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NATIONAL SAFETY COUNCIL

TRANSACTIONS

35th CONGRESS

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Transactions

35TH NATIONAL SAFETY CONGRESS

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GREEN CROSS FOR SAFETY



VOLUME I

Annual Meeting, Banquet, Women's Activities,
Index to all Volumes and Exhibitors

NATIONAL SAFETY COUNCIL, INC.
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Foreword

THE Transactions of the 35th National Safety Congress and Exposition of the National Safety Council are published in 29 volumes. Volume I includes the Annual Meeting, Banquet, Women's Activities, Index to all volumes and List of Exhibitors. Volume II contains the ASSE Session and the Industrial Subject Sessions. Volume XXIX contains the Early Morning Sessions, "Psychology You Can Use." Each of the other volumes is devoted to the sessions of a single section or division of the Council.

The transactions are a record of the proceedings of the Congress, condensed and edited for reference purposes. The complete original manuscripts, many of which contain charts and illustrations which could not be reproduced here, are available in the files of the National Safety Council.

The National Safety Council seeks to eliminate from discussion matters not pertinent to the aims of the Council. However, it cannot accept responsibility for the views expressed at the Congress or in this record.

It is expected that the new format of these Transactions will permit wider and more effective use of the material relating to various fields of safety. At the same time, the whole set provides a complete and indexed reference work on all phases of accident prevention.

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Annual Meeting of Members

MONDAY MORNING SESSION
October 6, 1947

Presiding: NED H. DEARBORN, President, National Safety Council, Inc.

The 1947 Annual Council Meeting of the National Safety Council was held in the Grand Ballroom of the Stevens Hotel, Chicago, on October 6, with Mr. Ned H. Dearborn, President, presiding.

Following the singing of the national anthem, President Dearborn announced a quorum present, in person or by proxy. It was voted to dispense with the calling of the roll; also to dispense with the reading of the minutes of the previous Annual Meeting.

Mr. Dearborn read a letter from President Harry S. Truman in which he asked that Mr. Dearborn "convey to all those attending the National Safety Congress my earnest hope they will leave this great meeting determined to wage the most successful nation-wide attack on accidents this country has ever seen." "Records prove again and again," said Mr. Truman, "that a factory, a community or a state can achieve amazing reductions in accident rates by united and persistent effort."

President Dearborn called for the report of the General Nominating Committee, which consisted of the following members: G .A. Heuser, Chairman, Ray Carr, Mrs. LaFell Dickinson, C. E. Pettibone, and Theodore F. Smith.

Mr. Heuser reported in behalf of the General Nominating Committee, pointing out that the Constitution authorizes the Committee to name candidates for election to the Trustees, to the Board of Directors, to the Executive Board, and to all offices except the office of Executive Vice-President. The selections of the Committee, Mr. Heuser stated, were reported to the Secretary of the Council seventy-five days before this meeting and were properly announced to all members of the Council on August 7, 1947.

Mr. Heuser then presented as the nominees for Trustees of the Council, to be elected for a three-year term: Winthrop W. Aldrich, James B. Black, S. Bruce Black Morgan B. Brainard, Kenneth B. Colman, Walter J. Cummings, Francis J. Gavin, William M. Jeffers, William A. Simpson, Herbert E. Smith, Juan T. Trippe, C. E. Wilson, and Robert W. Woodruff. Of the above nominees, all but Mr. Woodruff were named in the Nominating Committee's report circulated to the Membership. Mr. Heuser said that Mr. Woodruff's name had been added following consideration by his Committee after the original announcement. (Secretary's Note: A complete list of the Trustees, including those elected at this meeting, as well as those continuing in office from previous elections, is given on pages 6 and 7 of this volume.)

Mr. Heuser presented the nominations for Directors. In doing so he omitted the name of Mr. Ralph Hough who, along with the other nominees, had been announced to members of the Council on August 7, 1917. He explained that Mr. Hough had advised with regret that he would not be able to accept the office. Mr. Craig proposed the name of Mr. O. Gressens, of Chicago, to take Mr. Hough's place.

Mr. Heuser presented the nominees for the Executive Board, stating that the recommendations of the Executive Board Nominating Committee had been accepted in full, and that the list had been published to members of the Council on August 7, 1947.

Mr. Heuser presented nominees for Officers of the Council. He pointed out that in his Committee's report to the Membership, dated August 7, 1917, no nomination was made for the office of Vice-President for Finance and Treasurer and that, to fill this position, his Committee now desired to present the name of Mr. O. Gressens of Chicago.

There were no nominations except those presented by Mr. Heuser, and the Secretary announced that the entire proxy vote, numbering 5,149, was cast in favor of the nominees proposed by the General Nominating Com-

Safety Exposition Exhibitors

EXHIBITION HALL—STEVENS HOTEL
MEZZANINE FLOOR—SHERMAN HOTEL

Alphabetical List of Exhibitors of Industrial and Public Safety Equipment

Acme Protection Equipment Co., Chicago, Ill.
Gas Masks.

All American Safety Equipment Co., Chicago, Ill.
Power and Kick Press Guards.

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

American Cord & Webbing Co., New York, N. Y.
Acro-lyte Products, Reflectors and Fluorescent Webbing.

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

American Mat Corp., Toledo, O.
Safety Mattings.

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

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

Ansul Chemical Co., Marinette, Wis.
Fire Protection Equipment.

Audio Development Co., Minneapolis, Minn.
Hearing Testing Equipment.

Batterson Distributing Co., Houston, Tex.
Plastic *Traffic Markers for Streets, Highways and Industry.*

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.

Behr-Manning Corp., Troy, N. Y.
Coated Abrasives.

Benson and Associates, Inc., Chicago, Ill.
General Safety Equipment.

Bradley Washfountain Co., Milwaukee, Wis.
Group Washfountains and Multi-Stall Showers.

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

Stewart R. Browne Mfg. Co., Inc., New York, N. Y.
Flashlights and Extension Lights.

Buckingham Mfg. Co., Inc., Binghampton, N. Y.
Linemen's Accessories.

Buffalo Fire Appliance Corp., Dayton, Ohio
Fire Extinguishing Equipment.

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

E. D. Bullard Co., San Francisco, Cal.
Everything in Safety.

Canfield Oil Co., Cleveland, Ohio
Oil-Spunj Absorbents.

A. B. Chance Co., Centralia, Mo.
Line Construction and Live Line Maintenance Equipment.

Chello, Inc., New York, N. Y.
Polaroid Color and Contrast Vectograph Displays.
Chicago Eye Shield Co., Chicago, Ill.
Head and Eye Protective Equipment.
Columbia First Aiders, Chicago, Ill.
First Aid Supplies.
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.
M. E. Cunningham Co., Pittsburgh, Pa.
Safety Marking Tools.

Davis Emergency Equipment Co., Newark, N. J.
Respiratory Protection; Combustible Gas Indicators; General Safety and First Aid Equipment.
The Diversey Corp., Chicago, Ill.
Oil and Grease Absorbents, Cleaning Compounds, Hand Cleaners.
Dobbins Mfg., Co., Elkhart, Ind.
Portable Drinking Fountains and Accessories.
Dockson Corp., Detroit, Mich.
Industrial Head and Eye Protection.
C. B. Dolge Co., Westport, Conn.
Fungicides, Protective Creams, Skin Cleaner, Cutting Oil Germicides.
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., Glendale, Calif.
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.
Fyr-Fyter Co., Dayton, Ohio.
Fire Extinguishing Equipment.

General Detroit Corp., Detroit, Mich.
Fire Extinguishers, Motor Fire Apparatus and Allied Products.
Graubard's, Inc., Newark, N. J.
Gro-Cord Rubber Co., Lima, Ohio.
Gro-Cord, Raw-Cord and Neo-Cord Soles, Heels and Taps.

Haas Corporation, Mendon, Mich.
Optical Magnifiers.
Harley-Davidson Motor Co., Milwaukee, Wis.
Hild Floor Machine Co., Chicago, Ill.
Electrically Operated Floor Scrubbing & Polishing Machines—Portable Industrial Vacuum Machines.
Hillyard Sales Companies, St. Joseph, Mo.
Floor Treatments, Building Maintenance, Sanitation Products, Equipment and materials.
Holcomb Safety Garment Co., Chicago, Ill.
Protective Clothing Made of Asbestos, Leather and Fire-Proofed Duck.
Hospital Specialty Co., Cleveland, Ohio.
Manufacturers and Distributors—GARDS, FEMS, TAMPAX—Sanitary Pads and Dispensers.

Huntington Laboratories, Inc., Huntington, Ind.
Sanitary Supplies, Liquid Soaps, Disinfectants, Floor Finishes and Machines, Insecticides.
Hydro-Tex Corp., Chicago, Ill.
Industrial Aprons.
Hynson Westcott & Dunning, Inc., Baltimore, Md.
Mercurochrome and Thantis Lozenges.

Indian Motorcycle Co., Springfield, Mass.
Industrial Gloves Co., Danville, Ill.
Protective Clothing, Gloves, Mittens, Headguards, Leggings, Flame-Proof Suits.
Industrial Products Co., Philadelphia, Pa.
Safety Equipment for All Industries.
Industrial Safety Equipment Assn., New York, N. Y.
Insto-Gas Corp., Detroit Mich.
Underwriters Approved Torches and Furnaces.
International Business Machine Corp., Chicago, Ill.
International Shoe Co., High-Test Div., St. Louis, Mo.
Hy-Test Safety Shoes.
Iron Age Div., H. Childs & Co., Inc., Pittsburgh, Pa.
Safety Shoes.

