The stock of the Foundation is limited to 6 per cent dividends so that it can never be a profit-making company, and it is non-transferable without consent of the company, so that control may not be purchasable. The preferred stock is to be retired as soon as possible, and the common, which alone votes, is to be placed in a voting trust for 17 years, the trustees being Messrs. Otto T. Bannard, George L. Ingraham, Cleveland H. Dodge, B. Howell Griswold, Jr., and Ralph Stone. The officers and directors are: *President*: Mr. Garvan; *Vice President*: Col. Douglas I. McKay; *Secretary*: Mr. George J. Corbett. Mr. Ramsay Hoguet is its patent counsel, and I am its ordinary legal adviser. The Foundation is thus assured, for a long period, of absolutely impartial control; and since no one is to be allowed to buy more than a share or two of the voting stock, the impartiality should continue.

The charter provides that after the redemption of the preferred stock the income of the Foundation shall be used for research and the advancement of science; and on this line we see infinite possibilities of service. If, as we hope, its income is large, it can stimulate invention by buying new discoveries, can co-ordinate research by bringing together academic, governmental, and industrial laboratories, and can collect and render accessible information as to laboratory facilities now nowhere available. It can, we hope, license the use of German trade-marks and trade names and insist on the quality of the goods on which the marks are to be used. It can take over copyrights and use them to make more accessible the best of scientific literature. By reason of its unique combination of industrial connections and impartial control it lends itself to a hundred different public services for which no other organization is adapted.

The Custodian's study of German methods has thus led to what seems an important constructive work. It stands to-day as the sole defense of our new dye industry against the onslaught that will fall upon us on the signing of peace. It is a partial and imperfect defense only. The patents cover but a fraction—though the most important fraction—of the dyes the country needs. Unless Congress awakes to the fact that nothing but a license plan like the British can stop the flood, the defense may be utterly submerged.

On this question I must differ with Mr. Culbertson. A tariff alone will be no defense against the German attempt to secure its world trade. In order to get back their market they will undersell, even with a tariff of 100 per cent, thereby destroy domestic competition, and then jump their prices, even as they have been known to do in the past, and thus recoup whatever the fight may cost them.

The Chemical Foundation and tariff provisions will help, but are they to be the only protection? Do you suppose the Germans are doing nothing at this time? Do you suppose they will quietly submit to the loss of their trade, without an effort to recover it? The best information which the Property Custodian's office can secure reports large stocks accumulated in Germany, both of intermediates and finished dyes. Both the Foundation and the tariff will do something, but we cannot save the industry without more protection than either or both will provide. I state this not alone as my own opinion, nor as that of the A. P. C. Office, but as an opinion shared by those whose interests might be adversely affected. When the man on the outside of a protective wall approves its erection there is something in it. I have never heard of a case where the man who buys goods affected by a protective measure and whose costs will necessarily be increased by the measure has come to advocate that measure except when that measure was demonstrably and certainly right. Now in this case our judgment is fortified by that of the dye-consuming industry. I have addressed meetings in Boston, Providence, New York, and Philadelphia, and as a result a cable has been sent to the President, signed by 95 of the most important firms in the country, the men who

must buy the dyes, and who will have to pay more if the license plan comes into effect, and who will suffer if they cannot get all the goods they want. It is the most remarkable example of patriotism in commerce I have seen.

March 25, 1919

To the President of the United States:

The undersigned, representing various branches of the textile industry, respectfully submit that in their opinion an independent, self-sustaining, American dye manufacturing industry is a national necessity; that such a dye industry cannot be established unless competition from German factories, including those in occupied territory, be cut off for a period of years; that no tariff will furnish protection against the enormous resources and unscrupulous methods of the German trust fighting to regain its foreign market; and that only a licensing plan like the British, excluding all foreign dyes reasonably obtainable in the United States, will save the new industry. We respectfully urge that immediate steps be taken to procure both in the peace treaty and in legislation the measures necessary to establish such a plan.

We advocate this not merely because a domestic dye industry is essential to the independence of the American textile industry and manufacture generally, but chiefly because we believe that only through an established dye industry can the nation secure the progress in chemical education, in the application of chemistry to the arts, and above all in curative medicine, which are indispensable to the national welfare.

