THE 168TH MEETING
PITTSBURGH SECTION
AMERICAN CHEMICAL SOCIETY
Thursday, December 16, 1920, at 8:15 P. M.
—AT—
MELLON INSTITUTE, Thackeray Avenue and O'Hara Street

MR. F. C. BINNALL
B. S., M. S. (in Gas Engineering)
Engineer for General Oil Gas Corporation of New York City

WILL SPEAK ON

THE DAYTON OIL GAS PROCESS

This paper is an advance copy of a chapter in "American Fields" by R. F. Bacon and W. A. Hamor to be published by McGraw-Hill Book Company. It will be presented by permission of Messrs. Bacon and Hamor of the Mellon Institute of Industrial Research and School of Specific Industries, University of Pittsburgh.

Advance Announcement

At the meeting to be held January 20, 1921, Mr. R. B. Gilmore will speak on "Some Problems in Graphite Crucible Manufacture."
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ON DISPLAY AT PITTSBURGH BRANCH
“THE CHEMISTS’ CLUB”

In the last number of the Crucible, the Editor invited discussion on the prospect of a “Chemists’ Club” in Pittsburgh. As the writer has seen the need for this and had it up for discussion in the past, he takes the liberty of injecting his opinions again on this occasion.

Pittsburgh, with her seven hundred or more chemists, needs a center where these men may get acquainted, and by knowing each other better and exchanging ideas, render even greater service to the community.

It has been suggested that the local section become affiliated, or make arrangements with the Engineers Society of Western Pennsylvania. While the writer fully appreciates the value of this organization he does not believe in diluting the chemists’ group with members of another society. Temporary economy might result from such an arrangement but there is nothing like spending the money for “our own home” even if we have to make a modest beginning. What we need most just now is to get acquainted with the other chemists of the district by having a place (our own), be it ever so humble, where informal meetings are possible.

Our quarters may not be large enough for the monthly meetings for the time being, but the Mellon Institute and U. S. Bureau of Mines, are glad to furnish quarters gratuitously for this purpose.

We may not have a good library at the start, until ours is adequate there are good ones in the Technology Department of Carnegie Library, in the Mellon Institute and in the departments of chemistry of our educational and industrial establishments.

As to the financing of a Chemists’ Club, the writer feels that a bond issue would handle the situation nicely. Many members of the Pittsburgh Section would purchase bonds and there is every reason to hope for the liberal co-operation of manufacturers whose fortunes are largely or in part due to the fruitful efforts of Chemists in their service.

The writer repeats that a modest beginning is better than none. Chemists living in our home, will through the payment of rent help the up-keep. Others by merely paying the membership fees for house-privileges will add to the fund. The project is bound to grow and every optimist (there is no room in Pittsburgh for pessimists) can eventually look forward to a Chemists’ Club in our community equal to that of New York City.

All who favor a “Chemists’ Club of our own” (with due deference to the Engineers with whom we want to co-operate in a professional way) are urged to attend the December meeting and voice their sentiments. It is our social life and professional contact that we are considering. What do you think about the proposition?

A. S.

THE CHEMISTS’ CLUB AGAIN

As Treasurer of the local section, my first thought, when a Chemists’ Club is mentioned, turns to the financial side of it. As I see it, to be successful in such a venture the building must be prominent enough to be attractive in the community in which it is located. It must be self-supporting financially. About the only way I see to do this, is to copy New York City’s plan and have sufficient dormitories to make it so. There are two sections in the city which seem to me to have the advantages as to a location for such a building, namely, down—

Continued on page 118
To our many Friends:

May your Christmas be the Merriest Ever

and

The New Year Overflow with

Happiness and Prosperity

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210-12 Grant St., Pittsburgh, Pa.
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EDITORIAL

In another column of this number appears "Proposed Regulations of The Associated Engineering Societies of Pittsburgh". As most of our readers know, it is proposed to form an association of the Pittsburgh Branches of six Engineering and Technical Societies, one of which is the American Chemical Society.