Jackson Products, Warren, Mich.
Insulated Electrode Holders, Cable Connectors, Face Shields and Goggles.
Junkin Safety Appliance Co., Inc., Louisville, Ky.
Interlocking Barrier Gate and Swinging Die Closure Guards.
Justrite Manufacturing Co., Chicago, Ill.
Safety Cans, Safety Flashlights, Electric Lanterns.

Karel First Aid Supply Co., Chicago, Ill.
Industrial First-Aid Supplies and Equipment.
Kex National Service, New York, N. Y.
Safe Wiping Materials.
Keystone View Co., Meadville, Pa.
Industrial Visual Testing Equipment.
Walter Kidde & Co., Inc., Belleville, N. J.
Fire Extinguishing Equipment.
Kimball Safety Products Co., Cleveland, O.
Protective Clothing, Gloves and Goggles.

Walter G. Legge Co., Inc., New York, N. Y.
Non-Slip Floor Polishes and Treatments, Non-Sparking Floor Treatment.
Lehigh Safety Shoe Co., Inc., Allentown, Pa.
Safety Shoes and Rubber Boots.
Lightfoot Schultz Co., New York, N. Y.
Industrial Soaps—Powdered, Bar, Paste and Hand Lotion.

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Wire Rope and Wire Slings.
Magnesium Co. of America, Chicago, Ill.
Magcoa Light Weight Magnesium Dockboards, Pallets, Barrel Skids, General Fabrication.
Marsh & McLennan, Inc., Chicago, Ill.
Insurance Brokers and Agents.
Martindale Electric Co., Lakewood, Ohio.
Respirator for Non-Toxic Dusts, Electrical Testing Instruments.
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Safety Shoes.
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THE Transactions of the 35th National Safety Congress and Exposition of the National Safety Council are published in 29 volumes. Volume I includes the Annual Meeting, Banquet, Women's Activities, Index to all volumes and List of Exhibitors. Volume II contains the ASSE Session and the Industrial Subject Sessions. Volume XXIX contains the Early Morning Sessions, "Psychology You Can Use." Each of the other volumes is devoted to the sessions of a single section or division of the Council.

The transactions are a record of the proceedings of the Congress, condensed and edited for reference purposes. The complete original manuscripts, many of which contain charts and illustrations which could not be reproduced here, are available in the files of the National Safety Council.

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October 6, 1947

Presiding: NED H. DEARBORN, President, National Safety Council, Inc.

The 1947 Annual Council Meeting of the National Safety Council was held in the Grand Ballroom of the Stevens Hotel, Chicago, on October 6, with Mr. Ned H. Dearborn, President, presiding.

Following the singing of the national anthem, President Dearborn announced a quorum present, in person or by proxy. It was voted to dispense with the calling of the roll; also to dispense with the reading of the minutes of the previous Annual Meeting.

Mr. Dearborn read a letter from President Harry S. Truman in which he asked that Mr. Dearborn "convey to all those attending the National Safety Congress my earnest hope they will leave this great meeting determined to wage the most successful nation-wide attack on accidents this country has ever seen." "Records prove again and again," said Mr. Truman, "that a factory, a community or a state can achieve amazing reductions in accident rates by united and persistent effort."

President Dearborn called for the report of the General Nominating Committee, which consisted of the following members: G .A. Heuser, Chairman, Ray Carr, Mrs. LaFell Dickinson, C. E. Pettibone, and Theodore F. Smith.

Mr. Heuser reported in behalf of the General Nominating Committee, pointing out that the Constitution authorizes the Committee to name candidates for election to the Trustees, to the Board of Directors, to the Executive Board, and to all offices except the office of Executive Vice-President. The selections of the Committee, Mr. Heuser stated, were reported to the Secretary of the Council seventy-five days before this meeting and were properly announced to all members of the Council on August 7, 1947.

Mr. Heuser then presented as the nominees for Trustees of the Council, to be elected for a three-year term: Winthrop W. Aldrich, James B. Black, S. Bruce Black, Morgan B. Brainard, Kenneth B. Colman, Walter J. Cummings, Francis J. Gavin, William M. Jeffers, William A. Simpson, Herbert E. Smith, Juan T. Trippe, C. E. Wilson, and Robert W. Woodruff. Of the above nominees, all but Mr. Woodruff were named in the Nominating Committee's report circulated to the Membership. Mr. Heuser said that Mr. Woodruff's name had been added following consideration by his Committee after the original announcement. (Secretary's Note: A complete list of the Trustees, including those elected at this meeting, as well as those continuing in office from previous elections, is given on pages 6 and 7 of this volume.)

Mr. Heuser presented the nominations for Directors. In doing so he omitted the name of Mr. Ralph Hough who, along with the other nominees, had been announced to members of the Council on August 7, 1947. He explained that Mr. Hough had advised with regret that he would not be able to accept the office. Mr. Craig proposed the name of Mr. O. Gressens, of Chicago, to take Mr. Hough's place.

Mr. Heuser presented the nominees for the Executive Board, stating that the recommendations of the Executive Board Nominating Committee had been accepted in full, and that the list had been published to members of the Council on August 7, 1947.

Mr. Heuser presented nominees for Officers of the Council. He pointed out that in his Committee's report to the Membership, dated August 7, 1947, no nomination was made for the office of Vice-President for Finance and Treasurer and that, to fill this position, his Committee now desired to present the name of Mr. O. Gressens of Chicago.

There were no nominations except those presented by Mr. Heuser, and the Secretary announced that the entire proxy vote, numbering 5,149, was cast in favor of the nominees proposed by the General Nominating Com-

Safety Exposition Exhibitors

EXHIBITION HALL—STEVENS HOTEL
MEZZANINE FLOOR—SHERMAN HOTEL

Alphabetical List of Exhibitors of Industrial and Public Safety Equipment

Acme Protection Equipment Co., Chicago, Ill.
Gas Masks.

All American Safety Equipment Co., Chicago, Ill.
Power and Kick Press Guards.

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

American Cord & Webbing Co., New York, N. Y.
Acro-lyte Products, Reflectors and Fluorescent Webbing.

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

American Mat Corp., Toledo, O.
Safety Mattings.

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

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

Ansul Chemical Co., Marinette, Wis.
Fire Protection Equipment.

Audio Development Co., Minneapolis, Minn.
Hearing Testing Equipment.

Batterson Distributing Co., Houston, Tex.
Plastic Traffic Markers for Streets, Highways and Industry.

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.

Behr-Manning Corp., Troy, N. Y.
Coated Abrasives.

Benson and Associates, Inc., Chicago, Ill.
General Safety Equipment.

Bradley Washfountain Co., Milwaukee, Wis.
Group Washfountains and Multi-Stall Showers.

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

Stewart R. Browne Mfg. Co., Inc., New York, N. Y.
Flashlights and Extension Lights.

Buckingham Mfg. Co., Inc., Binghampton, N. Y.
Linemen's Accessories.

Buffalo Fire Appliance Corp., Dayton, Ohio
Fire Extinguishing Equipment.

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

E. D. Bullard Co., San Francisco, Cal.
Everything in Safety.

Canfield Oil Co., Cleveland, Ohio
Oil-Spunj Absorbents.

A. B. Chance Co., Centralia, Mo.
Line Construction and Live Line Maintenance Equipment.

Chello, Inc., New York, N. Y.
Polaroid Color and Contrast Vectograph Displays.
Chicago Eye Shield Co., Chicago, Ill.
Head and Eye Protective Equipment.
Columbia First Aiders, Chicago, Ill.
First Aid Supplies.
Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
Chain and Chain Hoists.
C-O-Two Fire Equip. Co., Newark, N. J.
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M. E. Cunningham Co., Pittsburgh, Pa.
Safety Marking Tools.

Davis Emergency Equipment Co., Newark, N. J.
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The Diversey Corp., Chicago, Ill.
Oil and Grease Absorbents, Cleaning Compounds, Hand Cleaners.
Dobbins Mfg., Co., Elkhart, Ind.
Portable Drinking Fountains and Accessories.
Dockson Corp., Detroit, Mich.
Industrial Head and Eye Protection.
C. B. Dolge Co., Westport, Conn.
Fungicides, Protective Creams, Skin Cleaner, Cutting Oil Germicides.
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., Glendale, Calif.
Resuscitator Inhalator and Aspirator
Elliott Service Co., New York, N. Y.
Foremanship Training Materia., Bulletin Board Displays on Safety, Quality and Waste; Suggestion Systems.
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General Detroit Corp., Detroit, Mich.
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Hild Floor Machine Co., Chicago, Ill.
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Hospital Specialty Co., Cleveland, Ohio.
Manufacturers and Distributors—GARDS, FEMS, TAMPAX—Sanitary Pads and Dispensers.

Huntington Laboratories, Inc., Huntington, Ind.
Sanitary Supplies, Liquid Soaps, Disinfectants, Floor Finishes and Machines, Insecticides.
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Iron Age Div., H. Childs & Co., Inc., Pittsburgh, Pa.
Safety Shoes.

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TUESDAY AFTERNOON SESSION

October 7, 1947

Presiding: LLOYD A. BLANCHARD, Chief, Safety Div., Corps of Engineers, Washington, D. C.

The Chapter of Accidents

By N. B. O'CONNELL

General Superintendent, Turner Construction Company

Those who build buildings can testify that a chapter of accidents in our business is a long and expensive one.

