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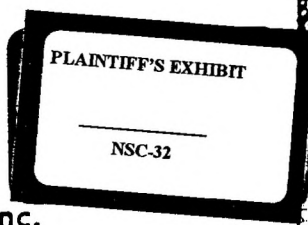
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Industrial Health

Poisoning, Infection, etc. A Department for Physicians and Laymen

Lesser Known Facts About Occupational Diseases

By ROBERT B. HUNT, M.D.

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PROBABLY the leader in the parade of industrial diseases is an acute or chronic inflammation of the skin which we call dermatitis. This disease may present itself in any type of shop, factory or foundry. Any paste, powder, gas or liquid which comes in contact with the employee's skin, even the water supplied by the town in which he lives or works, may be the potential cause of such a skin disturbance.

The wide diversity of causes, together with the varying susceptibility of different individuals, makes the problem of control difficult.

Much investigation is under way to determine why one person may be susceptible to a certain substance while another is not. It has been proved many times that a poisonous substance formed within the body has been able to prolong the action started by some external influence. A printer developed a marked dermatitis from ink which persisted for two years. Finally food tests were made and showed that he was susceptible to lettuce. Removing this from his diet cleared the skin. He returned to his usual occupation without a return of symptoms.

The poisoning of allergic substances is usually an accumulative process. It takes time to produce a manifestation of disease, but let any other substance cause the disease, and the irritating food may be of sufficient strength to magnify its action.

All cases of dermatitis cannot be cured by eliminating offending foods, but further investigation along these lines may give us a clue with which to lessen the loss of time from work and

the discomfort now produced by industrial dermatitis.

Metals

LEAD: The distribution of lead poisoning is quite extensive.

The skin of the body is a protective covering, and as long as it remains intact it does a good job except in the case of tetraethyl lead, which is used in blending gasoline and which is readily absorbed through the skin, having a tendency to create changes in the nervous system. The effect of other forms of lead, through that avenue of entrance, is practically nil, which explains the extremely low poisoning rate in typesetters, painters and others who continually come in contact with metallic lead.

Lead in any form, introduced through the mouth, acts rather slowly when compared with the inhalation of lead dust or fumes. However, no matter what the portal of entry may be, lead is acted upon by the body fluids and so converted that it may eventually be deposited within the bones.

Those bony safe deposit vaults may retain their lead contents for days or for years, and if the exposure is removed, may also free the employee of all signs and symptoms of lead poisoning. But imagine the surprise of that supposedly cured person when years later, perhaps following some type of infectious disease or the excessive use of alcoholic beverages, he awakes to find that he suffers the aches and pains and paralyses of an acute lead poisoning. As the body fluids alter lead that it may be deposited, so may those fluids attempt to de-lead the body, and too rapid absorption may pro-

duce the original disease with all its discomforts.

One can readily see, then, that in some cases investigation of previous occupations is quite necessary to determine the original contact with lead.

Heating of molten lead causes a black scum of lead suboxide to form on its surface, and the heat from the metal disbursts the fine powder into the air. Hence, in the process of smelting ores such as zinc, copper and silver, mixed with lead, we find a rather high lead poisoning rate.

Those engaged in the manufacture of lead wire and cables, batteries, glass, pottery and rubber industries, plumbers and users of dry colors offer their share of lead poisoning cases.

Probably the greatest source of lead poisoning may be found among those who sandpaper, scrape, chip or burn lead paint, for the dust and fumes caused by those activities are rather rapid in their action. Such workers may become incapacitated in a few days because the inhalation of lead dust causes the maximum amount of absorption into the blood stream in the minimum space of time.

CHROMIUM: Chromium is a metal widely used as a foundation for colors, and dusts from its various salts may produce lesions of the skin and mucous membranes of the nose. Chromium plating by electrolysis may cause fumes which are similarly irritating. Although chromium poisoning does not usually cause death, the number of days of absence from work on account of incapacity which it causes is gradually increasing.

OTHER METALS: The most efficient portals of entry of foreign substances into the body are the nose and mouth. The smaller the dust (the size of smoke particles for example, the greater the speed of absorption by the blood. Fumes from hot metals carry not only poisons but numerous minute dust particles. This explains the immediate irritation

...those engaged in acetylene and electric cutting and welding.

When men are so employed over a prolonged period of time, the constant inhalation of fumes and dust might produce symptoms of the metal upon which they work. In the shipbuilding trade, particularly in the construction of metal ships, we find occasional cases of metal-fume fever. "Brass chills" and "spelter shakes" from zinc are names applied by the lay people to such diseases. The terrific heat applied to some of our common metals and alloys by acetylene torches produces sufficient fumes to cause a temporary incapacity in 24 hours. Permanent disability from such causes is rare, however.

Diseases Due to Dust

Twenty-five per cent of all workers exposed to high concentrations of inorganic dust are expected to develop changes within their lungs due to that agency. We are at a loss to explain why the other 75 per cent are not so affected.

Mining, quarrying, foundry work, grinding, sandblasting, abrasive soap manufacturing, asbestos work, the making of emery and carborundum products and many other occupations offer opportunities for employees to inhale microscopic dust particles and create a foundation for possible future incapacity.

We are interested particularly in those men who work with sandstone, quartz, flint, granite, and sand, because they expose themselves to silica, and the chemical changes between that dust and the body fluids, in the presence of tuberculosis, may and usually do lead to a fatal ending.

It is safe to say, in light of our present knowledge, that the action of other inorganic dusts is much less virulent and incapacitating. That, however, does not allow us to lower the vigilant methods to improve dust control and protect employees, because all dusty occupations are potential trouble makers.

Although the actions of various dusts differ within the body, the exposure to asbestos fibres, present in the weaving and grinding of dry asbestos material, offers another type of dust which may cause fatalities among workers.

The organic dusts from cotton, silk, wool, tobacco, flour and similar substances are practically harmless. Such dusts rarely reach the lungs but may cause irritation of the windpipe and larger air tubes and result at the most in a mild bronchitis.

mind, particularly when dealing with silicosis and asbestosis, relates to the progression of such disease. When changes occur within the lungs as a result of the presence of such dusts, nature forms scar tissue to heal such lesions but may fail to stop when the job is finished. As a result, the continuation of that healing process may lead to such structural changes within the lungs that partial or total incapacity may follow months or years after the employee has been removed from his dusty occupation.

Benzol-Benzene

Benzol is a distillate of coal tar used extensively in industry. It is an essential ingredient in the manufacture of explosives. It is an excellent solvent for grease, oils and cements, and because of that property it is important in many phases of the rubber and cleaning industries. In the manufacture of shoes benzol may be an ingredient of the dressing applied to the leather and of the cement which fastens the heels and soles. Not only in the shoe trade but in other branches of industry where employees work with gummy, sticky material, the workers soon learn of the solvent and cleansing action of this liquid and use it freely for that purpose upon themselves. The subsequent outbreak of skin afflictions may be the first indication of such unauthorized use.