The first appearance of this proposal was early last summer or perhaps at the May meeting, where a tentative constitution was presented. A very lively discussion took place in which the prevailing idea seemed to be that the engineering society was trying to swallow us whole, that the individuality of our own organization would be lost. The Executive Committee was therefore directed to negotiate with the Engineers' Society of Western Pennsylvania to see if certain modifications could not be secured in the proposed constitution. On July 13, 1920, Mr. J. O. Handy wrote in part as follows:

The Executive Committee of the Pittsburgh Section of the American Chemical Society met yesterday, and registered their approval of the general plan of associating with Engineering Societies in the Pittsburgh District. The following points, however, were made:

First.—The present arrangements in the matter of hall for meetings, Secretary's office, printing of announcements and list of members are satisfactory, and probably more economical than we can obtain from the Secretary's office of the Associated Engineering Societies.

Second.—We would appreciate the privilege of better acquaintance with engineers, and of debating and expressing ourselves with them on public matters in which chemical questions were involved, but we feel obliged, because of our limited resources, to ask for a specific statement as to the maximum cost to us if we join the Association and continue to manage our own affairs as we are now doing. We have about 500 members at present.

Third.—We notice that the American Ceramic Society, the American Electro-chemical Society, the Steel Treating Research Society (A. W. Peterson, Secretary, Thaw Bldg., 108 Smithfield St.) and the American Steel Treating Society (D. W. McDowell, Secretary, care Jones & Laughlin Co.), which have local sections, have not been asked to join the Association. It seems to us that they should be.

Fourth.—We think that the word Chemical as well as Engineering should appear in the title of the Association, or that the title should be broad enough to include both, e. g., technical or scientific societies.

Mr. K. F. Treschow, Secretary of the Engineers' Society on November 3, 1920, replied:

1. The matter of the Secretary's office, printing of announcements, meeting room, etc., was purely optional with the members of the Association.
TUNGSTEN INCANDESCENT FILAMENT LAMPS.

By Duncan MacRae,

Speaker at the November Meeting.

The tungsten incandescent filament lamp industry is an important branch of the great electrical industry. In 1920, 200,000,000 lamps will be manufactured in this country alone. This is approximately two lamps for every person in the United States, and the time is coming when practically every home will be lighted electrically. It is one of those industries in which difficult mechanical operations are carried out by remarkable, automatic machinery. It is perhaps pre-eminently the product of painstaking and thorough scientific research. But it is of interest to chemists chiefly because of the unusual materials, conditions of temperature and pressure, and reactions involved in the manufacture and operation of the lamps. Tungsten, the most important single material used in lamp manufacture, is scarcely mentioned in elementary text-books on chemistry and finds no place in the ordinary schemes of qualitative analysis. This is true in spite of its connection with the production of light, and Roentgen rays and with the development of high speed tool steels. Argon, used in the gas filled lamps, is marked by the fact that it is a member of the group of inert gases whose discovery was such an addition to the Periodic Law. In the vacuum type lamp at pressures of a few millionths of an atmosphere, reactions take place between gas molecules at room temperature and the filament at 2100 degrees, hydrogen is dissociated into atoms, and reaction rates may be studied quite apart from the diffusion processes which control the velocities of reactions between solids and gases under ordinary pressure.

Tungsten is used as a lamp filament because it can be operated at a higher temperature than any other substance without melting or evaporating at such a rate as to excessively blacken the bulb. The higher the temperature to which the filament can be heated the greater will be the proportion of the electrical energy supplied that will be radiated in the form of light. While it does not have so high a melting point as carbon, yet at the same temperature, it does not evaporate so rapidly and therefore is preferable to carbon. Tungsten at its melting point, 3403 degrees C., would require only 0.2 of a watt to produce one candle power. In order to give a "life"
of 1000 hours the filaments of commercial lamps are operated at temperatures requiring from 0.5 to 1.0 watts per candle (w.p.c.). These figures may be compared with 0.03 w.p.c., the mechanical equivalent of a good white light, and 0.02 w.p.c., the mechanical equivalent of light of the wave length to which the human eye is most sensitive.

