AMERICAN BRAKE SHOE COMPANY

Plant Engineers' Conference

September 27, 28 and 29, 1948

HOTEL SHERMAN - CHICAGO, ILLINOIS

Proceedings of the First Conference

AMERICAN Brake Shoe COMPANY

I N D E X

FORWARD

The first engineers' conference was held in Chicago on September 27, 28 and 29 for the purpose of mutual sharing of information relative to industrial hygiene.

The idea of such a meeting was conceived when it became apparent that one division frequently had the solution of a ventilating problem while another division was trying to cope with a similar one.

It became increasingly evident that there should be a clearing house of information to which each division could contribute its knowledge and experience for the common good of all. When one plant made a costly error due to lack of experience or information, it seemed unjustifiable that the same error should be duplicated in another plant.

The need, therefore, of such a conference and of a clearing house seemed to be in order.

It is believed this was the first conference of company engineers ever assembled for such purposes.

The meeting was very successful and already a fund of information is being built up for the mutual benefit of all.

Herbert J. Weber
Industrial Hygiene Engineer
American Brake Shoe Company

FIRST CONVENTION OF INDUSTRIAL ENGINEERS

AMERICAN BRAKE SHOE COMPANY

Background, left to right:

E. Mead
Dr. L. E. Hamlin
J. E. Holtman
T. F. Lewis
J. T. Gresh
B. Bloom
A. R. Walpole
A. R. Nettenstrom
J. L. Mullin
W. E. Crocombe
H. J. Weber
Miss N. Pellicci
W. J. Olson
L. W. Saenger
E. H. Loecher
H. J. Gotmer
T. Burke
F. E. Tayler, Jr.

Foreground, left to right:

N. Anderson
A. C. Lamb
A. G. Shafer
J. De Jarnett
E. F. Bazzeghin
H. B. Reinhardt
C. E. Horn
G. J. Antrobius
L. Sacco
R. Walters


ENGINEERING & INDUSTRIAL HYGIENE CONFERENCE
AMERICAN BRAKE SHOE COMPANY
SHERMAN HOTEL · CHICAGO · SEPTEMBER 29, 1948
OSCAR
CHICAGO

MONDAY - SEPTEMBER 27

(H. J. Weber, Chairman)

A.M.	9:00 - 9:30	Assembly and Get Acquainted
	9:30 - 11:30	Orientation Preliminary to the Discussion of Aims of the Conference (a) The Engineer's Place in Industrial Medicine . . . Dr. L. E. Hamlin, Medical Director (b) Functions of the Construction and Maintenance Department. How It Can Be of Service to the Plant Engineer . . . Mr. W. J. Olson, Chief, C&M Department (c) Functions of the Industrial Hygiene Department. How It Can Be of Service to the Plant Engineer . . . Mr. H. J. Weber, Industrial Hygiene Engineer
	11:30 - 12:00	Discussion
P.M.	12:00 - 1:30	Lunch
	1:30 - 2:00	Aims, Purpose and Scope . . . Mr. J. T. Gresh, Headquarters
	2:00 - 3:00	Discussion
	3:00 - 3:15	Intermission
	3:15 - 4:30	Continuation of Discussion

TUESDAY - SEPTEMBER 28

A.M.	9:00 - 9:30	Characteristics of Industrial Hygiene Installations in Amsco . . . Mr. H. B. Reinhardt, Chief Engineer, Amsco
	9:30 - 10:00	Round Table Discussion
	10:00 - 10:15	Intermission

	10:15 - 10:30	Experience with Ventilation. Problems handled by the Construction and Maintenance Department . . . Mr. W. J. Olson, Chief, C&M Department
	10:30 - 11:00	Round Table Discussion
	11:00 - 11:30	(a) New Plant Ventilation, National Bearing Division . . . Mr. E. H. Loecher, Plant Engineer, NB
		(b) Old Plant Ventilation, National Bearing Division . . . Mr. L. Saenger, Maintenance Engineer, NB
	11:30 - 12:00	Discussion
P.M.	12:00 - 1:30	Lunch
	1:30 - 2:00	Characteristic Ventilation Problems and Solutions in Brakeblok . . . Mr. F. E. Tayler, Jr., Chief Engineer, Brakeblok
	2:00 - 2:15	Discussion
	2:15 - 2:30	Intermission
	2:30 - 5:30	Business Meeting and Round Table Discussion

WEDNESDAY - SEPTEMBER 29

A.M.	9:00 - 12:00	Round Table Discussion
P.M.	12:00 - 1:30	Lunch
	1:00 - 4:00	Visit to the Industrial Hygiene Laboratory
	6:00 - 7:00	Social Hour
	7:00 -	Dinner Meeting
		. . . Address by Mr. W. E. Crocombe Vice-President, American Brake Shoe Company President, American Forge Division

AIMS OF THE CONFERENCE

1. Discuss, formulate, and adopt a method whereby there will be a complete exchange among the plant engineers, of the Industrial Hygiene and Construction and Maintenance Departments, of problems encountered and solutions given to items such as:

    a. Exhaust and ventilation.
    b. Illumination.
    c. Material handling and preparation.
    d. New construction and construction changes.
    e. Plant layout.
    f. The use of toxic and corrosive materials necessary to a plant operation.
    g. Certain operating techniques.

    The discussion of these items should be in their relation to hygiene and safety control.

2. Exhaust and Ventilation - If this work is being done in accordance with new plant construction, an exchange of data and drawings should be made between the Construction and Maintenance Department, the Industrial Hygiene Department, and the Operating Division.

3. Material Handling and Preparation - This refers to material that could or may be dust and fume producers. In such cases a complete exchange of data and contemplated control measures may result in the use of a substitute (nonhazardous) and eliminate the need for mechanical control measures and resultant costs.

4. New Construction and Construction Changes - Under this category the Industrial Hygiene Department should be kept informed and supplied with data and drawings with regard to the following:

    a. Exhaust and ventilation.
    b. Illumination.
    c. Machinery and/or operations that may be dust or fume producers.
    d. Plant layout (if possible).

5. Illumination - Certain standards have been set up for maximum and minimum foot candles of illumination for certain jobs, and the Industrial Hygiene Department endeavors to conform to these requirements, thereby reducing eyestrain and fatigue. It is possible in some cases to recommend a reduced candle power with a consequent reduction in electric power.

6. Plant Layout - An exchange of information relating to plant layout may result in suggestions for rearrangement and preclude the need for costly ventilation and exhaust equipment.

7. Toxic and Corrosive Materials - It is possible that the plant engineer will have some knowledge of the use of toxic and corrosive substances since in all probability he will be called upon by his plant to arrange for some control measures. Therefore, notice of the contemplated use of this material should be given to the Industrial Hygiene Department in order that a study can be made of these materials and adequate control measures recommended.

8. Operating Technique - Those phases of operation having a definite relation to the health and safety of an employee should be referred to the Industrial Hygiene Department and the Construction and Maintenance Department for review and comment. It is possible that minor modifications of the over-all design could reduce or eliminate a health or safety hazard.

AGENDA

1. Express in detail the purpose of the meeting.

2. Outline the aims of this group concerning future action.

3. Explain the procedure we (Industrial Hygiene and Construction and Maintenance Departments) contemplate following hereafter in connection with handling problems relating to this subject, such as:

   a. Those items set forth in paragraph one under aims.
   b. Establish a clearing house, through which all problems and solution data will pass for review, recommendations, filing, etc.
   c. The categories covered, such as - exhaust, ventilation, material handling, plant layout, construction, illumination, certain operating techniques, the use of toxic and corrosive materials, etc.
   d. The desirability and frequency of future meetings.
   e. Attendance (number, who, authority).
   f. The need for having all information, as outlined under aims, submitted jointly to W. J. Olson and H. J. Weber.
   g. Review past experience of costly experimentation (trial and error methods) to arrive at a solution to a problem and the value an exchange of such information in the future can have in solving similar or allied problems.
   h. Discussion of State Labor Codes.
   i. Agreement of policy to be followed by this group hereafter.

PERSONS ATTENDING DAILY CONFERENCES

Medical Department	Dr. L. E. Hamlin Mr. H. J. Weber Mr. H. J. Gotmer Mr. L. J. Sacco
Headquarters	Mr. J. T. Gresh
C & M Department	Mr. W. J. Olson
Brakeblok	Mr. F. E. Tayler, Jr.
Forge	Mr. N. Anderson Mr. A. Lamb
Amsco	Mr. H. B. Reinhardt Mr. A. Shafer Mr. E. Mead
BS&C	Mr. E. Bazzeghin
Electro-Alloys	Mr. J. De Jarnett
Engineered Castings & Kellogg	Mr. C. Horn
National Bearing	Mr. L. W. Saenger Mr. E. H. Loecher
Southern Wheel	Mr. G. Antrobius

Secretary - Miss Nina Pellicci, Medical Department

THE ENGINEER'S PLACE IN INDUSTRIAL MEDICINE

Dr. L. E. Hamlin

No doubt some of you gentlemen are wondering what a doctor is doing at an engineering conference of this sort and furthermore, what possible excuse there is for his appearing on your program. Let me assure you that there is a very good reason as I hope to demonstrate in the next few minutes.

As time goes on and our knowledge of industrial medicine and new engineering methods increases, the interdependence of the two professions, especially in the field of sanitation and hygiene, becomes obvious. The engineer has a great stake in the field of industrial medicine as has also the physician in the engineer's bailiwick. While the doctor's job is to discover and treat occupational disease, he has to depend on the engineer to see that healthful working conditions are established and maintained. The old saying that "an ounce of prevention is worth a pound of cure" was never truer than in this connection. The fundamental concept of all industrial health and hygiene and safety is prevention and elimination of occupational hazards at their source. From every angle, efficiency, economy and health, this is the logical approach. As engineers, you know full well that your initial plans must be as complete as possible before they are put into effect. You can't afford to start construction and then have to tear it down and begin again. So why throw dust into the atmosphere and then proceed to work out ways and means of removing it. The reasonable thing to do is trap it before it gets in circulation.

We, as physicians and engineers, are vitally concerned with one great factor in any industrial process and that is: "What happens to the man?" Consideration of the human element in industry, something which has suffered a measure of neglect in the past, has now become a "must". It therefore behooves the engineer to think in terms of health and hygiene as well as production and costs.

Good health means greater efficiency, increased production, less absenteeism, satisfied workers, decreased labor turnover with better class applicants for work, improved safety and fewer claims for compensation. These are matters of direct interest to everyone associated with manufacturing processes. It follows, therefore, that production equipment ought to be designed for health and safety as well as efficiency. Up to the present too little thought has been directed toward this end. The smart engineer in the future will incorporate adequate exhaust measures in his machines so that later costly additions will be forestalled. Such effort will prove less painful to purchasing departments when considering prices on new appliances. In other words, "the barn door will be locked before the horse is stolen".

Engineers, hygienists and physicians are specifically interested in the control of any occupational procedure which is capable of causing a health hazard. This covers an assortment of jobs and materials in industry which has been greatly augmented by the war in the evolution of new processes and substances. Many things hitherto assumed to be innocuous have been found to cause bodily harm. For instance, the use of beryllium compounds in the production of unusually light and fatigue-resistant alloys has been held responsible for bizarre lung conditions which have not only been baffling, but have occasioned disability and death in exposed workers. Harmful dusts, fumes and vapors may give rise to such occupational diseases as silicosis, siderosis, asbestosis, and/or poisoning from lead and other heavy metals. Chemical hazards from solvents etc. may result in acute inflammatory lung conditions or dermatitis. Inadequate lighting may produce eye strain and excessive noise impaired hearing. Increased susceptibility to tuberculosis has been recognized as a complication of silicosis.

The two greatest occupational hazards we are faced with in Brake Shoe are those due to dust and lead. I can perhaps best demonstrate the necessity for your greater familiarity with the activities of the Medical Department by describing our program with respect to these exposures. An appreciation of the dangers arising from them should constitute a good background for some of the discussions in this meeting.