Benzol is extremely poisonous, entering either through the nose or mouth or absorbed through the skin. Its action within the body is varied and may produce a multitude of signs and symptoms. The bone marrow becomes affected which in turn alters the character of the blood; hemorrhages are common; it may cause death.

The fumes from benzol are heavier than air and lie near the floor, which is an important point in the engineering problem of ventilation.

The members of the benzene group are absorbed through the skin, and more cases of poisoning are found when men perspire than when their bodies are cool. Probably the answer to that is that the fumes may solidify as they cool and the powder may settle on the skin. The sweat on the body may dissolve this dust so that it is more readily absorbed through the increased surface blood supply.

Chlorinated Hydrocarbons

This group of petroleum derivatives has been known to science for years but

the industrial field has been widely distributed and most important. Led by carbon tetrachloride and its chemically associated members, it has furnished industry with refrigerants, excellent solvents for rubber, wax, oil and grease, thinners for lacquers and a very fine household necessity for the removal of spots from clothes. Hospitals have been using it more and more for the removal of adhesive plaster.

Due to the non-flammability of carbon tetrachloride, it is used in fire extinguishers. The rapid evaporation produces fumes which may smother a small blaze, but we must not forget that excessive heat of the actual fire may bring about combustion sufficient to produce such by-products as hydrochloric acid and phosgene gas. Like its associated member, chloroform, it may produce sleep when inhaled by an individual, and only 1/350 of an ounce in a quart of air is necessary to produce such action. That thought must be remembered when a large quantity of those liquid products is spilled on the floor, perhaps accidentally. Action should be started at once before the liquid gasifies, and employees should be notified to keep their heads up to avoid the low ceiling of gas.

Chemists have developed and introduced to industry many new products, the basis of which is the chlorinated hydrocarbons. These derivatives of petroleum distillation are frequently combined with those from coal tar to form valuable chemical combinations. They have been placed on the market so rapidly that medical science has been unable to determine their physiological effect upon the health of man. We have known that some of these chemicals are capable of creating changes in the liver, and only recently in a city in Massachusetts one of these newer products caused the death of two employees and a battle to retain life among two others.

Carbon Monoxide

You remember the adage. "Where there is smoke, there is fire." We might add to that, "Where there is fire there is carbon monoxide."

This odorless but poisonous gas may occur in any industry or in any home, but the poorer the ventilation the better the chance of producing physical incapacity.

Since the advent of the motor car whose exhaust pipe may pour forth as high as six per cent of carbon monoxide, we are all exposed to that gas, particularly in crowded cities. The carbon

Any passenger car liberates about two cubic feet per minute, and one can readily estimate the physical damage that may be done if such a motor is allowed to run within the doors of a poorly ventilated garage or shop. Fortunately, serious cases of such poisoning are not common among those employed in public garages, but many employees are likely to complain of headache and faintness at the end of a day's work, especially in colder weather when doors and windows remain closed.

In the steel industry, where gas is used as the heating agency in the blast furnaces, care must be taken to provide proper ventilation. Within the mines, workers are warned to allow enough time following blasts for the escape of this gas.

Infection

The skin is a protective covering of the body against infection and is extremely efficient as long as it remains intact, but allowing it to be broken or punctured introduces bacteria, and a battle ensues between the offensive agencies of infection and the defensive powers of the body. The winner of such a struggle may determine the presence or absence of incapacity. Infections are common throughout industry, but two types are particularly prominent—infection resulting from anthrax and infection among meat packers and fishermen.

Many of our fur, hair or wool-covered animals may contract anthrax. The germs of that disease defy the ordinary methods of sterilization and may linger on hides, bristles or hairs for long periods of time. Tanners, wool sorters, and hair or bristle workers may introduce the anthrax spore beneath their skin and undergo much physical suffering and sometimes death.

Infections are frequently found among meat and fish packers and those engaged in deep sea fishing. Although death rarely occurs, the loss of fingers, hands and nasty septic wounds are the result.

Summary

I feel that the time has come when an employer must demand of a manufacturer the answers to two questions:

1. How will your product affect my business?
2. How will your product affect the health of my employees?

That employer is entitled to honest answers based upon sufficient chemical and physiological examinations of the questionable product. Too many lives have been lost or jeopardized by too little knowledge of a product's action on those who handle it.

Ferrosilicon

Industrial Data Sheet D-Chem. 20

A. Problem

1. What are the hazards of ferrosilicon and what precautions are necessary in its use?

B. Hazards

2. The principal hazard is that of poisoning by inhalation of the gases that may be given off, especially in the presence of moisture.

C. Discussion

3. Ferrosilicon is prepared by melting iron ore or steel shavings with coal or coke and ganister or quartz at a temperature of about 2,000 degrees centigrade (3,632 degrees Fahrenheit) in an electric furnace. In making steel, ferrosilicon is used for removing objectionable gases and oxides and also as an alloying element. When alloyed with cast iron, it affects the carbides and renders the iron soft and gray. More concentrated silicon alloys are sometimes used in certain processes for making hydrogen gas and in the manufacture of explosives.

4. The hazard in connection with ferrosilicon results from very small percentages of phosphorus together with other elements which may be present as impurities originating in the raw materials used. In the presence of moisture the phosphorus compounds react to form phosphoreted hydrogen or phosphine. This is a gas which in sufficient quantities is decidedly poisonous. It has a strong and distinctive odor somewhat resembling garlic so that its presence can be readily recognized. The stability of ferrosilicon depends upon its silicon content, grades below 48 percent and above 65 percent being entirely stable and ferrosilicon in these ranges does not give off any appreciable quantities of phosphine, even in the presence of moisture. It is, therefore, only in the intermediate range between 48 percent and 65 percent that there is any appreciable hazard.

Symptoms of Poisoning

5. When a person has breathed poisonous gases liberated from ferrosilicon, the symptoms of poisoning usually develop quite suddenly and are character-

ized by general and abdominal pains, nausea, vomiting, diarrhea, hemorrhages, loss of consciousness, dilated pupils, cold clammy perspiration and coma. Cases of poisoning have been mistaken for cholera, gastro-enteritis, ptomaine poisoning, pneumonia and influenza.

First Aid

6. When a person displays any symptoms of poisoning because of the inhalation of the poisonous gases liberated by ferrosilicon, he should be promptly removed to the fresh air and, if conscious, be given a mild alkali drink. If unconscious, the prone pressure method of artificial respiration should be started immediately after the patient has been removed to the fresh air. In all cases of poisoning the services of a doctor should be promptly obtained.

