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INDEX

to the "Industrial Safety Survey", Vol. XXV (1949)

Abbreviations: A = Article; B = Book Review; O = Official Report; P = Review (of a periodical); R = Law, Regulation or Safety Code; S = Safety Institution, Association or Museum
Note: for Great Britain see United Kingdom

I. SUBJECT INDEX

1. General

International: Tripartite Technical Conference on Safety in Industrial Establishments. 1. 8 (S).
Argentina: Decree No. 6,891 changing the name of the Directorate-General of Industrial Inspection and Health to the Directorate-General of Industrial Health and Safety. Dated 23 March 1949. 3. 94 (R).
Australia: National Safety Council of Australia. Report for 1947-1948. 1. 10 (S).
Australia: National Safety Council of Australia. Report for 1948-1949. 4. 130 (S).
Belgium: Belgian Manufacturers' Association. 1. 15 (R).
Belgium: Annual Report of the Administration for the Technical Protection of Labour, 1946 and 1947. 4. 143 (O).
Bulgaria: Act amending the Industrial Safety and Hygiene Act. Dated 27 September 1948. 1. 16 (R).
Costa Rica: State Insurance Institute. Accident Prevention Campaign. 4. 131 (S).
Denmark: Annual Report of the Labour and Factory Inspectorate, 1947. 1. 23 (O).
France: French Manufacturers' Association for the Prevention of Industrial Accidents. 1. 11 (S).
France: National Safety Week, 1948. 3. 92 (S).
France: New Periodical, *Travail et Sécurité*. 4. 131 (S).
India (Bengal): Administration of the Factories Act during 1946. 1. 24 (O).
India (Central Provinces and Berar): Administration of the Factories Act during 1947. 1. 24 (O).
India (Orissa): Administration of the Factories Act during 1947. 1. 25 (O).
India (Travancore): The Travancore Factories Act, 1124. Dated 7 March 1949. 3. 96 (R).
Luxembourg: Accident Insurance Association. Report for 1947. 1. 12 (S).
Luxembourg: Accident Insurance Association. Report for 1948. 4. 131 (S).
Norway: Annual Report of the Labour Inspectorate, 1947. 2. 62 (O).
Poland: Second Trade Union Congress. Resolution concerning Safety and Health. 4. 132 (S).
Spain: National Labour Regulations for Various Industries. 1. 19 (R).
Sweden: Annual Report of the Labour Inspectorate, 1945. 1. 25 (O).
Sweden: Annual Report of the Labour Inspectorate, 1946. 2. 62 (O).
Sweden: Workers' Protection Act. Dated 3 January 1949. 3. 96 (R).
Sweden: Annual Report of the Labour Inspectorate, 1947. 3. 100 (O).
Sweden: Royal Notification concerning the Application of the Workers' Protection Act of 3 January 1949. Dated 6 May 1949. 4. 141 (R).
Sweden: Industrial Accidents, 1939-1943. 4. 146 (O).
Sweden: Industrial Accidents in 1945. 4. 146 (O).
Union of South Africa: Report of the Chief Inspector of Factories for 1946. 2. 63 (O).
United Kingdom: National Industrial Safety Conference, 1948. 1. 13 (S).
United Kingdom: Annual Report of the Chief Inspector of Factories, 1947. 3. 103 (O).
United States of America: Congress of Industrial Organizations. Resolution on Industrial Safety and Health. 1. 14 (S).
United States of America: The President's Conference on Industrial Safety. 4. 134 (S).
La prévention des accidents du travail. By E. Weymann. 1. 32 (P).
Absenteeism and Injury Experience of Older Workers. By Max D. Kossoris. 1. 34 (P).
Les accidents et leurs causes. By Dr. A. Morali-da-Ninos and Miss D. Solomonodis. 1. 34 (P).
Industrial Safety in the United States. By L. N. Duguid and R. E. Tugman. 1. 36 (B).
An Examination of Attitudes about Industrial Safety in Germany. By Ted F. Silvey. 2. 78 (B).
Industrial Accident Prevention. By H. Greenwood Thomas. 3. 108 (P).
Industry's Interest in Health and Safety Services. By H. W. Schwartz. 3. 108 (P).
Prevention of Accidents. 3. 108 (P).
Time Loss due to Industrial Injuries in Illinois during 1947. 3. 108 (P).
Aspetti della Prevenzione. By Giorgio Mastino del Rio. 3. 117 (B).
Prevençao de Acidentes do Trabalho. By Dr. Decio Parreiras. 3. 117 (B).
The Law and Practice Relating to Safety in Factories. 3. 117 (B).
Occupational Mortality Study Coming. 4. 151 (P).
Lavoro Sociale e Prevenzione degli Infortuni. By Giorgio Mastino del Rio. 4. 157 (B).
U.S. Navy Manual of Safety Equipment. 4. 157 (B).

2. Industrial Premises

Seasonal Variation of Daylight Illumination. 1. 36 (B).
L'éclairage artificiel des ateliers. By M. Coru. 2. 67 (P).
Sicherheitstechnische Einrichtungen bei Zentralheizungen. 2. 67 (P).

Lighting and Visual Efficiency: The Present Status of Research. By M. E. Bitterman. 3. 108 (P).
The Right Finish, the Right Color. 3. 108 (P).
Unusual Uses for Vacuum Cleaning. 3. 108 (P).
Ventilation and Heating. Lighting and Seeing. 3. 118 (B).
Give Industry a Safe Flooring. 4. 151 (P).

3. Fire Protection, Fire Fighting

International: Congress of the International Technical Fire Prevention and Fire Fighting Committee. 1. 6 (S).
France: Causes and Origins of Fires in France during the First Half of 1948. 4. 144 (O).
United Kingdom: Fire Protection Association. 4. 132 (S).
Emploi des extincteurs d'incendie sur des circuits ou appareils électriques sous tension. 1. 33 (P).
Fire Fighting Equipment and Methods in Germany during the Period 1939-1945. 2. 75 (B).
The Modern Automatic Sprinkler System. 3. 109 (P).
Fire and Explosion. By J. H. F. Smith. 4. 121 (A).
Fire Protection and Accident Prevention Year Book, 1950. 4. 157 (B).

4. Industries

AGRICULTURE, FORESTRY, FISHING

Norway: Provisional Act concerning Conditions of Employment in Agriculture. Dated 3 December 1948. 4. 141 (R).
United States of America: Accidents in the Pulpwood Logging Industry in 1943 and 1944. 1. 30 (O).
Sicurezza del Lavoro e Prevenzione degli Infortuni in Agricultura. 2. 75 (B).
Maestri e Contadini. 2. 76 (B).
La Prevenzione Infortuni Agricoli Nella Scuola. By Prof. Raffaele Resta. 3. 109 (P).

MINING, QUARRYING

Mining

General

International: Miners' International Federation. 4. 130 (S).
Australia (Western Australia): Mines Regulation Act Regulations. Dated 10 March 1949. 4. 138 (R).
Belgium: Work of the National Institute of Mines in 1946. 1. 10 (S).
Belgium: National Institute of Mines. Report for 1947. 2. 52 (S).
Belgium: Mining Health Institute. Activities in 1948. 3. 91 (S).
France: Accidents in Mines and Quarries, 1946. 2. 60 (O).
Japan: Mine Safety Law, No. 70. Dated 16 May 1949. 4. 140 (R).
United Kingdom: Report of the Chief Inspector of Mines for the Years 1939-1946. 1. 27 (O).
U.S.A.: United States Bureau of Mines. 4. 132 (S).
U.S.A.: Wartime Activities of the Health and Safety Division of the United States Bureau of Mines. 4. 133 (S).
U.S.A. (New York): Rules relating to Underground Mining Operations. Effective 1 March 1949. 3. 98 (R).
Hazards of Entering Old Mine Workings. 1. 38 (B).
Education des élèves agents de maîtrise du fond. By M. F. Bizouard. 2. 68 (P).
Safety and Performance Characteristics of Liquid Oxygen Explosives. 2. 76 (B).
Stress Analysis Applied to Underground Mining Problems. Part II: Stress Analysis Applied to Multiple Openings and Pillars. 2. 76 (B).
Safety in the Mining Industry. 3. 118 (B).
Safeguarding Underground Workmen from Noxious Gases Resulting from Blasting in Strip Mines. 4. 158 (B).

Coal, Lignite

General

International: Fifth International Conference of Directors of Mine Safety Research, Pittsburgh, Pa. September 1948. 1. 6 (S).
International: International Labour Office. Meeting of Experts on Safety in Coal Mines. 1. 9 (S).
International: Tripartite Technical Conference on Safety in Coal Mines. 3. 89 (S).
Canada (Alberta): Regulations governing the Operation of Strip Pit Mines. Dated 8 July 1948. 2. 54 (R).
France: Research Centre of the French Coal Board. Report for 1947. 3. 99 (O).
Germany: Ground-Pressure Research Committee of the German Coal Mining Administration. 3. 93 (S).
Netherlands: Decree concerning Surface Installations of Mines. Dated 21 June 1949. 4. 140 (R).
United Kingdom: Safety in Mines Research Board. Annual Report for 1947. 3. 101 (O).
Safety Achievements of the Continental Mine. Continental-Archbald Coal Co., Scranton, Lackawanna County, Pa. 1. 36 (B).
Mine Gases and Methods for Detecting Them. 1. 37 (B).
Protection Against Mine Gases. 1. 37 (B).
La Station d'essais de matériel à air comprimé de Montluçon. By R. Loison. 2. 68 (P).
Mine Safety. 2. 68 (P).
Safe Methods in the Anthracite Field. By H. A. Leidich. 3. 109 (P).
Safety Course for Bituminous Coal Miners. 3. 118 (B).
De Veiligheidsdienst van de Staatsmijnen. By P. F. de Zee. 4. 151 (P).