The ores chiefly used for the production of metallic tungsten are Scheelite [CaWO₄] and Wolframate [(Mn, Fe) WO₄]. These are converted into Na₂WO₄ by fusion with Na₂CO₃ or treatment in an autoclave with a solution of NaOH. The Na₂WO₄ solution so obtained is treated with acid to precipitate tungstic oxide [WO₃]. This is a lemon yellow powder and is the raw material purchased by some of the lamp companies. It is purified by dissolving in ammonium hydroxide, precipitating with acid and finally redissolving in ammonium hydroxide and evaporating to obtain crystals of ammonium tungstate [(NH₄)₁₀W₁₂O₄₁]. The tungstic oxide resulting from heating this compound in the air is reduced with hydrogen and the resulting tungsten powder is used for the manufacture of the filament.

The preparation of argon from the atmosphere is largely a physical process, namely, liquefaction and fractional distillation. Argon is used in place of argon in some of the very large gas filled lamps. Although it reacts with evaporating tungsten molecules to some extent it does not attack the filament.

The pressure attained in commercial vacuum type lamps on exhaust (about 30 millionths of an atmosphere) is still further improved, after sealing the lamp off, by the vaporization of a small amount of phosphorus in the lamp. This tends to remove any water vapor still remaining by converting part of it into P₂O₅ which absorbs the rest. It has also been shown that nitrogen will react with phosphorus under the action of the electric discharge between the parts of the filament. The action of this phosphorus together with the action of the filament itself is so effective that the pressure in the finished lamp is very nearly one millionth of an atmosphere, and becomes less on continued "burning".

At this pressure of one millionth of an atmosphere, there remains in a 200 cc. lamp bulb about $10^{15}$ molecules of gas. So the space in a vacuum lamp is far from free of gas molecules, but, as even this enormous number weighs only about one ten-millionth of a gram, the possibility of harm to the lamp by chemical action on the filament, conduction of heat or electricity by the gas is practically negligible and nothing would be gained by a more nearly perfect exhaust.

The effect of water vapor in the vacuum type lamp, even in very small quantities, is to hasten to blackening of the bulb and the explanation of this action as given by Langmuir is very ingenious. In the first place it cannot be due to a simple chemical reaction for the amount of tungsten is more than equivalent to the hydrogen evolved. The tungsten reacts according to the following equation $W+3H₂O=WO₃+3H₂$, depositing the WO₃ on the bulb. The liberated hydrogen is dissociated by the filament and in the active monatomic form reduces the WO₃ to metal and sets free the water vapor in the lamp. This cycle, repeated over and over again, results in the transfer of the tungsten from the filament to the bulb at a more rapid rate than would evaporation alone.

A similar cycle of reactions resulting in the transfer of tungsten has been used to prevent blackening of the bulb. It is brought about by introducing compounds into the lamp that will evolve chlorine at very low pressures. This chlorine is also dissociated by the filament and activated so that it reacts with the tungsten deposited on the wall of the lamp. It forms a colorless chloride of tungsten that is volatile and on coming in contact with the hot filament decomposes depositing the tungsten on the filament again. Compounds introduced into the lamp to retard blackening of the bulb in this or other ways are known in the industry as "getters".