Silicosis may technically be defined as a disease of the lungs due to breathing silicon dioxide dust, characterized anatomically by generalized nodular fibrotic changes throughout both lungs which are demonstrated by x-ray examination and by autopsy and resulting from any process of occupation involving inhalation of silicon dioxide dust. Silica or silicon dioxide (SiO_2) is the most common ingredient (60%) of the rocks and minerals which make up the earth's surface. It exists in two forms, "free" and "combined". As far as is currently known, only free silica can cause silicosis. Dusts produced from substances containing silica consist of particles of various size but only those below three microns in diameter (a micron is 1/25000 of an inch) are believed to be dangerous. This means that most of the visible dust is not of as much concern as the particles which are not seen by the naked eye. Silicosis is therefore likely to result only where there is sufficient exposure to dust which contains respirable sized particles of free silica (especially below three microns) over long periods of time (two to twenty-five years -- average 10).

As the dust particles are inhaled, most of the larger ones are trapped by the defensive mechanism of the upper respiratory tract and very few ever reach the alveoli or small air sacs of the lungs. Those particles below three microns, however, find easy access to the lungs and nature tries to get rid of them through ingestion by alveolar cells which in turn are transported by the lymphatic vessels toward the root of the lung. Along the way these cells become deposited about the lymph nodes and a slow chemical reaction occurs between the body fluids and silica particles in which the cell dies and the surrounding tissue is attacked. This results in destruction of lung tissue and consequent replacement by fibrous or scar tissue. As the process goes on and more and more silica is inhaled, the lymph drainage is blocked so that the process spreads throughout the lung, resulting in scattered areas of scar tissue which present a characteristic nodular pattern in the x-ray. If exposure continues over a long enough period, more fibrosis or scarring results and more lung tissue is destroyed. This eventually may result in disability particularly if infection (tuberculosis) complicated the picture.

SIDEROSIS

Grinding and burning operations in some of our cleaning rooms have produced an x-ray pattern in the chest films of a number of employees which presents quite a problem. The x-ray appearance closely simulates that of silicosis, but when checked with industrial hygiene surveys of these locations, not enough free silica of respirable size was found in the samples to account for it. It has been established in other industries here and abroad that iron oxide, when inhaled, will pigment the lungs to the extent that shadows are cast on the x-ray film. Our air samples showed a high percentage of iron in these operations, certainly enough to produce such shadows. Iron dust has been found to be incapable of causing fibrosis or damage to lung tissue. Its reaction is comparable to a tattoo mark on the skin - the skin is discolored but there is no impairment of function. This, however, has a definite implication from the health, economic and medico-legal angle.

In order to prove our contention that many of the cases of x-ray nodulation we have encountered in our plants are not silicosis but iron pigmentation, experimental work was instituted at the Saranac Laboratory, New York almost three years ago. Animals have been continuously exposed to high concentrations of air-borne dust collected in our Amsco Chicago Heights cleaning room since that time. The results obtained indicate no evidence of silicosis in any of those sacrificed thus far. The usual reaction to inert dust has been noted and x-ray shadows in the animals' lungs are comparable to those observed in our employees. These findings have been supported by the analytical work of our industrial hygiene laboratory and also by a recent autopsy in an employee who has been receiving compensation for "silicosis" but who died from cancer of the stomach. Post mortem examination of his lungs revealed no evidence of silicosis although his x-rays had previously shown a mild degree of nodulation.

This case demonstrates very clearly the importance of correlating medical findings with engineering studies.

LEAD

In certain foundries the greatest hazard arises from toxic fumes liberated in melting and pouring of various metals such as lead, chromium, magnesium and manganese.

"Lead poisoning" is a disease which dates back to ancient times. Many cases are on record where the condition has arisen from unusual sources - such as the drinking of wine from old pewter vessels, lead in paint used on children's toys, lead in cosmetics, etc., but these are mostly isolated instances and research in recent years has resulted in much more accurate diagnosis and reasonable thinking on the subject.

It is now well established that there is a difference between "lead absorption" and "lead intoxication," and the distinction is extremely important particularly in industry. Lead absorption simply means that lead is present in the body in unusual amounts without evidence of symptoms or disability. When this absorption reaches a sufficient degree, symptoms of poisoning or "intoxication" appear. This may vary in different individuals and also with the length of exposure. The common signs and symptoms are cramps in the abdomen, constipation, nausea, weakness, headaches, and, if the exposure is sufficiently heavy, prostration, stupor, violent delirium, convulsions, and even death. Sometimes palsy, or paralysis (wrist drop) of the extensor muscles of the hand and arm, result.

Lead can enter the body in three ways - by ingestion or swallowing, inunction or through the skin and inhalation, or via the lungs. The first two of these are relatively unimportant, but the inhalation of lead fumes or dust is something to be reckoned with. It is the commonest cause of lead absorption and lead intoxication.

Lead is so universally present that there is a "normal" rate of excretion in the urine. Traces can be found in the urine of new born infants. Definite standards of lead excretion have now been established and the examination of routine samples of urine from workers exposed to lead is generally accepted as the most valuable means of determining whether employees are being affected or not. The older tests such as Basophilic Aggregation and Stippling are of value in demonstrating the presence of lead absorption, but these cells are found to be increased in a number of other conditions such as anaemia, and are not truly diagnostic.

A good Industrial Hygiene program includes repeated examination of urine specimens from those exposed. The results are measured in gamma per liter. A gamma is 1/1000 of a milligram, so that when dealing with such minute quantities, it is essential that collection of the urine specimens be done with great care. A small bit of lead dust the size of a pinhead will contaminate the specimen to such a degree that it is readily recognizable during analysis.

Impending lead intoxication can be predicted with reasonable assurance by using this method, and workers can be safeguarded before disability occurs.

We have numerous examples of what can be accomplished by cooperation between engineers, plant management and the Medical Department. In our National Bearing plant in St. Paul, we used to have an average of thirteen or fourteen cases of lead intoxication a month. Since the inauguration of our hygiene program, the very commendable effort of the plant management and engineering staff in carrying out recommendations of our industrial hygiene engineer, Herb Weber, has produced a situation in which we have not had a case of lead poisoning in this plant in three years.

In our St. Louis plant where the lead problem has been acute, through similar cooperation results are now becoming appreciable and we are looking to the not too distant future where lead cases will be just an unpleasant memory.

In Amsco we have had an excellent example which I believe Brown Reinhardt will mention in his presentation. I refer to the burning table which now controls one of the worst exposures we have in this division. Because rather rapidly developing x-ray changes were noted on the chest films of workers on this job, something had to be done. A conference was held at Chicago Heights between the Medical Department and plant management and engineers. At that meeting Mr. Mullin detailed Al Shafer and Herb Weber to go to Denver at once, study the situation and come up with the answer for practical exhaust of the operation. They did this and within a few weeks designed and installed a new burning table which has completely reduced the dust hazard to well within safe limits.

I could cite many more examples, but these will suffice. The point I wish to make is that there is usually a practical answer to these problems. I would like to stress the thought that you, as engineers, ought not to use the "negative" approach to these things. I realize that you are vitally concerned with costs and that new ventilating equipment must be kept within reasonable limits. We in the Medical Department are also keenly aware of this angle, which is all the more reason for such conferences as this. Yet we, like you, have a job to do. Ours is perhaps a greater responsibility because we are concerned with human machines in contrast to those of iron and steel. We have been commissioned to protect the health of Brake Shoe employees and our first responsibility is to them. If you engineers become imbued with that same spirit and consider every working environment from the standpoint of whether you would like to spend the productive period of your lives in unhealthful atmospheres as some of these men do, I am sure that you will readily recognize the need for cooperation in making Brake Shoe a better place to work.

DISCUSSION

Dr. Hamlin's comprehensive paper, which dealt with the occupational disease hazards confronting Brake Shoe, was followed by a series of lantern slides showing: types of dust particles, path of a dust particle in the respiratory tract, normal and pathological lungs.

The discussion was opened by a reference to recent cases of beryllium poisoning caused by breaking fluorescent lamps. The inside of the lamps is coated with a phosphor (zinc manganese beryllium silicate). Medical Department bulletin No. 137 was discussed. A description of the physiological effects of beryllium on exposed persons was given by Dr. Hamlin.

Question: "Other than the hazard from fluorescent lamps, is Brake Shoe confronted with the problem of beryllium?"

Answer: "The National Bearing plant at Pittsburgh was making a 0.4% beryllium copper castings. Air analyses showed only extremely small amounts of beryllium in the air. The entire plant personnel was immediately given chest x-rays. There were no definite findings. However, in view of the seriousness of the problem and because very minute amounts of the metal have caused severe pneumonitis, and even death, the division discontinued the use of beryllium."

Question: "How does asbestosis compare with silicosis?"

Answer: "The action of asbestos is a more or less mechanical plugging of the air sacs of the lungs by the longer fiber asbestos. In silicosis, the lung disease is caused by the chemical reaction of free silica on the tissue. The x-ray picture of asbestosis is different from silicosis. In the former the lower part of the lung is affected first. The appearance is that of ground glass. In silicosis, the distribution of a nodular pattern is uniform. -- Asbestosis is not a problem in Brake Shoe but it could be if precautions are not taken."

Question: "In some states, the Safety Council is getting together with engineers to determine adequate exhaust. Who is going to decide what is required on a machine?"

Answer: "That can only be by industrial hygiene surveys. Each machine must be handled individually."

Question: "How about respirators as an aid in preventing silicosis and asbestosis?"

Answer: "Respirators are a stop gap and are not the solution to industrial hygiene problems. Moreover, if they don't fit properly, they do no good whatever. The answer to a dust problem is to eliminate it at the source."

A reprint of "Silica Bearing Dusts" by Dr. Hamlin as it appeared in Industrial Medicine was distributed to the conferees.

FUNCTIONS OF THE CONSTRUCTION & MAINTENANCE DEPARTMENT

HOW IT CAN BE OF SERVICE TO THE PLANT ENGINEER

W. J. Olson

Like most other departments in the Headquarters Division, the Construction & Maintenance Department was conceived by Mr. Given. He was motivated by the following factors:

1. A need to take off the division shoulders the work necessary for major repairs, building changes or new construction, feeling as he did that the divisions might better devote their time to increasing production and production problems.

2. A need for one central department to maintain construction and repair standards, rather than having each division working on an individual basis. This would make it possible for any one division to benefit by the mistakes of the others.

3. A need for a method of passing along ideas or suggestions originated by one division, or the C&M Department itself, to all divisions.

4. A need for originating and developing methods for increasing production per man hour - requiring more time than the divisions could spare from production work.

5. A need for the development of special machinery for increased production, better working conditions and improved safety.

The Construction & Maintenance Department was set up to further these aims.

One of the first assignments of the department was to bring up to standard all plant wash and locker rooms. I know most of you are familiar with the improved facilities which have been brought about as a result.

Another major assignment was the mechanization of the Brake Shoe & Castings Division foundries. This was climaxed by the construction of Meadow Lands plant where we incorporated all that had been learned in mechanizing the older foundries.

The C&M Department is operated in the same manner as any outside architectural or engineering consulting firm. Your division has the privilege of using the services of this department or employing an outside firm. In other words, the department competes for work and hence must produce results in order to have the divisions continue to use its facilities.

The department staff is now made up of specialists in the various fields of engineering: mechanical, electrical, structural, etc. In addition, the department has authority to employ outside consultants where it is felt that such aid may be helpful in the solution of a problem.

The department is growing. When it started in 1940, it had a staff of seven and three stenographers. Today, it has a staff of twenty-five and five stenographers.

Today, the department is set up to offer the divisions many engineering services.

Besides the preparation of sketches, working drawings, contracts and specifications, bids are secured and comparison sheets are made. These comparisons of bid sheets list: the contractors, prices, delivery dates, completion dates, alternates, difference in equipment specifications, as well as our recommendations where necessary.

We make inspections and reports applying to maintenance and repair of buildings and equipment, drainage, power and lighting, heating, layout changes and materials handling studies.

On extensive building work and equipment installations we can provide a field engineer. The responsibilities of the field engineer are many and include such items as:

1. Checking contractor's time sheets.
2. Making field changes and decisions.
3. Correlating contractor's changes into items as they should appear on our inventory.
4. Expediting delivery and furnishing of equipment.
5. Establishing work schedule. The engineer arranges work schedules to suit plant superintendent and contractor.
6. Seeing that the work conforms with drawings and specifications.
7. Approving invoices.
8. Checking purchase orders against material received and handling any discrepancies.
9. Making notations of field changes so they are incorporated in the finished drawings for record purposes.
10. Providing progress reports.

We make up cost estimates for budget purposes, for appropriation requests, and cost analysis of anticipated changes or additions in production equipment.

Consultation service is provided for those plants doing their own work.