Explosives and Shotfiring

Breaking Coal with Airdox. 3. 36 (B).
Ignition of Firedamp by Explosives. 1. 36 (B).
Hazards of Black Blasting Powder in Underground Coal Mining. 3. 118 (B).
Tests on the Ignition of Natural Gas-Air Mixtures by Permissible Explosives in the Experimental Coal Mine. 3. 118 (B).

Supports, Roof Control

Control of Roof and Prevention of Accidents from Falls of Rock and Coal. 1. 37 (B).
Control of Roof and Prevention of Accidents from Falls of Rock and Coal. Suggested Roof Supports for Use at Faces in Conjunction with Mechanical Loading. 1. 37 (B).
Suspension Roof Support. By Edward Thomas. 2. 68 (P).
Safe Timber Recovery in Coal Mining. By George H. Sambrook. 3. 109 (P).

Haulage

Review of Bureau of Mines Work on Use of Diesel Engines Underground. 1. 37 (B).
Safety Around Belt Conveyors. 2. 68 (P).
Metallurgical Aspects of Mining Gear Failures. By R. Jeffrey. 3. 109 (P).
Mining Gear Failures from a Metallurgical Aspect. By R. Jeffrey. 3. 109 (P).
Reducing Mine Haulage Accidents. 3. 110 (P).
Transportation—Key to Successful Mechanization. 3. 110 (P).
Conveyor Belt Vulcanising. 4. 152 (P).
Remote Control and Sequence Control of Electrically Driven Conveyors. By E. E. Grover. 4. 153 (P).

Winding (Hoisting)

Les câbles d'extraction en acier et leur contrôle du point de vue de la sécurité. By Yvon Verwilst. 2. 69 (P).
Deep Shaft Winding Problems. By H. Hitchen. 4. 152 (P).

Ventilation

A Mine Air-Conditioning Chart. 1. 37 (B).

Coal Dust

Consolidation of Dust on Floors of Mine Roadways. 1. 37 (B).
Tests in the Experimental Coal Mine to Determine Requirements for Preventing Propagation of Coal-Dust Explosions in Rooms. 1. 37 (B).
The Consolidation of Floor Dust on Mine Roadways. By F. Bradshaw and F. V. Tideswell. 2. 69 (P).
Kohlenstaubbekämpfung mit dem Stossränkverfahren in halbsteiler und steiler Lagerung auf dem Steinkohlenbergwerk "Consolidation". By Bergrat Dr.-Ing. Hubertus Rolshoven and Inspector Alexander Heitmann. 4. 152 (P).
Steam Infusion as a Means of Dust Suppression. By K. Z. George. 4. 153 (P).
Small Portable Coal-Dust Explosion Gallery. 4. 159 (B).

Firedamp

La combustion des mélanges grisouteux. By E. Audibert. 3. 110 (P).
Drainage of Firedamp from Coal Seams. By J. Ivon Graham. 4. 153 (P).
Erfahrungen über die Grubenwetteruntersuchung. By Dr. Paul Michaelis. 4. 153 (P).
Grisoumètre M.S.A. 4. 157 (B).
Grisoumètre Léon Cerchar. 4. 157 (B).

Lighting

Possibilités d'emploi de l'éclairage fluorescent en mines grisouteuses. 2. 76 (B).

Fire Protection, Fire Fighting

Fire Extinguishers. Their Application in Underground Fire Fighting. By W. Park. 2. 69 (P).
Grubenbrand-Versuche. By H. Schultze-Rhonhof and K. Klinger. 3. 118 (B).

Electricity

Canada: Canadian Electrical Code, Part V. Use of Electricity in Coal Mines. 4. 139 (R).
United Kingdom: Electricity in Mines in 1947. 4. 148 (O).
United Kingdom: Electricity in Mines in 1948. 4. 149 (O).
Earth-Leakage Protection. 4. 153 (P).

Rescue

Emergency Escapeways from Coal Mines. 1. 37 (B).

METAL MINING

Canada (Nova Scotia): Act to Amend the Metalliferous Mines and Quarries Regulation Act, 1937. Dated 14 April 1949. 4. 139 (R).
Safe Equipment, Guards and Practices. Lake Superior District Iron-Ore Mines. 2. 76 (B).
Safety Practices in Dredging and Hydraulic Mining. 2. 76 (B).
Accident Experience, Iron-Ore Mines, Lake Superior District, 1940-1947. 4. 157 (B).

Quarrying

Canada (Nova Scotia): Act to Amend the Metalliferous Mines and Quarries Regulation Act, 1937. Dated 14 April 1949. 4. 139 (R).
France: Accidents in Mines and Quarries, 1946. 2. 60 (O).
U.S.A.: The National Sand and Gravel Association. Safety Competition, 1947. 1. 13 (S).
Yugoslavia: Regulations respecting Safety and Hygiene in Quarries, and Brick Manufacturing Industry, etc. Dated 14 July 1948. 1. 21 (R).

Oil, Natural Gas

Canada (Alberta): Safety Regulations governing the Drilling, Cleaning, Repairing, Operation and Maintenance of Oil and Gas Well-Drilling Plants, Rigs and Equipment. O.C. 599-49. Dated 4 May 1949. 4. 139 (R).

MANUFACTURING INDUSTRIES

General

International: Tripartite Technical Conference on Safety in Industrial Establishments. 1. 8 (S).

Manufacture of Food

Germany: Food and Tourist Industries Mutual Accident Insurance Association. Report for 1948. 4. 145 (O).

Beverage Industries, Distilleries

British Dependent Territories (Mauritius): The Factories (Aerated Waters) Regulations, 1947. Dated 21 November 1947. 1. 16 (R).
Germany: Food and Tourist Industries Mutual Accident Insurance Association. Report for 1948. 4. 145 (O).
Manual sobre Prácticas de Seguridad en las Cervecerías. 2. 76 (B).

Tobacco Industries

Germany: Food and Tourist Industries Mutual Accident Insurance Association. Report for 1948. 4. 145 (O).

Chemical Industries

Belgium: Twenty-First Congress on Industrial Chemistry. 1. 10 (S).
United Kingdom: Imperial Chemical Industries Engineering Codes and Regulations, Safety Series. 2. 58 (R).
U.S.A.: Injuries and Accident Causes in Fertiliser Manufacturing. 3. 106 (O).
Veiligheid en Chemie. By Dr. H. A. J. Pieters and J. W. Greyghton. 1. 38 (B).

Poor College Safety Training Chided. 3. 110 (P).
Safety Measures in Chemical Laboratories. 3. 119 (B).
Unfälle beim chemischen Arbeiten. By Dr. Ernst Rüst and Dr. Alfred Abert. 3. 119 (B).
Safety Practice in Chemical Works. By A. Webster. 4. 153 (P).

Skin, Hide and Leather Industries

British Dependent Territories (Mauritius): The Factories (Tanning) Regulations, 1947. Dated 21 November 1947. 1. 16 (R).

Textile Industries

British Dependent Territories (Mauritius): The Factories (Aloe Fibre) Regulations, 1947. Dated 21 November 1947. 1. 16 (R).
United Kingdom: The Jute (Safety, Health and Welfare) Regulations, 1948. Dated 21 July 1948. 1. 20 (R).
United Kingdom: Agreement concerning Fencing of Machinery, First Aid, and other Safeguards in Cotton Weaving Factories. 2. 59 (R).
Air Conditioning in Textile Mills. 2. 76 (B).

Manufacture of Mineral Fuels

Violence Experienced in Ball's Reaction. By R. T. Mixer. 3. 110 (P).

Manufacture of Non-Metallic Minerals

Argentina: Decree No. 23660 respecting Safety Measures in the Glass Industry. Dated 7 August 1948. 1. 15 (R).
Yugoslavia: Regulations respecting Safety and Hygiene in Quarries and Brick Manufacturing Industry, etc. Dated 14 July 1948. 1. 21 (R).
Accident Prevention in Brick, Pipe and Tile Manufacture. 1. 38 (B).
Glass—Handle with Care! By Carl Minideo. 4. 153 (P).

Manufacture of Metal Goods

Are Cranemen Expendable? By R. D. Darrah. 4. 153 (P).

CONSTRUCTION

Australia (Queensland): Report of the Chief Inspector of Machinery, Scaffolding, and Weights and Measures. 1 July 1947 to 30 June 1948. 2. 59 (O).
Netherlands: Regulations for Building Hoists, 1948. 3. 96 (R).
Switzerland: Federal Order concerning Measures to be Taken to Prevent Accidents in Building Work when Suspended Scaffolds with Movable Platforms are used for Rough Casting, Painting, etc. Dated 27 May 1949. 4. 142 (R).
Building Regulations Handbook. 1. 38 (B).
Mesures de sécurité concernant les travaux de décoffrage. 2. 70 (P).
Ventilation of Long Tunnels during Construction. By W. P. Harris. 2. 70 (P).
Auvent de garantie pour travaux de maçonnerie à grande hauteur. By M. Chambon. 2. 71 (P).
La prévention des accidents dus aux bétonnières. 2. 73 (P).
Guide to the Building (Safety, Health and Welfare) Regulations, 1948. 2. 77 (B).
Sources of Ohio's Construction Injuries in 1947. 3. 111 (P).
Safe Practice in the Use of Tubular Steel Scaffolding. By N. B. Elliott. 3. 113 (P).

TRANSPORTS AND COMMUNICATIONS

Belgium: Order respecting the Marking of Weight on Heavy Packages Transported by Vessels. 1. 16 (R).
Germany: Mutual Accident Insurance Association for Inland Water Transport. Accident Prevention Regulations. Effective 1 July 1948. 3. 96 (R).
Pakistan: Pakistan Dock Labourers' Regulations, 1948. Dated 26 February 1948. 1. 19 (R).
Sweden: Accidents in the Loading and Unloading of Ships in 1947. 1. 26 (O).
Switzerland: Regulations of the Swiss Federal Railways for Prevention of Eye Injuries. Dated 1 July 1947. 1. 20 (R).
U.S.A.: Steam Railway Accidents in 1947. 1. 30 (O).
U.S.A.: Motor Carrier Fire Accidents, 1948. 4. 150 (O).
The Pier Fire Problem in the Port of New York. 1. 38 (B).
Zasady Bezpieczenstwa Transportu Rcznego. By S. Filipkowski. 2. 72 (P).