Precautions

7. Ferrosilicon should be stored away from such places as offices and work rooms or living quarters of any description.

8. All buildings in which ferrosilicon is stored should be well ventilated and dry. (See Note X.) Ordinarily, in an open factory building the natural ventilation through monitors in the roof or through windows is sufficient if the ferrosilicon is kept dry.

9. If men are required to handle wet ferrosilicon in a confined space, artificial ventilation should be provided.

10. In case phosphine has been allowed to accumulate in a closely confined space such as a closed room or box-car, so that a strong odor of the gas is noticeable, no one, unless he is wearing a suitable gas mask or fresh air hose mask, should be allowed to enter the room until it has been thoroughly ventilated. (See Note Y.)

NOTE X. Detailed information on ventilation will be found in National Safety Council Safe Practices Pamphlet No. 37 "Industrial Ventilation."

NOTE Y. Detailed information on fresh air hose masks will be found in National Safety Council Safe Practices Pamphlet No. 64 "Respirators, Gas Masks, Hose Masks and Breathing Apparatus."

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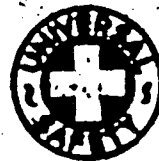
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PLAINTIFF'S
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**General Subject and
Industrial Sessions**

CHICAGO

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TUESDAY EVENING SESSION

October 3, 1944

Presiding: General Chairman, HAROLD R. BIXLER, Personnel Dir., The Mutual Life Insurance Co. of N. Y., New York City.

Aims and Responsibilities of the A.S.S.E.

By W. DEAN KEEFER

General Chairman, American Society of Safety Engineers—Engineering Section
 National Safety Council and Second Vice-Pres., Lumbermen's Mutual Casualty Co.,
 Chicago, Ill.

Ours is a great society. We now have more than 4,000 members and twenty chapters. We have had an interesting past in which much has been accomplished. You are all familiar with the research work; you know of our contribution to the Safety Standards of the American Standards Association.

Engineering colleges have been encouraged

to formulate plans for teaching the fundamentals of Safety Engineering to undergraduate students.

I need not remind you that through the efforts of our various committeemen, more engineering and technical societies are giving greater attention to safety than ever before.

There is one activity, however, that to

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Labor and Safety

THURSDAY MORNING

October 5, 1944

A Panel Discussion

Presiding: C. W. ELIASON, Chief Labor Relations Adviser, U. S. Maritime Commission, Oakland, Calif.

Participants:

T. O. ARMSTRONG, Personnel Dir., Westinghouse Electric, East Springfield, Mass.

EDWARD KLEWEX, Safety Dir., Oil Workers International Union, C.I.O.

VICTOR HANNIGAN, Representative Wisconsin State Federation of Labor, A.F.L.

JOHN H. HAZELHURST, Pres., Public Utilities Service, Chicago.

GRIFFIN JONES, Labor Representative, War Production Board, Washington.

VOYTA WRABETZ, Chairman, Industrial Commission of Wisconsin.

CHAIRMAN ELIASON: Last year, the pattern was set for the meeting this year. If you will recall, there was a platform adopted as follows: (1) Promotion of safety to create a definite objective of labor; (2) Management actively should seek labor's cooperation; (3) The basic responsibility for the safety program must be accepted by management; (4) The physical condition of the plant is an essential factor in any safety program; (5) Full cooperation of organized labor with the National Safety Council is necessary to put across the best possible safety program.

Before we hear from our first speaker, I should like to stress the importance of safety being accepted by top management. When I say that, I mean, from the chairman of the board or the chief executive officer, right on down. If that isn't the case, I cannot see how a safety program

can start in the middle of some level of supervision and carry through to the men that are affected more than anybody else.

I should also like to stress the need of the top people in organized labor to carry out their responsibility on safety. And now, Mr. Armstrong.

MR. ARMSTRONG: There shouldn't be any confusion about safety and the cooperation we should get between management and labor relating thereto. I don't think either side should refuse to sit down and get together on the subject that we are here to discuss this morning—the safety of those within our plants.

We have heard a great deal in the newspapers about strikes. We hear far too little about accidents. When we stop to look at the figures we find a tremendous number of hours lost due to accidents, as compared with any other phase of lost time, strikes, labor turnover, absenteeism, or anything else.

From my experience, and I only talk from my experience, and I hope it has not been unusual, we have been able to get along very nicely with labor, and its safety question. Now, I give you briefly just a pattern of organization. I will let the balance of it go to the questions relating thereto.

No. 1: Supporting the plant management is an executive committee. It is made up of the management of the plant, the president of the local and the various divisional superintendents. Each year they set the policy with respect to the jobs to be done that year and with respect to the

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TUESDAY AFTERNOON SESSION

October 3, 1944

Presiding: General Chairman, JOHN TREWEEK, Safety Eng., Homestake Mining Co., Lead, S. D.

Some Sources of Error in Dust Sampling

By A. S. RICHARDSON, J. W. WARREN and W. C. WILLIAMSON
Anaconda Copper Mining Co., Butte, Mont.

In the measurement of the concentrations of dust that are present in air used for the ventilation of mines, or other working places, it is recognized that the dust is not uniformly dispersed in the air. Also that under the same atmospheric conditions widely different results may be obtained by the use of different dust sampling instruments, and by different methods of quantitation. In dust sampling work done by the writers with impingers a number of sources of error have been found to exist, and these are here described for the benefits of others engaged in similar work.

Impinger Sampling in a Flow of Air

In the collection of any volume of air for dust sampling purposes, it is essential that the number of dust particles in the sample volume be the same before and after collection. When the air is not in motion it may perhaps be assumed that this condition exists for sampling with impingers. However, dust sampling in mines is often done in flows of air moving at fairly high velocity, and similar conditions exist in ducts carrying flows of air from dust collection hoods. Although nothing like exact measurement of dust conditions as yet seems possible, it is desirable that the methods of sampling streams of air in motion should be comparable to those taken in still air. Since dust particles carried in a moving current of air possess some definite directional momentum, it is indicated that for uniformity of dust content, the sample volume should be drawn from the air stream without change in the velocity and direction of flow.

In impinger sampling work the flask must necessarily be held in a vertical position and

with the tube vertical. This means that air drawn from a horizontally moving air stream must be deflected at right angles to its original direction of flow to enter the tube opening. The momentum of the dust particles would then tend to continue them in motion past the tube opening, and thus reduce the dust content of the sample volume.

To develop the effect of these conditions upon dust sampling results, some tests were made by taking dust samples from air moving horizontally at different velocities simultaneously with two impingers, one having the ordinary vertical tube opening at right angles to the direction of flow, and the other being equipped with an elbow extension to bring the tube in line with the direction of flow. Two samples were also taken with restricted orifices placed at the elbow openings so as to make the velocity of air passing through the orifice the same as that of the main air stream.