Billy Muldoon was born and raised in a small New England mill town. He finished the high school course and had hopes of going to college, but he had to help out at home, so he got a job at the local mill. By the time the construction of the big new addition to the factory got underway a few years later, Billy Muldoon was already happily married and the father of two fine children. Attracted by the high construction wages and the stories of big take-home pay, he quit his factory job, got himself a laborer's card and went to work for the contractor. Billy was strong and quick to learn and it was not long before he was a pusher in the stripping gang.

January 16, 1945 was a gray winter day with snow in the air and a brisk west wind whistling through the bleak skeleton structure. Billy Muldoon stood on the fifth floor, in charge of hoisting large form panels and was about to hook one on when a gust of wind blew the cable hook beyond his reach. He leaned out; the panel, unbalanced by the wind, toppled against him and pushed him overboard to the frozen ground sixty feet below.

For days he was on the critical list. Then it became evident that his rugged Irish constitution, aided by fervent prayer and competent medical attention, was going to prevail over a list of injuries which included fractured ribs, a fractured pelvis, fracture of three transverse processes and a comminution fracture of a lumbar vertebra, to say nothing of a punctured diaphragm and injury to the genito urinary tract. By April he was out of the hospital wearing a spinal brace and walking with the aid of a cane and by July, he was back on the job doing light work.

But he had to give up his job with the contractor, could not keep his end up at the mill, and, finally, his parish rector had to make a place for him working around the church. Billy Muldoon is still in his thirties. His fall has had a tragic effect not only on his life but on the lives of his wife and children.

Hjalmar Frederickson was 56 years old when his useful days as a journeyman carpenter came to an abrupt end. When he first came to this country, he worked on building construction because all his friends were in that line. He was a good mechanic, loved his trade but hated intensely working as a "wood butcher" on concrete forms.

Not long after he married, he put the family savings into a little carpenter shop. But the war came on with its restrictions on lumber. Hjalmar had to go back to working on buildings. He hated the work, but those war plant construction jobs paid well.

It was while placing the forms for a fill on top of a new type of sound absorbent insulating roof tile that Hjalmar met his misfortune. One of the tiles broke under his weight and he fell 22 feet to the concrete floor below. The doctor called it "'a comminuted fracture of the right humerus" and stated that there was some indication of injury to the spine. There was not much the doctors could do and, as time went on, Hjalmar suffered almost constant pain in the ulnar nerve, which I understand is the one which gives the "'funny bone" sensation. Hjalmar's wife got herself a job soon after the accident, for they had obligations which could not be met by compensation checks. Hjalmar catches odd jobs when he can, but he is not good for much, and the doctors deem him totally disabled. It is just a sort of slow, living death.

Patsy Moreno was an Italian immigrant many years ago. He came over with his father while he was still a young boy. They settled in a small New England town with his father's relatives who worked on the large estates in the neighborhood. As was generally the rule, Patsy was one of a large

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TUESDAY AFTERNOON SESSION

October 7, 1947

Ship Operators Day

Presiding: VICE ADMIRAL LYNDON SPENCER, Vice Pres., Lake Carriers' Association

Prevention of Accidents Peculiar to the Operation of Tankers

By CHARLES L. BOYLE
Manager, Marine Dept., Sun Oil Company

It is a little difficult to interpret the meaning of "accidents peculiar to the operation of tankers," except in the broad sense that because tankers carry petroleum products they are susceptible to more violent hazards than freighters and other floating equipment. Some petroleum products are relatively safe to transport, but most are not, and accordingly we think in terms of the dangerous products in formulating rules for prevention of accidents. That the tanker industry has enjoyed a very reasonable degree of success in its campaign to prevent accidents can be readily attested to by the fact that personnel consider service on tankers as safe as freighters.

While the nation's railroads boast of their miles of service without accidents and aviation companies boast of their hours in the air without accidents, the tanker industry can pridefully point to the *billions* of gallons of petroleum products transported without accidents. In the oil industry accidents not only cause pain, suffering and unhappiness, but also mean lower morale of personnel, denial of higher management insistence on good safety records, breakdown of schedules through loss of time with consequent disruptions in other parts of the industry, monetary losses, and an insult to the industry's pride.

It is difficult to differentiate in tanker operations between materiel and personnel in formulating an accident prevention program, for the simple reason that accidents to materiel present a high degree of exposure to personnel and, vice versa, personnel exposure can result in serious accidents to materiel. However, we do differentiate, and unconsciously find ourselves devoting the greater share of our attention to prevention of accidents among personnel. In addition to the hazards that all seagoing personnel are exposed to in their daily routine, tanker personnel must be fully aware of hazards peculiar to their trade, some of which we mention below.

Asphyxiation is probably the most serious hazard, when one considers the high volatility and attendant toxicity of most cargoes carried. As the old saying goes—"familiarity breeds contempt" and you find many tankermen indifferent to the deadly nature of the fumes and they often take chances when entering compartments and tanks. Experience figures indicate that this hazard rates among the top in fatalities to tanker personnel. Pumprooms, cofferdams and cargo spaces present the greatest amount of exposure for asphyxiation. This is particularly true of the main cargo pumproom. Leaks from cargo pump glands, pipelines and cargo valves should receive prompt attention and the bilges should be kept free of oil at all times. It is good practice to hook up the bilge pump discharge to the shore slop line while discharging cargo and while loading cargo, because many cargo pipelines and valve glands begin leaking as a result of the high cargo loading rates now employed.

A hard and fast rule should be enforced that no man, for any reason whatsoever, be permitted to enter a cargo tank, pumproom, cofferdam or any closed space until a thorough test of the space has been made. Various instruments and devices are available for the detection of gas vapors and oxygen, and even if the space to be entered is found safe, continued vigilance is required until definite assurance is obtained that a static condition exists. Spaces which have contained petroleum products, unless thoroughly cleaned and ventilated, have a nasty habit of becoming gassy again due to temperature changes, dislodgment of scale, agitation of sludge, etc. Effective ventilation of the compartment to be entered is an important

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MONDAY AFTERNOON SESSION

October 6, 1947

Presiding: J. L. RIDINGER, Safety Director, Inland Steel Company.

How the Front Line Supervisor Should Carry Out His Safety Responsibility

By H. H. FEIT

Superintendent of Industrial Relations, Homestead District Works, Carnegie-Illlinois Steel Corporation

I shall not burden you with a discussion of the history of the safety movement and the progress we have seen within our lifetime, because as has been said before, "there is no need to continually examine the past to fully understand how much a part of what we are."

One thing, however, we should fully recognize is that the progress we have thus far made was largely within the field of facilities. As is so frequently the case, scientific development of material things is much more rapid than the scientific development of men and their actions. Briefly, we have seen much accomplished in the way of safeguards on machinery, the use of colors and signs to designate dangerous areas, governors placed on machinery to hold it within safe speed limits, and a host of other improvements too numerous to mention here.

Obviously, then, it is the individual toward whom we must direct our attention from the standpoint of safety. We must increasingly concern ourselves with what he does if we are to determine why it is that accidents still occur. Such a problem cannot be solved unless there is a definite and conscious effort made on the part of all management through the front line supervisor to get at the source of the trouble.

In the field of equipment everyone recognizes that the best performance is obtained when that equipment is attuned to a sensitivity that makes for smoothness and freedom from trouble. It follows, then, that the supervisor, too, must have that sensitivity—or we can otherwise state—an awareness of those conditions which are necessary for the continued safety of all concerned. Awareness to me, is being alive; the intuition to know when something is out of the ordinary, *although to all outward appearances there has been no appreciable change from the normal.* The ability to be aware of these subtle changes spells the difference between success and failure for the modern front line supervisor. We cannot be content with such answers as prevailed in the past: "I didn't see anything wrong in the way they were doing it," or "They surely know better, because they've been told often enough." Our responsibility is to be aware of *why* individuals continue to be involved in accidents and to develop a solution of this problem. In connection with this increased awareness there must also be an increased sense of responsibility as a necessity on the part of all supervision.

"Passing the buck" is an indication that the proper degree of responsibility has not been accepted, or has not been delegated to the proper degree. Ideally, everyone should assume the responsibility for the safety of himself and others to the degree that accidents of any kind would be only history. But this is idealism of the highest order, and will occur only when man has reached the millennium. Until then, we will continue to recognize that the front line supervisor has a definite responsibility for the safety of those *for* whom he has assumed the position of supervisor. He cannot, if he is to be the kind of supervisor we must have in industry today, assume *part* of the responsibility without assuming the *whole*.

Before entering into the detailed discussion of how the front line supervisor exercises his responsibility in connection with safety, I feel it would be well to depart momentarily and consider the responsibility of management as a whole. I do this because we all realize that the front line supervisor is a member of the management team. It is therefore necessary that each element in man-

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TUESDAY AFTERNOON SESSION

October 7, 1947

Presiding: J. HOWARD MYERS, Director of Safety and Fire Prevention, The Atlantic Refining Co.

The Safety Program, a Unique Tool of Management

By H. H. ANDERSON

Vice President and General Manager, Shell Pipe Line Corp.

safety program merits a key place in management plan because, adroitly handled, it is an exceptional tool for improvement of profits. It affords the manager a ready means amongst his workers to promote many actions beneficial to the business. It is unique because the workers respond through awareness of reciprocal benefits.

Several such business conditions or factors can be improved through a well-planned and carefully-administered safety program. Effectiveness of supervision, employee relations, customer acceptance, public relations, productivity, service continuity, reduction of waste and reduction of absenteeism are open fields for improvement in our own companies.

Heinrich* has shown that an average lost-time accident, including expenses of all kinds, costs the company about $975 plus the legal costs of any industrial deaths. Thus we may accept without discussion the value of a safety program for reducing accident costs to the company and anguish and wage losses to employees; but some industrialists who recognize these obvious benefits seem unaware of the benefits to be derived from applying the program to other phases of the business.