SERVICE INDUSTRIES

Canada: Canadian Standards Association. Code of Practice for Window Cleaning. Z.91-1949. 4. 139 (R).
Cuba: Decree No. 3104 respecting Safety Measures for Cinematograph Operators' Cabins. Dated 23 September 1948. 1. 17 (R).

5. Industrial Processes

HANDLING GOODS

Podnoszenie i przenoszenie ciezarów a wydajnosc i bezpieczestwo pracy. By A. Mazurkiewicz. 2. 72 (P).
Safe Upending of Steel Drums. 2. 71 (P).

SANDBLASTING

Safety in Sandblasting. A Manual. 2. 77 (B).

WELDING

Belgium: Decree of the Regent amending the Provisions governing Calcium Carbide Depots, Acetylene Generators and the Use of Blowpipes, forming the subject of Sections 284 to 319 inclusive of the General Regulations for the Protection of Labour. Dated 17 August 1948. 1. 15 (R).
Bulgaria: Regulations concerning Electric and Oxy-acetylene Welding Equipment. Dated 3 June 1949. 4. 139 (R).
India: Indian Government Railway Standard Code of Practice for Electric Arc Welding of Locomotive Boilers (Maintenance). Adopted in 1948. 2. 58 (R).
Practical Safety Considerations in Oxy-Acetylene Applications. By J. I. Banash. 2. 72 (P).
La sécurité et l'hygiène dans les industries de la soudure. By J. Danna and Drs. P. Theil and L. Granjon. 2. 77 (B).
Beschermingsglazen voor lasarbeid. By G. A. W. Rutgers. 4. 154 (P).
Gas, Flames and Sparks. By J. I. Banash. 4. 154 (P).

6. Industrial Equipment

BOILERS, PIPES AND PRESSURE VESSELS

General

Australia (South Australia) : Report of the Factories and Steam Boilers Department for the Year 1947. 3. 98 (O).
Canada (Nova Scotia) : The Steam Boiler and Pressure Vessel Inspection Act. Dated 14 April 1949. 4. 140 (R).
Netherlands : Decree concerning Steam Appliances. Dated 17 September 1949. 4. 140 (R).
The Supervision of Steam Boilers and Pressure Vessels in Italy. By Professor F. Roma. 1. 1 (A).
The Accident Potential of Steam Boiler Plant. By Sydney D. Scorer. 3. 111 (P).
Fire and Explosions in Refrigeration Equipment. By A. S. Hall. 3. 114 (P).

Boilers

British Dependent Territories (Trinidad and Tobago) : Boilers Regulations. Dated 24 August 1948. 1. 16 (R).
France : Ministerial Circular respecting Vertical Field-Tube Boilers and additional Supervision and Safety. Dated 10 September 1948. 2. 57 (R).
India : Indian Government Railway Standard Code of Practice for Electric Arc Welding of Locomotive Boilers (Maintenance). Adopted in 1948. 2. 58 (P).
Accidents et incidents de chaudières équipées pour le chauffage au mazout. 2. 73 (P).

Pressure Vessels

Sweden : Association for the Supervision, etc., of Pressure Vessels. 1. 13 (S).
United Kingdom : British Standard 487 : 1949. Fusion-Welded Steel Air Receivers. 3. 98 (R).

Compressors

The "Carbon-Oxygen Complex" as a Possible Initiator of Explosions and Formation of Carbon Monoxide in Compressed-Air Systems. 4. 158 (B).

ELECTRICAL INSTALLATIONS

France (Algeria) : Order respecting the Examination of Electrical Installations in Undertakings employing Electric Current. Dated 23 August 1948. 1. 19 (R).
Netherlands : Safety Decree concerning Electric Fences. Dated 2 November 1948. 3. 96 (R).
Switzerland : Electrical Accidents, 1947. 1. 26 (O).
United Kingdom : Electrical Accidents, 1947. 3. 102 (O).
National Electrical Safety Code. 1. 39 (B).
Electricity in Factories under Conditions of Special Flammability. By H. W. Swann. 3. 81 (R).
Raumexplosionen durch elektrische Anlagen. By Helmut Freytag. 3. 119 (B).
Electrical Code. 4. 158 (B).
Prescriptions et recommandations pour installations électriques en Belgique. By H. K. de Meerendre and M. Pypen. 4. 158 (B).

FURNACES

Safety in Design and Operation of Gas-Heated Ovens and Furnaces. 2. 77 (B).

HAND TOOLS

Sencillas pero peligrosas. 2. 73 (P).

HOISTING APPLIANCES

Bezpieczenstwo Pracy w Transporcie Przy Uzyciu Lin Stalowych. By Józef Helbrecht. 2. 73 (P).
Inside That Coil of Rope. By Capt. Aylmer R. Hatch. 2. 73 (P).
Arrows Identify Hoist Controls. 3. 11 (P).
Kettingen en Staaldraadstroppen. By J. H. de Weerd. 4. 154 (P).
There's No Need to Hang by a Thread. 4. 155 (P).

LADDERS

Bulgaria : Safety Regulations concerning Portable Wood Ladders. Dated 3 June 1949. 4. 139 (R).
U.S.A. : American Standard Safety Code for Wood Ladders. ASA.A.14.1-1948. 1. 20 (R).
The Emergency Rung. By J. S. Millet. 2. 50 (A).

MACHINERY

General

Australia (Queensland) : Report of the Chief Inspector of Machinery, Scaffolding, and Weights and Measures. 1 July 1947 to 30 June 1948. 2. 59 (O).
France : Decree No. 48-1253 amending and supplementing, with respect to Dangerous Machinery, the Decree of 10 July 1913 concerning General Measures of Safety and Health applicable to all Undertakings covered. Dated 5 August 1948. 2. 56 (R).
Some Fundamental Principles of Machine Guarding. By Henry A. Hepburn. 3. 111 (P).
Safe Openings for Some Point of Operation Guards. 4. 158 (B).

Transmission Machinery

Bulgaria : Safety Regulations concerning Transmission Gear. Dated 3 June 1949. 4. 139 (R).
Working Machines in Manufacturing Industries.

Metalworking Machines

Bulgaria : Safety Regulations concerning Work at Grinding and Sharpening Machines. Dated 3 June 1949. 4. 138 (R).
France : Resolution fixing Safety Principles for the Certification of Grinding Machines. Dated 1 April 1948. 1. 18 (R).
France : Decision fixing the Safety Principles for the Certification of Protective Devices for Power Presses used for the Cold Working of Metal. Dated 16 July 1948. 2. 56 (P).
Die Pressenfibel. 2. 77 (B).

Woodworking Machines

Bulgaria : Safety Regulations concerning Work at Woodworking Machines. Dated 3 June 1949. 4. 138 (R).
France : Decision determining the Safety Principles for the Certification of Thicknessing Machines with Rotary Cutter Blocks for Work with Wood and Similar Materials. Dated 19 May 1948. 2. 54 (R).
France : Decision determining the Safety Principles for the Certification of Single-Unit Planing Machines with Rotary Cutter Blocks for Work with

Wood and Similar Materials. Dated 20 May 1948. 2. 55 (R).
France: Decision concerning the Certification of Multi-Cutter Planing and Moulding Machines for Work with Wood and Similar Material. Dated 5 November 1948. 2. 56 (R).
France: Decision determining the Safety Principles for the Certification of Vertical Spindle Moulding Machines for Work with Wood and Similar Materials. Dated 21 December 1948. 2. 57 (R).
Union of South Africa: South African Bureau of Standards. Specification for the Guarding of Power-Driven Woodworking Saws. Approved 20 December 1948. 2. 58 (R).
Sawing and Planing. By A. H. Haycock. 2. 76 (B).
Spreaders for Vari ty and Universal Saws. 4. 158 (B).

Miscellaneous

New Wire Fatigue Testing Method. By F. A. Votta, Jr. 3. 113 (P).

7. Dangerous Substances

EXPLOSIVE, FLAMMABLE SUBSTANCES

General

Investigations of Explosion Hazards of Perchloric Acid and Mixtures of Perchloric Acid and Organic Materials. 2. 77 (B).
Butadiene-Crotonaldehyde Explosion. By Kenneth W. Greenlee. 3. 114 (P).
Fire and Explosion. By J. H. F. Smith. 4. 121 (A).
Brand- en Ontploffingsgevaar geboden door Ammoniumnitraat. By Is. Dehing. 4. 155 (P).
Explosive Properties of Hydrazine. 4. 158 (B).

Commercial Explosives

Australia: Australian Standard Rules for the Storage and Use of Explosives. Dated February 1949. 4. 137 (R).
Belgium: Order of the Regent regulating the Use of Explosives in Undertakings other than Mines and Underground Quarries. Dated 31 March 1949. 4. 138 (R).
Norway: Report of the Explosives Inspectorate for 1947. 1. 25 (O).
Yugoslavia: Regulations on the Manufacture of Explosives. Dated 7 June 1948. 1. 21 (R).

Flammable Liquids

Liquid Fluorine-Cotton Explosion. By R. H. Lafferty, Jr., J. C. Barton and J. A. Westbrook. 3. 114 (P).

Gases, Vapours, Fumes

Belgium: Decree of the Regent amending the Provisions governing Calcium Carbide Depots, Acetylene Generators and the Use of Blowpipes, forming the subject of Sections 284 to 314 inclusive of the General Regulations for the Protection of Labour. Dated 17 August 1948. 1. 15 (R).
France: Order respecting Regulations for Acetylene Generators. Dated 26 October 1948. 3. 94 (R).
Germany: German Acetylene Committee. 2. 53 (S).
Switzerland: Swiss Acetylene Association. Annual Report, 1948. 3. 101 (O).
Un danger de la peinture benzolique: l'explosion. By Dr. Julien and H. Loustau. 1. 33 (P).
Analyses of Complex Mixtures of Gases. 1. 38 (B).
Effect of Hydrocarbons and Other Gases upon the Explosibility of Acetylene. 1. 39 (B).
Flammability of Methyl Alcohol Vapor-Air Mixtures at Low Pressures. 4. 158 (B).