Dusty air for this purpose was obtained by allowing a flow of dust, collected at a bag type dust arrester, to fall at a short horizontal distance away from the inlet of a blower. The induced flow of dusty air was then forced through a galvanized iron duct to the sampling position. Compensation for variations in dust collection efficiency of the two impinger instruments used in the test was made by alternating use of the instruments in the two sampling positions.

Geometric mean diameter of the dust particles was 0.65 microns with standard geometric deviation 2.09, as determined by samples taken with an Owens Jet sampler with microscopic work done by micro-projector at a magnification of 10,000 diameters.

Tabulation No. 1
Dust Counts with Impingers Alternated in Two Sampling Positions

Air Velocity Ft. Per Min.	High Concentrations				Low Concentrations			
	Impinger No. 3 Pos. A	Impinger No. 3 Pos. B	Impinger No. 5 Pos. A	Impinger No. 5 Pos. B	Impinger No. 3 Pos. A	Impinger No. 3 Pos. B	Impinger No. 5 Pos. A	Impinger No. 5 Pos. B
250	80.2			81.9	29.9			35.2
250		108.0	112.3			27.9	30.3	
250	69.2			80.2	32.0			30.0
250		61.6	68.8			19.3	25.0	
Average		79.8		85.8		27.3		30.1
Per Cent Variation in Instrument Collection			7.0				9.35	

Tabulation No. 2
Dust counts for Vertical and Parallel Impinger Tube Intakes

Air Velocity Ft. Per Min.	Sample Drawn at Right Angles to Flow		Samples Drawn Parallel to Flow		Per Cent Right Angles to Flow Parallel to Flow
	Imp. No. 3	Imp. No. 5	Imp. No. 3	Imp. No. 5	
250		64.3	65.4		98.9
500	88.2			92.0	96.0
500		83.6	90.3		92.5
750		37.8	41.3		91.6
750		21.8	22.8		95.6
1000		28.4	46.6		61.0
1000		17.2	27.6		62.2
1000	43.6			56.8	76.8
1250		15.8	22.3		70.9
1250	36.7			51.1	72.0
1500	9.96			33.3	29.9
1500	17.1			74.8	22.9
1500		34.4	74.0		46.4
1500*	51.6			110.8	46.5
1500*		48.3	98.3		49.2

*8.5 mm circular orifices on impinger sampling tubes.

Calibration of Impinger Tubes

In the taking of a number of dust samples at one time with one instrument, it is necessary that a number of impinger tubes be used, and variations in the volumes of air sampled by different tubes under such otherwise identical conditions is a matter of some importance. Variations in sample volume may occur because of differences in size and shape of the tube, particularly the size of the orifice from which the air stream is impinged against the bottom of the flask.

For calibration of the tubes it is, however, necessary to take into account the suction pressure, or vacuum, induced by the pump since in the case of compressed air operated ejectors, it seems impossible to

obtain exact uniformity in the size of the ejector orifice and this will cause some variations in the induced vacuum.

In the case of the standard tubes not much variation is shown but in the case of mid-gut impinger tubes, there are appreciable differences. A maximum variation of 23 per cent in the volume of air sampled may be noticed for tubes used in two different mid-gut impingers and this is known to be mainly due to variations in the size of the orifice in the tubes supplied by the manufacturer. Midget impinger number one is equipped with a hand-operated, constant pressure pump and Midget impinger number two is equipped with a hand-operated pump delivering constant volume at constant speed.

Tabulation No. 3
Calibration Comparisons of Midget Impinger Tubes

No. 1 Midget Impinger						
Tube No.	Volume Thru Gas Meter Cu. Ft.	Manometer Reading	Vacuum Gauge H ₂ O	Time Minutes	Volume of Liquid CC	Flow thru Tube C.F.M.
1	1.0	12.1	12.5	9.48	10	0.1058
2	1.0	11.75	12.5	8.40	10	0.1191
3	1.0	11.75	12.5	8.44	10	0.1186
4	1.0	11.80	12.5	7.28	10	0.1374

No. 2 Midget Impinger						
Tube No.	Volume Thru Gas Meter Cu. Ft.	Manometer Reading H ₂ O	Time Minutes	Volume of Liquid CC	Flow thru Tube C.F.M.	
5	1.0	10.7	6.36	15	0.1573	
6	1.0	13.6	7.50	15	0.1344	
7	1.0	13.0	7.68	15	0.1300	
8	1.0	10.3	6.70	15	0.1492	

Tabulation No. 4
Calibration Comparisons of Standard Impinger Tubes

No. 3 Standard Impinger					
Tube No.	Volume Thru Gas Meter Cu. Ft.	Manometer H ₂ O	Time Minutes	Volume Collecting Medium C.C.	Flow thru Tube C.F.M.
1	5.0	37.2	4.74	75	1.055
2	5.0	45.5	4.74	75	1.055
3	5.0	32.5	4.75	75	1.053
4	5.0	38.4	4.745	75	1.054
5	5.0	35.1	4.77	75	1.048
6	5.0	32.6	4.775	75	1.047
7	5.0	38.4	4.74	75	1.055
8	5.0	36.1	4.76	75	1.050
9	5.0	36.0	4.765	75	1.049
10	5.0	39.6	4.72	75	1.058
D	5.0	42.3	4.75	75	1.053

No. 5 Standard Impinger					
Tube No.	Volume Thru Gas Meter Cu. Ft.	Manometer H ₂ O	Time Minutes	Volume Collecting Medium C.C.	Flow thru Tube C.F.M.
1	5.0	32.2	5.165	75	0.967
2	5.0	40.3	5.15	75	0.971
3	5.0	28.2	5.16	75	0.969
4	5.0	33.0	5.18	75	0.965
5	5.0	30.8	5.145	75	0.972
6	5.0	29.1	5.125	75	0.975
7	5.0	32.9	5.17	75	0.966
8	5.0	31.3	5.17	75	0.966
9	5.0	31.7	5.145	75	0.972
10	5.0	34.5	5.125	75	0.975
D	5.0	36.5	5.19	75	0.963

Effect of Dirty Glassware

While the effect of the presence of dirt on glassware used in dust determination work is so obvious that in most cases no illustration of its importance is needed, it is believed, that there are some fairly common practices in which lack of adequate cleanliness has an appreciable effect upon the results obtained. These are related mainly to the cleaning of the impinger tubes and counting cells.