A very recent development in the use of such substances—or rather in the theory of their use—has been made in Holland. Very stable chemical compounds, such as CaF₂ or NaCl, which are incapable of evolving a halogen in the lamp, have been found to be effective in preventing the blackening of a lamp. These substances are most effective when evaporated from the filament onto the bulb walls. They form a layer on the glass about 70 molecules deep. The tungsten atoms, travelling with high velocity from the tungsten filament, strike this layer of deposited salt and perhaps penetrate it to a slight extent and are held surrounded by the salt molecules so that they cannot form a coherent conducting metallic film which seems to be necessary for light absorption by metals.
PROPOSED REGULATIONS OF THE ASSOCIATED ENGINEERING SOCIETIES OF PITTSBURGH

Composed of:
Engineers' Society of Western Pennsylvania.
Pittsburgh Association of Members, American Society of Civil Engineers.
Pittsburgh Section, American Society of Mechanical Engineers.
Pittsburgh Section, American Chemical Society.
Pittsburgh Section, American Institute of Electrical Engineers.
Pittsburgh Association of Members, American Institute of Mining & Metallurgical Engineers.

ARTICLE I.

Name.

Section 1. The name of the Association shall be the Associated Engineering Societies of Pittsburgh, hereinafter referred to as the Association.

Sec. 2. With the Engineers' Society of Western Pennsylvania the local organizations of the American Society of Civil Engineers, American Institute of Electrical Engineers, American Chemical Society, American Society of Mechanical Engineers, and American Institute of Mining & Metallurgical Engineers are charter affiliated organizations of the Association. Other engineering and technical organizations are eligible for affiliation.

ARTICLE II.

Aims and Objects.

Section 1. The object of the Association shall be the co-operation of Engineering Societies of Pittsburgh.

Sec. 2. In furtherance of the spirit of the Engineers' Society of Western Pennsylvania, which prompts it to offer its club rooms in order to promote local united engineering, each affiliated organization shall encourage its members to join the Society in order that they may gain social relationship with, local professional standing among, and personal friendship of fellow engineers in Pittsburgh. The Engineers' Society of Western Pennsylvania shall encourage its members to join the National Engineering body through an affiliated organization. It is further recommended that all organizations belonging to the Association shall recommend to their respective sections that an arrangement be made with the Engineers' Society of Western Pennsylvania whereby all secretarial work, such as printing and mailing of notices, arranging for meetings, etc., be done through the office of the Engineers' Society of Western Pennsylvania and that all individual meetings of the different organizations be held in the Auditorium of the Society. It is believed that this would aid greatly in uniting the engineering activities in this district.

Sec. 3. The Engineers' Society of Western Pennsylvania, having an auditorium, library, club rooms, employment bureau, entertainments, bulletin for news items, journal for publication of technical papers and the services of a paid secretary, is recognized as the parent engineering society of Pittsburgh.

ARTICLE III.

Council.

Section 1. The affairs of the Association shall be conducted by a Council consisting of the President and two other members of the Board of Direction, preferably two Junior past presidents of the Engineers' Society of Western Pennsylvania, together with two other Councilors chosen by each of the affiliated organizations, one each year for a term of two years, at least one of whom shall be a member of its governing committee or Board.

Sec. 2. The President of the Engineers' Society of Western Pennsylvania shall be chairman of the Council. In his absence the Council shall choose a chairman pro tem. The Secretary and Treasurer of the Engineers' Society of Western Pennsylvania shall act in similar capacities for the Council.

Sec. 3. Meetings of the Council may be held upon call of any two Councilors, but not less than four per year upon call of the Chairman. A majority of the members of the Council representing not less than half of the affiliated organizations shall constitute a quorum. The yes and no vote of members on all questions shall be recorded. Decision of the Council shall require a majority vote of those present, except as provided for in Section 5 of this Article.

Sec. 4. The Council shall have jurisdiction over all matters of joint interest insofar as its decision shall not conflict with the rules of the various affiliated organizations.

Sec. 5. The Council shall act upon all petitions for affiliation received from other organizations and its decisions shall be printed in the notice for the next meeting of the Association. Such petitions shall be proposed at a regular meeting of the Council and voted on at a subsequent meeting; a two-thirds affirmative vote of the total membership of the Council being required to elect.