That, gentlemen, is what the dye-consuming industries think of it, the manufacturers of textiles, woollens, cottons, silks, hats, inks, leather, printing, in fact every dye-using industry. This is the way they have put themselves on record. When they say that this measure is right, I believe it. If you want to save this industry the way to do it is to get at your congressman, and whisper your views in his ear. Put it as strongly as you can, and you will get such legislation.

In conclusion, it is clear that great progress has been made in the development of this industry, which truly represents a national necessity. American manufacture is free in almost the whole dye field, and is already on its way to fill our every want. With all the forces now at work in its defense, it will—it must—be saved. German methods will never again be allowed to do to the American chemical industry those things which they have done in the past.

THE AMERICAN SPIRIT IN CHEMISTRY

By EDGAR F. SMITH

Provost, University of Pennsylvania, Philadelphia, Pa.

Sitting daily within arm's reach of a little, priceless chemical balance, brought in 1794 by Joseph Priestley to this country; surrounded by pictures, ancient volumes, prints, and letters, sear and yellow—all reminders of Joseph Priestley, whose great-great-grandson, also Joseph Priestley, it is my privilege to-day to instruct in the ways of the chemist, it is to be wondered that interest in the man who revealed oxygen to us should have caused me to seek further knowledge regarding the influence he exerted upon those about him? His radicalism, his inborn dissenting spirit, led him, against all good advice, to project himself into that cauldron of seething national politics which reigned in the last decade of the eighteenth century in America, until sharply rapped on the knuckles by those in high places, with broad hints that Americans be permitted to conduct their own government and be let live and move, undisturbed by unnaturalized sojourners—then Joseph Priestley turned to our science, but began by tantalizing its professed followers with a re-statement of his remarkable ideas on phlogiston, the intangible. We may rejoice that it was America's good fortune to have this crude theory held aloft and talked about and written about almost incessantly for a period of years. It was the old European struggle or controversy transported to America and here it was—here on American soil—that it was settled for all time. But of this interesting fact, many, yes, too many, American chemists were never aware. He who speaks to you

FIG. 1—SECTION OF THE FURNACE, SUPPORTING A SAND BATH

The ash pit may be separated from the place where the fuel is lodged, according to the fancy of the manufacturer. The fuel may be either wood, charcoal, or pit coal

FIG. 2—GLASS VESSEL

FIG. 3—IRON PAN, CONTAINING ONE OF THE VESSELS

were achieved in the very dawn of the life of the Republic. And, as lovers of our country, is it not due the rising and future generations that these facts should be spread before them? If we would be true to our science and true to our country we *must* do this, remembering that

"From the old soil doth thy new corn grow."

When, in the seventeen-nineties, Joseph Priestley threw down the gauntlet of "Phlogiston Established" it was not men of 40, 50, or 60 years of age who were arrested in their thought. No, they continued in their customary way of presenting chemistry as they had learned it; but it was the young men, men in their twenties, and boys—yes, boys in their teens—who, alert, inquisitive, bubbling over with energy, full of initiative, proceeded to test out the aged champion's thought, and in time utterly routed him. The honor of this signal victory falls in large measure upon one of whom I have written more fully elsewhere, but for a brief space I am constrained to ask your indulgence for a few words more about James Woodhouse, then 24 years of age. Why have no chemical texts told of him and of his wonderfully good fortune in overcoming Priestley? Why has no mention ever been made of his isolation of potassium and his explanation of the rôle plants play in their imbibition of carbon dioxide? Why have we been—may I say it?—ignorant of his presence? And further, that one of the most striking features of his career was his ceaseless efforts to utilize chemistry for the benefit of his country and its people. Witness in this connection his suggestions, the result of experiment, and not of speculation, relative to breadmaking, beginning with the study of the flour, then the raising of the bread, and finally its actual baking. The yeast introduced into it came under his survey, and as one reads one is reminded of similar, more far-reaching studies in breadmaking, carried on at the Mellon Institute. Visiting there not long ago, my thoughts turned back to Woodhouse and, in silence, I pronounced him a pioneer in the chemistry of the bakery!