In order to have our layouts contain a higher degree of built-in safety, advance planning is essential. This advanced planning requires the knowledge and skill of experienced engineers and industrial hygienists who are familiar with ventilation and exhaust systems, industrial illumination, and sanitary facilities. Literature pertaining to exhaust ventilation is astonishingly scanty and for this reason, we hope to pool any information you have learned from your experiences achieved in work for your division.

<u>DISCUSSION</u>

This paper brought out the inefficiency and waste of duplicating mistakes. Each division should profit by the mistakes in another division.

During the discussion, dust collectors were discussed at great length. Mr. Olson suggested that the Medical Department routinely check the efficiency of the dust collectors now installed so as to acquire performance data and to determine if they are operating satisfactorily.

Mr. Saenger reported that his department tests the collectors at National Bearing Division every four months.

Question by Mr. Weber: "How busy is the Construction and Maintenance Department? Engineers have told me that if they submit a problem the delay is too long."

Answer by Mr. Olson: "For the past three or four years they have been very busy, but a major reason for the delay is that when they are requested to do some work they are not furnished with full information. They cannot tackle a problem unless all the information is available and sometimes it isn't available and sometimes it isn't available to the plant engineer. This involves delay and sometimes a special visit must be made to get the necessary information."

Question: "In the event the Medical Department has an urgent problem, such as the cleaning room in Chicago Heights, can we expect from the Construction and Maintenance Department priority in helping us with the solution?"

Answer: "In such a case, the Construction and Maintenance will assign a man to handle this work."

FUNCTIONS OF THE INDUSTRIAL HYGIENE DEPARTMENT

HOW IT CAN BE OF SERVICE TO THE PLANT ENGINEER

H. J. Weber

The Industrial Hygiene Department, a branch of the Medical Department, was organized to aid in preventing occupational disease. It is under the supervision of the Medical Director who reports to the Vice-President and Treasurer of the company.

It is a service department with a fair degree of authority and exists in an advisory capacity. Its service may be used by operating heads, superintendents, or engineers accordingly as they see fit and the smart operators will take advantage of it. The cost is pro-rated against the various divisions so that each should make full use of our facilities.

Now what is an industrial hygienist? He is not a toxicologist who specializes in investigating deaths of a homicidal or suicidal nature. He is not a latrine inspector. He is not interested in V. D. (venereal disease), but he is interested in O. D. (occupational disease). It is his job to recognize potential health hazards in industry and to devise ways and means for their prevention and correction.

In Brake Shoe, the following are some of the potential hazards to health: Silica, Lead, Chromium, Tellurium, Zinc, Phosphorus, Iron Oxide, Asbestos, Manganese, Mercury, Solvents, Carbon Monoxide, Radiant Heat, X-Ray Emanation, Ultra Violent and Infra Red, Acrolein, Phenolic Resins.

It is the duty of the Industrial Hygiene Department to assay these hazards and to recommend methods of control. Even where plants are thought to be in good hygienic condition, we feel it is important to survey them periodically on the basis of past unpleasant experiences.

You would be amazed at the unsuspected hazards brought to the attention of management. At the National Bearing plant in Pittsburgh, we had finally succeeded in reducing the lead-in-air concentration to safe limits. We then became complacent because here, at last, was a bad plant finally brought under control. On a routine follow-up survey, we found very hazardous conditions because the ventilators were not being turned on; the cupola hoods were not kept in repair; ladle skimming was not done under the hood provided; etc.

At National Bearing St. Louis, the machine shop air appeared to be as clear as outside air. We didn't suspect any hazard there. However, routinely, we collected urine samples from the workmen. We found them excreting abnormal amounts of lead, indicating high exposure. Air analyses confirmed the findings of the urinalyses.

In the Southern Wheel Division, we discovered that the operation of rolling a wheel from the cooling pits to the sand blast was hygienically far more hazardous than the shakeout. Although visibly, you would swear that the reverse was true.

At Ramapo Hillburn, we found a lead hazard at the spray paint booth. The enamels being used contained from 4.4 to 15 per cent elementary lead by weight. The lead mist in the breathing zone of the sprayer was 8.6 milligrams per 10 cubic meters of air. (The M.A.C. is 1.5 milligrams per 10 cubic meters.)

At Amsco Denver, we found an explosive atmosphere in the gas booster room, and at Brake Shoe & Castings Baltimore, we found that spraying molds with Delta Gra-Kate Mold Wash, an apparently harmless operation, was a definite hazard as far as silicosis is concerned. We could mention many more instances.

We are equipped with field and laboratory instruments to evaluate hazards such as these, improve ventilating design, substitute materials, or convert from dry to wet processes. We have been called by plants for assistance in many varied things. We can help you too in your work.

During the war, when man power was scarce, it was necessary for an employee to get a release from the War Man Power Commission in order to quit his job. Some men sought a release on the grounds that the plant was too dusty. The Amsco and Wheel Divisions used our industrial hygiene reports to prove that the allegation was not so and the release was not granted. Hence, one of the reasons for periodic survey even in the case of known good plant environment. A good number of surveys giving the plant a clean bill of health is pretty good evidence for a lot of purposes.

The Brake Shoe & Castings Division called on us to make efficiency tests on the new wet dust collector at Meadow Lands. By weight, the collector was approximately 90 per cent efficient (and this is the way the manufacturer reports efficiencies), but by count it was only 52 per cent efficient. In other words, it was not getting the fines which were being discharged toward the adjacent high school. The school authorities were complaining about the dust.

At the new Meadville plant, we were also called on to determine the efficiency of the electrostatic precipitator used for the collection of phosphorus pentoxide fumes. We have equipment to perform similar service for other divisions.

The Amsco Division is presently confronted with the new smog or dinance in Los Angeles. The ordinance will not allow more than 0.4 grains of particulate matter per cubic foot of effluent. The division asked us for help and we were able to demonstrate that certain operations could be exhausted with our collectors and still be within the requirements of this limitation.

Brake Shoe & Castings asked us to make a study of the use of wetting agents in allaying dusts.

In the Minneapolis plant, we reduced dust concentrations from 52 million particles per cubic foot to 8.6 million. This is a 83.4 per cent reduction.

The improvement at Southern Wheel Portsmouth on the floors where wetting agents are used is very pronounced.

Kellogg and Ramapo called on us to make illumination studies.

In the Ramapo case, our study was quite extensive. Seventeen buildings were surveyed, and at the request of management the installation and maintenance costs were developed for each building.

We were recently called by National Bearing to make exhaust studies on the wheelabrators in use in their plants. With the testing equipment we have, we were able to locate defects in design.

We had two conferences with the manufacturer's representatives and pointed out the designing defects. They didn't know anything about dangerous exposure. They were talking in terms of silica and the problem was concerned with lead.

At Brakeblok, we were able to demonstrate to the unions that the exhaust system was well designed and was affording excellent protection against the various toxic materials used.

The men applying for insurance from the Prudential Insurance Company were assessed an extra premium because they worked in a supposedly hazardous plant. Dr. Hamlin and I met with the union stewards and explained the medical and industrial hygiene control program and pointed out the facts about lead poisoning and asbestosis.

The stewards felt that if the plant were safe we ought to be able to get their insurance premiums reduced. On the basis of our survey findings, we were able to demonstrate to the insurance company that the hazards were controlled and reduction in premium was immediately obtained.

A humerous incident occurred while we were meeting with the union stewards. I left the electrostatic precipitator at the asbestos weigh station in order to collect an air sample during the conference in order to save time. When I returned, the collector was full of asbestos. Someone had thrown a handful of the material into the tube to make sure I would find the place very dusty. I wouldn't have had that much dust if I left the sampler running for a year. Our medical director has just outlined the importance of the engineers' thinking in terms of health as well as production and cost. Dust and fume control constitute an important part of the correlation of medical and chest x-ray findings with exposure.

Before placement of an employee, Dr. Hamlin consults with me about exposure, and he makes use of our dust findings as an aid in the interpretation of chest films.

This leads to an important point. The test of whether you have well designed a hood or exhaust system is whether you have protected the man. All your mathematics and ventilation guides will not give you the absolute answer. You may design according to good engineering practice, but the proof of a good job depends on whether it will pass a field test. Here we can help. For example: A wheelabrator is designed well enough for silica dusts but it is poorly designed for lead bearing dusts. The nature of the material you are exhausting is important.

The original designer thinks in terms of visible dust without consideration for the dust that cannot be seen with the eye. This demonstrates the need for the industrial hygienist's assistance. A system that is satisfactory for coal dust may be totally ineffective for mercury vapor.

Recently the Amsco Division became interested in buying a Do-All Saw for cutting manganese steel gates and fins. Before placing the order, they asked our department to test this machine for any dust and fume hazard while it was cutting some test castings. That's good common sense! You wouldn't think of buying the machine unless it could solve your production problem.

Why use it if it won't solve your health problem, or worse, introduce one? We can report that the machine was satisfactory from both angles.

Since there are few basic laws of ventilation design, since nearly every job must be tailor made, since we cannot be sure the job is right when it is on the drawing board, we must depend on our own past experience, the experience of others, and the standards for safe limits as developed in the field of hygiene. In other words, ventilation may be in large measure empirical - the result of trial and error. Errors can be expensive, but if consideration is given to the factors just enumerated, they can be eliminated or kept to a minimum.

Now if an engineer designs a system of exhaust ventilation, our tests will indicate whether minor or major alterations are necessary or whether the system is performing properly. Such knowledge will add to the peace of mind of the conscientious engineer. You can't tell by eyesight always.

The fallacy of considering an operation safe because no visible dust is evident has been demonstrated. We found lead contamination in the office at Pittsburgh; and at the old Meadville plant, recirculated air contained a good percentage of the fines and came close to making a lead intoxication case in an area that you would not suspect. The hygienist and engineer should bear in mind that there is a natural tendency to believe our eyes.

Another fallacy current is to rate the need for ventilation on the basis of composition of the parent material used or processed. Let me illustrate. Consider a wall made of 90 per cent quartz rock and 10 per cent lime mortar. A workman begins demolishing the wall with a jack-hammer. The dust produced will be overwhelmingly mortar dust, a fact that bears no relation to the original composition of the wall.

We have been told that a parting compound contains less than 5 per cent free silica and that a copper casting contains no lead. Therefore, why exhaust a processing operation? Here again we must think in terms of industrial hygiene. How much silica is the man breathing? In the case of the copper castings, are you speaking metallurgically or hygienically?

Therefore, I should think that an engineer would want to know how well he has designed so that he can profit by his experience. For example, you can't tell Al Shafer that he doesn't know how to design a burning table; he knows from our tests that his design is 100 per cent effective. It will be an easy matter for him to work out a second table.

For the present ventilation project at National Bearing St. Louis, we have worked right along with the Engineering Department. Design and test has been the procedure until now we feel a good practical exhaust system has been developed.

We were also called on to make studies on the effectiveness of a Ruemelin exhaust for cupola fume. We were able to report that the method is impractical. Suppose these units had been installed division-wise before their effectiveness in this application was known?

We have been able to show that an overhead ventilator above a fume producing operation had absolutely no effect on improving the atmosphere around the men most severely exposed. Such information in the hands of the plant engineer is helpful. He won't repeat the mistake!

At Denver before the installation of the ventilator, the dust count was 300 million, and after, it was 278 million. These two results are of the same order of magnitude.

Again in designing, you may have to comply with state codes. When the code gives much latitude to the inspector, we may be able to deal with him for you and perhaps influence him to modify some of his unreasonable requirements. At Amsco we were able to reduce 11 hygiene indictments to 3.

Labor inspectors sometimes enter our plants and demand a lot of useless or unnecessary ventilation. Before proceeding with their recommendation or orders, why not check with us? Maybe the money could be spent more wisely in another part of the plant or in a different plant of your division.

Salesmen peddling an exhaust gadget may have some plausible and convincing data. Maybe we can tell you that another division tried it and it didn't work.

Are you working on the elimination of an explosion hazards from solvents, dusts, etc.? We have testing equipment for this purpose and maybe we saw a ready solution in another division.

I know a good way to exhaust a planer grinder. I saw and tested one in the Ramapo Division!

How would you exhaust a mechanical oxyacetylene torch, cutting steel bars on a production basis? I saw an excellent design at the Forge Great Lakes plant. If you had a similar problem, we could tell you where to find a ready answer.