Dusts

Denmark: Explosion of Sugar Dust. 3. 99 (O).
Fume and Dust Exposure. By V. J. Castrop. 1. 33 (P).
Nagot om Dammexplosioner. By C. F. Westrell. 2. 73 (P).
Industrial Air Sampling and Analysis. By Leslie Silverman. 2. 78 (B).
Dust Hazards in Industry. 3. 114 (P).
Preventing Dust Explosions in Starch Factories. 3. 114 (P).
Cyclone Dust Collectors. By A. J. Ter Linden. 4. 156 (P).
Dust in Industry. 4. 158 (B).

NOXIOUS, TOXIC SUBSTANCES

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Steam Railway Accidents in 1947. 1. 30.
Work Injuries in the United States during 1947. 2. 64.
Injuries and Accident Causes in Fertiliser Manufacturing. 3. 106.
Motor Carrier Fire Accidents, 1948. 4. 150.
Illinois: Industrial Accidents in 1946. 1. 31.
Illinois: Industrial Accidents, 1947. 2. 65.

V. LIST OF AUTHORS

Anda, Guillermo de. 1. 34.
Audibert, E. 3. 110.

Bales, Ronald E. 4. 156.
Banash, J. I. 2. 72, 4. 154.
Barton, J. C. 3. 114.
Bitterman, M. E. 3. 108.
Bizouard, M. F. 2. 68.
Bradshaw, F. 2. 69.
Brandt, Allen D. 4. 156.
Bresler, R. Ralph. 1. 35.
Bühler, Dr. H. 2. 77.

Castrop, V. J. 1. 33.
Chambon, M. 2. 71.
Collins, Robert T. 3. 115.
Coru, M. 2. 67.
Creyghton, J. W. 1. 38.

Dale, Ernest. 2. 41.
Danna, J. 2. 77.
Darrah, R. D. 4. 153.
Dehing, Is. 4. 155.
Dragotti, Dr. G. 3. 116.
Duguid, L. N. 1. 36.

Ebert, Dr. Alfred. 3. 119.
Elliott, N. B. 3. 113.

Felton, Jean Spencer. 1. 35.
Filipkowski, S. 2. 72.
Fischer, Dr. H. 1. 36.
Freiman, David G. 1. 34.
Freytag, Helmut. 3. 119.
Fröhlicher, Dr. R. 1. 36.

George, K. Z. 4. 153.
Gessner, H. 2. 77.
Gill, George H. 1. 39.
Graff, Paul W. 3. 116.
Graham, J. Ivon. 4. 153.
Granjon, Dr. L. 2. 77.
Greenlee, Kenneth W. 3. 114.
Grier, Robert S. 1. 34.
Grover, E. E. 4. 153.

Habersat, R. W. 3. 116.
Hall, A. S. 3. 114.
Harris, W. P. 2. 70.
Hatch, Aylmer R. 2. 73.
Haycock, A. H. 2. 76.
Heitmann, Alexander. 4. 152.
Helbrecht, Jozef. 2. 73.
Hepburn, Henry A. 3. 111.
Hitchen, H. 4. 152.

Ignatius, Paul. 3. 119.

Jeffrey, R. 3. 109.
Julien, Dr. 1. 33.

Klinger, K. 3. 118.
Kossoris, Max D. 1. 34.

Lafferty, R. H., Jr. 3. 114.
Leidich, H. A. 3. 109.
Loison, R. 2. 68.
Loustau, H. 1. 33.

Mallart, José. 1. 34, 2. 74.
Mastino del Rio, Giorgio. 3. 117, 4. 157.
Mazurkiewicz, A. 2. 72.
McElroy, Frank S. 3. 116.
de Meerendre, H. K. 4. 158.
Mellor, Joseph F., Jr. 3. 115.
Michaelis, Paul. 4. 153.
Millet, J. S. 2. 50.
Minideo, Carl. 4. 153.
Mixer, R. T. 3. 110.
Morali-da-Ninos, Dr. A. 1. 34.
Moros, Alexander. 3. 116.

Nash, Peter. 1. 34.
Nibecker, P. B. 1. 35.
Norbe de Lacarda Filho, F. 2. 79.

Park, W. 2. 69.
Parker, Bernard T. 3. 116.
Parreiras, Dr. Decio. 3. 117.
Pieters, Dr. H. A. J. 1. 38.
Pypen, M. 4. 158.

Queralt Roge, Francisco. 2. 74.
Quervain, Dr. F. 2. 77.

Raymond, V. 1. 39.
Resta, Prof. Raffaele. 3. 109.
Rolshoven, Hubertus. 4. 152.
Roma, F. 1. 1.
Rüst, Dr. Ernst. 3. 119.
Rutgers, G. A. W. 4. 154.
Ryan, Thomas Arthur. 2. 79.

Sambrook, George H. 3. 109.
Schultze-Rhonhof, H. 3. 118.
Schwartz, H. W. 3. 108.
Scorer, Sydney D. 3. 111.
Silverman, Leslie. 2. 78.
Silvey, Ted. F. 2. 78.
Smith, J. H. F. 4. 121.
Smith, Williams. 2. 75.
Solomonodis, D. 1. 34.
Stanbury, W. A. 1. 35.
Swann, H. W. 3. 81.

Teleky, Ludwig. 2. 79.
Ter Linden, A. J. 4. 156.
Theil, Dr. P. 2. 77.
Thomas, Edward. 2. 68.
Thomas, H. Greenwood. 3. 108.
Tideswell, F. V. 2. 69.
Tugman, R. E. 1. 36.
Turnbull, Alan, Jr. 3. 115.

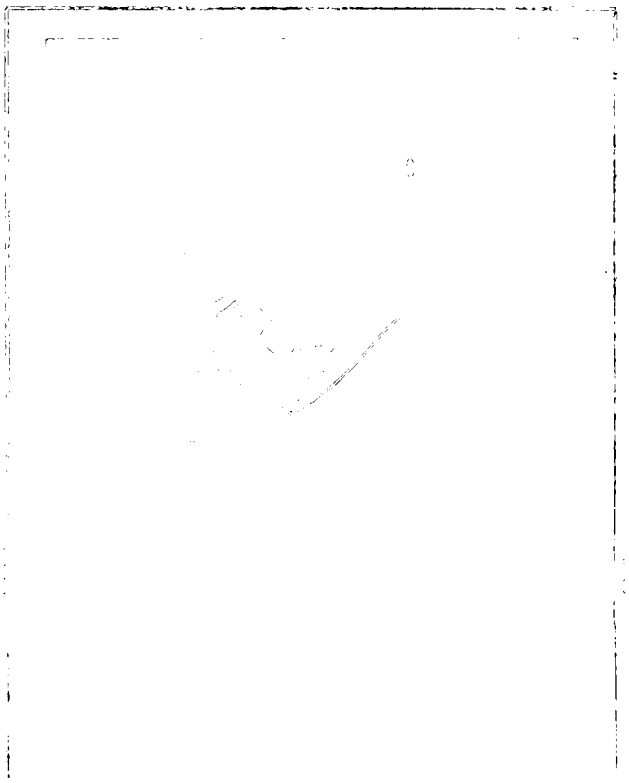
Vallaud, A. 1. 39.
Verwilst, Yvon. 2. 69.
Votta, F. A., Jr. 3. 113.

Webster, A. 4. 153.
de Weerd, J. H. 4. 154.
Westbrook, J. A. 3. 114.
Westrell, C. F. 2. 73.
Weymann, E. 1. 32.
Wolf, Ernst, Ph.D. 3. 115.

de Zee, P. F. 4. 151.

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CONTENTS

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Page

The Supervision of Steam Boilers and Pressure Vessels in Italy. By Professor F. Roma 1

Safety Institutions, Associations and Museums

International: Fifth International Conference of Directors of Mine Safety Research 5
Congress of the International Technical Fire Prevention and Fire Fighting Committee . . . 6
Ninth International Congress on Industrial Medicine 7
Tripartite Technical Conference on Safety in Industrial Establishments 8
International Labour Office: Meeting of Experts on Safety in Coal Mines 9
Australia: National Safety Council of Australia: Report for 1947-1948 10
Belgium: Work of the National Institute of Mines in 1946 10
A New Safety Magazine 10
Twenty-First Congress on Industrial Chemistry 10
Two-Week Campaign for Safety, Health and Embellishment of Workplaces 11
France: French Manufacturers' Association for the Prevention of Industrial Accidents 11
Italy: Italian Centre for Safety Officials 12
Luxembourg: Accident Insurance Association: Report for 1947 12
Netherlands: Veiligheidsmuseum, Amsterdam: Annual Report 1947 12
Sweden: Industrial Accidents in Engineering Undertakings in 1947 12
Association for the Supervision, etc., of Pressure Vessels 13
Labour Protection Committee: Enquiry concerning Works Safety Organisation 13
United Kingdom: National Industrial Safety Conference, 1948 13
United States of America: The National Sand and Gravel Association: Safety Competition, 1947 . 13
President's Conference on Industrial Safety 13
Congress of Industrial Organizations: Resolution on Safety and Health 14

Laws and Regulations, Safety Codes

Argentina: Decree No. 23660 respecting Safety Measures in the Glass Industry. 7 August 1948 . . 15
Belgium: Belgian Manufacturers' Association Safety Codes 15
Decree amending the Provisions Governing Calcium Carbide Depots, Acetylene Generators etc. 15
Order respecting the Marking of Weight on Heavy Packages Transported by Vessels 16
British Dependent Territories (Mauritius): Factories (Health Provisions) Regulations, 1947 . . 16
(Trinidad and Tobago): Boilers Regulations. 24 August 1948 16
Bulgaria: Act amending the Industrial Safety and Hygiene Act. 27 September 1948 19
Cuba: Decree No. 2318 respecting Industrial Hygiene. Dated 5 July 1948 16
Decree No. 3104 respecting Safety Measures for Cinematograph Operators' Cabins 17
France: Resolution on the Certification of Grinding Machines 18
Act No. 48-1106 concerning the Sale and Use of Harmful Products for Industrial Purposes . 18
(Algeria): Order respecting the Examination of Electrical Installations 19
Hungary: Order regulating Certain Matters respecting Accident Insurance. 30 April 1948 . . . 19
Pakistan: Pakistan Dock Labourers' Regulations, 1948. 26 February 1948 19
Spain: National Labour Regulations for Various Industries 19
Switzerland: Regulations of the Swiss Federal Railways for Prevention of Eye Injuries . . . 20
United Kingdom: The Radioactive Substances Act, 1948. 30 June 1948 20
The Jute (Safety, Health and Welfare) Regulations, 1948. 21 July 1948 20
United States of America: American Standard Safety Code for Wood Ladders 20
Yugoslavia: Regulation on the Manufacture of Explosives 21
Regulations respecting Safety and Hygiene in Quarries, and Brick Manufacturing Industry, etc. . 21

Official Reports, etc.