No business large or small can succeed only as it serves its public, and the larger it is, the more it is dependent on its employees to carry out its objectives. To win their best efforts the employees must be brought to recognize their mutuality of interest with their employer. Only then will they prefer to work on the job; to work harmoniously, courteously and carefully; and to carry the message of good report to customers and the general public at large.

These conditions or factors mentioned are related. The others are responsive to the first, effective supervision, and its corollary, good employee relations. However, the improvement of each factor requires special effort, if not a separate program in the management plan. Of course the safety program cannot replace that other effort, but well-planned safety promotion will create a propitious atmosphere for that effort and supplement it to unique advantage for workers as well as management.

The experts say that good industrial relations require effective two-way channels of communication between workers and management. Such are imperative if a manager expects to sell the company and its policies to his workers, and if he is to be honestly apprized of—and in a position to respond to—their attitudes, problems and needs. To illustrate how safety promotion can create such two-way channels, I will describe the experience of our own company with 1,500 employees operating 4,500 miles of oil pipe lines.

The best channels are provided by our Safety Chapters. Twenty-nine of these have been organized by the safety engineers to include all rank-and-file workers and their direct supervisors. Formed by a conveniently-adjacent group of about 50 employees, each chapter elects officers who conduct formal quarterly meetings. These are held on employees' time, but company transportation may be used. More than 80 per cent of the workers attend them regularly, and full attendance at a good program is common. Division, Area and Head Office supervisors are always invited. Working funds are obtained when desired by dues or collections.

The meeting programs vary. One each year includes a dinner or picnic for the families, largely financed by the company. But all of them usually feature two or three items such as a short talk by a local citizen, a description or discussion of a company policy, the showing of a selected motion picture, or the presentation of service and safety awards, plus a brief talk on safety. The last is followed by a general and frank discussion of any unsafe local conditions. Minutes are written and mailed to all concerned.

Supervisors join in the safety discussions,

*Heinrich, H. W.: "Industrial Accident Prevention"

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TUESDAY AFTERNOON SESSION

October 7, 1947

Presiding: E. C. WOODWARD, Safety Director, A. O. Smith Corporation

Memorial to Ben Grainger

By GEORGE H. BERRY

Safety Engineer, Western Electric Co., Inc.

Ben Grainger is gone. Gone these many months. We who but a short while ago, were [illegible]icing at his assignment as staff representative for the Power Press Section as well [illegible] other sections, still can scarcely believe [illegible] he is gone. It seems but yesterday that [illegible] stood at the door, counting the attendance [illegible] our sessions with a view toward obtaining [illegible] larger room for us at this present Congress. [illegible] does not seem possible that we shall [illegible]er again see his genial sunny smile—that [illegible] can never again pick up the telephone or [illegible]te to Ben asking for advice—nor lean upon [illegible]m for guidance in the formulation of [illegible]rograms or for some idea from his vast [illegible]orehouse of experience.

There was nothing selfish about Ben. He [illegible]d no flare for self publicity. He was modest [illegible] a fault. He asked nothing more for himself than he'd like to give to others. He talked [illegible] a language we all could understand and [illegible] liked him right from the start.

Ben Grainger was born April 4th, 1888, [illegible] St. Louis, Missouri and died February 12th, [illegible]947.

His service to safety was of a kind and [illegible]uality duplicated by few men. It runs [illegible]hrough a period of 34 years—almost exactly [illegible]arallel to the history of the National Safety [illegible]ouncil itself!

In addition to his sectional activities, Ben [illegible]as a staunch supporter of the American Society of Safety Engineers. His fellowship and [illegible]ealth of experience in human relationships [illegible]nd safety work will be missed by countless [illegible]riends in industrial safety fields.

Ben Grainger's first industrial job was that [illegible] plant engineer with the Stromberg Carlson Motor Devices Company of Chicago in [illegible]918.

In 1932 he took charge of safety work for the Bendix Aviation Corporation of South Bend, Indiana for whom he established an enviable program of accident prevention.

In addition to his safety work at Bendix, he also served for four years as chairman of South Bend's Safety Council's Industrial Division.

In the early days of the last World War he went with the Newport Shipbuilding Company at Newport, Fla.

Later he became safety director for the Ingalls Shipbuilding Corporation at Pascagoula, Miss.

Having filled various offices in the Power Press and Automotive and Machine Shop Sections down through the years, he was a "natural" for staff representative of these sections when he joined the National Safety Council's staff in 1943.

A practical man rather than a theoretician he was more interested in the means and devices for preventing accidents than delving into the theories of programming alone.

As a master of personal relationships, (which he preferred to call "getting along with the boys") he was highly successful as a shop safety man as well as a staff representative. His colleagues at National Headquarters tell me they found him to be a "caustic critic of 'fancy' ideas and an inexhaustible source of workable ones."

In human relationship Ben Grainger has set an example which will be difficult for many of us who remain here to follow.

As Admiral Gregory so aptly said at the grave of General Harbord in Arlington Cemetary on the 21st of last August:

"Half of our troubles we make ourselves by rebelling against our misfortunes. As soon as we can accept them, can say and believe they are for the best, their sting is gone. Trusting in God, we shall not fancy we should be happy were we only somewhere else, had we only that something else which seems to us wanting in our lives. We shall feel that God put us exactly where we are, sent or withheld whatever was right; and

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TUESDAY AFTERNOON SESSION

October 7, 1948

Presiding: J. O. LESLIE, Director of Safety, Gilbert Associates, Inc.

An Ex-President Reviews a Twenty Year Safety Program

By W. E. MITCHELL
Ex-President, Georgia Power Company

A recent issue of the Saturday Evening Post carried the striking headline—"License to Kill." Of course it had reference to the terrific toll of lives lost in highway accidents. Whenever we have a 3-day week-end holiday we are warned that 300 or 400 people will be killed, and they are. The number of accidents in and around the home are appalling. Even this great convention indicates the deep interest of every line of business here represented in doing a better job of accident prevention. With that thought in mind it seemed to me that it might be helpful if I were to look back over the electric light and power business, with which I have been connected for nearly 45 years, and see if we have made real progress there. Those things that have been tried and proved helpful in one industry should be helpful in others. Of course, there are some hazards that, like the danger from coming in contact with live wires carrying high voltage, are much more prevalent in the electric utility business.

There is one thing, that I know as well as anyone here—a thing that we all ought to know. It is the recognition that we can't let up, that, on the contrary, we must work harder than ever to make safety pay bigger dividends than it ever has paid before in terms of human life and happiness, of industrial productivity and economic well-being. Here, as perhaps nowhere else, eternal vigilance is the price of continued success.

Why have a safety program? What makes a successful one? How do you measure its accomplishments? Much has been written and spoken on this subject. I can't tell you anything new, but old lessons, like sound old proverbs, will bear repeating. Men at work are still much like overgrown children, prone to forget and prone to slip backward.

Why have a safety program—because it pays big dividends in cash, and in a clearer conscience. Accidents cost money and are an economic waste, aside from causing needless human suffering. The training of men in safe practices and the avoidance of accidents fully justifies having a safety program.

What will make a successful one—that is harder to say but certainly it will take careful planning, thorough training, and sustained follow-up as part of the duties of all regular employees.

How shall we measure its accomplishments—that is not difficult. A steadily decreasing number of accidents per 100 man-hours worked and a continued reduction in fatal and permanently disabling accidents are positive proof that your program is working.

How to develop a successful plan—well, I'd say that the first and most important factor is that top management be completely and enthusiastically sold on the importance of safety.

Management must take the leading part in a program of accident prevention that amounts to anything. Management has to initiate it, see that it permeates the whole organization, give it emotional appeal, and keep it alive and going after the first interest has died down. You can employ safety directors to advise with the management, and with the men about good techniques. Safety directors can help to carry out the policies of the management, but they can't do the job alone, without the assistance of management.

The wages paid must be fair and adequate and there must be reasonable permanency in the job, if we expect the workman to become interested in accident prevention.

It is the duty and obligation of a company to take the leadership in activities of this kind from which the employees benefit. The president or general manager cannot delegate the organization of the safety program to some minor subordinate. This is not the way management gets results in production, or in purchasing, or in selling. Management must realize that the functioning of the

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•Past General Chairman

TUESDAY AFTERNOON SESSION

October 7, 1947

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Safety Factors Involved in Mechanical and Manual Materials Handling

By C. S. LINK, JR.
Avondale Mills

This entire paper is based on the experience gained in connection with the safety programs and materials handling projects as being carried on in Avondale Mills' eleven plants in Alabama.

In Avondale Mills, the matter of safety is on an equal footing with such items as production, quality and deliveries, and, most fortunately, is the fact that this interest in safety is spearheaded by top management.

It was top management's idea to set up the plan by which a group of people in each department and each plant were asked to serve for a month on a committee whose interests would lie in one of four directions—one group on safety, another group on good-housekeeping, another on thrift and still another on planning. These groups are selected in alphabetical order from the payrolls and at the start of the program, half of them served for two months, the other for one month; thus we now have the half of the group with experience in the subject, breaking in the new half. Over a period of time, therefore, all employees will have served, at some time or other on one or all of these groups.

These groups hold monthly inspections of the entire plant, then sit down and talk over their findings; a written report is made to the general office. All suggestions are acted on or rejected if not feasible, and prizes are given for worthwhile suggestions.