The instances I have cited may have no application to you. We do not profess that we know all the answers to your problem. Neither do we presume to tell plant engineers their business. I am merely stating that we have certain facilities which are at your service and we will gladly cooperate in any way we can if you feel our efforts might be helpful.

If your problem involves industrial hygiene, and in a great majority of cases it well may, I think we can help if only as a liason between divisions. Your concern is with your own division; ours is with all ten. We may be able to channel a good idea from another division to yours.

DISCUSSION

The purpose of the first three papers was to orient the group in order to approach the discussion of the aims of the conference more intelligently.

Dr. Hamlin pointed out that the Medical Department's job is to protect the health of Brake Shoe employees, and to do this it needs the help of the engineers. Equipment costs a lot of money and if it is not properly used, the investment in ventilation is wasted. It was suggested that someone in the plant see to it that all equipment be used properly.

Question by Mr. Olson: "How often are industrial hygiene surveys made?"

Answer: "We try to survey every plant once a year; National Bearing plants twice a year; where conditions warrant we will check a plant as often as necessary."

Mr. Tayler pointed out that the industrial hygiene surveys were an aid to the engineer in determining the effectiveness of their equipment. In some plants, maintenance is bad and thus it is important to check on plants frequently.

AIMS, PURPOSE AND SCOPE

J. T. Gresh

As stated in our agenda for this meeting, the purpose of our being here is to discuss, formulate and adopt a method or procedure whereby there will be a complete exchange among Brake Shoe's plant engineers of the problems encountered and the solutions to such plant and operating conditions, as follows:

1. Exhaust and ventilation of buildings, rooms, processes, etc., resulting in a hygienically safe environment.

2. Illumination, the proper application of which reduces eyestrain among employees and affords greater accuracy of workmanship, resulting in improved quality of work and product with less spoilage.

3. Material handling and preparation in relation to the prevention of contaminated air being produced and/or dispersed in an area or areas.

4. New construction and construction changes as it relates to Industrial Hygiene Engineering. Obviously, the most efficient and successful way to have a hygienically safe operation or environment is to have proper control measures engineered into the building and/or machinery.

5. Plant layout - operating techniques. Proper arrangement, and use of toxic or nuisance dust producing operations so that their atmospheric pollution effect might be limited or eliminated.

6. The use of toxic and corrosive materials necessary to plant operation. Needless to say, the surest way to correct a toxic or corrosive material hazard is to find a non-toxic material to substitute for a toxic one. Of course this method is quite limited in its practical application. Therefore, it becomes necessary for each of us to apply individually or collectively our engineering know-how in controlling the hazard. It can be done by proper design of, or changes to plant, equipment, methods--installation of local exhaust ventilation--enclosure, etc.

To realize results in any one or all of the foregoing items necessary to good Industrial Hygiene is no small job. It does not necessarily result from one engineer doing the work, or one plant having the experience, or one solution being the only answer to a problem, or one department having the responsibility - rather it is the idea of making use of as many of these so-called tools as possible.

For example, Dr. Hamlin's comments on the Medical phases of our Industrial Hygiene Program indicates that best efficiency and economy result from a consideration of the medical and engineering phases or a given condition. Furthermore, Dr. Hamlin's presence here and his participation in this conference program is indicative of the fact that the control of Occupational Disease exposures is the responsibility of both the doctor and plant engineer.

To substantiate this, Dr. Hamlin explained the pathology of two diseases common to the foundry industry and which our company strives to control, namely, Silicosis and Siderosis. Silicosis, an occupational disease, is a lung involvement due to the inhalation of silica and is disabling. Siderosis, a pigmentation of the lungs, is due to the inhalation of iron dust and according to well advanced medical opinion is not disabling. However, Siderosis is very troublesome from the Medico-legal aspect and the necessity of its control, as is the case with Silicosis, can not be over emphasized.

Since a variance of opinion exists in connection with this disease, the best and surest way of licking the problem is to control the substances producing the cause. Therefore, the plant engineer is responsible, and properly so, for the solution of this problem. I'm sure you will agree that it can be done by proper engineering control measures.

In general the items mentioned at the beginning of my discussion and which we are concerned with at this meeting, namely, ventilation, illumination, material handling and processing, use of toxic and corrosive materials, etc., constitute our industrial health and atmospheric control problems.

Complete or near complete elimination of an atmospheric contaminant is seldom accomplished by the application of a single measure - rather it usually involves the use or application of a combination of methods.

There are many different measures and methods of preventing the generating of, and consequently the worker inhaling, air excessively contaminated with various toxic or corrosive materials. However, the principles are essentially the same and for the purpose of dealing with them at this meeting are, in my opinion, as follows:

I. Eliminate or reduce the contamination at the source by one or all of the following means:

a. Proper design, alteration and/or maintenance of the building and equipment.
b. Changes in the operation or process where practical.
c. Substitute a less toxic or non-toxic material for a toxic one.
d. Good housekeeping.

II. Preventing the dispersion of the contaminant, such as:

a. Local exhaust ventilation.
b. Enclose the process and ventilate.
c. Isolation of the process and ventilate.
d. Use of wetting agents to alloy harmful dust.
e. Properly maintain existing equipment.
f. Educate the worker in the proper handling of toxic materials and use of the control equipment provided.
g. Good housekeeping.

III. Adequate protection of the worker by:

a. Supplement local exhaust with general ventilation and air dillution.
b. Alterations to present or contemplated equipment and/or processes, namely, operators working position relative to controls, feeding, inspection, etc.
c. Availability and use of respiratory protective equipment in emergencies. This is the least desirable way to protect workmen but it can be used as a "stop gap" in case of mechanical failure, etc.

d. Again, educating the operator or operators is important. Advise them in the proper handling of toxic materials, the use of ventilation equipment, and how to prevent the creating of unnecessary dusts, fumes, mists, etc.

In summary, I should like to repeat that to provide and maintain safe working atmospheres is not easy. We must be conscious of it in all of our planning and designing.

Our plants, and it follows our operations and processes as well, if constructed without due consideration to keeping the atmosphere healthful and the contaminants generated within the allowable limits as prescribed by our Industrial Hygiene Department precludes the most efficient use of our engineering know-how. Therefore, it is sound, efficient, and economical engineering practice to have these control measures engineered into the building and/or operation. This is the aim of our meeting here now.

This conference signalizes, I feel, a great movement in our company in that individually and collectively we have the opportunity to add immeasurably to the efficiency and economy of Brake Shoe's plant and industrial hygiene engineering programs.

Your presence here and your willingness to exchange ideas and experience substantiates this opinion. Our adherence to this aim cannot help but produce results.

DISCUSSION

The need for a meeting of this kind appears overdue. One division may have the answer to a ventilating problem while another is seeking a solution of the same or a similar problem. There should be some way to exchange ideas and pool experience.

In any occupational disease, whether due to dust, fume or toxic solvents, the best treatment lies in prevention which is an engineering job rather than medical.

Even innocuous dusts should be eliminated for personnel reasons. It is becoming more difficult to get men to work in a dirty environment. Unions are becoming more conscious of dirt. We will eventually be forced by state laws to clean up our plants.

To meet these changing conditions, the divisions must join forces so as to pool the skills of all for the common good.

Wetting agents were discussed at length and Brake Shoe's experience with them was reported.

Question: "If a clearing house for ideas is formed, what is to be done about past accomplishments or failures?"

Answer by Mr. Gresh: "Those who have had experience with successful or unsuccessful installations should write up any information and send it to the clearing house for reference."

Question: "Is the clearing house information to be released only to members of the company?"

Answer by Mr. Olson: "Yes, but if we can help another company in problems of health and safety we should."

Dr. Hamlin pointed out that the Medical Department has had visitors from many other industries whom we have helped in setting up a medical program.

Mr. Saenger suggested that we in our turn might benefit from other industries, so why not help them?

Mr. Gresh pointed out that the information referred to the clearing house should not be passed out indiscriminately. We should keep in mind so-called trade secrets and aviod violations.

PROBLEMS

Vacuum Cleaning methods were thoroughly discussed. Messrs. Bazzeghin, Antrobius, Saenger and Tayler had the most information on these methods and they pointed out the benefits and practical problems inherent in their use.

Housekeeping: This subject formed the basis of a considerable exchange of experiences:

Question by Dr. Hamlin: "Do we in Brake Shoe give enough consideration to keeping a plant clean? Do we actually designate enough people in the plant to really keep it clean?"

Mr. Tayler suggested that it is better to spend money to exhaust a job completely rather than to let the plant get dirty and then try to clean it up. Foundries have been accepted as dirty places for too long.

Question by Mr. Tayler: "Will somebody state the company policy on this matter of housekeeping? How far should we go dollar-wise in keeping plants clean?"

Answer: "There is no over-all policy, but Mr. Given has always stressed that he wants to make our plants a better place to work."

COLOR DYNAMICS

Question by Mr. Saenger: "Has anyone tried color dynamics as an effective good housekeeping practice?"

Answer by Mr. Bazzeghin: "The Brake Shoe division tried it, but has discontinued it because of high maintenance."

Clarence Horn who did considerable work with color combinations reported that it is an effective housekeeping medium, but also an expensive one. It decreases absenteeism, engenders safety, and promotes cleanliness around machines. However, painted surfaces must be continually touched up or the effect becomes worse than if no color treatment were used at all.

Radiant Heat. The radiant heat problem in the Forge Division was explained by Arnold Lamb. He demonstrated at the blackboard the nature and severity of the problem, and indicated the suggested remedies.

Mr. De Jarnett explained that a low temperature luminous flame in front of a furnace may act as an effective barrier against furnace radiation.

Screening and hooding were also discussed as effective remedies against radiation.

Cope Dusting. George Antrobius explained a problem confronting the Southern Wheel Division. How can we eliminate the dust associated with the operation of dusting a chiller with dry facing materials? Suspension of the facing in various wet media was proposed. Mr. Antrobius said the Southern Wheel Division would consider the problem at its operating meeting.

Ladle Fumes - Lead Oxide. Mr. Saenger sketched on the blackboard the problem confronting him in trying to exhaust a ladle while being transported from furnace to molding area. Various suggestions by the conferees were offered.

CHARACTERISTICS OF

INDUSTRIAL HYGIENE INSTALLATIONS IN AMSCO

H. B. Reinhardt

Since there are a lot of kindred souls present who have been given the job of trying to satisfy the Medical Department's recommendations for cleaning up the plants, I would like to ask for a little sympathy on the number of people that usually have ideas that have to be considered on a dust control installation.

The job frequently starts as a result of a survey by the Industrial Hygienist, who makes a specific request for action. Then the Works Manager has to be considered because he won't like it if the installation interferes with operations and his hours per ton are increased. The department foreman thinks along the same lines, but may have entirely different ideas of how the job should be done. Frequently, the state safety or health inspector will put in his "oar" because his book says that it ought to be done this way. In many locations, building codes have to be met. At our Los Angeles plant, and I believe it will be coming elsewhere, we have an Air Pollution Board to contend with that is very fussy about the dust that gets out of the building. Then, of course, we all have a boss that is responsible for his division making a profit and of necessity has to be careful about the amount of money spent. By the time all of these requirements are taken care of, I sometimes wonder how we have accomplished even as much control of dust as has been done to date.

Some of you are dealing with high production work where the size of flasks used and other factors remain fairly constant over a reasonable period of time. That makes your dust jobs easier to solve. As you know, ours is primarily a jobbing business where flask and casting sizes vary greatly from one day to the next, which means we cannot design a closefitting hood for a specific operation because next month that same pouring line or that same grinder might be used for an entirely different purpose. Please bear this in mind in the discussion that follows.

Classes of Problems: There are three general classes of problems that the Medical Department asks us to correct, namely, toxic gases, illumination and dust.

Under the subject of gases, we do have a little trouble from carbon monoxide discharged from ladle heaters, but practically nothing else of any consequence.

Illumination is none too good in many of our working areas due to a great extent to higher standards having come into being since our lighting installations were made. I am not going to discuss those two problems to any extent, but will concentrate on the subject of dust and smoke, which is the one that gives most of our headaches.

Troublesome Operations - Melting: Although you are all familiar with foundry operations, I would like to go down the list of departments and point out the operations that cause trouble from a dust and smoke standpoint.