Upon another occasion after remarking that there were not more than eight persons in the United States capable of refining crude camphor, he proceeded to describe how this might

was born and grew up in this country, received his training here, and studied in a distant land, returned, and taught our science, but, through it all, was as ignorant as a new-born babe concerning the consequences of Joseph Priestley's advent in the young Republic. There seem to have been others who were no wiser than he on this particular subject. At least, association with colleagues through many years has demonstrated that they, like he, were pretty certain that chemistry had no past in this country, that if its beginnings here were placed in the eighteen-fifties, the announcement might go unchallenged, but just what the character of chemistry was at that period was in doubt. However, here in America, great things in chemistry

easily be performed in a very simple contrivance consisting of a furnace supporting a sand bath, glass vessels, and iron, copper, or earthen pans (Figs. 1, 2, 3).

His description of the furnace ran thus:

A furnace sufficiently large for one active and industrious man to attend, will occupy the space of eight feet nine inches in length, and two feet six inches in breadth. It must be made of seven cast iron plates, half an inch thick, thirty inches long and fifteen broad. These plates are to be placed upon eight piles of bricks, parallel to each other, and nine inches apart. The bricks are to be ten inches high, thirty long, and six broad. Great care must be taken, that the lower sides of the plates meet each other exactly midway on the upper side of the bricks, which should be well covered, with a thick bed of mortar. Bricks serve to confine the sand. When the furnace is connected with a wall, there is no occasion for more than a single row of them: and to obtain a considerable draught of air, a chimney should be carried from the fourth plate, with an aperture four inches in diameter, and the flues of the third and fifth plate may communicate with this chimney. Two separate flues may be carried from the second and sixth plates, and the first and seventh should enter the second and sixth.

The chimney, if convenient, may be made to enter into that of the house, but if not, it should be about fifteen feet high.

The glass vessels are procured at a glasshouse, and are made of green glass. They should be blown as thin as an oil flask. They are of circular form, shaped flat like a turnip, and have a neck from one to three inches high, with an aperture from half an inch to one inch in diameter. Their bottoms should be eleven inches broad, and the top ought to be four inches from the bottom.

They cost twenty-five dollars a hundred in Philadelphia.

Fourteen pans may be made of iron, copper or earth. Sheet iron is the best material. They should be round, one foot in diameter, with a rim pecked on four and a half inches high, and ought to have two small handles. They cost one dollar apiece in this city (Philadelphia).

Having prepared this necessary apparatus, the next thing is to make use of it in such a manner as to refine the camphor.

FIG. 4—HARE'S ELECTRIC FURNACE

Having taken the article out of the tubs, the glass vessels are to be filled two-thirds full of it, and the apertures in the necks, slightly stopped, with paper or cotton plugs. They are then to be placed on the bottom of the pans, and covered near to the base of their necks with sand.

The pans, holding the vessels containing the camphor, are to be carried to the sand bath, and surrounded near to the top of the rim with sand.

A gentle fire is to be kindled in the furnace, at four o'clock in the morning, and gradually increased until the camphor melts, which it does when it arrives at 304° of Fahrenheit's thermometer. It will first rise in flowers, which will dissolve,

and run down the sides of the vessel. When it has melted, or is boiling, the glass is to be elevated in such a manner that the hot sand may reach only to the middle of its belly, in order that the cool air may be admitted to the upper surface of the glass, to congeal the camphor as it sublimes.

Having kept it in a liquid or boiling state, from eight to ten hours, the refined camphor will be found adhering to the upper side of the vessel, and is to be taken from it by breaking the glass while hot, or it may be kept until cool and then broken. The glass is easily separated from it, by means of a knife.

The foul parts which adhere to the bottom of the glass, and which cannot be easily parted from it, are to be broken into pieces, and sublimed a second time, with an additional supply of camphor.

When the crude camphor is of a white color, or contains little foreign matter, no addition is to be made to it; but when it is brown or black, one ounce of slacked or quick lime, is to be mixed with every three or four pounds of it. The utility of lime in this operation is noticed by Margraff.

One man can refine and pack up from eighteen to twenty-five pounds every day.