Brazil: Industrial Accidents in 1947 22
Bulgaria: Industrial Accidents from 1938 to 1944 22
Denmark: Annual Report of the Labour and Factory Inspectorate, 1947 23
Dominican Republic: Industrial Accident Statistics in 1946 23
India (Berar): Administration of the Factories Act during 1946 24
(Central Provinces and Berar): Administration of the Factories Act during 1947 24
(Orissa): Administration of the Factories Act during 1947 25
Norway: Report of the Explosives Inspectorate in 1947 25
Sweden: Annual Report of the Labour Inspectorate, 1945 25
Accidents in the Loading and Unloading of Ships in 1947 26
Switzerland: Electrical Accidents 1947 26
United Kingdom: Report of the Chief Inspector of Mines for the Years 1939-1946 27
United States of America: Accidents in the Pulpwood Logging Industry, 1943 and 1944 . . . 30
Steam Railway Accidents in 1947 30
(Illinois): Industrial Accidents in 1946 31

Review of Periodicals 32

Recent Books 39

New Posters 4

INDUSTRIAL SAFETY SURVEY

VOL. XXV JANUARY-MARCH 1949 No. 1

THE SUPERVISION OF STEAM BOILERS AND PRESSURE VESSELS IN ITALY

By Professor F. ROMA,
Chairman of the Technical Council of the National Association for the Control of Combustion, Rome

ORIGIN AND DEVELOPMENT

A beginning was made with technical regulations for pressure vessels in Italy about 60 years ago. In 1890 the authorities responsible for public safety made regulations which, although confined to steam generators, specified how they were to be supervised and made the associations of steam boiler owners responsible for supervision, through experts specially appointed by the competent Prefects.

This supervision was later made stricter, and extended by a series of supplementary rules. All the regulations in force were completely recast in 1926, and the voluntary owners' associations were dissolved and replaced by a public institution, namely the National Association for the Control of Combustion (A.N.C.C.), under the Ministry of Labour and Social Welfare. The Association was also made responsible for the supervision of all gas- or steam-pressure appliances (generators, receivers, cylinders, etc.), the thermal control of fuel-burning installations in the interests of fuel economy, as well as various additional tasks relating to research, propaganda, training of the technical personnel in charge of the above-mentioned installations, etc. Various additional rules have ensured and continue to ensure a constant adaptation of the work of the A.N.C.C. to technical progress and the development of Italian industry.

The Association, which was established as a *compulsory* national consortium of owners of gas- or steam-pressure appliances and fuel-burning installations, is at present subject to dual supervision by the Ministry of Labour and Social Welfare and the Ministry of Industry and Commerce.

The administration (which includes the headquarters, thirteen sections and regional or multi-regional areas) is largely decentralised, and thus ensures effective liaison between the Association and the industries subject to its supervision. Finally, two experimental laboratories, one for physics and one for chemistry and both with complete, modern equipment, make it possible to test the metallic materials to be used in pressure appliances and to analyse fuels, thus making a very valuable contribution to the improvement of statutory technical supervision, to the development of research and to the efficacy of the propaganda undertaken to generalise and facilitate the use of the technically best types of equipment and systems of operation. The efficiency of the central and regional technical services is ensured by specialised engineers, who at present number 108.

Briefly, the main work of the A.N.C.C. now includes the following:

(1) supervision of pressure appliances as regards safety;

(2) thermal control of fuel-burning appliances and installations;

(3) testing of materials used in the manufacture of such appliances;

(4) vocational courses for the personnel in charge of pressure appliances and thermal installations;

(5) research, propaganda and publications on accident prevention and thermal engineering; and

(6) participation in national and international exhibitions and conferences bearing on the work of the Association.

The Executive Regulations issued in 1927 [1], embodying the constitution of the A.N.C.C., have so far remained practically unchanged thanks to excellent technical drafting and to the power given to the competent Ministry (Ministry of Labour and Social Welfare) to supplement the general provisions by specific rules which can be made rapidly under the more expeditious procedure followed for Ministerial Decrees. Thus it is possible to ensure, in the most satisfactory manner, that safety measures are continuously adapted to technical progress in the manufacture of appliances subject to the supervision of the Association.

With the exception of very small appliances or appliances that are completely safe in operation,

[1] See *Industrial Safety Survey*, Vol. IV, No. 2, March-April 1928, p. 46.

the A.N.C.C. supervises the different stages of manufacture, installation and operation of the following types of pressure appliance: *(a)* steam generators; *(b)* steam receivers; and *(c)* containers for compressed, liquefied and dissolved gases.

Supervision starts in the manufacturer's (examination of materials and appliances during manufacture and when finished) and continues at the user's, first when the appliance is installed and taken into use, and subsequently, during the entire period of use, by means of annual inspections at the place of use.

It should be emphasised that the Association has always sought to carry out its complex and delicate task as if it were offering its members courteous assistance, and not exercising strict discipline and control over them. The members, for their part, have appreciated the aims and benefits of the Association and have responded with real understanding and perfect propriety.

The importance of the task assigned to the A.N.C.C. can be seen from table I, which indicates the number and the distribution of the appliances registered in the years 1939, 1945 and 1947.

TABLE I

Kinds of appliance	1939	1945	1947
I. Appliances in use subject to regulation supervision:			
(1) Steam boilers .	35,300	25,531	29,723
(2) Steam receivers	26,407	25,384	34,225
(3) Gas-pressure vessels	36,604	40,379	55,348
Total . . .	98,311	91,294	119,296
II. Appliances in use totally exempt from regulation supervision, but voluntarily registered	4,398	5,254	4,953
III. Appliances out of use	27,139	52,460	49,982
IV. Appliances exempted	5,450	1,063	3,311
V. Appliances examined when rebuilt or repaired .	13,388	10,784	19,908
Grand total . .	148,686	160,855	197,450

Table II gives a clear picture of the extent and the development of the services rendered by the A.N.C.C. in the war on industrial accidents caused by steam boilers and gas- or steam-pressure appliances.

TABLE II

Types of operation	1939	1945	1947
Hydraulic tests	26,086	17,210	31,516
Internal inspection of appliances	70,650	56,013	76,748
Tests in operation . . .	50,659	29,446	45,717
Other operations (inspections on the spot, hydraulic tests of cylinders and piping, testing of materials, etc.)	230,631	62,829	243,504
Total . . .	378,026	165,498	397,485

But the explanation and the importance of the supervision exercised by the A.N.C.C. are made more clearly apparent by examining the results obtained by the measures taken against those accidents which it is the purpose of the Association to prevent. Out of about 200,000 generators, receivers and cylinders subject to the supervision of the Association in 1947, six caused accidents during that year (one steam generator, two steam receivers, one gas-pressure vessel and two cylinders). It should likewise be added that most of these accidents were caused not by a defect in the construction or operation of the appliance, but by negligence on the part of the persons in charge of their operation or by pure chance.

Organisation of Supervision of Pressure Appliances

As regards the limits and methods of supervision of pressure appliances, the appliances may be classified as follows: *(a)* appliances excluded; *(b)* appliances exempted; *(c)* appliances subject to supervision.

The "excluded" appliances are not subject to any supervision, either because they operate at a pressure below a specified minimum, or because their capacity is lower than a specified minimum, and they are considered to be quite safe.

The "exempted" appliances are those which, although included in the lists of the Association, are exempted from the application of certain rules in the general regulations because of certain characteristics of size or operation. However, they are subject to a series of provisions that regulate the extent of the exemption granted, according to the type, size and the working or operating conditions of the appliances, and affect, according to circumstances, one or more provisions in the general regulations regarding construction, the installation of certain accessories (valves, feeding devices, etc.), or the qualifications required of the persons in charge of operation, or even the periodical inspections.

As regards the "appliances subject to supervision", which constitute the great majority of the appliances subject to full supervision, they must comply with a series of provisions framed and supplemented from time to time to take account of the results of past examinations and technical progress. This supervision is carried out in the following four successive stages.

1. *Inspection and Supervision of Plans*

(a) Calculations. Every manufacturer of pressure appliances is required to submit the plans to the A.N.C.C. for approval. The Association makes all the necessary calculations to verify the strength and the stability of the appliance. The methods of calculation used have been improved as a result of very numerous studies undertaken by different scientists and technical specialists. Such studies are sponsored and co-ordinated by the Association, which gives them publicity in its monthly journal, *Il Calore*. The entire field of pressure-appliance calculations is at present being reviewed in the light of modern construction technique, with special reference to the behaviour of materials at high temperatures. The Technical Council of the A.N.C.C. has set up a committee to draft a new set of regulations concerning verification of the strength and stability of pressure appliances. This text is now under consideration by the different interests concerned; later it will be submitted to the competent Ministries for their approval, and will finally acquire the force of law.