When a lost time accident occurs, the full details are reported to all superintendents as well as the main office; statements are taken from the injured as to how it occurred and the best possible safe-guard suggested as to how to prevent a re-occurrence. Each such accident and report is then taken up at the monthly meeting of the safety group and thoroughly discussed, and notes made of their suggestions and criticisms.

When a minor accident occurs that does not involve lost-time, but which does involve medical attention or first aid, the name of the injured, his explanation, the nature of the accident and the causes are carefully recorded and a monthly report filed with the main office. Here they are consolidated, and a frequency rate established and results are reported to the committee and occasionally published in our house organ, the Avondale Sun.

We own and operate our own hospital in Sylacauga, and thus the statistics presented will be a result of actual hospital cases as well as results obtained from the monthly reports.

Materials handling equipment must fulfill certain basic requirements: safety to operators and to other employees; prevent fatigue; increase productivity per employee; promote good-housekeeping and make a reasonable return on the investment. All of these are basic and fundamental.

In two plants we have installed low-level dump chutes for doffers, so that when a frame is doffed there is no need to lift 150 pounds four feet to dump the yarn into a larger box. The yarn is dumped into the proper chute which leads to a large hopper which holds from 1500 to 1700 bobbins—six or seven doffs.

In one of these plants, before this installation, we had a hospital record of four to five cases a day of lost-time due to strained back. Since this installation has been in use there hasn't been a single case.

In another plant a system was installed to return empty bobbins to a conveniently located station, near the center of the spinning room, as fast as they were emptied at the winders. This eliminated a large part of running with doff boxes, kept large supply boxes off the floor, utilized space under the mill and along the ceiling with savings on all these points.

In the weaving mill the cloth doffers took their rolls of cloth great distances, hoisting

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MONDAY AFTERNOON SESSION

October 6, 1947

Presiding: DR. A. L. BROOKS, Medical Director, Fisher Body Division, General Motors Corporation

Recognition and Control of Fume and Dust Exposure

By V. J. CASTROP

Research Laboratories Division, General Motors Corporation

Illness which can be attributed to the occupation may occur in the automotive and allied industries. While occupational disease cases are much fewer in number than those resulting from accidental injury, there still remains the need for vigilance in maintaining a healthful working environment. The responsibility for employee health is delegated by management to the medical director with the safety director charged with matters pertaining to safety. For the smooth functioning of either department it is necessary that these individuals work in close harmony with each other.

A safety engineer who is capable of recognizing conditions which may be detrimental to the health of the employee is an excellent teammate for the doctor in any employee health maintenance program. The safety engineer need not be capable of actually sampling air in the environment or designing a ventilation system for the control of toxic materials. He should, however, have knowledge of the materials which have been proved harmful, should be fairly well informed of how these materials may be used safely, have some understanding of basic control measures which are normally recommended when such materials are used.

The intention is not to present a highly technical discussion of fume and dust exposures or detailed information regarding ventilation systems, as such matters are of interest to the professional industrial hygienist and of comparatively little value to safety engineers. This discussion will be limited to the more basic principles of industrial hygiene as they relate to fume and dust exposures, to indicate what control measures are available or used to protect the employee's health, and, to call to your attention operations and materials which are commonly used in the automotive and allied industries, at the same time indicating the generally accepted opinion as to their effect on health.

Many conditions are corrected or improved because of reasons other than their effect upon the health of the employees. Better products, better employee relationship, reduction in maintenance of equipment may be cited as justification for management's decisions for such correction or improvement.

Generally speaking there are two means of entrance of toxic compounds into the human body under industrial conditions, namely, by ingestion or via the respiratory tract through the inhalation of fumes, dusts, mists or gases. Ingestion is of importance if toxic materials which have a systemic effect are used and adequate washing facilities are not provided, or, where the employees are slovenly in their personal habits. Inhalation is considered the most important portal of entry of fumes or dusts and the particle size, therefore, becomes significant in evaluating an exposure. The particles which cause the physiological changes are those which are small enough to remain suspended in the air and not those which immediately fall to the floor. Flying particles, which are of concern to a safety man and for which he advocates the use of goggles, are not of hygienic significance since they are not of respirable size. To judge the seriousness of an exposure by the quantity of detritus adjacent to an operation is often misleading. This is especially true where mechanical ventilation has been provided which will remove the fine material but is inadequate to trap or convey the larger particles.

In evaluating an exposure it is necessary to consider the toxicity of the material, the duration of the exposure, the average concentration of the contaminant with special attention being paid to those operations which produce high concentrations at some phase of an operating cycle, and the measures which have been provided to control the exposure.

Medical records of the individuals subjected to the exposure may be of value if the examinations are thorough and frequent and not of a cursory type. It must be remembered that occupational diseases are slow in development and in some instances lasting in effect. Slow changes may not be detected and the mere fact that cases have not occurred is no definite assurance that exposures to known toxic materials may be ignored.

The determination of the concentration of the toxic material in the air is important in evaluating the exposure. Tests of this type are not only indicative of the degree of contamination but in some instances which operation is the major offender.

The apparatus used in collecting the contaminant and the method used in estimating the amount present in the atmosphere vary with the type of material. Tests of this type are specialized in nature and are beset with many pitfalls which can lead to very erroneous results and conclusions if done by other than experienced personnel.

In a discussion pertaining to toxic materials it is generally necessary to quote permissible concentrations or as it is sometimes expressed—maximum allowable concentrations—permissible limits, or threshold limits. These terms are used extensively by industrial hygienists to indicate concentrations of a substance in the air which are considered compatible with good health. The limit usually applies to exposures of eight hours duration for a prolonged period.

The limits are, for the most part, advisory standards or bench marks which are practical to meet. In general, these limits are derived from three types of evidence all of which have value and limitations.

1. Animals have been exposed at different concentrations and the effects noted.
2. A few experiments have been made on human subjects for short periods of time.
3. Safe limits have been arrived at by measuring the concentrations of substance in the workroom air and correlating this information with results of medical examinations of workmen.

There is no magic connected with these limits and the mere fact that they are exceeded does not necessarily mean that someone will definitely become ill, but there is a good probability that someone will suffer ill effects if the limit is greatly exceeded for a considerable period. There remains much to be learned regarding the toxicity of many substances used in industry, and it is hoped that with more research and study that the answers will be found.

So much for the general picture. Now let's take a look at some specific operations.

Welding—Welding processes most commonly used can be divided into three types, arc, gas, and resistance. The safety measures pertaining to clothing, goggles, and helmets are of common knowledge and therefore, shall not be considered in this discussion.

Arc welding when performed on uncoated steel does not produce a condition which is considered harmful to the welder provided it is accomplished in a comparatively large open area. The fumes which result from welding consist essentially of the oxides of iron and oxides of metals which may comprise the steel or coating of the welding rod. Some investigators have found characteristic markings on chest x-rays of men who have welded under severe conditions for long periods of time. These markings are presumably due to the deposition of iron fumes within the lungs, but it has not been demonstrated that such fumes have caused physical impairment.

A frequently suggested limit for welding fume is 15 milligrams of iron oxide per cubic meter of air. Concentrations of this magnitude existing in the workroom would materially reduce visibility and thereby become a nuisance or an unsafe condition requiring correction.

Welding within confined areas, such as tanks, inside machinery or equipment, or in small rooms presents a condition which can be of concern. The concentration of fume is materially higher under these conditions as there is little opportunity for dilution by natural air currents normally present in a large shop. Nitrogen oxides formed by the electric arc when inhaled in sufficient quantities causes fluids to form in the lungs—edema—with the resultant failure of the respiratory system. While welding in large open areas these toxic gases are normally not present in sufficient quantities to cause harmful effects. However, when welding is done in confined areas, the nitrogen oxides may reach a concentration which will be harmful.

Gas welding generally is not productive of harmful fumes. There are, however, instances involving two potentially harmful exposures. When boric acid or borates generally are used as brazing fluxes, some metals require fluxes containing significant quantities of fluoride compounds and fumes from these fluxes have been known to produce significant nasal irritation. Fluorides in general are looked upon with suspicion since they may produce harmful effects upon the bone structure. A limit of 2.5 mg. per cubic meter has been suggested for fluorides, but no standard has been agreed upon. Most industrial hygienists attempt to keep them as low as practicable in order to be absolutely certain that bone damage does not occur among the workers.

Silver solder is one of the more common alloys used in brazing. Solders of this type vary in composition and may in some instances contain cadmium which if volatilized in sufficient quantities is considered to be harmful. At present the suggested limit for cadmium fume in air is 1 milligram per 10 cubic meters of air.

Resistance, spot, or butt welding of plain steel is of no concern from the physiological standpoint. The fumes arising from such operations generally are caused by the volatilized oil which has come upon the metal stock during previous operations or which has been placed upon the metal as a rust preventive.

The preceding discussion of welding operations has been based upon the assumption that the metals being welded are of plain steel. The performance of welding operations, either arc, gas, or resistance, upon metals which have been coated with such toxic materials as lead, cadmium, or mercury may cause harmful exposures. The heat of the flame or of the arc causes volatilization of these metals. Welding or cutting of terne plate or other metals containing significant quantities of lead can result in the volatilization of lead fume, which if inhaled for a sufficient period of time, may result in lead absorption and ultimate poisoning. The cutting or welding of surfaces which have been coated with paint containing lead has caused lead poisoning in the past and will continue to do so unless adequately controlled.

Welding of cadmium plated material was attributed as the cause of illness and even death to a number of individuals during the recent war activity. The reported cases indicated that death occurred in a comparatively short time after the exposure.

Welding of galvanized metal causes the volatilization of the zinc coating. Temporary discomfort associated with metal fume fever may result from such an exposure.