If any of the glass vessels holding the melted camphor should crack, which sometimes happens, and which is discovered, by the flowers rising into the air from their sides and tops, the pans containing it are to be immediately removed to a cool place; and if the camphor is found mixed with the sand, the whole is to be put into other vessels, and the operation conducted as before.

The loss in refining one hundred weight of this article cannot be accurately ascertained, as it depends upon the purity of the crude material, and the care in conducting the process. It cannot be very great.

Perhaps the greatest discovery made by Woodhouse was Robert Hare. Of him also I have made abundant mention elsewhere and introduce his name now merely to emphasize one or two contributions which relate to operations at present in process not many miles from here—over at Niagara Falls.

FIG. 5—HARE'S ELECTROLYSIS APPARATUS, USING MERCURY CATHODE

There the electric furnace is well known. Everybody in the vicinity is familiar with it. There, too, caustic is produced from common salt using a mercury cathode. With no idea of disturbing the calm equanimity of those who are intimately concerned with these applications in the science of chemistry, I make bold to assert, for the purpose of historical accuracy, that the first electric furnace ever built was constructed by Robert Hare. Look well at the slide before you (Fig. 4), for in the device it represents, charcoal was converted into graphite—artificial graphite—and, in the hands of Robert Hare, that graphite wrote the characters of a note to his devoted friend Silliman, announcing the wonderful transformation. In the same ap-

paratus calcium metal was obtained from its cyanide. But prior to all this Hare had used mercury as cathode in the electrolysis of a concentrated aqueous solution of calcium chloride, obtaining a calcium amalgam which, upon subsequent distillation, gave as residue, calcium (Fig. 5).

FIG. 6—OXY-HYDROGEN BLOWPIPE INVENTED BY HARE AND ATTACHED DEVICE TO PRODUCE THE OXY-HYDROGEN FLAME

These things were done nearly 70 years before present-day chemists—chemists of our generation—rediscovered them. Dr. Bancroft has well said:

Hare was in many respects the precursor of Moissan, though a much more brilliant man than the latter. Hare was born too early. * * * *. If we call Moissan the Christopher Columbus of the electric furnace, we must call Hare the Leif Ericsson of the same.

How many reasons could each one of us advance for the fact that Hare's observations had to be remade? In my study I have quietly gathered many, and yet there clings to me the thought that these discoveries should have been widely known and been followed up, but perhaps the world was not ready for their consequences.

To this same Robert Hare the world is indebted for the oxy-hydrogen flame and all its recent modifications—the oxy-acetylene torch, etc.

What must have been Hare's feelings when, at but 20 years of age, he had the honor of standing in the presence of Joseph Priestley and demonstrating to him the wonderful dynamics of the oxy-hydrogen flame, when platinum and the most refractory substances were melted and flowed like water? All this was done on American soil by a native American. You will pardon me if once again I let the slide before you exhibit the primitive contrivance, the compound blowpipe, the oxy-hydrogen blowpipe invented by Hare, and the attached device to produce the oxy-hydrogen flame. It marked an epoch in chemical and philosophical thought in our country (Fig. 6).

Woodhouse and Hare have become chemical heroes with me. I have many of their printed contributions and as I have studied these, I have really marveled at their contents. These two men were American-trained. Neither cared for foreign lands. This in a measure explains the fact that comparatively little is known of their work. Hare in particular was a pamphleteer, until his friend Silliman began, in 1818, the publication of the *Journal of Science and Arts*.

If it be theory in which we delight, what can be more refreshing than to studiously peruse Hare's thought on double halides, e. g., K_2PtCl_6 ? While thus engaged it must not be forgotten that his opponent was no less a distinguished personage than John Jacob Berzelius. The latter would express this salt as

FIG. 7—APPARATUS FOR OBTAINING SULFURIC ACID WITHOUT NITER

2KCl.PtCl₄, but Hare wrote it K₂PtCl₆, potassium chlorplatinate as experimentally demonstrated many times since the day of Hare, whose remarkable discussions may now be dismissed, so that some curious efforts by American chemists along other lines may receive attention. For example, in an old, out-of-the-way publication of 1790, I discovered the following method of obtaining sulfuric acid without niter. It reads as follows:

The present mode of obtaining a vitriolic acid, by the combustion of Niter and Sulphur, is so very expensive, that an economical method has long been sought for by Chemists.