Sec. 6. No individual organization of the Association shall act upon any local public matter, except to refer it to the Council, until the Council has considered and taken action upon it. If the Council's action is to refer it to the Association, no action shall be taken by any individual organization of the Association until final action shall have been taken by the Association. The Council may refer such a matter to a meeting of the Association or may order a referendum ballot.

Sec. 7. In National public affairs, recommendations of the Council, if any, shall be printed in the notice for the next meeting of the Association. A majority vote of Council may decide to refer the question to the consideration of one or more of the National Engineering Bodies, through their affiliated societies or the National Council.

ARTICLE IV.

Meetings.

Section 1. The Council shall at its discretion call meetings of the Association.
Sec. 2. Each corporate member of the affiliated organizations shall be entitled to a vote at meetings of the Association.

Sec. 3. The Auditorium of the Engineers' Society of Western Pennsylvania shall be available for all meetings of the Association. The order of business at these meetings shall be as follows: Call to order by Chairman of Council; reading of the minutes; reading of Council minutes; unfinished business; new business; presentation of subject; discussion; adjournment.

ARTICLE V.

Finances.

Section 1. The regular expenses of the Association shall be as follows: Rent of auditorium, secretary's services, stenographic services, printing, and postage. Any additional items of expense shall be considered special.

Sec. 2. Each affiliated organization shall pay its pro rata share of the cost of meetings, based on total number of members as of January 1st of each year. Statements of account shall be rendered quarterly by the Secretary. An affiliated organization failing in its obligations shall be notified in writing by the Council and if such obligations are not met within three months thereafter, such organization will be dropped from the Association, upon a vote of a majority of the Council by letter ballot. Any organization may withdraw from the Association three months after service of written notice to the Council, provided it is not financially in arrears.

ARTICLE VI.

Year Book.

Section 1. A year book shall be published in October of each year and shall have as the title on the front cover

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA
and
ASSOCIATED ENGINEERING SOCIETIES
OF PITTSBURGH

Sec. 2. The Engineers' Society of Western Pennsylvania and each affiliated organization shall have equal privileges irrespective of the number of members. Each Society may publish: List of officers, list of committees, alphabetical list of members, local constitution and By-Laws, qualifications for and privileges of membership, amount of dues.

The Association shall include its regulations, names of Councillors, annual report of the Chairmen of the Council and other matters of general interest.

Sec. 3. Each organization shall pay its pro rata share of the cost of publication based on number of pages used.

ARTICLE VII.

Revisions.

Section 1. These regulations may be amended by the Council, subject to approval of a majority vote of the Association.

PERSONAL NEWS

Bureau of Mines

Mr. M. B. Cooke has accepted a position as chemical engineer in the petroleum laboratory of the Bureau of Mines. Mr. Cooke was formerly in the Jackson Research Laboratory of the DuPont Company at Carneys Point, N. J.

Mr. S. H. Katz has spent the month of November in the vicinity of Barre, Vermont, making a study of the rock dust content of air around stone quarries.

The Bureau of Mines Bowling League is well into another successful season. The following is the standing of the teams to date.

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<th>W. L. Ave.</th>
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<tr>
<td>Mines 11 4 .733</td>
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<td>United 9 6 .600</td>
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<td>Bureau 6 9 .400</td>
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<td>States 4 11 .267</td>
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Individual honors for the highest season averages go to the following men:

- Morris 163.47
- Denny 159.47
- Fieldner 158.40
- Cunningham 157.00
- Barrett 150.33

Mr. G. St. J. Perrott spent several days at Washington in connection with the co-operative work on coal treatment by the Trent process.

The annual convention of the American Gas Association was held in New York, November 16 to 18. The Bureau of Mines was represented by Messrs. Fieldner, Davis, and Powell, all of whom are committee members of this organization. A paper on "Coal Sulphur and its Conversion in the Gas Retort" was presented by Dr. Powell.