Where warranted the control of welding fumes is generally accomplished by providing a mechanical ventilation system. The type of ventilation used is dependent upon the nature of the welding. When the object to be welded is positioned in a fixture or jig it is possible to obtain effective control of the fumes by the use of a grill side hood, or flexible duct near the source of fume. If the parts are large and it is necessary to weld more than a foot from a fixed point it is difficult to obtain good control of the fume with reasonable air volumes through system using flexible ducts. Since the effective range of most flexible ducts is approximately 8 inches from the duct opening, it is necessary for the welder to move the duct whenever the arc is outside this range. The practical result is that most ducts are normally not moved and the ventilation system does not remove the fumes when liberated. According to reports this type of system has been effectively used in shipyards, for the control of welding fumes in confined areas. In view of this experience it should therefore be a satisfactory means of control for welding fumes in tanks. However, excellent supervision and education is necessary to make such systems effective.

Where the room volume per welder is large, the natural ventilation within the plant is usually sufficient to prevent the accumulation of excessive concentration of fumes from plain steel welding. Circulating fans directed from the side help to dilute the fume which may be concentrated in the breathing zone of the welder.

Another means of control is the use of personal respiratory equipment. Air line respirators and fume respirators have been developed which will provide adequate protection. Some manufacturers of this type of equipment have on the market welders' helmets with facilities for providing fresh air to the wearer. The use of this type of equipment has been limited. Since the welder is already burdened with helmet, goggles, and protective clothing he probably will not be receptive to a respirator. It is usually sufficient in most welding for the employee to wear an ordinary helmet and to arrange the position of the work so as to prevent the concentrated fume from flowing under the helmet.

Dry Grinding—The dust resulting from the

grinding of nontoxic metals which are free of sand is generally considered a nuisance and is not harmful per se. Despite this fact some state laws require griding operations to be ventilated. This requirement has probably been a hold over from the days when sandstone wheels were prevalent and also to prevent the creation of a nuisance condition. Grinding wheels in use in industry have artificial abrasives such as aluminum oxide or silicon carbide. Emery, which is a natural product composed of essentially aluminum and the magnetic oxide of iron, may also be used. A permissible limit of 50 million particles per cubic foot of air for aluminum oxide and silicon carbide was recently accepted by the members of the American Conference of Governmental Industrial Hygienists. Such a limit is liberal and concentrations of such magnitude are normally not encountered.

When lead, silica, or some similar toxic material comes in contact with the grinding wheel the exposure to the abrasive matter may be ignored and the exposure evaluated on the basis of the toxic material. If this latter material is controlled the nuisance will also be eliminated.

Ventilation systems for grinding wheels have been fairly well standardized and generally are satisfactory to prevent a nuisance. Hoods should enclose the wheel as completely as is practicable. Air volumes should be provided which are sufficient to cause an inward flow into the hood when using the smallest wheel. This is especially true where toxic materials are involved.

Wet Grinding—Baffles, hoods, and guards are generally located near wet grinding wheels to prevent dispersion of the liquid used as a coolant. These devices are usually sufficient to control the dust if it is nontoxic in nature. If the dust liberated is toxic, mechanical exhaust ventilation may be required.

Buffing and polishing—The buffing compound applied to wheels used for buffing and polishing vary in composition. Waxes and various types of abrasive are the major components. These materials plus lint and fibers from the wheel are the essential ingredients of the airborne dust. The toxicity is dependent upon the type of abrasive. Generally ventilation is provided so as to improve housekeeping and reduce the number of complaints and not because of the hazard to health.

Machining—Smoke from oily parts is the prevailing source of air contamination at machining operations. Illness has not been attributed to this type of exposure. As is the case with most fumes and dusts of the nuisance variety little is known as to what effect such materials have on already existing physical abnormalities.

Machining operations on steel produce large chips or turnings; consequently, dust is not a problem. Operations involving the machining of high lead alloys have been studied, and significant quantities of airborne lead have not been demonstrated.

Graphite which becomes airborne during the machining of cast iron is not considered to be physiologically significant, and therefore is classified as a nuisance dust. Frequently management considers it advisable to provide ventilation for the machines which are productive of the most dust, as graphite on the clothing and person and surrounding machinery is conducive to many complaints. Ventilation systems for the machining, drilling, and so forth, of cast iron should include hoods located as near the cutters or drills as is practicable. Many of these hoods are in use on production machinery and are doing an excellent job of dust control.

Abrasive Cleaning—Since silica is recognized as the most harmful of mineral dusts, an adequate ventilation system is normally provided at the time of installation of commercially built sand blast equipment. Continuous usage and lack of maintenance result in a breakdown of adequate control. Visible escape of dust is the best evidence that this has occurred and it is advisable to correct such a condition without undue delay.

Employees who are stationed in blast rooms are dependent upon personal respiratory equipment. It is of utmost importance that such devices are of a type which will provide the necessary protection. Devices of this type are of the supplied-air variety, and it is necessary that the air provided be free of harmful contaminants. The air compressors should be located in an area free of contamination otherwise the contaminant will be transmitted to the helmet and the breathing zone of the worker.

Normally, ventilation within the room is provided so as to improve visibility and to help prevent the escape of dust to the surrounding areas not to reduce the concentration of silica dust to a safe level.

Tumblast or rotating table type of sand blast units should be provided with sufficient ventilation to prevent the escape of silica dust. Leakage due to excessive wear should be remedied.

Small sand blast cabinets, where the operator controls the blast nozzles from outside the cabinet, frequently have faulty seals around the doors or the rubber gauntlets are loose or torn. The dust which escapes from the cabinet through these openings is in close proximity to the breathing zone of the employee and in many instances exceeds the permissible limit for silica. This leakage should be corrected and the men should not be required to use respirators.

If the articles being blasted are free of silica or other toxic material, the dust resulting from grit or shot blasting is classified in the nuisance category. It follows that the maintenance of ventilating systems for grit blasting, although desirable, is not always so necessary as for sand blasting.

The use of steel grit or shot in blasting rooms produce excessively high concentrations of dust within the enclosure. It is therefore, necessary to protect the worker within the room. The remarks included in the section devoted to sand blasting rooms are therefore, pertinent when considering rooms in which steel grit or shot are used as the abrasive.

Vapor blasting, a variation of sand blasting, is of comparatively recent development. This procedure involves the use of fine silica and water under pressure. The silica used in vapor blast units varies in size and may even be as small as 1250 mesh (approximately 10 microns). It is generally believed that airborne silica particles below 5 microns are most significant in causing silicosis. It then follows that operations involving the use of silica abrasive whose initial particle size approaches that order of magnitude are more hazardous, and require continual vigilance in maintaining good control. It is, therefore, essential that the vapor blast cabinets be maintained so that leakage of mist does not occur. Good housekeeping is also essential as spillage of the sand and water sludge upon the floor will create a source for dust dissemination when the water evaporates. Likewise, containers of the dried sludge should not be allowed to stand in the factory where they can be influenced by air currents of high velocity.

Practically all industrial plants have operations which involve the use of leading base bearing metal or solder. Babbitt bearing metal containing approximately 75 per cent lead has been encountered. The composition of solder metal is variable and dependent upon the purpose for which it is used, with ordinary soft solder containing a comparatively high percentage of lead.

Assuming that the babbitt or solder in use is one containing a significant amount of lead, the question then arises as to whether or not the employees working with this material will become ill. The answer to such a question could be given by a qualified industrial hygienist after he had seen the operation and considered such factors as the temperature to which the metal is heated, the method of removing excess solder, the length of exposure, and the effectiveness of the control measures provided.

It is a well known fact that lead causes illness if absorbed in excessive amounts, and therefore operations wherein lead is used have received considerable attention and study. Out of this experience certain practices are known to produce excessive exposure whereas other practices have been proved not to be harmful. It is generally conceded that excessive concentrations do not result from operations where solder is applied by means of an electric soldering iron. This is probably due to the small amounts of solder used and the comparatively low heat of the metal. When an iron is used which is heated in a small gas fired furnace, the exposure may be of greater consequence. Solder which remains on the iron coming into contact with the flame or heat is vulnerable for volatilization. Small amounts of solder drop from the iron onto the hot floor of the furnace where it is readily volatilized or oxidized. The oxidized material may become airborne due to disturbances created by the flame or by removing or placing the soldering iron in the furnace. Frequently industrial hygienists recommend that ventilation be provided for heating units of this type thereby removing lead fumes and dust from the environment. This is particularly true in small rooms or where many units are in use.

The atmospheric contamination occasioned by the use of either gas or electrically heated pots containing solder is dependent on a number of factors. With higher temperatures more volatilization will occur and the greater

will be the exposure. With the higher temperature the metal is more readily oxidized to produce a dross consisting of a high percentage of lead oxide. The dross may provide a protective coating to reduce the volatilization of the lead; however, disturbance of this coating will create an exposure. As a safeguard against excessive contamination, pots containing solder or babbitt are usually ventilated. Wherever possible it is advisable to enclose the pot as completely as possible and provide sufficient air volume to overcome the thermal effects of the molten metal. Attempts have been made to use natural draft ventilation systems to control these fumes and in those instances where the ducts were not of sufficient diameter the system was inadequate. A preferable method is the use of mechanical systems.