Sulfur is a substance composed of vitriolic acid and phlogiston, or, according to the pneumatic doctrine, it is vitriolic acid deprived of air. In combustion the phlogiston is supposed to be dissipated, or the air absorbed by the acid. Sulfur, like all combustible bodies, will not burn in closed vessels. Niter contains a large quantity of pure air—hence the practice of combining them together, in order to maintain the combustion by a supply of air. If it can be supplied by any other means, we save the expense of an article hitherto found to be necessary.

When I first used the apparatus * * * * * I expected either to be suffocated by the fumes of the sulfur, or knocked down by the bursting of the balloons; but neither of these things happened, and from one pound of sulfur 15½ parts of acid were obtained (Fig. 7).

AAAA is a stove made of iron or copper, or of iron coated with lead or copper, one of the side-plates is wanting in the drawing, B is a door through which the sulfur is placed and lighted in the dish C. DD, the spaces between the stove and dish, contain a small quantity of water, that part of the fumes, which are not carried through the copper pipe EE, may be absorbed and condensed. F is a small cock to draw off the water at the end of the operation. G is a funnel, the end of which is divided into a number of conical points, pierced with small holes. HHH are three receivers of brass or copper, the last of which is tubulated to prevent any mischief when the fumes are not readily condensed. Upon lighting the sulfur the air is immediately rarefied in the pipe, and so great is the draught through the funnel, that the combustion is continually maintained, and the fumes prevented from flying into the room.

We smile, but this occurred 129 years ago, when it met with approval. Americans were then just getting on their feet in the technical world.

And now turn for a few minutes to the *Emporium of Arts and Science*. In this publication was clearly expressed the burning desire of American chemists for the promulgation of a knowledge of the application of chemical principles. Note these topics:

Manufactures dependent on copper; on lead; on tin; on gold, silver, mercury, antimony, and bismuth.

Color making; carmine; red lakes, yellow lakes; copper brown; Frankfort blacks; Spanish white; white from barytes and strontium; Saxon blue; Dutch and rose pinks; French green; Brunswick green; Olympian green; smalt; bice; cinnabar; vermilion; colored chalks, etc., etc.

Thought was also given to chemicals in a large way:

Pot and pearl ash; pure alkali; soda; ammonia; oil of vitriol; cream of tartar; sugar; benzoic; sulfate of manganese; preparations of antimony; elastic gum tubes; common quack medicines; detection of adulterations in medicines; chemical manufactures with reference to the law of nuisance.

Bleaching; dyeing; printing; cotton; pottery; etching on copper and glass, etc., etc.

As an example of the effort in bleaching observe the apparatus shown in Fig. 9.

As an exhibit of another form of apparatus to be used in the bleaching of stuff for paper Fig. 10 has much interest. It consists of:

A the cap of the still. B the body of ditto, which stands 7 or 8 in. above the surface. The cap is in the form of a hive, entirely hollow, with the tundishes soldered, as you see, one for the use of charging the still with the vitriol, and the other takes off the inflammable air, which is C, then it enters the intermediate box, through which it passes through the pipe D, and enters the vessel by the reservoir, which is E. The pipe stands about 11 or 12 in. above the surface, 1 in. bore, but does not dip in the reservoir; it drops its strength in its reservoir, while the motion of the wheel circulates the body; the wheel or windlass, is the letter F, which is only the handle and a boy continually turning it during the whole process; Xz the wheel is in this form, with the arms the full diameter of the vessel; the intermediate box, as you see: the pipes or tubes stand 12 in. at the top, from the horizontal of the top of the vessel. The center pipe, which is H, dips in the water which is in the intermediate box, and has two nostrils which give air, although being under water; the intermediate box has always 4 in. of water, which is put in every time the still is charged; and has a cock at the bottom to empty it occasionally; there is also the consolidate vessel, which is G, it stands about 7 in. high, but made fast to the top of the reservoir. The consolidate vessel has a lid, and on the lid is made fast a pipe which dips in the water 1 in.; the lid is taken off to put the lime water in; also there is another pipe which stands 3 in. on the top, and in that pipe fits a tube which dips in the pitcher as you see in the draught; the lid of the consolidating vessel fits in a cavity the same as the cap of the still; and the cavity is filled with water to keep it staunch; also there is a cock at the bottom of the reservoir to rack off the liquor, and another at the bottom to cleanse it out. The letter K is the vessel which the old lees are thrown into as before mentioned. As to the proportions of the vessels—the depth of the still is 2 ft. 5 in.; the diameter, 2 ft. 3 in.; the cavity where the lid fits is 13 in. deep; the proportions of the intermediate vessel are 16 in. long, 12 in. broad, and 11 high; the reservoir is in depth 20 in., diameter 4 ft. 8 in.; the consolidating vessel which dips in the water is 14 in. square, 7 in. high at the top, and the lid has two handles to take it off. To introduce the lime water, the cap of the still is elevated by a pulley, while at the top of D° you see a hook made fast to D* for the same purpose, to put it on and take it off without any further trouble. The still is laid in a metal boiler and underneath the still is 4 in. of sand, but the body is a cavity all round to the top, which is inclosed with brick work; the whole apparatus is lead. N. B.—The reservoir is also lined with lead, as also the cistern which the old lees is thrown into. The reservoir is a wooden vessel, lined with sheet lead.

An apparatus designed for the liberation of coal gas, to be used in that far-away period, is represented in Fig. 11.

This was described as follows:

The retort is filled and the cork taken out at D, which should be 4 in. diameter, stopped with an iron plug. The tar and liquid partly runs down the tube with a stopcock, next the furnace, but some of it mounts with the gas, and being cooled in the bent part of the tube runs down at the second tube with the stopcock into the barrel B, which is inserted in an outermost barrel, and surrounded with water to condense the contents. The gas-holder C is suspended with its balance weight from the ceiling. The rest is obvious. The gas holder and its containing vessel may be tin, copper, sheet iron, or simply casks. The perpendicular tube that rises into the chimney is designed to carry off the carbonic gas and water which rise at the beginning of the process, and which if mixed with the carburetted hydrogen

FIG. 8—TITLE PAGE OF THE EMPORIUM OF ARTS AND SCIENCES

would hurt the combustible quality of the gas sought for. The tubes may be lead, tin, or copper.

The distilled products will pay a great part of the expense.

FIG. 9—BLEACHING APPARATUS

AA is the machinery to agitate the limewater within the cask in which it turns around. BB is the still holding the materials. 1, 2, 3, 4, 5, 6, 7 places made air-tight with water to prevent escape of the gas

for me to tell you the pleasure that has been mine in mulling over the contents of this ancient, hoary book. A few of the titles of papers in it are:

- 1—Remarks on the Phlogistic and Anti-Phlogistic Systems of Chemistry.
- 2—Speculations on Lime.
- 3—Remarks on Heat.
- 4—An Inquiry whether M. Berthollet was warranted, from Certain Experiments, in Framing the Law of Chemical Affinity, "That it is Directly Proportional to the Quantity of Matter."

Yes, to read at random in moments when the mind was overburdened and wearied by other arduous duties, brought peace and rest, while there was simultaneously developed a most profound admiration for the earlier members of the Guild of American Chemists.

FIG. 10—APPARATUS FOR THE BLEACHING OF MATERIAL FOR PAPER

For instance, we hear James Cutbush calling reagents "the compass by which the chemist steers," and then he launches forth into a description of the production of oxyacetate of iron which in his words, "I propose as a test for arsenic," and Thomas Cooper suggests neutral soluble chromates for the detection of this same element. And, by the bye, on having this reagent tested quantitatively for the recognition of arsenic, it was demonstrated that $\frac{1}{100,000}$ part of it could be easily found.

In the *Memoirs of the Columbian Chemical Society*, published 106 years ago, are for the first time assembled contributions to a Society founded in 1811 by "persons desirous of cultivating chemical science." The contents are chiefly original, partly speculative and partly practical. They give a fair picture of the chemical thought of the years of the Society's existence.