Mr. P. B. Place has just returned from his home in New Hampshire where he was laid up five weeks on account of illness.
ALPHA CHI SIGMA

The smoker held on November 19 was very well attended, many Alumni being among the guests. Boxing, cards, smokes and eats were the main events of the evening.

Among recent visitors at the house were C. O. Young from Clendenin, W. Va.; R. D. Cook from Terre Haute, Ind., and E. H. Bohn from Norfolk, Va.

A. F. Shupp has returned from Ashland, Ohio and is now staying at the house.

A very enjoyable house dance was held November 24th; fourteen couples attending.

The chapter was honored by many guests for Thanksgiving dinner.

The Pittsburgh Alumni held a dinner on November 18 at Klemann Inn.

SCHOOL OF CHEMISTRY

Dr. Godfrey, consulting engineer, gave a talk at a School Assembly on the "Relationship Between Chemistry and Engineering". He emphasized their mutual interdependence.

The first issue of the Glass Industry, a monthly publication devoted to the Glass industry and technical manufacture, has recently been issued. This is the first publication of its kind in the United States. The November number contains an article on "The Importance of Technical Control in the Glass Industry", by Prof. Alexander Silverman.

The Student Chemical Society held a social evening in the Fellows room of the Mellon Institute on November 4th. About forty people were present.

Dr. Gebhard Stegeman went to Atlanta, Ga., on November 18th to officiate in the final game of the season for De Hart's University of Georgia team. He spent a few days with his brother who is Director of Athletics for that institution.

Dr. Alexander Lowy's pamphlet "Organic Type Formulas' published in 1919 by Van Nostrand Company is used at present in 72 colleges and universities.

John L. Acheson, formerly instructor in Inorganic chemistry, is on the Instructional staff of the Carnegie Steel Company. The Iron Age of November 17 gives an interesting account of his work.

Much interest is being shown in the annual interclass athletic contests in this school. In preparation for the basketball season, the faculty team has been training under Dr. Stegeman.

Prof. and Mrs. Alexander Silverman entertained the Chemistry faculty, their wives and friends, at the Heinz house on December first. Dancing was one of the many pleasant features of the evening.

Mrs. John Gorrell, who as Miss Catherine Charlton used to be an analytical chemist with the Central Laboratory of the Technical Direction Bureau, has returned to her old position and Mr. and Mrs. Gorrell are now both in this laboratory.

Mr. H. V. Churchill, Chief Analytical Chemist for the Aluminum Company of America, addressed the Science teachers of Western Pennsylvania on November 27, on the "Relation of Industry to the High School".

THE CHEMISTS' CLUB AGAIN

Continued from page 111

town and Oakland, which would necessitate an expensive layout.

I am not in favor of rooms as they are not prominent enough and it would be difficult to make them self-supporting. We could never expect to have a reference library, which could even compete with the Carnegie Library in Oakland.

Again, we are situated a little different from New York. Our chemist membership, while it is scattered over Allegheny County and surrounding territory, can manage to get home, when night comes, without much trouble or inconvenience, and we do not have the number of outside chemists visiting our city that New York City has.

Then there comes the question whether it would be used daily, except by a few. Few of our 600 members are in the downtown section frequently.

If this venture could be solved financially, I see many advantages of having a club of our own. Do we have any wealthy members, who do not know what to do with their money?