(b) Materials. When a plan for an appliance is examined, the properties of the materials to be used in its construction have to be verified, and it must be determined whether they are suitable for the various parts and satisfy the requirements applying to them. These requirements, which go back to the first years of official supervision, have been gradually developed and improved. In 1939 the entire collection was published in a booklet, " Rules for Acceptance of Iron and Steel Materials for Use in Boilers, Steam Receivers and Compressed-Gas Containers ". The characteristics of these materials have been progressively standardised in Italy by a series of standards issued by the National Association for Industrial Standardisation.

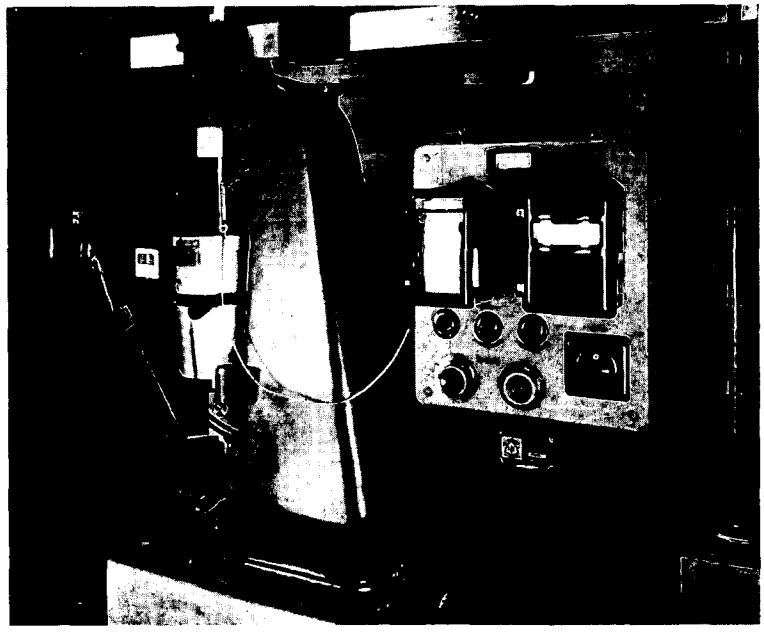
(c) Construction. The rules for calculation as well as those relating to materials form the basis of the rules for construction, which are incorporated in general regulations for the construction of steam appliances.

2. *Inspection and Supervision during Construction*

When examination of a plan shows that a given appliance will satisfy the various requirements mentioned above, the plan is approved and construction of the appliance authorised. The appliance under construction is subject to supervision in the factory in order to verify that the manufacture is carried out in conformity with the plan already approved, and also to ensure that the manufacturing technique is rational, exact and meticulous, up to the highest standards and justified by experience and progress.

A first group of tests naturally concerns the materials used. These tests range from macroscopic examination to chemical analysis. They are designed to determine, *inter alia*, the mechanical characteristics of the materials (tensile strength, apparent elastic limit, elongation, resilience, hardness, weldability, micrographic characteristics, etc.). The tests are carried out in the presence of A.N.C.C. technicians, in laboratories of the large iron and steel works, wherever such laboratories exist.

The Association has, however, set up an Experimental Thermotechnical Centre at its headquarters in Rome, which is responsible more especially for co-ordinating the results obtained in different tests and for making a systematic study of materials to be used in the construction of pressure appliances. The Centre has been



provided with a physical laboratory with the most modern equipment, such as universal machines for testing tensile strength and machines for testing hardness, viscosity of metals (see fig. p. 3) and resilience, as well as graduating benches for electric measuring apparatus, for thermo-electric couples and for pressure gauges and vacuum gauges. For scientific research work the laboratory is also equipped with a Zeiss metallographic microscope, an X-ray apparatus for crystallographic examination, a Zeiss spectrograph and a photometer.

The results of the tests made in the factory laboratories or in the laboratory of the Experimental Centre of the A.N.C.C. are recorded in certificates that form part of the documentation for each pressure appliance. The tests and researches carried out by the Centre have provided the basis of certain regulations.

As soon as construction is begun, each appliance is marked with a serial number and stamped so that it can be identified throughout its existence. At the same time, it is given a register in which are recorded the characteristics of the appliance, and those of the materials of which it is made, the method of manufacture, the results of the factory tests and of all later tests, and examinations in use. Thus the register contains a well-documented "history" of the appliance.

When necessary, there are additional examinations during manufacture (such as X-ray examinations of welding). On the completion of manufacture, the appliance is subject to a thorough internal and external examination, as well as to a hydraulic test carried out in each case in conformity with specific rules.

Other provisions govern imported appliances and appliances for export.

3. *Examination and Supervision* in situ

After the finished appliance has been installed in its place and before it is taken into use, other tests and examinations are carried out on it. The purpose is to see that it has not been damaged during transport and to ensure that it works properly and that its accessories (safety valves, pressure gauges, feeding devices, etc.) are in good order. Special attention is paid to the premises in which steam boilers and pressure vessels are installed.

4. *Examination and Supervision in Use*

All steam appliances (steam generators or pressure vessels) must be inspected periodically at intervals not exceeding 12 months. Normally inspection is made in the following way: one year the apparatus is examined internally and externally when out of use, empty and clean; the following year its proper working, as well as that of its accessories, is verified when in use, and so on alternately. In addition, a hydraulic test is made every ten years.

Appropriate rules apply to appliances that have been repaired or altered, others apply to old appliances.

It is no exaggeration to assert that the supervision exercised over steam boilers and pressure vessels has enabled the A.N.C.C. to gather together a really remarkable documentation on the operation of pressure appliances and thus to make considerable progress as regards their safety.

Training of Persons in charge of the Operation of Steam Generators

In Italy the minding of steam boilers is governed by a certain number of special provisions with a view to ensuring that the operation of this particularly important kind of pressure appliance is carried out under the constant supervision and under the responsibility of persons possessing the requisite theoretical and practical qualifications. Generally speaking, no steam generator can be taken into or retained in use except in the continuous presence of a person at least 18 years of age and possessing a certificate authorising him to tend the type of generator concerned. The A.N.C.C. engineers and the labour inspectors are responsible for supervising the enforcement of these provisions.

Candidates for the certificate must pass a special examination held once or twice a year in the chief cities of Italy by the Ministry of Labour; those successful receive a certificate that specifies the type and power of the boilers that they are authorised to tend. At present there are four kinds of certificates. In order to be allowed to take the examinations, all the candidates must have been apprenticed for periods varying according to the certificates that they already have or the preparatory courses that they have previously followed.

The A.N.C.C. has given special care to the organisation and development of training courses for candidates for steam boiler attendants, and has enabled the candidates to benefit from the wide knowledge of its specialised engineers. After the second World War, the Association felt that this educational task was one of particular importance and urgency, in view of the need to retrain veterans. With the moral and financial support of the Ministry of Labour, it has greatly developed such courses, making a special effort to combine theoretical teaching harmoniously with the practical training of candidates at the actual workplaces.

Highly encouraging results have been achieved, thanks to the experience acquired by the A.N.C.C.

technicians in organising courses and teaching and to the facilities granted to pupils with the help of the Ministry (free distribution of a special manual published by the A.N.C.C., free insurance against accidents that might occur during practical training, various prizes).

During the last two years, the Association has also organised the first courses to be given in Italy for candidates for posts of minders of certain types of industrial furnaces. In spite of the greater complexity of such training, initial results have been satisfactory.

It may be of interest to give some particulars of the 33 courses given in 1947: 26 theoretical courses and four theoretical and practical courses for steam-generator attendants, two theoretical and practical courses for furnace attendants and one for those in charge of sterilising apparatus in hospitals. The total number of pupils registered for these courses was 1,574. The programme for 1948 provided 42 courses.

The A.N.C.C. publishes a propaganda bulletin *(Bollettino)* for workers in thermal installations, and it is distributed to them free of charge through the large and medium-size operators. It contains basic information on accident prevention and thermal engineering, and gives the syllabuses of the different courses. The increasing circulation—9,000 at the present time—justifies its publication and testifies to the interest of the workers in the development of their vocational education.

Accidents Occurring in the Operation of Steam Generators and Pressure Vessels

In spite of all the safety measures applied and the activities displayed in the fields of education and supervision, a certain number of accidents have unfortunately occurred. Although they are very few and generally caused by pure chance, they provide valuable information bearing on the safety of pressure appliances.

After an accident has occurred, the representatives of the A.N.C.C. immediately undertake a thorough investigation of its circumstances and causes. The results of the investigation are sent to the Ministry of Labour and Social Welfare. If necessary, the Association then proceeds to make physical and chemical tests of the materials used in the appliance in question, compare it with other similar installations, analyse the water or other fluid substances utilised in the technological cycle of the installation, etc. The most important cases are examined by a committee composed of university professors, scientists and specialists.

Although the immediate purpose of such investigations and tests is to furnish material for incorporation in regulations that it may seem desirable to issue subsequently, they have the added advantages of providing very valuable data for study by all those concerned with this important aspect of industrial life and, above all, of contributing to the safety of workers and of improving accident-prevention measures.

SAFETY INSTITUTIONS, ASSOCIATIONS AND MUSEUMS

INTERNATIONAL

Fifth International Conference of Directors of Mine Safety Research, Pittsburgh, Pa., September 1948

The series of international conferences of mine safety research institutions, which was interrupted by the recent war, was resumed when the fifth was held at Pittsburgh under the auspices of the United States Bureau of Mines. Delegations attended from Belgium, France, Germany, Poland, United Kingdom and United States. There were discussions on explosives, firedamp, coal-dust explosions, electricity, haulage and mine fires, as well as health and safety generally. In addition to considering numerous papers, the delegates visited the Bureau of Mines experimental coal mine and explosives testing station at Bruceton, Pa., a coal mine, the laboratories of the Bureau of Mines Central Experiment Station, Pittsburgh, and the Mine Safety Appliances Company.