Of course, nothing in its pages ever reached English shores. England was not particularly fond of America in 1811, 1812, and 1813. Knowing that this volume had been printed, I searched everywhere at home and abroad without success. Most unexpectedly I found a copy in a junk shop. It is impossible

Further, John Mannors was convinced "that oxygen is not only unessential to putrefactive fermentation, but has, when in actual contact with putrefying substances, no influence on that process * * * * but to magnify and render more conspicuous, any absorption in consequence of a diminution of the included atmospheric air, by the combination of its oxygen with the animal flesh."

Of the apparatus shown in Fig. 12 he speaks as follows:

I invented an instrument which I shall now describe. I took a cylindrical bottle (A) perfectly transparent, and put half a pound of muscular flesh (a portion of the diaphragm of a bullock) in the bottom of it, and secured it there. (B) The flesh was taken, while warm, and cooled under mercury to prevent the access of air. To the bottle was adapted a cork which was perforated, and a bent tube passed through the perforation, the other end of which was hermetically sealed. (E) Some mercury was then put into the bottle, the bottle corked, and made perfectly air-tight by luting and sealing. The bottle was now inverted. The mercury filled about two inches of the neck of the bottle, (D) and was made to pass up the glass tube by heating it, and expanding the air and thus expelling a portion of it, to a proper distance. (F) In this situation the bottle was put to rest in a fixed position.

A thermometer (I) was included within the bottle in order to note its temperature.

FIG. 11—COAL-GAS APPARATUS

The bottle and curved tube in some measure represented Mr. Leslie's differential thermometer. Here barometrical influence was perfectly excluded. And as the variations in the temperature equally affected both the air included in the tube, (G) and that in the bottle, (C) it is evident that thermometrical influence could not affect the experiment.

To the tube was adapted a graduated scale which would mark any rise or fall of mercury in the tube.

Now it is clear that the smallest diminution of air in the bottle would be marked by a corresponding fall of the mercury in the tube, the calibre of which was not more than one line. Or on the contrary, any evolution of gas would raise the mercury in the tube.

The apparatus remained three days without any change of mercury in the tube. On the fourth day the mercury began to rise and continued to rise until the experiment was suspended; which proves that there was no absorption of oxygen gas by the putrefying substance.

Presumably all of us have determined carbon in the wet way and we may have made aldehyde by oxidizing alcohol with chromic acid, and did these things wholly ignorant of the fact that they were first suggested by an American chemist.

It is also a fact that the fathers thought on the speed of reaction, and that the discovery of chloroform, independently of Soubeiran, Liebig, and Dumas, was made by an American.

No harm would be done if this were mentioned in our textbooks.

And this completes my chemical story. It is a mere fragment. Hours might be filled with additions, but the purpose I had in mind, I trust, is evident, namely, to demonstrate that there is an American spirit in chemistry, as there is an American spirit in literature so entertainingly revealed by Bliss Perry in his recent volume, "Chronicles of America." And it is that spirit which should constantly be held before students of chemistry and before every man, woman, and child who is engaged in any of the great industries founded upon chemical principles.

Therefore, I am prompted to make an appeal. Let every college, university, and works laboratory minutely record the story of the work done in it annually, not for publication, but for the sake of preserving for future students of chemistry in this country source-data from which may be drawn the material for a great history of the science. Let the apparatus used be accurately delineated, and its modifications and developments be truthfully outlined. And last, but not least, make biographical sketches of the directors and workers in such laboratories, mindful that the charm of biography consists of minor truths neglected by graver history. The human side in all history illuminates as nothing else can. As a result, theories, failures, achievements, all possess life, and in turn encourage, incite, and inspire to press on, emulate, and even surpass each preceding generation. In addition there is created, fostered, and perpetuated a solidarity in our Guild which will surely culminate in stupendous endeavors, to be eventually crowned with undreamed success and national glory.