Starting in the Melting Department, we do our melting in arc furnaces which discharge a considerable quantity of smoke through the charging door and around the electrodes. About 5 per cent of the metal charged into the furnace is lost during the melting operation and a good percentage of that comes out as dust and smoke. With a charge of 8,000 pounds, you can see a lot of dust is involved.

Our sand preparation equipment consisting of screens, transfer belts and elevators handling dry sand for the most part is another bad source of dust.

Troublesome Operations - Cleaning Room: Although the foregoing operations can, and frequently do, fill the building with unpleasant dust and smoke, they are not extremely hazardous to the men due primarily to the large particle sizes involved. Our real trouble shows up when we come to the cleaning room. Here, of course, we have to contend with the burning of heads, gates and fins with acetylene torches, tumbling of small castings, welding operations and various and numerous grinders. The chest x-ray program has shown that the burners and the grinders are the men that have to be watched more closely than any others for lung changes. The same condition exists in our machine shop where most of our machine tools are equipped with grinding wheels in place of the conventional cutting tools.

Solutions - Arc Furnaces: I have given you a brief picture of our problems. Although we have not made enough progress to satisfy all concerned in solving them, we have come up with a satisfactory solution in many cases. I am going to give you a little information on some of the dust control installations and, if you want to go into any of them further, we can do so in the discussion that will follow.

Until recently, our furnace smoke has been removed by means of roof ventilators above the furnaces. Although they did not do a 100-per-cent job, the smoke that remained in the building did not affect anyone very much except the crane operators.

In their plant surveys, the Medical Department has been recommending for some time that hoods be installed on the furnaces, so last year we decided to install one at St. Louis more or less as an experimental installation. These hoods are made by the American Air Filter Company, each one tailored to fit the individual furnace, and they really do a grand job. They pick up the dust and smoke at the source, thereby doing a better job with considerably less air being exhausted. It is interesting to note that our melters at St. Louis were opposed to the installation on the grounds that it would interfere with their operations, but the hood had not been in use for more than one heat when they became most enthusiastic and wanted to immediately promote a similar hood on the second furnace.

This particular installation did not include a dust collector, the exhaust being handled by a fan that we happened to have on hand.

Had our plant been located inside the city limits, the installation would have been condemned by their Air Pollution Control authorities, and I feel that any future installations of this kind should include a Roto-Clone unit to prevent the extremely heavy concentration of dust being discharged to the atmosphere. There is no question but what these hoods will go a long way toward cleaning up the atmosphere inside the plant, but the cost has to be considered. With a dust collector, the installation on a single furnace will run around $7,000 or $8,000 and it is my opinion that this money could better be spent in the cleaning room where many more people are exposed.

Sand Preparation: Where a mechanical sand preparation system is installed, the control of dust becomes a fairly simple matter. Usually the screens, belts and elevators can be easily enclosed or hooded, permitting the dust to be picked up right at the source and passed through a wet collector. I don't think anyone today would consider such an installation without a dust collector.

The problem becomes a little more difficult, however, where the sand is reconditioned in a Royer machine or something similar. The Royer is a portable machine consisting of a hopper to receive sand from a grab bucket, a set of moving grate bars to remove lumps and metal, and a belt traveling at high speed that aerates the sand by throwing it 30 or 40 feet into a pile on the floor. At New Castle, we have recently installed sprays on one of these machines, using a wetting agent in the water. Although no dust counts have been taken as yet, the Works Manager, as well as the men in the plant, are highly in favor of it and report the dust to be considerably lessened. The installation is very inexpensive, costing around $200.00 and is the most logical answer we have found yet to this particular operation.

Pouring: Smoke from our pouring operations is almost impossible to catch at the source since most of our tonnage is poured in an open area under a crane. We have contented ourselves with the installation of roof ventilators in an effort to keep the smoke diluted.

Shakeout: The shakeout operation is another one that is not too hard to control where a mechanical shakeout is involved, but is almost impossible where the molds are shaken out by the crane into a pile on the floor. At the present time, we have only one large mechanical shakeout in operation, and it is equipped with a side hood which does a fairly satisfactory job. Another one will be installed before the end of the year, and again, we are putting a side hood on it.

For smaller shakeouts, I believe a down draft would be more satisfactory, but with the sizes of molds we have to contend with, I question whether the down draft would be effective. The shakeout being installed this year at our Oakland plant has an 8' by 10' deck and the hood is being designed to allow clearance for a mold 8' square by 6' high. If any of you have any idea that a down draft would be effective on such an installation, I would like to discuss the matter with you.

Burning Operation: We are now getting into the cleaning room operations where I have already mentioned we are having our worst experiences with lung changes. The burning of heads and gates has, until recently, all been done on the floor or on a table with the burner usually leaning over his work, allowing the iron oxide fumes to rise right into his face. This is a case where the exhaust must be taken right at the source and we have so far come up with only a partial answer. At the Denver plant, we have put in an exhausted table using a down draft as well as a back hood, which does a swell job on the smaller castings that can conveniently be placed on the table. Dust counts taken near the operator's face while burning on the floor showed from 150 to 380 million particles per cubic foot. The use of the exhausted table dropped the dust count to 1.6 million particles per cubic foot, which is probably well below the general atmosphere in the cleaning room. This first table was about 4' by 6', and those going in at other plants at the present time are 4' by 10'. Even so, they will handle only about 50 per cent of the burning at the outside and we don't yet know what we are going to do about the larger castings. Any similar installation to take care of large bowl liners, mantles and dippers would require a terrifically large volume of air, and even then might not be effective because the heads on some of these castings might be several feet above the floor.

Welding: Repair welding in the cleaning room is, of course, done in enclosed booths as far as possible, some of which are provided with Ruemelin units. As you probably know, they consist of a small exhaust fan connected by a flexible pipe to a hood which can be moved around by the welder and which will remain in any position he places it. If the hood is brought up close to the work, it does a good job. We have not, however, been able to convince the welders to use this equipment and usually find it pushed back against the wall. I would be interested in knowing whether any of you have had this same experience, and if so, how you have overcome it.

Grinding: Silica dust resulting from our grinding operations could be minimized if we could maintain close control of sand and other foundry conditions to the point where sand would not be burned into the surface of the casting. Unfortunately, that is an ideal condition that we strive for but cannot always reach. In order to get the sand off the castings before they were ground, we installed a Hydro-Blast system in 1943 at Chicago Heights. The layout of our cleaning room with three adjacent crane bays is such that it is almost impossible to install dust control equipment at each grinder and it was felt that the Hydro-Blast would at least minimize the silica content of the dust. Although it did reduce it considerably, the total dust count, mostly iron oxide, is still well above the safe level.

Aside from portable hand grinders, which we have not considered exhausting, we have four basic types of grinders in use. They are: stand grinders, swing grinders, end grinders and stiff shaft grinders. The stand grinder presents no particular problem since the wheel can be hooded and it is a simple matter to exhaust at the source.

Swing grinders can be well handled in the conventional booth, but we have found that solution rather hard to apply to existing equipment. We do, however, have two types of installations in operation, both of which are doing a good job. Our Denver cleaning room building has a leanto on the side with the swing grinders hung from the crane runway beam. The back end of the grinder extends into the leanto and the wheel, of course, is out in the main bay under the crane. By bringing a sheet metal curtain down along the column line to within about three feet of the floor and installing similar baffles all the way to the floor across the leanto, the section of the leanto directly behind the grinder was turned into a plunum chamber. An exhaust fan was then installed on the roof of the leanto, all air being taken in from the main bay close to the floor. This resulted in an effect similar to that obtained from the conventional swing grinder booth and dropped the dust count from 15 million particles per cubic foot to 2.5 million. These installations, incidentally, cost only about $700.00 per grinder, but are only feasible where the building design is suitable. At Los Angeles, we have recently completed an entirely different type of installation on two swing grinders, consisting of hoods mounted on the frames of the grinders directly behind the wheels. No dust counts have as yet been taken, but the men who use the machines as well as the management are most enthusiastic. That type of installation happens to work out at that plant where much of their work consists of flat castings. A similar arrangement tried several years ago at Chicago Heights did not pan out very well because the castings were so varied that the hoods interfered with the operation.

An end grinder is similar to a swing grinder, but instead of grinding on the bottom of the wheel, it uses the front face of the wheel to grind against a more or less vertical surface. This problem was solved at Denver by installing a floor grill with an underground duct and showed good results.

All of the grinders mentioned so far can be exhausted one way or another. We don't yet know, however, quite what to do about the stiff shaft grinders. They are used for the biggest part of our heavy grinding work because, like a hand grinder, they can be used in various positions and can reach parts of the castings that would be impossible to grind with a swing grinder. We have 23 of them in operation at Chicago Heights against 7 swing and end grinders. In some cases, they are used on small castings that can be placed on a table, in which case a down draft table seems like the logical solution, although we have not as yet tried it. Most of their work, however, is on larger castings such as dippers where the casting is placed on the floor and the grinder hung on a jib crane is moved around in various positions. We have reached the point where something will have to be done about these machines and if any of you have any suggestions, I would like very much to have them.

<u>Machine Shop</u>: As I mentioned above, most of our machine tools are equipped with grinding wheels due to the difficulty of machining manganese steel with tools. In the last couple of years, however, we have installed some tooling equipment, which has been working out most satisfactorily on some castings. This has reduced the dust in the machine shop to some extent, but unfortunately we are, so far, tooling only about 20 per cent of the work and still grinding the rest. Very little has been done to alleviate the dust in this department except for general ventilation.

<u>General Considerations - Building Design</u>: So much for the specific installations we have made. Before I stop I would like to bring up several points of interest that might be well to consider.

Since all of our dust control work to date has been in existing buildings, we have discovered that some building designs can make the job difficult and others can make it easy. For example, the leanto on the cleaning room building at Denver allowed us to exhaust their swing grinders at a minimum cost. On the other hand, the Chicago Heights cleaning room consists of three bays, side by side, with cranes in each and with no more than one foot between the crane clearance lines. Even if expensive sheet metal design did allow us to squeeze a long, thin, rectangular duct up between the cranes, the duct would emerge through the roof in a valley where drainage would be obstructed.

I would highly recommend that any new buildings, intended for operations where numerous exhaust systems will be required, be designed with several feet between the ends of adjacent cranes. The extra cost of such a building will probably be justified in the years to come.

<u>Heating Costs</u>: We have been somewhat concerned about the additional cost of heating our cleaning room buildings when and if we reach the point where all the grinders are properly exhausted. At Chicago Heights we have about 30 machines altogether which will require in the neighborhood of 5,000 cubic feet per minute each. Based on average winter conditions and heating the building to only 50° or 55°, the extra oil required because of the exhaust systems would amount to around $4,000 per season. One way this cost can be reduced is to install an individual exhaust unit on each grinder instead of using a central system.

On a proposed new cleaning room for Chicago Heights that was recently laid out, we obtained figures on 30 small units as against 4 large ones and found to our surprise that the cost was very close to the same either way. With the individual units, the fan can be interlocked with the grinding wheel so that it runs only when needed, and I would guess that the air exhausted would be reduced around 25 per cent to 35 per cent. Bear in mind that when I say small units, I mean units of about 5,000 cubic feet per minute each. Obviously with low air requirements, as in the case of stand grinder, it would not be economical to install an individual exhaust unit for each machine.

That is about all I have to say on the dust question. I would like, however, to show you a before and after picture showing what can be done with illumination.

DISCUSSION

Slides were shown to illustrate the various items mentioned in the paper.

The discussion dwelt chiefly with the following: recirculation of air, exhausted burning tables, stiff shaft grinder exhaust, Hydro-Blast method of cleaning, mechanical shakeouts, and Ruemelin exhaust units.

Mr. Gresh mentioned that the New Jersey Silicosis Code requires that the employer post a notice in his plant that silica is present. Employees must use protective equipment provided for them.

NEW PLANT VENTILATION

NATIONAL BEARING DIVISION

E. H. Loecher

When the new plants at Meadville and Niles were designed, we took advantage of all available knowledge and attempted to design plants which would be ideal from the point of view of ventilation. Our plant ventilation can, in general, be broken down into three categories: removal of poisonous fumes which are injurious to the health of our employees; removal of dust; and removal of obnoxious fumes. The removal of poisonous fumes is, of course, our prime objective.

Since the ventilation systems at our two new plants are incomplete, we will not attempt to describe them fully, but we will describe some of our problems and how we attempted to solve them.