In the flow of dusty air through an impinger tube, the increased velocity of air motion at the approach to the orifice causes a reduction of pressure which, with the accompanying cooling effect caused by evaporation of the collecting fluid in the flask, causes a lowering in the temperature of the

air stream and a consequent deposition of dust on the inside of the tube. Being difficult of access, this inside tube surface is often given only insufficient cleaning as by hand with the use of a pipe cleaner or tapered brush.

The following tabulation shows, for four different samples, the effect upon dust counts of placing a poorly cleaned impinger tube in a flask with the usual quantity of collecting fluid and then briefly shaking the flask by hand.

A method of cleaning the tubes, both standard and midget that has given satisfactory results includes a replaceable fibre brush held in a metal shaft that is rotated by the motor of an electric erasing machine, having a friction grip.

Tabulation No. 5

Data Dirty Impinger Tubes

Description	Midget No. A	Midget No. B	Standard No. A	Standard No. B
Dust count in 5 Fields before insertion of Impinger tube or Control Count.....	2	2	2	2
Dust count in 5 Fields after insertion of Impinger tube and shaking.....	38	95	32	56
Net increase in Count in 5 Fields.....	36	93	30	54

Depth of Counting Cells and Effect of Settling Time

At the present time a wide variety of cells of different design are used to contain the portion of sample collected for counting. A common defect in the Sedgewick-Rafter type is failure to closely seal the corners of vertical containing strips or walls, with the result that leakage or the evaporation of alcohol causes the formation of air bubbles that interfere with counting. Corners of the cell are also difficult to clean. These defects are well recognized but it is perhaps not so well recognized that appreciable variations in the depth of cells also occur. In the case

11 cells received from a supply house the variation in depth, as determined by microscope and micrometer was from 0.945 mm. to 1.195 mm.

A cell that has been found to give good results is made with the use of a brass ring placed without any cement, upon a base of

non-corrosive glass and covered with a coverslip 1 mm. thick. The brass ring is 38 mm. outside diameter, 29 mm. inside diameter and is machined to exactly 1 mm. in thickness. The glass base is 75 mm. long, 38 mm. wide and 3 mm. thick. The coverslip is 38 mm. square and 1 mm. thick. Since all component parts are separated for washing and cleaning, there are no surfaces that are not easily cleaned. An essential piece of equipment for brushing cell surfaces free of air-borne dust before filling with sample fluid is a good camel's hair brush.

An illustration of the effect upon dust counts of variations in the depth of cells is shown in Tabulation number five, which shows the counts obtained from two different portions of the same samples when counted in two different cells. Cell number five had an average depth of 0.87 mm. and Cell number six had an average depth of 1.13 mm.

Tabulation No. 6
Variable Cell Depth

Cell No. 5.....	0.0344" = 0.87 m.m.		Ratio No. 5 to No. 6 = 1 to 1.3							
Cell No. 6.....	0.0445" = 1.13 m.m.		Cell No. 6 = 30% deeper than Cell No. 5							
Sample Number	1		2		3		4		Total 1-4	
Cell Number	5 6		5 6		5 6		5 6		5 6	
Field Concentration	354	472	308	366	352	401	262	360	1276	1599
Calculated Concentration at 1 m.m. depth	407	417	354	324	404	355	301	318	1467	1415
Ratio Concentration in Cell	1.0	1.33	1.0	1.19	1.0	1.14	1.0	1.37	1.0	1.26
Increase Cell No. 6 over Cell No. 5 in percentage	33		19		14		37		26	

Tabulation number seven, below, shows the counts obtained from different portions of the same sample when counted in five different circular cells of the type previously described.

Tabulation No. 7

Cell No. -	1	2	3	4	5	Avg.
Count	376	405	370	386	390	385

When, as is required for accurate results, two counting cells are filled from each sample flask, it is necessary that an interval of time be allowed to elapse between the filling of the first and second cell so that the settling time before the start of the count be the same for both cells. In general, it is well recognized that increased settling time causes a larger count but it may not be so well understood how much the results are affected by this influence.

Tabulation number eight shows the effect upon dust count of allowing the settling time to increase from 25 to 35 minutes.

Tabulation No. 8

**Effect of Increasing Settling Time from
25 minutes to 35 minutes**

Count at 25 min. Settling	Count at 35 min. Settling	Increase in 10 min.	Increase in 5 min.	% increase in 5 min. from 25 min. settling
14	15	1	5	3.6
18	23	5	25	13.9
33	42	9	45	13.6
38	48	10	50	13.1
43	52	9	45	10.5
54	71	17	85	15.8
55	62	7	35	6.4
61	75	14	70	11.5

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*RALPH S. FARNUM, U. S. Rubber Co., Detroit, Mich.

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*J. M. KERRIGAN, U. S. Rubber Reclaiming Co., Buffalo, N. Y.

W. H. MACKAY, Dunlop Tire & Rubber Corp., Buffalo, N. Y.

*R. W. MORSE, The Firestone Tire & Rubber Co., Akron, Ohio.

*WALTER SCHNEIDER, The B. F. Goodrich Co., Akron, Ohio.

Staff Consultants—F. A. VAN ATTA, National Safety Council, Inc., Chicago, Ill.

**Past General Chairman*

Safety Exposition Exhibitors

EXHIBITION HALL—SHERMAN HOTEL

Alphabetical List of Exhibitors of Industrial Safety Equipment

- Aetna Casualty & Surety Co., Hartford, Conn.**
Insurance Underwriters.
- American Abrasive Metals Co., Irvington, N. J.**
Safety Treads, Abrasive Paints.
- American Allsafe Co., Inc., Buffalo, N. Y.**
Industrial Safety and Fire Protection Equipment.
- American-LaFrance-Fosmire Corp., Elmira, N. Y.**
Fire Protection Equipment.
- American Mat Corp., Toledo, O.**
Safety Matting and Switchboard Matting.
- American Optical Co., Southbridge, Mass.**
Industrial Safety Goggles, Respiratory Devices, and Protective Clothing.
- American Safety Tank Co., Kansas City, Mo.**
Safety Fuel Tanks for Trucks.
- Ampco Metal, Inc., Milwaukee, Wis.**
Beryllium-Copper Non-Sparking Safety Tools.
- Automatic Canteen Co. of America, Chicago, Ill.**
Food Services.
- Bausch & Lomb Optical Co., Rochester, N. Y.**
Safety Lenses and Goggles.
- Bear Manufacturing Co., Rock Island, Ill.**
Motor Vehicle Inspection and Correction Equipment; Static and
Dynamic Balancing Machines.
- Benjamin Electric Mfg. Co., Des Plaines, Ill.**
Industrial Lighting Equipment; Call and Warning Devices;
Punch Press Safety Device Equipment.
- Boyer-Campbell Co., Detroit, Mich.**
Face Shields, Welding Helmets, Safety Tongs, Grinder Guards, Inspection Lights,
Protective Clothing.
- John H. Breck, Inc., Springfield, Mass.**
Protective Creams and Hand Cleaner.
- Brown Shoe Co., Chicago, Ill.**
Safety Shoes.
- R. H. Buhrke Co., Chicago, Ill.**
Safety Equipment and Allied Products for Construction and Maintenance Work.
- E. D. Bullard Co., San Francisco, Cal.**
Safety Equipment.
- Burroughs, Wellcome & Co. (U.S.A.) New York, N. Y.**
First Aid Equipment.