As one looks backward to the days in which "my heroes" and their associates lived and one searchingly scrutinizes their work, it will be seen that it bears the stamp of marked originality. The Republic was then young. It was not sure of the genuine friendliness of the then great nations of the world, and our early chemists, heeding the spirit of the immortal Washington's admonition relative to "entangling alliances," were trying out their skill and knowledge alone. Many undertakings were crude and came to naught, while many brought success. Perhaps if our chemical fathers had been disposed to avail themselves of the helps they might easily have had from foreign sources, chemistry in this country would have advanced by leaps and bounds. However, they were content to go their way. Anyone who will turn over the pages of Hare's "Compendium of Chemistry" will be profoundly impressed with its striking originality. The various forms of apparatus employed by him in chemistry and physics are his own thought and made by his own hands. Most of it is cumbersome, but it answered superbly the purposes for which it was designed. How this remarkable individual was able to adhere so closely to his own plans is astonishing when it is recalled that he was the American editor of several standard English works before he wrote the Compendium. An examination of other early texts will disclose a like tendency and you will sympathize with me when I say that as I have slowly read the earliest writings of our earliest chemists—the writings of those who taught and the writings of those who were applying the principles of the science in industrial operations—and noted this truly independent American spirit, I thrilled with joy to ob-

serve that while the little Republic was struggling heroically to develop its new form of government, to grow up, and to utilize its great, God-given resources, the science dear to me was being most earnestly cultivated.

And how many of us gathered here to-night found in our student days the impression all around us that other lands must be sought that we might be inoculated with the genuine inspiration to go forward in our science? Never was it said that our forefathers had done anything in this domain and so we went on, but at last a rude awakening came to us. The talent in our land was per necessity compelled to face serious, old and very new, unimagined problems, and how splendidly these have been solved. The early spirit of the fathers, who assisted in the upbuilding of the Republic, reappeared. And it is not too extravagant to declare that there is nothing in the category of chemical enigmas which American chemists cannot solve. While glorying in this magnificent exhibition of intellectual, inventive power and skill, let us be sure to review what the fathers did and in this manner incite eagerness for the fray before us, now that we have tested out our powers. Let the old American spirit become our spirit in chemistry. We must not step backward. Let us resuscitate old industries, if desirable, and develop new industries. Let us jealously protect those in this country who came forward with financial aid to further the industries which are and may be inaugurated. Let us also generously promote chemical teaching and, among other things, bid the youth look back to the early representatives of our science who wrought quietly, thoughtfully, and unceasingly, thus giving us a past of which we may be justly proud, for

"These are deeds which should not pass away,
And names that must not wither."

REPORT OF OMNIBUS COMMITTEE

We have carefully considered a total of 178 suggestions from 20 sections, 8 individuals, 2 outside organizations, and 5 unidentified sources. Of this total, 57 suggestions fall naturally within the 9 group-suggestions, for which provision was made at the Council Meeting of December 14, 1918, as recorded in the minutes and published in the *Journal of the American Chemical Society*, Proceedings for 1919, pp. 2-4. The subject matter of these group-suggestions may be summarized as follows:

- 1—Publication of compendia and monographs under the auspices of the AMERICAN CHEMICAL SOCIETY.
- 2—Annual formula index to *Chemical Abstracts*.
- 3—Duty-free importations of chemicals, apparatus, etc., by colleges and other educational and scientific institutions.
- 4—Fellowships and relations between the industries and educational institutions.
- 5—Federal aid to scientific and industrial research.
- 6—Metric system to be made United States standard.
- 7—Developing work of Division of Chemicals and Chemical Technology, National Research Council.
- 8—Coördination of chemical work in the War Department.
- 9—Recording and publishing, so far as public interest permits, of the work of the Chemical Warfare Service.

The remaining suggestions, numbering 121, cover, as might be expected, an extremely wide range of subject matter. Some are obviously outside the province of the SOCIETY, and many involve the expenditure of SOCIETY funds to an amount which, though indeterminate, is certainly far beyond our present income or resources. The remaining suggestions naturally range in present interest and importance from the intensely practical and desirable to the obviously futile, but your committee is glad to testify to the evident care with which most suggestions have been formulated and to their high average of value.

The 121 suggestions have been somewhat arbitrarily classified by subject matter into 7 groups, which your committee has de-

FIG. 12—MANNERS'S APPARATUS TO SHOW OXYGEN NOT ESSENTIAL TO PUTREFACTIVE FERMENTATION