The original design figures for the Meadville plant showed a total requirement of 450,000 cubic feet of air per minute to be exhausted in order to provide the desired results. To compensate for this we proposed to introduce 450,000 cubic feet of air per minute into the plant. It was our contention at that time that we should introduce the same amount of air that was to be exhausted, and completely disregard normal building leakage. We might add that the present trend of thought is that 10 per cent excess air should be introduced into a plant to provide good balance. In introducing the 450,000 cubic feet of air, we estimated that 350,000 cubic feet would have to be heated, and 100,000 cubic feet could be introduced as unheated air.

As near as we can determine, we are introducing approximately 100,000 cubic feet of unheated fresh air into this plant. Unfortunately, we have been faced with a very serious problem with unit heater construction, and to date we have been unable to determine the exact amount of heated air which is introduced into this plant. We hope that during the coming winter months we will overcome our difficulties so that at our next Plant Engineers' Conference we will be in a position to tell you more of the results obtained.

Of the 450,000 cubic feet of exhausted air, approximately 350,000 cubic feet are removed by roof type ventilators. This can be termed as "General Ventilation". The balance of the air is removed by fans, or dust collectors through ducts, and this can be termed as "Local Ventilation".

In introducing 350,000 cubic feet of heated air per minute, we must take into consideration the cost of heating this air. Last winter we burned 3,200 tons of coal at the Meadville plant. In addition to the fuel bill, we operated our heating plant 24 hours a day. When we add the cost of fuel, its handling, boiler operations, etc., it is easy to see that the cost of heating air, which is removed by a ventilation system, is very expensive.

The original design figures for the Niles plant showed a total requirement of 110,000 cubic feet of air per minute to be exhausted, and to compensate for this we proposed to introduce 125,000 cubic feet of air per minute. Of the 125,000 cubic feet of air per minute introduced, 35,000 cubic feet is unheated air, which cannot be introduced during severe cold spells because of the effect on employees working in the vicinity of the introduced air.

We have a great many sources in our plants where poisonous fumes emanate. One of our raw material is borings, which are often purchased on the open market. On these borings are deposited micron sized particles of lead which are dispersed through the air when the borings are disturbed. These tiny particles are the ones which must be removed before heavy concentrations are inhaled by employees. Problems such these are extremely difficult to solve.

When our materials are melted down prior to the pouring into actual castings, excessive volumes of poisonous fumes are produced. The removal of these fumes presents our most serious problem. Because of the design of the furnaces in which our metals are melted, the problem of local removal of these fumes is often extremely difficult. In the past we attempted to remove these large quantities of fumes by isolating the furnaces within large rooms and using the rooms as individual enclosures and providing ventilation in these units. However, this has generally proven unsatisfactory and we have attempted to find methods whereby we can provide local ventilation. At the Meadville plant we have a room in which are located 12 bronze melting furnaces. Into this room we introduce 60,000 cubic feet of unheated air per minute. From this same room we exhaust 100,000 cubic feet of air per minute. In designing this room we felt that an excessive exhaust would produce a vacuum in this area and that air would rush into the room through all openings, thereby preventing poisonous fumes from being dispersed through the balance of the plant.

From the furnace bay molten metal is transferred to the molding departments and poured into castings. As you can readily see, the problem of confining fumes emanating from ladles which are being transported, is an extremely difficult one. To date we have been unable to find a satisfactory solution.

After the castings have been made, we are faced with the problem of removing gates and risers and cleaning and grinding the castings so that they may be ready for shipment to our customers. At our Meadville plant we use shot-blast machines such as wheelabrators for cleaning the surface of our castings. The wheelabrators are used on small and medium sized castings. Since micron sized lead particles are freed by the use of steel shot against the castings during cleaning operations, we are faced with the problem of carefully ventilating our wheelabrators. In spite of good ventilation, we have found that some of the lead fumes are still dispersed into the surrounding atmosphere. At the Meadville plant we located the wheelabrators within an individual room and provided general ventilation in this room. This has proved to be a fairly successful operation.

For the cleaning of large castings we provided a Hydro-Blast unit. In recommending a Hydro-Blast, we felt that besides a means for cleaning the inside and outside of the castings, we would also provide a means of wetting down lead particles which would be loosened from castings, and thus prevent them from being dispersed into the atmosphere.

Poisonous fumes are also produced when our castings are chipped and ground. Our snag grinders are equipped with wheel guards and hoods and there is still a question as to whether or not sufficient protection is provided for the operator. For the chipping and grinding of the small castings we have provided ventilated chipping benches which remove the lead particles from the air at the point of origin. So far we have not solved the problem of providing ventilation for chipping and grinding large castings, because the varied size and number of the castings which we make makes this problem extremely complex.

At the Meadville plant we have a rather extensive and well equipped machine shop. Certain machine operations produce poisonous fumes and very shortly we expect to provide local ventilation wherever the need exists.

Up to now we have confined our comments mostly to removal of lead fumes. At the Meadville and Niles plants we have sand handling units and mechanical shakeouts, from which we must remove dust. At both plants the dust is removed by means of wet type dust collectors. We should add here that removing dust by means of wet type dust collectors provides a further problem in the State of Pennsylvania. The sludge water from our collectors cannot be discharged into the streams of the State of Pennsylvania.

At Meadville we must now find some method for carefully settling out any solids from the water before it is discharged into the stream passing by our plant. The problem of discharging industrial wastes into streams is rapidly becoming a very serious one and we would like to warn anyone who is involved in such a problem to give careful consideration to planning for disposal of industrial wastes.

As previously stated, the ventilation systems at the two new plants are incomplete, which makes it extremely difficult for us to give you concrete figures as to the results obtained. Still more important and of interest to you, would be the problems which we encountered in setting up our ventilation systems, and the manner in which we solved these problems. As we see it, the great value to be gained from conferences such as this would be the sharing of ideas and problems so that all of us can benefit from mistakes made by others. We made a great many mistakes in designing the ventilation systems for the two new plants, but we have made good progress in correcting these mistakes. Within the next eight to ten months we expect to be in a position to advise the management that the ventilation systems at both the Meadville and Niles plants will be almost complete and by far the best in any of our plants. At that time we sincerely hope that we will be given an opportunity to attend another Plant Engineers' Conference, and present to you complete data on the entire ventilation systems of our two new plants.

DISCUSSION

The discussion of this excellent paper was confined principally to the corrective remedies that were required after the ventilation system was tested out under normal working conditions. Minor changes were necessary, but these are in process of being corrected.

OLD PLANT VENTILATION

NATIONAL BEARING DIVISION

L. W. Saenger

In differentiating between the old plant and the new plant, we refer to the old plant as not necessarily an old, decrepit, ready-to-fall-down shop, but rather the foundry that has been operating prior to the setting up of a Health Control Program. In providing exhaust systems and ventilation in established operating foundries and their complimentary departments, we encounter the same problems of engineering, design and installation as in the new plant, with the exception, however, that operating conditions, existing equipment, installations and building obstacles must be taken into consideration before final design can be completed. In the new plant provisions are made in the construction and general arrangement drawings to accommodate the installation of exhaust and ventilating systems after the equipment has been placed. In the old plant operating conditions, equipment and building obstacles often play an important part in the final design of the different systems to the extent that modification of the original design is often necessary to fit the system into the existing structure, which may result in lower operating efficiency of the system or else a more complicated and costly installation to maintain design conditions. It is for this reason that management has often frowned upon the installation of ventilating and exhaust systems - because of the high cost involved. If management can be given a clear picture as to why the cost of installing systems of this nature in the old plants are more costly than the new plants to obtain the same results, in most cases approval can be obtained. The responsibility for justifying such expenditures, although considered excessive, rests with the Engineering Department and does not necessarily indicate poor design.

The first step in setting up a program of health control by means of exhaust systems and ventilation, is to make a complete survey of the plant in question to determine both the sources of contamination and the degree of concentration in which it occurs. In our division we start out with an industrial hygiene survey by the Medical Department to determine the degree of contamination in the various departments from both the dust and metallic oxide hazards. With this information, our Engineering Department then surveys the plant by departments to formulate a tentative program of control and elimination. When the tentative program has been completed, it is submitted to both the Medical and Division Operating Departments for their perusal and comment. After exchange of suggestions and criticisms, and finally mutual agreement as to the course to be pursued, the Engineering Department then proceeds to design in detail the various systems in the order of their importance, and submits to the management Appropriation Request for approval to begin the work. In the non-ferrous plants there are two problems of health control, namely, dust control and metallic oxide contamination, principally lead and zinc. The latter is probably the most pronounced of our health hazards. Regardless of which hazard is being reduced or controlled, effective industrial dust and fume control depends largely upon proper confining and elimination of the hazard as close to the source as possible, and establishment of proper air movement through hoods or enclosures to the exhaust piping system. What is done with the dust or fume-laden air after it enters the exhaust system depends largely upon the community in which the plant is located. Those of our plants located in metropolitan areas are usually required by local ordinance to be provided with dust and fume collecting equipment for all exhaust systems handling contaminated air to prevent pollution of the air in the surrounding community.

As we mentioned before, in setting up a program of health control, the sources of lead and zinc contamination are usually dealth with first. This means starting in the melting department of the foundry, which is unquestionably the largest source of contamination throughout the plant. In our various old plants we have different types of furnaces for melting our metals. We use cupolas in some plants, and either the U. S. or Stroman Furnaces in the others as our primary melting equipment. Most all plants have either ground-type crucible furnaces, or the tilting-type, above-the-ground crucible furnaces. If cupolas are used, the greater portion of the fume goes up the stack to the outside atmosphere and only the tapping-out spout requires attention. We have handled this problem differently in two of our plants having cupolas. In one plant we use a small hood over the cupola spout with proper induced draft for removing the fume. In the other plant we use a large hood extending out from the front of the cupola approximately 20 feet and approximately 5 feet on both sides of the spout in width. This entire hood arrangement is exhausted by four large ventilating fans in the monitor of the roof. The reason for the two different types of hood arrangement is that the plant having the small hood over spout does not have water jackets on their cupolas; consequently, a lower air pressure is used through the tuyeres, resulting in a very small blowout when the cupola is empty. The other plant, however, has water jackets on the cupolas and requires higher air pressure through the tuyeres for proper operation. When the cupola is almost empty, a considerable blowout occurs that might extend as much as 12-15 feet into the room. By using the large hood, we are able to confine the fume given out in the blowout to the hooded area, but this requires the wearing of respirators by the pouring crews when working under the hood. We know that the respirator is not the best answer for health control, and men are prone to forget wearing their respirators in contaminated areas if they must be worn continually. We do not have any objection on the part of the men to wearing the respirator for only a few minutes when working in such an area. When such furnaces as the U. S. or Stroman Furnace is used for melting the metal, we use individual hoods over each furnace connected to a stack leading to the outside atmosphere, and by means of gravitation remove the fume at the source. Because of the intense heat in such a hood, we found it was not practical to use our existing fan equipment which had the motor in the air stream. Rather than incur a large expenditure for fans driven by motors out of the air stream, we experimented with the gravity type hood and found it worked satisfactorily. Therefore, all of the direct hoods over our large melting furnaces are now operating on a gravity basis. The ground type crucible furnace is handled in a similar manner, and at the present time we have just completed installing individual hoods over a pit of five ground furnaces at our St. Louis plant. We do not have a Medical Department test on the efficiency of these hoods, but our expectations are such that we believe this to be the method for properly exhausting this type of furnace installation. We have made several tests of various other types of hooding for this type of furnace, but did not experience too good results; thus, we rejected the design. The tilting-type, above-the-ground furnace, if properly located, can be handled with a baffle curtain extending from the ceiling down to within 7 feet of the floor and by using a power ventilator between the baffle curtain and the wall, we are able to properly exhaust the fumes from this source. If the tilting-type furnace is not located near a wall so that a baffle curtain can be used, then the individual type of hood is required. In the furnace bay of our St. Louis plant we have some fifteen or so melting furnaces and prior to the installation of individual hoods over these furnaces, we dropped a baffle curtain from the ceiling down to within 7 feet of the floor to separate the melting bay from the pouring and molding floor. This bay is approximately 40 feet wide and from the floor to the highest point of the monitor is approximately 35 feet. The total length of this bay is 320 feet. It is divided into seventeen sections by roof trusses and in each of these seventeen sections we originally installed seventeen power ventialtors having a capacity of approximately 3,000 cubic feet of air per minute each. We found after a period of time that the ventilators were not effective, and we replaced them with seventeen ventilators having a capacity of approximately 27,500 cubic feet of air per minute each. Better results were obtained with the increased fan size; however, the tremendous air movement over the molding and pouring floors toward the melting bay in severe weather caused many complaints from the workmen on these floors because of cold drafts. Heating equipment to furnish hot air into these areas could not be installed in sufficient quantities and size due to the restricted size of our boiler plant. Because of these operating conditions we further experimented with individual hoods, and the gravity type was eventually adopted.