The following are the papers of which preprints have been prepared.

"Ignition of Natural Gas-Air Mixtures by Permissible Explosives during Shot Firing in Creviced Coal Seams", by John Nagy, H. C. Howarth, Irving Hartmann, and H. P. Greenwald.

"Coal Mining Explosives — Present-day Researches of the Safety in Mines Research and Testing Branch, Ministry of Fuel and Power", by W. C. F. Shepherd.

"Sheathed Explosives in Belgium", by J. Fripiat.

"Ignition of Firedamp by Explosives", by Bernard Lewis and Guenther von Elbe.

"The Combustion of Methane Mixtures", by Etienne Audibert.

"Coal-dust Explosions in Wide, Connected Rooms: The Effectiveness of Generalized Rock Dusting and of Bag-type Devices", by Irving Hartmann, H. C. Howarth, and John Nagy.

"Prevention of Coal Dust Explosions: A Survey of Recent British Experience and Research", by F. V. Tideswell.

"Recent Research on Coal Dust Explosibility at the Polish Experimental Mine", by W. B. Cybulski.

"The Courrières Accident: April 19, 1948", by R. Saint Guilhem.

"Flameproof Electrical Apparatus, the Role of Flanges in Conferring Protection. Part I — Experiments with Methane", by G. Allsop and P. B. Smith.

"Research on and Development of Electric Mining Equipment to Promote Safety of Underground Workers", by E. J. Gleim.

"Statistics Applied to the Testing of Fuseheads for Electric Detonators, with an Application to the Rating of Multi-shot Exploders", by G. Allsop.

"Review of Bureau of Mines Work on Use of Diesel Engines Underground", by Martin A. Elliott.

"Coal Mine Inspection and Related Work of the Health and Safety Division of the Bureau of Mines", by J. J. Forbes.

"Tests and Investigations by the Health Branch Relating to Health and Safety in Coal Mines", by H. H. Schrenk.

"Control of Air-borne Dust in Bituminous-Coal Mines in the United States", by C. W. Owings.

"A Method for Estimating the Explosibility of a Mine-fire Atmosphere from its Analysis", by S. H. Ash.

Considerations of space make it impossible to review here the papers presented to the Conference, but it should be said that together they constitute a comprehensive survey of recent research into some of the most important problems of coal mining safety.

Congress of the International Technical Fire Prevention and Fire Fighting Committee

More than one hundred delegates from various countries attended the Congress of the International Technical Fire Prevention and Fire Fighting Committee (C.T.I.F.) at Brussels on 6 and 7 September 1948. The Congress was preceded by a meeting of the Permanent Council which included representatives from Austria, Belgium, Denmark, France, Luxembourg, the Netherlands, Poland, the United Kingdom, and Switzerland. The delegates to the Congress were welcomed by Mr. Vermeylen, Belgian Minister of the Interior.

The International Labour Office was represented by Mr. P. Gherardi, Member of the Industrial Safety Section.

Colonel Maruelle, President of the C.T.I.F., gave a very detailed report on "The International Aspect of Technical Studies respecting Fire Fighting". He pointed out, among other things, that the C.T.I.F. had collected at its headquarters substantial documentation on the prevention and extinction of fire, which was at the disposal of all those who might need it. [1]

Major Morant *(Belgium)* presented a paper on the question of terminology. The elaboration of an international fire dictionary by the C.T.I.F. is being actively pursued. English, French, German, Portuguese, Danish and Dutch texts are at present being used for the dictionary. In addition to the definition of terms, the C.T.I.F. intends to reproduce drawings of the most important items of equipment.

[1] C.T.I.F., Grand Palais, Porte H, Avenue Alexandre III, Paris 8me.

Mr. P. L. van BOVEN *(Netherlands)*, Chief Inspector of the Netherlands Fire Brigades, dealt with "Fire Fighting at Airports ".

Commander MONGODIN, Joint Chief of the Technical Services of the Paris Fire Brigades, made a report on the question of "Safety in the Storage of Hydrocarbons ".

A number of delegates emphasised the necessity for uniform international regulations on the subject, and in view of the urgency of the problem (a large number of new installations have been constructed since the end of the war), the following resolution was unanimously adopted. The resolution was forwarded by Colonel MARUELLE, President of the C.T.I.F. and Mr. André J. L. BRETON, Secretary-General, to the Director-General of the International Labour Office. [1]

Whereas in the field of international safety it is unreasonable that safety regulations should vary from one country to another, and

Whereas there already exist two sets of international regulations applying respectively:

(a) to the transportation of hydrocarbons by rail (Appendix I to the International Convention for the transport of goods by rail); and

(b) to the transport of liquid fuel by inland waterways (International Regulations, The Hague, dated 1 February 1939); and

Whereas the existence of these two suggests the possibility of others also relating to hydrocarbons, *e.g.*, their extraction, processing (refining), transportation by sea and land, handling, sale, use and storage,

The International Technical Committee for Fire Prevention and Fire Fighting at its Congress held in Brussels on 6 and 7 September 1948 expresses the hope that, in order to meet the most urgent need, the International Labour Office may:

(1) prepare a Convention or Recommendation laying down fundamental rules for the protection of the workers in respect of the prevention of fire and the campaign against the outbreak of fire among petroleum products in liquid, solid or gaseous form, especially in refineries and other industries, on airports, etc.;

(2) convene an International Safety Commission to study the technical aspects of this question, and including representatives of the I.L.O. and the International Technical Committee for Fire Prevention and Fire Fighting.

Action of this kind would cover workers employed in the extraction of petroleum products, in refineries, in the transport of goods by sea and land and all the persons employed in the handling, sale, use and storage of hydrocarbons.

Chief Officer MILLS of Newcastle then gave a paper concerning the use of respiratory equipment with liquid air supply.

[1] To give effect to this Resolution, the Governing Body of the International Labour Office decided, at its 107th Session (Geneva, December 1948), that the C.T.I.F. would be represented by a delegate at the next meeting of the Correspondence Committee on Accident Prevention in order to present its views and to furnish all the necessary information on the work that had already been undertaken in this field by the C.T.I.F.

Doctor LIPS, the delegate from *Switzerland*, emphasised the necessity for collecting complete documentation and presented a resolution, which was adopted unanimously, requesting the C.T.I.F. to undertake an investigation in the various countries on the development of fire-prevention and fire-fighting services.

After the working sessions, the delegates visited, among other things, the Port of Antwerp where they examined the organisation of fire-fighting services.

During the course of the visit, it was noted that the workers carrying or handling goods often did not know what these were, since frequently the packages did not bear any indication of their contents.

NINTH INTERNATIONAL CONGRESS ON INDUSTRIAL MEDICINE

The Ninth International Congress on Industrial Medicine, organised by the Permanent International Commission for Industrial Medicine, was held in London from 13 to 17 September 1948. There were 746 delegates from 43 countries and the International Labour Office was also represented. The Conference was divided into nine sections as follows: I. Industrial Medical Services (organisation, training of medical officers, integration with national and community services, medical services in industry); II. Industrial Legislation; III. Environment (architecture, lighting, thermal comfort, applied physiology, air pollution, mining); IV. Industrial Nursing (administration and training); V. Surgical Conditions in Industry; VI. Pneumoconioses and other Lung Diseases; VII. Specific Hazards (radiant energy, electricity etc.); VIII. Toxicology (explosives, new metals, carbon monoxide, solvents); IX. Job Adjustment.

In all, 187 papers were read in the various sections.

In addition to the meetings there were exhibitions, film shows and excursions to places of technical interest such as rehabilitation centres, factories, industrial research units, coal mines and hospitals.

Although the Congress was chiefly concerned with industrial disease problems, a few papers dealt with different aspects of industrial safety and accidents. Dr. I. URBANDT *(Argentina)* read a paper entitled "Regulation of Hygiene and Safety in Factories " in which he defined the scope of safety and health activities and discussed operations with special risks such as exposure to noxious chemicals. Mr. W. GISSANE *(United Kingdom)* spoke on "The Organisation of an Accident Service " for purposes of treatment and rehabilitation. Mr. W. P. D. ROSS *(United Kingdom)* dealt with "The Problem of Burning and Scalding Injuries"; his paper described the work

of the Burn Institute of the Birmingham Accident Hospital and discussed dressings for covering burns and preventing infection. A paper on "Occupational Hazards of Dockers" was read by Dr. G. BUCHANAN *(United Kingdom)*, who discussed port welfare and medical services and the hazards of various types of cargo. Mr. H. W. SWANN *(United Kingdom)*, speaking on "Electrical Accidents", discussed the Electricity Regulations of 1908. A paper on "Prevention of Accidents in the Electrical Industry" was presented by Drs. C. S. DOPFF and A. R. MIRÓ *(Spain)*. Further papers on electricity were read by Dr. M. MARCHAND-ALPHANT *(France)* whose subject was "Pathological Findings in Electrocution with High Voltage Currents"; and by Prof. S. JELLINEK *(United Kingdom)* who spoke on "Faraday Symbols as a Basis of a New Line of Biological Research". Lastly, a paper on "Apparent Death in Industrial Accidents" was read by Dr. S. FABRONI *(Italy)*, describing a method for determining whether a death has actually occurred.

TRIPARTITE TECHNICAL CONFERENCE ON SAFETY IN INDUSTRIAL ESTABLISHMENTS

A Tripartite Technical Conference on Safety in Industrial Establishments was held at the International Labour Office, Geneva, from 27 September to 16 October 1948 to discuss and adopt a Draft Model Code of Safety Regulations for Industrial Establishments.