C. E. Nesbitt.
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ELECTION OF OFFICERS FOR 1921

The Canvassing Committee reports the following results of the election of officers for the year 1921:

**Chairman—**

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**Vice-Chairman—**

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**Secretary—**

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**Treasurer—**

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**Councilors—Continued**

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<td>J. R. McTaggart</td>
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<td>S. St. J. Perrott</td>
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<td>E. E. Andrews</td>
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<td>R. H. Wynne</td>
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<td>Mr. Myers</td>
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Respectfully submitted,

E. W. TILLOTSON,
E. W. DEAN,
G. W. JONES,
Canvassing Committee.
HOT AIR
The above subject is believed to be of interest to readers of the Crucible. Interest is now centered on hot air production in house heating furnaces. There are a number of reasons for disconnecting the cold air inlet, and drawing the air supply from the cellar above the furnace itself.
In the first place, you do not distribute through your house the soot particles from your neighbors' furnaces. If your cellar windows are fairly tight, they act as filters for such air as comes in around them, but the usual cold air inlet has no filtering device.
In the second place, you will find that you can warm your house with less fuel, and this is exceedingly important if you are using gas in a furnace designed for coal.
There will be a further saving of heat if the gas burner flames are caused to heat up a porous refractory material. Fire-brick and pottery stilts are too dense for the best results.
Some further heat may be saved by drawing the air from above the pipes conveying the combustion gases to the chimney. These suggestions are the result of my experience. J. O. HANDY.

COMMITTEE ON LIBRARY
The Committee appointed by Chairman Tillotson consisted of J. O. Handy, Chairman, Dr. F. E. Frary and Mr. M. S. Evans. The activities of the Committee are to be directed toward securing extension to the collection of reference books and periodicals in the Technology Department of the Carnegie Library.
As a first step, endorsement was obtained from the local engineering societies and the Chamber of Commerce, of a request made by the Chairman of the Committee to the Finance Committee of the City Council, that $5,000 be added for the Technology Department, to the appropriation for the Library for 1921. The Chairman also appeared before the Finance Committee, and explained the necessity for the appropriation. The request was favorably received, but because of pressure to keep the rate of taxation as low as possible, it is improbable that the additional money will be appropriated.

It is the Committee’s plans, as soon as the decision of the Finance Committee is definitely known, to bring the matter to the attention of the industrial interests and ask their aid.
The Committee request active cooperation upon the part of all chemists who are connected with the industrial concerns of the Pittsburgh District. J. O. HANDY.

A CHEMISTS’ CLUB FOR PITTSBURGH
Chemists may be interested in knowing that certain engineers in Pittsburgh believe that an Engineers’ Club would be successful here. Possibly the chemists and engineers would wish to work together for a club were both could have opportunities for social meetings.
Correspondence with the Secretary of the Chicago Engineers’ Club brought out the following facts, which are necessarily important to chemists as well as to engineers who are considering club organization.
First. The first requisite is a strong desire among a number of engineers for a daily meeting place. These men must be willing to put in the time and effort to provide this meeting place for the larger number who will attend when it is established.
Second. The Chicago Engineers’ Club is a social organization which carefully avoids the danger of becoming technical. It allows 25% of the membership to be non-engineers.
Third. Their expenses have been based on a very carefully prepared budget.
Fourth. Gradual growth is better than rapidly stimulated expansion.
Fifth. The principal attraction in the seven-story building which they own, is their dining room or grill. Facilities are also given for billiards, chess and bridge.
The principal aim is to give the members a place to eat and to take their minds off the day’s work. J. O. HANDY.

IGNORANCE OF SCIENCE
In these days when the colleges are being criticized from various points of view and many innovations are being introduced into education, anything that throws light upon the subject should be welcome. One of the most illuminating criticisms of the failings of education is contained in H. G. Wells’ recently published “Outline of History.” Mr. Wells, as is well known, received a scientific education and believes, as Huxley did before him, in the need for levelling the old-time classical studies with a considerable proportion of well-taught physical science.
It is in his account of Mr. Gladstone that Mr. Wells assails the old pedantic education that, in spite of its virtues, has so hampered our colleges. Mr. Wells explains the old-time classical training as consisting mainly of “the study, without any archaeology or historical perspective, of the more rhetorical and ‘poetic’ of the Latin and Greek classics.” The grad-
uates from such a course, continues Mr. Wells, had no vision of history as a whole, or any notion of the elementary ideas of biology, of modern political, social and economic science and modern thought and literature. Such an education as Mr. Gladstone's is typical of that of many of our public men, lawyers and even some business men. Mr. Wells' test of an education is whether it enables one to interpret correctly the life around him; of Mr. Gladstone he says that he never attained any real vision of the world in which he lived.