In all of our melting departments we use ladle heaters for preparing ladles to transport metal from furnaces to the pouring floor. Through Medical Department tests we have found that these ladle heaters also are offenders, and accordingly, we have provided all ladle heaters with an exhaust hood.

The next area in our control program is the foundry pouring floor. Because of the fact that molds containing molten bronze cannot be moved immediately after pouring, it is necessary to have the molds setting on a conveyor and pour up and down the line with the pouring ladle in motion rather than the molds. Probably the most effective type of control at this source is a hood over the entire conveyor area where molds are poured with some type of damper system to proportion the air to gain the highest velocity over each mold. We have at the present time two such hoods in one of our plants. We are now working onsimilar types of hoods for the remainder. We have not as yet worked out successfully any type of hood arrangement to cover the ladle while it is in motion on the pouring floor. We understand that an arrangement of this sort has been used at some other plants, not in our company, but here again building conditions play an important part in this type of installation. This problem is still under study, and perhaps in the future we will develop a hood effective for this type of operation. At the present time we have not attempted to control the fume given off on miscellaneous pouring floors where conveyors are not used. In some plants where these areas are fairly confined, we have used roof ventilators for general area exhaust. These have proved effective to the extent that we have reduced the degree of contamination to safe limits.

The other source of contamination on the foundry floor is at the shakeout, and at this point we are using an exhaust hood connected to a wet type of dust collector to control dust and metallic oxides contained in the sand and released during the shakeout operation.

In all of our plants having sand conditioning systems, we have installed an exhaust system to control dust and oxides during the various processes the sand passes through. This system also is connected into a wet collector because often the sand handled is still hot and the steam vapor would not permit the use of a dry-type collector. To date we have not provided any exhaust system for sand conditioning plants in our core rooms as Medical Department tests show that the dust hazard is not present in sufficient degree to warrant hood enclosures, as most of the sand is handled in a damp condition.

Adjacent to the foundry molding and pouring floors we have our cleaning operations which, for the most part, consist of sand blast rooms, wheelabrators, floor and bench chipping, and grinders. All of our grinding stands are equipped with exhaust connections and these are connected into an exhaust system connected to a dry-type dust collector. The sand blast rooms are similarly provided with exhaust connections and, with proper exhaust as recommended by the manufacturers, no difficulties are experienced from this source. With the wheelabrators, however, we have been having considerable amount of contamination from both the insufficient amount of air exhausted from the machines and also our inability to keep the equipment in good mechanical order to properly seal the unit to prevent dust and fume from escaping. We have had this problem under surveillance for some time, and now believe that the answer to proper control of wheelabrators is to increase the suction on the machine to 200 per cent of rating recommended by the manufacturer, primarily for the control of metallic fumes, rather than dust; to provide an additional exhaust outlet on the opposite end of the cleaning barrel and to enclose the bottom of the machine so that all entering air for exhaust pruposes must come through the natural leakage around the charging door. While these corrections have not as yet been made, they are in the plan stage and we hope to complete in the very near future. At the present time we have not provided exhaust hoods or ventilation for floor chipping. This problem, however, will be studied to see if we can install some system with sufficient flexibility for the type of work we handle on these floors.

The bench chipping has probably had as much experimentation for proper exhaust in this area as any other portion of our plant. We originally started out by replacing the old wooden bench with a bench having grilles in the top upon which work was placed, and a hopper under the grille to catch the heavy dirt, with an exhaust outlet in the side of the hopper to carry off excess dust and metallic particles. This was the first step in the control of the hazard from this source. Subsequently, we improved the construction details of this type of bench and incorporated similar exhaust features. The next step was the development of an entirely new type of bench which is now in operation in one of our plants. We hope in the very near future to have the same type of bench in the other old plants of our division. This new type of bench incorporates the original grille in the top of the bench with the hopper underneath and an exhaust outlet, and also a grille in the backboard of the chipping bench in a vertical position connected into the exhaust system. The greater percentage of the exhaust air from the chipping station is taken from this rear grille, and only sufficient air through the bottom grille and hopper to prevent kickbacks in dust dropping into the hopper. According to Medical Department tests, contamination from this area has been reduced below the maximum allowable concentration of metallic contamination.

The remainder of our exhaust systems and ventilation does not apply to all of our plants. Some of our larger plants have some departments that our other plants do not have, or perhaps we should say some of these departments are not as large in some plants as in others. All of our plants have some sort of reclamation department. Here we melt out returned bearings to remove the babbitt from the brass. In this operation considerable oil smoke is given off because the returned bearings are heavily coated with grease and oil. While this type of smoke is not harmful, it is highly irritating to the men working in those areas. Therefore, it has been necessary to provide exhaust hoods over our melt-out pots, as well as an exhaust hood over the area in which the melted out bearings are thrown after removal from the melt-out pot. These melted out bearings give off considerable smoke even after removed from the pot. As previously mentioned, the extent of our exhaust in the reclamation department depends upon the size of the plant as well as the size of the reclaim operation.

At our St. Louis plant we operate a white metal department. All the metals handled in this department are melted in a round melt-out pot of about 12,000 pounds capacity. Normally, the temperature of the metals melted in these pots runs high enough to emit metallic fumes, but we do have gravity-type exhaust hoods over each one of these pots. Reclamation of chips and borings is usually done in this department, and here again we encounter heavy oil smoke because of the cutting oil used in the various cutting and machining operations. These pots, too, are protected with exhaust hoods.

Also, at our St. Louis plant we have a centrifugal casting building where bronze castings are produced by centrifugal casting process. Both the casting machines and the melting furnaces are handled in a manner similar to that of our main foundries, with roof ventilators for general exhaust were required.

In our pattern shops we have the usual exhaust system for removal of sawdust and shavings from the normal compliment of woodworking equipment. These shavings and sawdust are collected in a cyclone collector and regularly removed to reduce fire hazard.

In machining operations at our plants, we have at all plants car brass finishing and lining. The new finishing and grinding machines recently acquired by our division have exhaust connections on the machine and these are connected into an exhaust system. The babbitt pots used for lining do not require exhaust hoods from a fume standpoint, but in some plants we do have hoods over them to remove the excess heat to make for better working conditions. These pots are normally gas-fired and we do have products of combustion exhaust vents.

In our larger machine shops where rough and finished machining is done, we have encountered cases of lead intoxication which has been traced by our Medical Department to the inhalation of fumes given off from our high-speed machine tools. At the recommendation of the Medical Department, we have now on our drawing boards preliminary designs for an exhaust system for the various machine tools. This system will be comparable to that used by Brakeblok Division in their machine shop. At the present time the design of these systems is in a preliminary stage and we are not in a position to offer much along these lines. We hope in the near future, however, to install and test a portion of this exhaust system to determine the effectiveness in controlling our fume hazard. We believe, however, that in addition to the exhaust, it will be necessary to use a coolant in the machine operation in the form of a mist or fog to help suppress the fine particles causing the contamination.

I have attempted to outline briefly what has been done, what is being done, and what is contemplated for the future with regard to ventilation in our old plants. At this point I believe a word about the future would be in order. It is my opinion, based upon recent developments in Federal, State and Local Municipal health departments, that we are to be confronted with more strict health control ordinances than in the past. This is somewhat due to pressure exerted by labor unions for better working conditions, by people living in the locality of our plants for means of reducing air pollution, and by companies themselves in their endeavor to make their plants and our plants better places for men to work.

I believe that in the not-too-distant future we will be required by Ordinance to suppress any contaminated air that is now being discharged into the atmosphere, by installing some type of dust and fume suppression equipment. Towards this end we have already prepared a suitable system whereby we can remove fume and dust from the discharge of our cupolas. This system, while yet in a preliminary form, is sufficiently complete to initiate papers for management's approval should we be required to install such facilities in any of our plants using cupolas in their operations. I hope that in making this presentation that I have covered, even though in a general manner, the highlights of our Health Control Program.

DISCUSSION

Mr. Saenger's paper was illustrated with some very interesting slides of characteristic ventilation problems and their solution.

The slides were discussed as they were shown so that no formal discussion period was allotted.

CHARACTERISTIC VENTILATION PROBLEMS

AND SOLUTIONS IN BRAKEBLOK

F. E. Tayler, Jr.

Dr. Hamlin, in opening the meeting yesterday, pointed out the various occupational disease hazards confronting the Brake Shoe divisions.

We all are aware of the moral obligation that Brake Shoe has in reducing and preventing occupational disease. It is not only a moral matter, but if we fail to properly meet this obligation it becomes an economic problem.

Certainly without adequate dust control and ventilation it costs more to maintain our buildings, equipment and good lighting. Uncontrolled dust not only contributes to lower health standards, but also to a loss of time by the employee. Everybody loses when an employee is sick. A workman will be happier and produce more and better products if his work place is clean, properly ventilated and lighted.

Brakeblok's manufacturing processes may differ from those in your divisions, but we are, no less, confronted with the matter of occupational disease, particularly Asbestosis from inhalation of Asbestos, and Lead posioning from contact with lead compounds. We are handling other powders and solvents which must be rigidly controlled. We create dust and chips by our grinding and machining operations. We are favored to some degree in that our product in most instances, is small permitting closer hooding of the operation.

Because many of our dust control problems may be similar to yours, Mr. Weber asked me to tell you about some of them and the methods we are using.

Brake lining consists largely of Asbestos, powders, pulverized coal, resins and solvents. These are blended together in various compounding machines. Some formulae contain as many as fifteen different items, each of which has to be weighed out, transported, and loaded into mixing machines and each when weighed, transported or mixed creates either a dust or fume control problem.

The finished product is subjected to six or seven machine finishing operations, each presenting a dust control problem.

At present, our Detroit compounding department is equipped with about 45,000 cubic feet of air per minute in dust collector capacity, consuming approximately 160 horse power, and serving fifty dust and fume control hoods. The finishing department has 88,500 cubic feet of air per minute in collector capacity, consuming approximately 340 horse power, and serving one hundred and twenty dust control hoods. In all, the Detroit plant exhausts over 200,000 cubic feet of air per minute through dust and fume collectors. This represents a large sum of money in electric power to get the dust and fume laden air out and a considerable additional sum to heat the replacement air during the winter.

Brakeblok has provided itself with adequate dust control. To the best of my knowledge no case of occupational disease or sickness has ever been attributed to the dust other than mild cases of contact dermatitis. However, we feel there is still room for improvement. We are continually improving hood designs not only to increase collection efficiency, but also to reduce the quantity of air required to do the job.

We have found by more recent experience that we can satisfactorily convey our dusts at velocities lower than those used previously.

In 1935 our finishing department system was designed with 5,600 feet per minute velocities in the branches, and 5,000 feet in the mains. Today we operate at 4,500 feet in the branches and 4,000 feet in the mains, and we experience no settling out of collected materials. This means a saving in horse power at the collector and in many instances less air exhausted from the plant.

Improved methods of handling and processing often permit better control, and at the same time allow a reduction in the air required.

With the construction of the Winchester plant, we had an opportunity to employ new and different ideas of handling materials, particularly in the compounding department. The slides which I will show you shortly will illustrate these. The new methods employed at Winchester permit the loading of storage bins, weighing and batching of powders and compounding of materials with almost a complete absence of contact between employee and materials handled. The Winchester compounding department is very clean considering the type of materials handled, and can be kept clean at a minimum of expense.

I want to say at this point that the Brake Shoe Construction and Maintenance Department was of considerable help to us in working out many of the details of these new methods.

The slides I have with me were taken in Winchester and Detroit. They will illustrate some of the characteristic problems we have in dust control. Many of the hoods are standard design; others are adaptable to only our particular methods.

((At this point slides were used to suppliment the discussion))

The pictures shown might convey to you the idea that Detroit has poor dust control in the compounding department. This is not the case as Mr. Weber's investigations have borne out. Winchester, starting from the ground up, gave us the opportunity of modernizing our methods. This is also true in other new Brake Shoe plants. Wherever possible, what we learn at Winchester will be applied to Detroit in the future.

