc ores are free of duty under paragraph 514 or 614 of the tariff. The surveyor's assessments are modified to conform herewith; and in his reliquidation of these entries, where the lead content has been determined by a wet assay, it is proper to allow 1.5 units to find the fire assay, upon which the lead duty should be predicated.

(T. D. 1468). *Violations of the Oleomargarine Law—Hartman and Hartman v. United States.*—The decision of the United States circuit court finding the defendants guilty and imposing a fine of $1,000 and sentence of imprisonment for six months affirmed. The evidence showed that plaintiffs were engaged in the business of manufacturing oleomargarine by mixing with the white tax-paid oleomargarine a coloring material, which gave the product the yellow shade of butter, for the purpose of selling or disposing of the same to other persons than those of their own family tables, and that they had packed this colored product in packages which had contained colored oleomargarine tax paid and had been emptied without destroying the stamps upon the empty packages. The evidence resulting from a search of the premises is competent, although the search warrant was irregular and illegal.

TREASURY DEPARTMENT,
OFFICE OF COMMISSIONER OF INTERNAL REVENUE,
Washington, D. C., March 2, 1909.

The appended decision of the United States circuit court of appeals for the sixth circuit in the case of Hartman and Hartman *v.* United States is published for the information of internal-revenue officers and others concerned.

JOHN G. CAPERS, *Commissioner.*

(T. D. 1469). *Denatured Alcohol.*—Authorizing formula for special denaturant for use in the manufacture of fulminate of mercury.

TREASURY DEPARTMENT,
OFFICE OF COMMISSIONER OF INTERNAL REVENUE,
Washington, D. C., March 5, 1909.

SIR: This office is in receipt of application, Form 581, and bond, Form 582, of the ——— of your district, for specially denatured alcohol to be used in the manufacture of fulminate of mercury, and the same are hereby approved.

The application of ——— for permission to use the following formula—to 100 gallons of ethyl alcohol add one-half gallon of pyridin bases—is approved, and its use in the manufacture of fulminate of mercury is hereby authorized. This formula will be listed as No. 6 *b*, and its use will be restricted to factories operating in connection with either a distillery or central denaturing bonded warehouse.

Respectfully,
JOHN G. CAPERS,
Commissioner.

Mr. H. C. H. HEROLD,
Collector Fifth District, Newark, N. J.

(T. D. 29394). Nov. 28, 1908.—Decision in favor of the government. Cocoa-butterine-cocoanut oil, manufactured. A cocoanut oil which has been subjected to a process of manufacture and is sold to confectioners and bakers is held dutiable under paragraph 282, tariff act of 1897, as "cocoa-butterine" rather than under paragraph 626 as cocoanut oil.

(T. D. 29404). Dec. 12, 1908.—Drawback on incandescent gas mantels manufactured by the Solar Light Company, of New York City, with the use of imported thorium nitrate. T. D. 27043 of January 27, 1906, extended.

(T. D. 29431). Nov. 28, 1908. Decision partly adverse to the Government.

1. Orchil extract—Persian-berry extract—unenumerated articles—drugs. Orchil and Persian-berry extracts are not "drugs" within the meaning of paragraph 20, tariff act of 1897, but are dutiable as unenumerated manufactured articles under Section 6.

2. Orchil—orchil extract. Orchil extract is a manufactured article, and is therefore excluded from the provision in paragraph 628, tariff act of 1897, for "orchil, or orchil liquid."

(T. D. 1444). Dec. 16, 1908. Malt extracts, held out to be medicinal in character, may be shipped under trade name without violation of Section 3449, Revised Statutes.

(T. D. 29342.) Dec. 21, 1908. Distilled spirits not exported in good faith not entitled on return to United States to entry under Section 2500, Revised Statutes, nor to warehousing privileges.

(T. D. 29436—G. A. 6842). Dec. 23, 1908. A watermark in the form of a firm's name, business and address does not constitute a decoration, and writing paper so marked is not subject to the additional duty provided in paragraph 401, tariff act of 1897, for "writing * * * paper, * * * decorated in any manner."