For instance, "When Mr. Gladstone was taken by Sir John Lubbock to see Charles Darwin, he talked all the time of Bulgarian politics, and was evidently quite unaware of the real importance of the man he was visiting. Darwin, Lord Morley records, expressed himself deeply sensible of the honor done him by the visit of 'such a great man,' but he offered no comments on the Bulgarian discourse." Obviously this Eton and Oxford graduate, intellectual as he was supposed to be, had little conception of the world-moving importance of Darwin's work in science. Therefore, reason Mr. Wells, since he could not interpret correctly the life around him, he was not educated.

Again, Mr. Gladstone paid a visit to Faraday, "the English electrician, whose work lives wherever a dynamo spins, who is in the airplane, the deep-sea cable, the lights that light the ways of the world, and wherever electricity serves our kind... The man of science tried in vain to explain some simple piece of apparatus to this fine flower of the parliamentary world. 'But,' said Mr. Gladstone, 'after all, what good is it?' 'Why, sir,' said Faraday, doing his best to bring things home to him, 'presently you will be able to tax it.'"

If Mr. Gladstone could see the great power-houses and electric lines today, all of which have come from Faraday's humble experiments of a century ago, he would see "what good it is"; and he might see also how poorly his education in what Mr. Wells calls rhetorical literature fitted him to understand the progress of his time.

But Mr. Gladstone is not the only prominent man who has failed to do justice to science because of a narrow education. Our own Congress hesitated six years over voting $30,000 to test Morse's telegraph, even after he had demonstrated its merits. When the appropriation was being discussed, one Congressman proposed an amendment that half of the money be given for an investigation of mesmerism. When the vote was taken on the original motion, (the amendment having been defeated), it carried by only 89 to 83. Morse meanwhile had nearly starved to death, after vainly trying to get European nations to buy his invention.

Coming down to the present, it is not difficult to see similar blindness in the importance of science by men trained according to the old classical standards. Congress still votes huge appropriations for more or less useless projects while cutting to the minimum any sums devoted to engineering or to scientific research. When, occasionally, large amounts are voted for necessary engineering undertakings, men untrained in science are as likely as not to be put in charge. Engineers and technologists employed by the national, state and municipal governments are given as little authority as possible, and are paid salaries astonishingly small compared with what Government-employed lawyers and publicists are paid.

One of the most striking examples of lack of knowledge of science is in our newspapers and general magazines. Reporters with almost no understanding of science are assigned to write accounts of scientific importance, and the way in which they garble the facts and falsehoods they pick up is a disgrace. The apportionment of space in the newspapers further emphasizes the prevailing ignorance of science among men who have received the traditional arts education. Half a page is devoted to a murder or a scandal, or even to a wedding or a society rumor, whereas a tiny paragraph in the lower corner has to do for an important scientific discovery.

It is interesting to observe how ignorant people in general are when a scientific matter is mentioned. Speak in the ordinary club or at a general social gathering some such term as "organic acid" or "fuselage" or "metallurgy," and notice the blank looks that follow. As Herbert Spencer pointed out, the customary education that most people receive makes them more anxious to pronounce correctly some word of merely literary significance, such as "Iphigenia" or "Don Quixote" or "L'Allegro," than to understand the scientific phenomena among which they live. Listen to the remarks of the average citizen as a street car passes a bridge under course of construction, or when the composition of the latest anarchist bomb is discussed. In spite of all the books on science available, and all the science courses in our schools and colleges, the average citizen, like the lawyer and the reporter and the public man, is astonishingly ignorant of science and engineering. — From December "Chemical & Metallurgical Engineering."
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