- Carbisulphoil Co., Dallas, Tex.**
Antiseptic Emulsion, Ointment, Liquid Soap.
- Cardox Corp., Chicago, Ill.**
Fire Extinguishing Systems, Fire Trucks, and Mobile Extinguishing Equipment.
- Celanese Celluloid Corp., New York, N. Y.**
Plastics for Safety Devices.
- A. B. Chance Co., Centralia, Mo.**
Live Line Maintenance Tools and Equipment.
- Chicago Eye Shield Co., Chicago, Ill.**
Head and Eye Protective Equipment.
- Columbus-McKinnon Chain Corp., Tonawanda, N. Y.**
Chain and Chain Hoists.
- C-O-Two Fire Equip. Co., Newark, N. J.**
Carbon Dioxide Fire Extinguishers, Hose Units, Manual-Automatic Systems,
Smoke Detecting Systems.
- Davis Emergency Equip. Co., Inc., Newark, N. J.**
Respiratory Protection. Combustible Gas Indicators, General Safety and
First Aid Equipment.
- Dickson Safety Products Co., Los Angeles, Cal.**
Personal Protective Equipment.
- Dionol Co., Kalamazoo, Mich.**
Ointment, Protective Creams, Salt Tablets.
- Dockson Corp., Detroit, Mich.**
Industrial Head and Eye Protection.
- C. B. Dolge Co., Westport, Conn.**
Fungicides, Protective Creams, Skin Cleaner, Cutting Oil Germicides.
- Dugas Engineering Co., Marinette, Wis.**
Fire Protection Equipment.
- Dunn Products, Chicago, Ill.**
Industrial Protective Clothing Made from Rubber, Asbestos Cloth and Leather.
- Duo-Safety Ladder Corp., Oshkosh, Wis.**
Safety and Fire Ladders, Ladder Shoes.
- E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.**
Hand Protective Creams, Industrial Hand Creams, Neoprene Products, Rayon Yarn.
- E. & J. Manufacturing Co., Philadelphia, Pa.**
Resuscitator Inhalator and Aspirator.
- Elliott Service Co., New York, N. Y.**
Foremanship Training Material, Bulletin Board Displays on Safety,
Quality and Waste; Suggestion Systems.
- J. H. Emerson Co., Cambridge, Mass.**
Automatic Resuscitation and Respiration Equipment.
- Finnell System, Inc., Elkhart, Ind.**
Floor-Care Machines and Floor Treatments.
- Franklin Research Co., Philadelphia, Pa.**
Anti-Skid Floor Maintenance Materials.
- General-Detroit Corp., Detroit, Mich.**
Fire Protection Equipment

Goodyear Tire & Rubber Co., Akron, O.
Non-Slip Surfacing Materials.

Holcomb Safety Garment Co., Chicago, Ill.
Protective Clothing Made of Asbestos, Leather and Fire-Proofed Duck.

Hollywood Turban Products Co., Chicago, Ill.
Protective Headwear for Women Industrial Workers.

Hynson, Westcott & Dunning, Inc., Baltimore, Md.
Mercurochrome and Thantis Lozenges.

Industrial Gloves Co., Danville, Ill.
Protective Clothing, Gloves, Mittens, Headguards, Leggings, Flame-Proof Suits.

International Cellucotton Products Co., Chicago, Ill.
Menstruation Materials for Women in Industry.

International Shoe Co., St. Louis, Mo.
Safety Shoes.

Iron Age Div., H. Childs & Co., Inc., Pittsburgh, Pa.
Safety Shoes.

C. Walker Jones Co., Philadelphia, Pa.
Industrial Knitted Specialties, Protective Clothing.

Junkin Safety Appliance Co., Louisville, Ky.
Safety Guards for Punch Presses, Splint Type Stretchers.

Justrite Manufacturing Co., Chicago, Ill.
Safety Cans, Safety Flashlights, Electric Lanterns.

Karel First Aid Supply Co., Chicago, Ill.
Industrial Hospital Supplies, First Aid Supplies.

Keystone View Co., Meadville, Pa.
Industrial Vision Tests.

Walter Kidde & Co., New York, N. Y.
Fire Prevention and Extinguishing Equipment and Systems.

Kimball Safety Products Co., Cleveland, O.
Protective Clothing, Gloves and Goggles.

Klear-Vu Products Co., Newark, N. J.
Safety Caps, Hair Guards, Arm Guards, Aprons.

Walter G. Legge Co., Inc., New York, N. Y.
Non-Slip Floor Polishes and Treatment, Non-Sparking Floor Treatment.

Lehigh Safety Shoe Co., Inc., Allentown, Pa.
Safety Shoes and Rubber Boots.

Lien Chemical Corp., Chicago, Ill.
Soaps, Cleaning Compounds, Disinfectants, Insecticides Deodorants,
Maintenance Supplies.

Lightfoot Schuls Co., New York, N. Y.
Powdered Hand Soap for Industrial Use.

Lonn Mfg. Co., Inc., Indianapolis, Ind.
Blow Guns, Spraying and Cleaning Guns, Water Savers.

MacWhyte Co., Kenosha, Wis.
Wire Rope and Wire Rope Slings.

Thom McAn Safety Shoe Co., New York, N. Y.
Safety Shoes.

B. F. McDonald Co., Los Angeles, Cal.
Industrial Safety Equipment.

Medical Supply Co., Chicago, Ill.
First Aid Kits and Supplies.

Meili-Blumberg Corp., New Holstein, Wis.
Safety Line Markers for Roads, Streets, Airports, and Industrial Plants.

Metropolitan Life Insurance Co., New York, N. Y.
Life, Health, Accident, Annuities and Group Insurance.

Melflex Products, Akron, O.
Flooring Materials, Treads and Standing Mats.

Milburn Co., Detroit, Mich.
Protective Creams and Plastic Safety Clothing.

Mine Safety Appliances Co., Pittsburgh, Pa.
Safety Equipment for Personal and Plant Protection.

E. R. Moore Co., Chicago, Ill.
Work Clothes for Women.

National Safety Council, Inc., Chicago, Ill.
Services and Material for Safety Education.