The removal of excess solder with power driven tools, such as grinding wheels, discs, or wire wheels, creates airborne dust which may contaminate large areas of the factory if the operation is extensive. Diligent use of abrasive cloth will also result in excessive concentrations of lead dust. Filing, however, is not productive of small particles and is preferred over the use of power driven tools. If filing is not practicable or feasible it will be necessary to provide some type of mechanical ventilation system for the solder removal operations involving the use of power tools. Since the permissible limit generally accepted for lead is 1.5 milligrams per 10 cubic meters of air (353 cubic feet) it will be necessary to have an effective system to provide adequate control. Engineers experienced in designing ventilation systems to control toxic materials should be consulted, otherwise a costly system might be erected and later discovered to be entirely ineffective. Frequently solder removal operations require the use of portable tools on large objects and a local exhaust system would not be effective, as is the case in the fabrication of automobile bodies. General contamination of the factory with lead dust has been eliminated by enclosing the entire operation in a large booth and exhausting a sufficient quantity of air from the enclosure to insure a constant inward flow of air from the factory into the booth. Under these circumstances no practical amount of air could be removed from the booth to reduce the lead concentration to a safe level, and therefore it is necessary that the men working therein be provided with adequate personal protective devices.

Heat Treating—High temperatures are a frequent source of complaint from employees in heat treat departments but such conditions and their control are not within the subject matter under discussion.

Fumes disseminated from cyanide pots are often associated with cyanides used as fumigants or as the lethal agent in death chambers and supervision as well as the employee becomes apprehensive. Fumes from such source are irritating and because of this property should be adequately ventilated. The irritant nature of the fume is caused by alkali formed upon decomposition of the cyanide.

Molten lead is sometimes used as a hardening medium for metals. Frequently charcoal or some similar material is placed on the surface of the metal to conserve heat and prevent oxidation. A covering of this type reduces the volatilization of lead while the bath is quiescent, but has no effect while the bath is in use. Adequate ventilation should therefore be provided for baths of this type. As complete an enclosure as is practical for the operation being performed is advisable with air quantities dependent upon the open areas in the hood. To prevent contamination resulting from volatilization of lead accumulating in the combustion chambers the products of combustion from gas fired lead pots should be vented to the outdoors and not be allowed to dissipate into the workroom.

Iron Foundries—The principal ingredients of foundry dusts are silica, sea coal, clays, and parting compounds. The predominant material will be dependent upon which phase of the foundry operation is being studied and what operation is being performed. The control of dust is the major problem, whereas fume is of secondary importance.

A discussion of all the aspects of the industrial hygiene problems in such plants would require a separate treatise. For the present discussion it should be sufficient to state that all obvious sources of dust dispersion should be reduced to a minimum by adequate localized exhaust systems. In a mechanized foundry such places would be sand conditioning and mixing equipment, tumbling mills, shakeouts, core removal and knockout stations, transfer points of dry sand, abrasive blasting operations, and the grinding operations performed on castings containing appreciable quantities of sand.

Maintenance of ventilation equipment is a major item in foundries because of the abrasive action of the dust. It is imperative that a good program be maintained so as to keep the equipment functioning at maximum efficiency.

Because of the heat associated with large scale foundry activities it is a common sight to see pedestal fans or air cooling ducts directed in such a manner as to create cross drafts which interfere with the efficient removal of the dust dispersion. Better discretion in the placement of these fans or ducts will go far in reducing dust concentrations in the areas where they are used.

After the obvious has been corrected, it is advisable that a survey of the foundry be made by an industrial hygienist so that an accurate evaluation of the exposure may be obtained.

Respiratory Protective Devices—As has been stated, the atmospheric concentration of dust and fume and other materials may be reduced to a safe level by adequate exhaust ventilation. In some cases it is possible to correct the condition by substituting a less toxic material. If these measures are not practical respiratory protective devices may be used. They may also prove valuable in giving protection during an emergency or to provide protection for intermittent exposures or to supplement other methods of control. They should, however, not be considered as the desirable means of controlling a health hazard.

Experience has shown that frequently protective devices have been issued which do not provide adequate protection. Upon inquiry information was generally offered that the safety engineer was not too well informed as to what should have been provided.

The U. S. Bureau of Mines at their experimental station in Pittsburgh tests equipment of this type and studies the protection offered to the wearer. If the device is satisfactory in performance, they issue an approval number to the manufacturer which appears on the device as well as the container in which it is received from the manufacturers. The approval granted by the Bureau also stipulates that type of materials for which it is approved.

It has become general practice in the field of industrial hygiene to recommend the use of only those respirators which have been approved by the Bureau. Safety engineers should likewise insist that such devices be procured and acquaint themselves with the type of protection afforded by each device and thereby provide adequate control for the individual wearing the equipment. Some engineers prefer to stock only that type of respirator which will protect against the more harmful dusts or fumes, since a respirator of this type will also give adequate protection for materials of lower toxicity. The advantage of such a procedure has merit as it reduces the types of devices needed in stock and likewise insures the correct device for the more serious exposures.

Metal Cleaning

By THOMAS MOONEY
Med-Fac Industrial Hygiene Laboratories

The complete finishing of metals by electroplating may include:

1. Cleaning by abrasives.
2. Polishing the base metals.
3. Cleaning with solvents.
4. Cleaning with alkaline solutions.
5. Cleaning with acids often referred to as "Pickling."
6. Metal deposition or electroplating.
7. Buffing the deposits.
8. Lacquering the finished product.

In abrasive cleaning, sand or steel shot is used under pressure. The potential health hazards in this type of cleaning are exposure to dust of a high free silica (SiO_2) content caused by the sand and also to metallic dusts where metals capable of producing toxic dusts are cleaned by shot and sand blasting. Steel shot blasting is a much less severe health hazard than sand blasting; consequently, steel shot abrasive cleaning methods should be used wherever possible.

The maximum allowable concentrations (M.A.C.) for free silica are five million parti-

cles of dust in one cubic foot of air, as determined by actual count, using the standard light field technique.

The dust hazard in abrasive blasting may be controlled in several ways; however, most of the industries now use mechanically enclosed exhaust-ventilated machines where the operator observes and controls his work from the outside by looking through a protected glass window.

These machines are built in the form of a cabinet forming a sealed or enclosed area, so that little of the dusts escape into the general workroom area. If necessary, the workers are provided with personal protective devices, such as hoods with air-line respirators, and approved filter type respirators, and other equipment necessary to protect against dusts and rebounding abrasives.

Cleaning by polishing the base metals is usually carried out by the use of revolving wire brushes, which are used to remove rust and loose scale, adhering dust, dirt or materials which have to be removed before the metal can be electroplated. The principal hazard to health is dusts, and these wire brush buffing machines should be provided with adequate suction to remove the dusts from the working area; otherwise the worker should be provided with an approved respirator to protect against any toxic innocuous dusts which might be present.

Cleaning with the use of solvents is the principal method used to clean metal parts before electroplating. It is usually referred to as "solvent degreasing." Cleaning by this method involves the use of such chlorinated solvents as Permachlor (trichloroethylene), perchloroethylene and carbon tetrachloride. These solvents are all toxic and adequate protective measures must be employed for their safe use.

When used in a mechanically operated, properly designed and maintained degreaser, little health hazard is involved, if the manufacturers' rules and other safety regulations are followed. In manually operated degreasing operations, however, considerable solvent vapor can be released and inhaled if close and constant supervision is not exercised over the workers. In hand cleaning of small batches of materials to be plated, if speed in drying is not too important, perchloroethylene on account of its lower vapor pressure and higher boiling point is to be preferred over trichloroethylene or carbon tetrachloride.

Exhaust ventilation of solvent degreasing operations is rarely recommended on account of solvent loss. In the great majority of cases, as we have already indicated—if the manufacturers' instructions are followed as to installation and maintenance and safety rules, and, provided the degreaser is protected from drafts, little or no health hazard is involved in its use.

The M.A.C. of trichloroethylene or perchloroethylene for most states is 200 parts per million (p.p.m.). The M.A.C. for carbon tetrachloride is 100 p.p.m. Some health departments think this last solvent is of such toxic character that its M.A.C. should be reduced to 50 p.p.m. Tests should be made in the vicinity of solvent degreasers to see these values are not exceeded for continuous eight hour exposures.

The health hazard in cleaning by caustic treatment results from exposure to caustic mists and vapors liberated from the hot caustic solutions in which the metal is dipped for treatment.

Local exhaust and other control measures may be needed. This will be the more needful if the solutions are strongly heated.

Some of the potential health hazards in pickling metals are the acid mists, acid gases and gases liberated due to impurities either in the pickling acid or in the metal being cleaned, which is immersed in the sulphuric acid solution. Some of these products are hydrogen chloride, hydrogen sulphide, sulphur dioxide, arsine, phosphine and nitrogen oxides.

Pickling operations should be enclosed or isolated to prevent the liberated mists and gases from entering and contaminating the general workroom air. This enclosure should have sufficient exhaust ventilation so that air is admitted to it at all openings at a rate of at least 100 feet per minute. This should prevent exfiltration of the gases to workers in adjoining areas.

If the pickling operation can not be isolated, then local exhaust ventilation should be provided at the tank by means of slot type hoods located at the upper edge of the container which holds the acid. The exhaust ventilation rate should as a minimum be at least 120 cubic feet per minute for each square foot of tank area. The workers should be protected with acid proof clothing and should be instructed as to the corrosive character of the solutions used, as well as the necessary first-aid measures to be used should some of the acid solution accidentally come in contact with their skin.

For the removal of oxides, tarnish and scales from copper, bronze and some other materials, a solution known as "Bright Dip" is used. This solution consists of sulphuric, nitric and hydrochloric acids. It is very corrosive, and when used, good ventilation must be provided.

If sand is present in the surface grains of the metal, then hydrofluoric acid is used. This is also a very corrosive acid and care is needed in handling it. The M.A.C. is low.