The balance of the slides to be shown illustrate dust control methods and hood designs as they are applied to the various grinders, saws, drills, and other machines that are required to finish a piece of brake lining.

The dust collectors are of various types. We originally had only dry bag type collectors which you have seen in the slides. However, this type presents both a fire hazard and a double dust problem. Once collected, the dust must be handled again in removing it from the collector hoppers and disposing of it at the dump grounds. The material is readily combustible in this form and burns like peat. We therefore prefer the wet type collector, but frankly we haven't found one that is completely satisfactory.

We've tried the water wheel type, Schneible, the wet type, Roto-Clone and many others. Next to the dry bag collector, the Roto-Clone has the highest efficiency. However, when handling brake lining dust, the maintenance becomes high. A hard scale gradually forms on the blade of the Roto-Clone wheel reducing its efficiency and causing it to throw water out the stack. We find it necessary to spend at least four hours each week per machine removing this scale. It must be done by hand and done thoroughly, otherwise the wheel will be out of balance. Because of the nozzles, reclaimed water from the settling tanks cannot be used.

At Winchester and Lindsay we compromised by using the Schneible collector. This type is somewhat lower in efficiency, but is extremely low in maintenance, can be mounted outside without freezing, and recovers the water from the settling tanks.

Our brake lining dust is extremely difficult to wet, and we have not yet found a wet collector that will trap the fine particles in our dust.

In recent years we have not suffered from any fires in the bag collectors. This experience tends to lead us back to the dry bag collector because of its extremely high dust collecting efficiency. It would then be necessary to devise a method of wetting the dust as it is removed from the hoppers. This combination seems the best unless someone designs a wet collector of higher efficiency than that available today.

Thank you.

DISCUSSION

This paper was very well illustrated with slides. Vacuum methods of transporting materials as used in the new Winchester plant were very interesting. Methods of applying local exhaust to various types of machines were demonstrated.

Question: "Do bag type collectors present a fire hazard?"

Answer: "Yes, even with fire proof bags, if the materials are combustible as they are in Brakeblok."

BUSINESS MEETING

In the business meeting it was decided to establish a clearing house of ideas so that all divisions could profit from each other.

The problems described by the various speakers firmly proved the need for a medium of idea and information exchange.

A committee consisting of W. J. Olson; F. E. Tayler; J. T. Gresh; and H. J. Weber, chairman, was elected to work out methods of establishing a clearing house, of defining its functions, and of deciding the routine to be set up and followed. It was agreed that the committee's duties were, in addition to drafting a procedure plan, to make recommendations to management as to the frequency of future conferences, and personnel to attend.

ROUND TABLE DISCUSSION

The following topics were submitted to the conferees for discussion:

1. Wetting Agents

2. Dust Collectors - efficiency by weight and count.

3. Problems in Brake Shoe & Castings Division

   a. Vacuum systems
   b. Cupola hooding
   c. Core removal by Hydro-Blast

4. Problems in Forge Division

   a. Radiant heat

5. Problems in Amsco Division

   a. Exhaust for stiff shaft grinders
   b. Exhaust for swing frame grinders

6. Problems in Electro-Alloys Division

   a. Burning
   b. Glare and chipping benches

7. Problems at Engineered Castings Division

   a. Illumination

8. Problems at Kellogg Division

   a. Spray paint exhaust
   b. Test engine exhaust - carbon monoxide

9. Problems at National Bearing Division

   a. Exhaust of machines in machine shop
   b. Ladle fumes
   c. Centrifugal casting machine exhaust
   d. Wheelabrator leakage

10. Problems at Ramapo Ajax Division

    a. Exhaust for stiff shaft and swing frame grinders
    b. Planer grinder exhaust

11. Problems at Southern Wheel Division

    a. Hooding conveyors
    b. Cope dusting with sea coal
    c. Cleaner wheels from shakeout
    d. Manual plants - molding floors

12. Substitution methods

    a. Wet for dry - Wheel
    b. Do All Saw for gate burning
    c. Welding rod grinding machine for hand grinding
    d. Vacuum chip removal for shoveling

13. Welding

14. Continuity of exposure

15. Short circuit ventilation

16. General ventilation - versus local exhaust

17. Bringing material to the man

18. Cooperation with the Industrial Hygiene Department - Labor shortage

19. State labor codes

VISIT TO THE INDUSTRIAL HYGIENE LABORATORY

During the visit to the industrial hygiene laboratory, analytical methods were demonstrated to the conferees. Industrial hygiene field and laboratory instruments were explained as well as the lead control program involving analyses of blood and urine specimens.

DINNER MEETING

A dinner meeting was held Wednesday evening at the Sherman Hotel to which the superintendents of the plants in the Chicago area were invited. Before the address by the principal speaker of the Conference, Mr. W. E. Crocombe, President of Forge Division, a summary of the work of the conferees was given by Mr. Weber for the benefit of the guests.

Mr. Crocombe spoke after the dinner. He recited briefly the history of the Medical Department. His talk contained plenty of food for thought as attested by the following text.

ENGINEERING AND INDUSTRIAL HYGIENE CONFERENCE

W. E. Crocombe

Vice-President, American Brake Shoe Company
President, American Forge Division

I know I am going to enjoy this talk this evening because I am not an engineer, but probably am acquainted with quite a few of your problems.

In my thirty-five years with the Brake Shoe Company, I have visited forty-three of our plants and I can assure you that in recent years I have noticed a marked improvement. When I first started with Ajax Forge Company, for some unknown reason, I was made secretary. In walking through the plants, I never knew the difference between a frog and a crossing; and one day, while looking at a crossing some engineer told me that the angle was thirty-eight degrees and forty-seven minutes. I thought it was thirty-six degrees and forty-nine minutes, but I refused to argue with him.

Shortly after my appointment as President of Amsco, one of our very bright young men asked me to tell him the difference between a cope and a drag. My face got a little red when I told him he would have to ask the foundry foreman for the correct answer. I don't know if everyone here knows it or not, but our President, Mr. Given, is a graduate electrical engineer. After my experience at Ajax and Amsco, I decided to give him the acid test. I asked him what a volt was. He told me it was a place to keep money; that I was pronouncing-it wrongly, and it was spelled V-A-U-L-T. However, I must admit that I do know the difference between a drop forging and an upset forging. It has been a great pleasure for me to work with practically the same organization for so many years and to see our sales grow from $8,000 to $10,000 a month to the volume attained this month, when we will ship close to 4,500 tons with sales of $1,100,000.

However, in speaking about Mr. Given and my own experience, there is one requisite in every job from the top executive down that we expect, and that is - "common sense and initiative". It is so easy to mention these very important points, but in my experience I find many short comings.

This meeting, as I understand it, is divided into two groups - one plant engineering, and the other plant hygiene. Let's take up plant hygiene first. I hope nobody here ever had to go through what we experienced at Amsco Chicago Heights in connection with the silicosis suits. Briefly, we were sued for about $2,500,000.00, and I believe everyone here knows about the trial and how the plaintiff sat on the witness stand chewing licorice and taking out a nice white handkerchief to show the jury the dust he swallowed at Chicago Heights.

These suits, however, really woke up the Brake Shoe Company on the condition of our plants. It really started the Medical Department. Dr. Cowle came first, then Dr. Cummings and through him, we were fortunate in securing the services of Dr. Hamlin. Dr. Cowle discovered at two plants that there was not even a spigot for men to wash. Dust collectors were put in and neglected. Respirators were unknown. Behind Mr. Given's push, however, things changed and really changed fast. Wooden block floors were placed in cleaning and grinding departments. Dust collectors, wash and shower rooms, and fine first aid rooms were installed in practically all our plants. Respirators were issued, a chest x-ray program inaugurated, and nurses hired. Today the Brake Shoe Company is one of the outstanding leaders in plant hygiene and equipment. In taking visitors through the Forge plants, one of my greatest thrills is going through our first aid and wash and locker rooms. I can assure you they are clean at all times.

Now for the plant engineers. I have tried to get the actual figures of the cost of installing all our safety devices at all plants in our company. This was impossible, but we know it is over several million dollars. One of the aggravating things about these huge expenditures is that some times our plant superintendents are not in complete harmony with the installations which are often completely neglected as far as maintenance and upkeep are concerned. Here's an example: At Chicago Heights, years ago, we must have had one hundred and fifty salamanders. We spent $200,000 to put in one of the finest heating plants in any foundry in the country. The blowers were delivering hot air in the winter months and with cold water running through the lines, cold air in the summer. Imagine my surprise as the cold weather came along when the molders and grinders told me the fans were not working for lack of maintenance and care. This also applied to the Forge plant. Ventilators did not work on account of lack of care and maintenance. The ventilators with catwalk for maintenance purposes cost about $50,000.

It is just as important to keep these safety appliances functioning properly as any piece of production equipment. This does not show up in sales, but it pays big dividends in many other ways. It is certainly up to you plant engineers to see that this equipment is kept in constant repair and good working order. I can assure you all a complete backing in this matter from Mr. Given and all divisional heads if you bring it to their attention when you think this equipment is being neglected. Another very important point is the correct installation of equipment. It is very simple to check with our Construction and Maintenance Department and Medical Department on all safety and health installations.

Meetings of this kind cost the Brake Shoe Company a lot of money and I have attended a great many of them. It is very difficult for us to really show the great benefits that accrue, especially in actual money savings to the company.

Here are a few ideas of mine that could possibly be put on your memos for future study, and I am certain, if followed through, would result in substantial savings for Brake Shoe.

Tote Boxes and Platforms: The Forge division has hundreds of them and every other division has a great many. Let's assume in our central district that we have 1,300 boxes, trays, and platforms. At a cost of $100.00 each, we have an investment of over $130,000.00. These boxes get very hard abuse especially where hot work is handled and where contraction and expansion are encountered. The other day at Great Lakes I ran across forty or fifty of these - all damaged and unfit for further use unless repaired. Our repair department is so busy, it can not handle them. Now boxes are constantly on order to keep our production moving. Recently we contacted a small company to take in about twenty boxes and repair them. We probably lost some, but got back a good percentage of usable boxes. I really believe repairing these boxes is a business that really can be developed. We should have some cost data on this soon.

Elwell-Parker Trucks: The same thing applies to lift trucks. I estimate that the Brake Shoe Company in the Chicago area has an investment of close to $300,000.00 in these units. Could some outside party be interested in rebuilding these for us when a complete overhaul is needed? We have a very fine crew at Great Lakes, and I have seen trucks rebuilt that certainly worked as good as brand new ones. These units now cost about $7,000.00 each, and every effort should be made to get the maximum life out of every one of them.

Flasks: Being an expert foundry man I can now talk freely about flasks. These also have gone up sky high in price. In my visits to various plants I notice flasks that have not been used for years. Generally asking the superintendent why they are not scrapped, I always get the same answer: "We might get another order for those castings." Is it not possible to check with another division and see if they have flasks of the same size that could be loaned in case the order finally did arrive? Couldn't we scrap a large tonnage of old flasks when scrap of all kinds is so badly needed?

I really think it would be impossible for me to talk without bringing in good housekeeping. I shudder to think of how many times I have seen the Maintenance Department make either a minor or major repair and then walk off to another job, leaving all the scrap, and wire, and everything else right at the spot. It is the responsibility of the plant engineer to see to it that all waste material is removed at once and scrapped. I don't know how much old junk I have seen in all our plants that is put aside with the thought that sometime in the next ten or twenty years we might have use for it. Let's think of scrap at two cents a pound and turn it into real dollars for the Brake Shoe Company.

The only think I can think of to bring this home forcibly is to have all of you walk into Kempton Dunn's office and see one, two, five, and ten dollar bills strewn all over the floor. You probably would think he was a hell of a treasurer. Still and all, we have this very same condition in every one of our plants today.

I hope none of you ever have the "pleasant" experience we had in Chicago Heights of excavating our core room to a depth of two feet to put in a concrete floor, and after leveling off at that distance, of finding a nice concrete floor already there.

Thanks a lot!

CONCLUSION

The dinner meeting marked the close of the first plant engineers' industrial hygiene conference. The engineers of the various divisions were glad to have the opportunity of meeting their fellow engineers for the purpose of discussing common problems.

A tentative date for a second meeting was set for April of 1949.