National Society for the Prevention of Blindness, New York, N. Y.,
Conservation and Utilization of Eyesight in Industry.

Oil-Dri Co. of America, Chicago, Ill.
Oil and Grease Absorbent.

Onox, Inc., San Francisco, Cal.
Athlete's Foot Preventive.

G. H. Packwood Mfg. Co., St. Louis, Mo.
Skin Cleansers, Soap Dispensers, Cleansing Cream.

Patent Scaffolding Co., Chicago, Ill.
Safety Ladders, Scaffolding and Work Stands.

Phister Mfg. Co., Newark, N. J.
Maintained Air Pressure Liquid Fire Extinguishers.

Protectoseal Co., Chicago, Ill.
Safety Devices for Hazardous Liquids.

Pyrene Mfg. Co., Newark, N. J.
Fire Extinguishers, Compounds and Systems.

Rose Mfg. Co., Denver, Colo.
Industrial Safety Equipment.

Safety Clothing & Equipment Co., Cleveland, O.
Industrial Safety Equipment.

Safety Engineering, New York, N. Y.
Publishers, Safety Engineering Magazine.

Safety First Shoe Co., Holliston, Mass.
Safety Shoes.

W. H. Salisbury & Co., Chicago, Ill.
Linemen's Rubber Protective Equipment.

A. Schrader's Son, Brooklyn, N. Y.
Pneumatic Safety Control Devices.

- Sellstrom Mfg. Co., Chicago, Ill.
Face and Eye Protective Equipment.
- Spencer Turbine Co., Hartford, Conn.
Industrial Vacuum Cleaners and Dust Collecting Equipment.
- Standard Safety Equipment Co., Chicago, Ill.
Personal Safety Protective Equipment.
- Stepan Chemical Co., Chicago, Ill.
Skin Cleanser.
- Stonehouse Signs, Inc., Denver, Colo.
Accident Prevention Signs.
- The Strauss Co., Pittsburgh, Pa.
Personal Protective Equipment.
- Sugar Beets Products Co., Saginaw, Mich.
Skin Cleanser and Cleaner; Non-Slip Floor Treatment.
- Surty Mfg. Co., Inc., Chicago, Ill.
Safety Appliances for Machines and Underfoot Hazards.
- G. H. Tennant Co., Minneapolis, Minn.
Floor Cleaning Machines, Floor Seal and Floor Wax.
- Trimont Mfg. Co., Roxbury (Boston), Mass.
Forged Steel Safety Tools.
- United States Army, Washington, D. C.
- U. S. Safety Service Co., Kansas City, Mo.
Industrial Safety Equipment.
- Wagner Electric Corp., Brooklyn, N. Y.
Industrial Hydraulic Brakes.
- Wahlert Products Corp., Brooklyn, N. Y.
Industrial Safety and Fire Equipment.
- Watchmocket Optical Co., Inc., Providence, R. I.
Industrial Safety Goggles.
- Waverly Petroleum Products Co., Philadelphia, Pa.
Oil Absorption Material.
- Weaver Mfg. Co., Chicago, Ill.
Automatic Brake Testers "Safety Lanes."
- West Disinfecting Co., Long Island City, N. Y.
Personal Protection Safeguards and Plant Sanitation Products.
- F. H. Wheeler Mfg. Co., Chicago, Ill.
Protective Apparel.
- Willson Products, Inc., Reading, Pa.
Personal Protective Equipment, Instruments.

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33rd National Safety Congress, 1944

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J. A. LATHROP, Safety Supvr., Oregon Motor Stages, 506 S. W. Mill St., Portland 1, Oregon.

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J. W. LORN, Safety Eng., Atlantic Refining Co., 3144 Passyunk Ave., Philadelphia, Pa.

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A. E. NEYHART, Administrative Head, Institute of Public Safety, The Pennsylvania State College, State College, Pa.

G. R. WELLINGTON, Chief, Section of Safety, Bureau of Motor Carriers, Interstate Commerce Commission, Washington 25, D. C.

Safety Exposition Exhibitors

EXHIBITION HALL—SHERMAN HOTEL

Alphabetical List of Exhibitors of Industrial Safety Equipment

Aetna Casualty & Surety Co., Hartford, Conn.
Insurance Underwriters.

American Abrasive Metals Co., Irvington, N. J.
Safety Treads, Abrasive Paints.

American Alliance Co., Inc., Buffalo, N. Y.
Industrial Safety and Fire Protection Equipment.

American-LaFrance-Foamite Corp., Elmira, N. Y.
Fire Protection Equipment.

American Mat Corp., Toledo, O.
Safety Matting and Switchboard Matting.

American Optical Co., Southbridge, Mass.
Industrial Safety Goggles, Respiratory Devices, and Protective Clothing.

American Safety Tank Co., Kansas City, Mo.
Safety Fuel Tanks for Trucks.

Ampco Metal, Inc., Milwaukee, Wis.
Beryllium-Copper Non-Sparking Safety Tools.

Automatic Canteen Co. of America, Chicago, Ill.
Food Services.

Bausch & Lomb Optical Co., Rochester, N. Y.
Safety Lenses and Goggles.

Bear Manufacturing Co., Rock Island, Ill.
Motor Vehicle Inspection and Correction Equipment; Static and
Dy-Namic Balancing Machines.

Benjamin Electric Mfg. Co., Des Plaines, Ill.
Industrial Lighting Equipment; Call and Warning Devices;
Punch Press Safety Device Equipment.

Boyer-Campbell Co., Detroit, Mich.
Face Shields, Welding Helmets, Safety Tongs, Grinder Guards, Inspection Lights
- Protective Clothing.

John H. Breck, Inc., Springfield, Mass.
Protective Creams and Hand Cleaner.

Brown Shoe Co., Chicago, Ill.
Safety Shoes.

R. H. Buhke Co., Chicago, Ill.
Safety Equipment and Allied Products for Construction and Maintenance Work.

E. D. Bullard Co., San Francisco, Cal.
Safety Equipment.

Burroughs, Wellcome & Co. (U.S.A.) New York, N. Y.
First Aid Equipment.

Carbisulphoil Co., Dallas, Tex.

Antiseptic Emulsion, Ointment, Liquid Soap.

Cardox Corp., Chicago, Ill.

Fire Extinguishing Systems, Fire Trucks, and Mobile Extinguishing Equipment.

Colanese Celluloid Corp., New York, N. Y.

Plastics for Safety Devices.

A. B. Chance Co., Centralia, Mo.

Live Line Maintenance Tools and Equipment.

Chicago Eye Shield Co., Chicago, Ill.

Head and Eye Protective Equipment.

Columbus-McKinnon Chain Corp., Tonawanda, N. Y.