The "Stripping" of defective plated coatings may be accomplished electrolytically, or in strong acid or alcoholic solutions. In these cases gases and sprays are involved which require good ventilation.

In operations using solutions of cyanides in a bath, care should be taken to avoid the introductions of acid into the bath since hydrogen cyanide is liberated under such conditions. This gas is very poisonous. All cyanide baths should be conspicuously marked "Poisonous."

Electroplating consists of the passage of an electric current through a solution of a metallic salt and the separation of a metal on one of the electrodes.

The potential health hazards associated with electroplating are chromic acid mists, metallic salts, cyanides and other toxic gases and compounds.

Electroplating protects against tarnish and corrosion and improves appearance.

The applications of electroplating are almost as extensive as the uses of metals. The largest industrial application is in the automobile industry, in which not only many visible parts are finished by plating, chiefly with nickel and chromium; but also many concealed parts are plated with zinc, cadmium or tin.

Most of the plating is done in several hundred large plants, that are supervised by technical persons and provided with modern equipment, including that for effective ventilation. In addition, there are at least 3,000 smaller plating plants, many engaged in "job plating," in which the facilities and staff are more limited, and for which more instruction and supervision are required.

Many of the plating operations involve the use of large volumes of solutions of poisonous materials, including strong acids and alkalis, cyanides, chromic acid, and salts of toxic metals, such as lead and cadmium. In addition to the danger of contact with the solutions, there is also the hazard of inhaling poisonous gases, and sprays that are carried into the air by evolved gases. One such gas that may be liberated is hydrocyanic acid by the action of the carbon dioxide of the air on cyanide solutions.

Chromic acid, the principal constituent of chromium plating baths has specific effects that are distinct from those of the common strong acids. Its high oxidizing properties cause it to attack membranes, especially of the nasal tissues, and to cause "ulcers" to form wherever the skin is abraded.

It is important to note that these effects are confined to hexavalent chromium (chromic acid and chromates). Trivalent chromium, as in chromic sulfate, has no such effects. It has been reported that large amounts can be ingested without injury. This distinction is important in considering the possible health hazards should any chromium be dissolved from cooking utensils, as then the trivalent compounds are formed, and not the hexavalent.

There is always a large evolution of gas during chromium plating. Oxygen is evolved at the insoluble anodes and considerable hydrogen is evolved at the cathodes. These gases tend to carry a fine mist or spray of the liquid present in the tank into the surrounding air. The injurious component is deemed to be chromic acid. For this reason effective ventilation must be provided. Early in the development of chromium plating a study was made of the hazards involved by Bloomfield and Blum (1).

The results of this early exploratory study appear to be confirmed by later observations and experience. They showed that nasal injuries were likely to occur on long exposure to air containing more than 1 milligram of chromic acid in 10 cubic meters of air. It was then concluded that, under favorable conditions of cross ventilation, the desired low concentration can be maintained by drawing air through a narrow slot on one or more sides of the tank with a slot velocity of about 2,000 linear feet per minute.

In the American Standard for "Safety in Electroplating Operations," approved August 13, 1941 by the American Standards Association, the degree of ventilation suggested for

severely hazardous plating operations such as chromium plating, is expressed as equivalent to 120 feet (cubic) per minute for each square foot of tank surface, when drawn through a slot from 1 to 3 inches wide, extending the full length of the tank, and ventilating a width of not more than 24 inches. With a 2 inch slot and a tank width of 24 inches, this volume of air results in a slot velocity of 1,440 linear feet per minute, i.e. about 75 percent of that suggested by Bloomfield and Blum.

To achieve satisfactory ventilation in chromium plating, it is desirable to have the slot in the edge of the tank and the solution level at least 8 inches below the slot. Anodes and other devices should be so placed as not to interfere with the movement of gas and spray into the slot. Cross currents of air from window or other ventilatois should be avoided.

Attack of the tissues by the chromic acid can be reduced by the use of vaseline in the nasal passages and on any abraded skin, and by wearing rubber gloves, aprons and waterproof shoes. Healing of chromium ulcers is fostered by early applications of a reducing agent, such as sodium bisulfite or polysulfide.

All of the cyanide baths, including those for copper, zinc, brass, bronze, cadmium, silver and gold plating contain (a) a soluble double cyanide of the metal plated, with either sodium or potassium, (b) some "free" sodium or potassium cyanide, and (c) in some cases, e.g. zinc baths, free sodium hydroxide. The copper baths are frequently operated at high temperatures, e.g. 70° C or 158° F, but most of the others are used at room temperature.

From all such baths there is a constant slow evolution of the very toxic hydrocyanic acid, which is more rapid if the baths are heated. This gas arises from the action of the carbon dioxide of the air, to form sodium carbonate and hydrocyanic acid. This reaction is retarded by the addition of free alkali to the baths. Except with heated baths, if good normal room ventilation is used, the concentration of the hydrocyanic acid in the surrounding air is not likely to be sufficient to cause permanent injuries.

The most serious hazard with cyanide solutions is the possibility that acid may be introduced and cause evolution of large volumes of hydrocyanic acid. Fortunately, careful precautions are taken against this possibility, so that very few instances have been reported. During the early bombing of London, some fatalities in plating plants were reported as a result of the mixing of cyanides and acids.

Many of the hazards in plating arise from the types of compounds used, rather than from inherent toxicity of the metals themselves. There are, however, several plated metals that are toxic in all their compounds, e.g. lead, cadmium, arsenic and mercury. Arsenic deposits are sometimes used to produce dark or "oxidized" finishes on copper and brass. For each of these metals specific precautions must be taken.

Cadmium poisoning may not always be recognized because it has a delayed action. The first sympton of acute cadmium poisoning is a severe cough, followed by dizziness, shortness of breath, and constrictive pain in the chest. Severe lung damage may result and prevent the lungs from supplying oxygen to the blood. Death may then quickly ensue.

One hazard is in the melting of these metals, e.g. lead or cadmium, in the casting of anodes, as any fumes evolved are extremely poisonous. Protection of workers against these metal fumes can be secured by the use of a metal fume filter respirator approved by the U. S. Bureau of Mines; by special ventilation, properly designed for this purpose; and by good foundry practice.

The electroplating industry necessarily involves the use of toxic materials, with the dangers and effects of which all workers should be carefully instructed. With proper safeguards, including the use of gloves, aprons, boots, available running water, good general ventilation, and adequate local ventilation, these hazards can be generally reduced, and have been so minimized that the occupation of electroplating need not now be a dangerous one.

In electroplating, buffing the deposits is used to develop the finished lustre of the plated article. This process presents no health hazard apart from some dusts.

A coat of lacquer protects the plated surface from mars and scratches until it reaches the market or user. The lacquer solvent, which is usually composed of alcohols and esters with some acetone, presents no serious health hazard; however, the solvents used are very flammable.

Metal finishing is an operation which is performed to remove imperfections from metal surfaces, such as dents, wrinkles and scratches, before the metal is plated or painted. The principal hazards to health in metal finishing are the dusts of toxic metals such as lead, which are used to fill hollow surfaces when power grinding or disc machines are used to grind them down to a smooth finish, as is often done in automobile finishing.

In operations of this kind, where the lead surface is ground with power tools, the job should be isolated from other adjoining departments and have suction applied to it to remove the fine lead particulate dusts from the area. All workers involved in metal finishing where lead is used and ground with power tools should be required to wear a metal fume respirator approved by the U. S. Bureau of Mines for lead dust, if the concentration of lead in the air is 1.5 milligrams per ten cubic meters of air as determined by test. The writer knows of no lead hazard introduced when finishing lead surfaces by hand filing.

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Control of Solvent Exposures

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The term "solvent" as used in industry denotes a variety of liquids that are used mainly for the purpose of dissolving some other material. The term is used rather loosely and may include such liquids as water or acids. Although there are many interesting factors involved in the proper control of all types of solvents, perhaps the greatest concern is attached to the organic solvents, and this discussion will be limited to that group of solvents generally referred to as "organic solvents." Most of these solvents are purchased to perform a specific function and they are later thrown away, usually in the form of a vapor. For example, a varnish may be made by dissolving a resin in toluol. The varnish is applied to some piece of equipment and the toluol is then evaporated by placing the equipment in an oven. Or, perhaps it is desired to wash grease from some metal parts. The parts may be wet with the solvent until the grease is removed and they are then allowed to dry. We can almost generalize and say that solvents are purchased for the express purpose of creating solvent vapors. These vapors create hazards which must be controlled.

There are about 200 different organic solvents available in drum or tank car quantities. These solvents are supplied to industry both as a specific chemical compound and also as a mixture of one or more of these chemical compounds. Thousands of these mixtures are supplied to industry. In addition to this group of liquids which is available to industry in large quantities, there are several thousand others which are available in quantities of a few quarts or gallons.

Out of the many millions of gallons involved, the 200 organic solvents which are available in large quantities present the greatest problem of control. At the same time, this group of solvents has been used and studied sufficiently, so that reasonably good technical information and methods of control are available. Many of the several thousand organic solvents used in small quantities are not so well known and adequate technical information may not always be available. They thus present a more difficult problem in control.

In addition to these solvents which are now available, there are probably at least a dozen new organic solvents made available in large quantities each year, and hundreds of new solvents are made available in limited quantities. A continual check on new materials and new processes is therefore advisable to be certain that the use of new solvents will be adequately controlled.

When we speak of controlling solvent exposures, we obviously must include all the hazards associated with the use of the solvent. We must include such elements as fire, explosion, and health hazard. When speaking of control, we may feel the desirability of

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