Chain and Chain Hoists.

C-O-Two Fire Equip. Co., Newark, N. J.

Carbon Dioxide Fire Extinguishers, Hose Units, Manual Automatic Systems, Smoke Detecting Systems.

Davis Emergency Equip. Co., Inc., Newark, N. J.

Respiratory Protection, Combustible Gas Indicators, General Safety and First Aid Equipment.

Dickson Safety Products Co., Los Angeles, Cal.

Personal Protective Equipment.

Dionol Co., Kalamazoo, Mich.

Ointment, Protective Creams, Salt Tablets.

Dockson Corp., Detroit, Mich.

Industrial Head and Eye Protection.

C. B. Dolge Co., Westport, Conn.

Fungicides, Protective Creams, Skin Cleaner, Cutting Oil Germicides.

Dugas Engineering Co., Marinette, Wis.

Fire Protection Equipment.

Dunn Products, Chicago, Ill.

Industrial Protective Clothing Made from Rubber, Asbestos Cloth and Leather.

Duo-Safety Ladder Corp., Oshkosh, Wis.

Safety and Fire Ladders, Ladder Shoes.

E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

Hand Protective Creams, Industrial Hand Creams, Neoprene Products, Rayon Yarn.

E. & J. Manufacturing Co., Philadelphia, Pa.

Resuscitator Inhalator and Aspirator.

Elliott Service Co., New York, N. Y.

Foremanship Training Material, Bulletin Board Displays on Safety, Quality and Waste; Suggestion Systems.

J. H. Emerson Co., Cambridge, Mass.

Automatic Resuscitation and Respiration Equipment.

Finnell System, Inc., Elkhart, Ind.

Floor-Care Machines and Floor Treatments.

Franklin Research Co., Philadelphia, Pa.

Anti-Skid Floor Maintenance Materials.

General-Detroit Corp., Detroit, Mich.

Fire Protection Equipment.

Goodyear Tire & Rubber Co., Akron, O.
Non-Slip Surfacing Materials.

Holcomb Safety Garment Co., Chicago, Ill.
Protective Clothing Made of Asbestos, Leather and Fire-Proofed Duck.

Hollywood Turban Products Co., Chicago, Ill.
Protective Headwear for Women Industrial Workers.

Hynson, Westcott & Dunning, Inc., Baltimore, Md.
Mercurochrome and Thantis Lozenges.

Industrial Gloves Co., Danville, Ill.
Protective Clothing, Gloves, Mittens, Headguards, Leggings, Flame-Proof Suits.

International Cellucotton Products Co., Chicago, Ill.
Menstruation Materials for Women in Industry.

International Shoe Co., St. Louis, Mo.
Safety Shoes.

Iron Age Div., H. Childs & Co., Inc., Pittsburgh, Pa.
Safety Shoes.

C. Walker Jones Co., Philadelphia, Pa.
Industrial Knitted Specialties, Protective Clothing.

Junkin Safety Appliance Co., Louisville, Ky.
Safety Guards for Punch Presses, Splint Type Stretchers.

Kestrite Manufacturing Co., Chicago, Ill.
Safety Cans, Safety Flashlights, Electric Lanterns.

Karel First Aid Supply Co., Chicago, Ill.
Industrial Hospital Supplies, First Aid Supplies.

Keystone View Co., Meadville, Pa.
Industrial Vision Tests.

Walter Kidde & Co., New York, N. Y.
Fire Prevention and Extinguishing Equipment and Systems.

Kimball Safety Products Co., Cleveland, O.
Protective Clothing, Gloves and Goggles.

Klear-Vu Products Co., Newark, N. J.
Safety Caps, Hair Guards, Arm Guards, Aprons.

Walter G. Legge Co., Inc., New York, N. Y.
Non-Slip Floor Polishes and Treatment, Non-Sparking Floor Treatment.

Lehigh Safety Shoe Co., Inc., Allentown, Pa.
Safety Shoes and Rubber Boots.

Lien Chemical Corp., Chicago, Ill.
Soaps, Cleaning Compounds, Disinfectants, Insecticides Deodorants,
Maintenance Supplies.

Lightfoot Schulz Co., New York, N. Y.
Powdered Hand Soap for Industrial Use.

Loom Mfg. Co., Inc., Indianapolis, Ind.
Blow Guns, Spraying and Cleaning Guns, Water Savers.

MacWhyte Co., Kenosha, Wis.
Wire Rope and Wire Rope Slings.

Thom McAn Safety Shoe Co., New York, N. Y.
Safety Shoes.

B. F. McDonald Co., Los Angeles, Cal.

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Work Clothes for Women.

National Safety Council, Inc., Chicago, Ill.

Services and Material for Safety Education.

National Society for the Prevention of Blindness, New York, N. Y.

Conservation and Utilization of Eyesight in Industry.

Oil-Dri Co. of America, Chicago, Ill.

Oil and Grease Absorbent.

Onox, Inc., San Francisco, Cal.

Athlete's Foot Preventive.

G. H. Packwood Mfg. Co., St. Louis, Mo.

Skin Cleansers, Soap Dispensers, Cleansing Cream.

Patent Scaffolding Co., Chicago, Ill.

Safety Ladders, Scaffolding and Work Stands.

Phister Mfg. Co., Newark, N. J.

Maintained Air Pressure Liquid Fire Extinguishers.

Protectoseal Co., Chicago, Ill.

Safety Devices for Hazardous Liquids.

Pyrene Mfg. Co., Newark, N. J.

Fire Extinguishers, Compounds and Systems.

Rose Mfg. Co., Denver, Colo.

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Industrial Safety Equipment.

Safety Engineering, New York, N. Y.

Publishers, Safety Engineering Magazine.

Safety First Shoe Co., Holliston, Mass.

Safety Shoes.

W. H. Salisbury & Co., Chicago, Ill.

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A. Schrader's Son, Brooklyn, N. Y.

Pneumatic Safety Control Devices.

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- Wenger Turbine Co., Hartford, Conn.**
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- The Strass Co., Pittsburgh, Pa.**
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Oil Absorption Material.
- Weaver Mfg. Co., Chicago, Ill.**
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- West Disinfecting Co., Long Island City, N. Y.**
Personal Protection Safeguards and Plant Sanitation Products.
- F. H. Wheeler Mfg. Co., Chicago, Ill.**
Protective Apparel.
- Willson Products, Inc., Reading, Pa.**
Personal Protective Equipment, Instruments.

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33rd NATIONAL SAFETY CONGRESS

Volume II



**Traffic, Commercial Vehicle, Transit, School and College,
Home, and Farm Safety**

CHICAGO

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National Safety Council, Inc.

20 North Wacker Drive, Chicago 6

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