The preliminary draft of the Code was prepared by Mr. Swen KJAER, former Chief of the Industrial Accidents Division of the United States Bureau of Labor Statistics, with some assistance from the International Labour Office; this draft was then revised by the Correspondence Committee on Accident Prevention, and to some extent also by the Correspondence Committee on Industrial Hygiene. As submitted to the Conference it comprised 229 sets of Regulations, arranged in 16 Chapters as follows: I. General Provisions; II.. Factory Premises; III. Fire Prevention and Protection; IV. Machine Guarding; V. Electrical Equipment; VI. Hand Tools and Portable Power-Driven Tools; VII. Boilers and Pressure Vessels; VIII. Furnaces, Kilns and Ovens; IX. Handling and Transportation of Materials; X. Dangerous and Obnoxious Substances; XI. Maintenance and Repairs; XII. Health Protection; XIII. Personal Protective Equipment; XIV. Selection of Workers; Physical Examination; XV. Medical Aid; and XVI. Safety Organisation.

The Conference was attended by delegates from the following 25 countries: Austria, Belgium, Brazil, Bulgaria, Canada, China, Colombia, Denmark, Ecuador, Egypt, France, Hungary, India, Italy, Luxembourg, Mexico, Netherlands,. Norway, Panama, Poland, Portugal, Sweden, Switzerland, United Kingdom and United States of America. Sixteen countries sent tripartite delegations, eight countries sent governmental delegations and one, Bulgaria, sent one Government delegate and one workers' delegate. In all there were 101 delegates and advisers.

To facilitate discussion, the Code was divided among five Committees. None of the Committees made any fundamental changes in the structure or nature of the Code, but there were very numerous changes in the different provisions of the text. On a few provisions the Conference did not reach a final decision and the Governing Body of the International Labour Office has authorised the Office to refer them to small bodies of experts.

The matters on which the Office will consult experts are electrical equipment (Chapter V), certain toxic substances (Chapter X) and dangerous radiations. Arrangements have been made for all three groups of experts to meet at Geneva early in 1949. When they have completed their work the Code will be laid before the Governing Body of the Office.

It was the general understanding of the Conference that the Code, or parts of it, would require to be revised from time to time in the light of technical advances, and that the work of revision might suitably be undertaken by Committees of experts and, more particularly, the Correspondence Committees on Accident Prevention and Industrial Hygiene. It would not be practicable to reprint the entire Code at frequent intervals, but amendments to particular Regulations could be distributed to Governments as they were approved by the experts, under any procedure that might be decided upon by the Governing Body.

In addition to revising the Draft Model Code, the Conference considered and adopted a number of Resolutions bearing on industrial safety and health. These Resolutions read as follows:

I

The Technical Tripartite Conference on Safety in Factories (Industrial Establishments) requests the Governing Body of the International Labour Office to examine the possibility of instructing the Office to prepare a Draft Model Code of Safety Regulations for Commercial Establishments, which should be examined, at the earliest possible date, by the Correspondence Committee on Accident Prevention.

II

The Tripartite Technical Conference on Safety in Industrial Establishments,

Considering that it would be of great value to illustrate the provisions of the Model Code of Safety Regulations for Industrial Establishments by the separate issue of an appendix containing photographs, drawings and explanations of various safety installations, appliances and devices,

Considering that, while the provisions of the Model Code will probably be valid for a fairly long

period, machinery, installations and safety devices may change much more rapidly owing to technical progress, and that such an illustrated appendix should therefore be kept up to date by the publication of successive editions, in which the documents reproduced should be dated,

And considering that such an illustrated appendix would prove of great value and assistance to all those who are charged with the responsibility of safety in industry — factory inspectors, industrialists or safety delegates — making use of the Model Code, by providing them with concrete examples of the manner in which its provisions can be applied,

Requests the Governing Body of the International Labour Office to consider the possibility of instructing the Office to take the necessary steps for the publication of successive editions of an appendix containing photographs, drawings and explanations of safety installations, appliances and devices.

III

The Tripartite Technical Conference on Safety in Industrial Establishments requests the Governing Body of the International Labour Office to examine the possibility and desirability of having the Office prepare a Convention prohibiting the sale and hire of machinery and other equipment that is not properly protected.

IV

Whereas the Model Code that it has adopted provides for the employment of specialised personnel possessing the indispensable experience and technical knowledge for the performance of numerous operations presenting special risks;

Whereas in general instruction and education in the domain of industrial safety and health are the best means of arousing the workers' interest in these problems and that no really effective action can be taken without the wholehearted collaboration of the workers themselves;

Whereas the measures taken in several countries to provide workers with suitable instruction have already given excellent results;

Invites the Governing Body of the International Labour Office to consider the possibility of:

(1) drawing the attention of Governments, Employers' organisations and Workers' organisations to the importance of the questions referred to above, and to the need for taking positive measures to deal with them as promptly as possible;

(2) examining the practical means by which Governments, Employers' organisations and Workers' organisations may, in the course of the next few years extend education in the domain of industrial safety and hygiene to all persons working in dangerous conditions;

(3) recommending to Governmen's, within the limits to be determined by the competent authority of each country, the introduction of officially supervised apprenticeship followed by compulsory examinations in matters of industrial safety and certificates recording these examinations, for all workers who, by reason of their occupation, have to perform particularly dangerous work, for instance, the operation and maintenance of boilers and industrial furnaces.

International Labour Office: Meeting of Experts on Safety in Coal Mines

A meeting of experts was held at the International Labour Office in Geneva from 31 January to 5 February 1949, to continue the preparation of the Draft Model Code of Safety Regulations for Underground Work in Coal Mines, which had been left incomplete on the outbreak of war, so as to provide a text for submission to a Tripartite Technical Conference to be held in the autumn.

The following experts were present:

Mr. N. Barraclough, Chief Inspector of Mines, India.

Mr. A. M. Bryan, Chief Inspector of Mines, United Kingdom.

Mr. John Crawford, Chief Inspector of Mines, Alberta, Canada.

Mr. C. F. Davis, Director of the Safety Division, United Mine Workers of America, United States.

Mr. P. de Haart, Chief Inspector of Mines, Netherlands.

Mr. Joseph Martens, Divisional Inspector of Mines, Belgium.

Mr. H. le Sueur, Chief Inspector of Mines, France.

Mr. Stanislas Nizinski, Engineer, Warsaw, who had been nominated as an expert by the Polish Government, was unable to attend.

The International Labour Office was represented by:

Mr. D. Vaage, Chief of the Safety Section, Mr. E. Gherardi and Mr. J. E. Wheeler.

Mr. Bryan was unanimously elected Chairman.

The Draft Model Code of Safety Regulations consists of 24 chapters as follows: I. General Rules; II. Means of Access and Egress; III. Maps and Plans; IV. Explosives; V. Shotfiring; VI. Supports; VII. Haulage of Material; VIII. Travel and Transportation of Workers on Roads and Inclines; IX. Winding of Men and Materials; X. Ventilation; XI. Precautions against Firedamp; XII. Precautions against Coal Dust; XIII. Miners' Lamps; XIV. Precautions against Inrushes of Water; XV. Prevention and Extinction of Mine Fires; XVI. Shaft Sinking or Deepening; XVII. Electricity; XVIII. Machinery and Plant; XIX. Qualifications and Duties of Managing Officials, Supervisory Officials and Miners; XX. Notification, Investigation and Recording of Accidents and Dangerous Occurrences; XXI. First Aid and Rescue; XXII. General Inspections by Managers and Supervisory Officials; XXIII. Safety Organisation; and XXIV. Miscellaneous.

The experts very carefully considered those provisions of the Code which were still under discussion in 1939 and reached agreement on all of them, with the exception of those relating to electricity.

The experts felt that they were not fully competent to discuss the electrical provisions of the Code, and recommended that the Governments of the countries represented at the Tripartite

Technical Conference should be asked by the Office to include in their delegations to the Conference experts qualified to deal with this subject, and that these experts should meet two or three days before the Conference to prepare the text of these provisions for submission to the Conference.

In addition to redrafting numerous provisions, the experts added a set of rules for the prevention of mine fires due to conveyors, a serious risk that has developed since the Code was drafted in 1939.

The Code as amended by the experts will in due course be distributed to the Governments of the States Members of the International Labour Organisation, together with a report on the law and practice relating to safety in coal mines, which will constitute a revision of that published by the Office in 1939. [1]

AUSTRALIA

National Safety Council of Australia

Report for 1947-1948 [2]

The 21st Annual Report of the National Safety Council of Australia indicates that the activity of the previous year was not merely maintained but intensified in the fields of road transport and aviation.

The activity of the Industrial Safety Committee was devoted mainly to the publication of various pamphlets, the periodical *Safety News*, 65,120 posters and 1,230,000 pay-envelope inserts which were distributed in factories and workshops. In addition, the Committee continued to co-operate with the Australian Standards Association in the formulation of safety standards. It also examined, before publication, the regulations issued by the Victorian Department of Labour respecting the manufacture, use and storage of nitrocellulose products.

The Council undertook a study of accidents occurring on the way to or from work, which indicated that the greatest number of accidents occurred to persons using bicycles.

In October 1947, the Sydney Branch of the Council entered an industrial safety exhibit in the Local Health and Safety Exhibition.

The Traffic Committee carried on intensive propaganda activities and examined a number of questions within its competence.

The report also contains summaries of the activities of the Home and Air Safety Committees.

[1] Cf. *Safety Provisions for Underground Work in Coal Mines*: Vol. I : Legislation, Geneva, 1939.

[2] For 1946-1947, see *Industrial Safety Survey*, Vol. XXIV, No. 1, p. 14.

BELGIUM

Work of the National Institute of Mines in 1946 [1]

The Institute's report for 1946 deals with explosives and detonators, flame lamps, portable electric lamps, flameproof equipment, measures against dust and various laboratory researches.

Under the head of explosives and detonators the report describes a number of accidents caused by shotfiring, and discusses sheaths, various defective conditions in shotfiring, gases given off by explosives, detonators of various types, and a new type of ohmmeter.

In connection with lamps an account is given of an accident due to a defective petrol lamp, and of researches on the ignition of firedamp by portable electric lamps, and the ignition of explosive gases in these lamps. As regards these gases the researches were concerned with the tightness of the lamps, ignition by sparks from batteries, and gaseous discharges from alkaline lamps after charging.

In connection with flameproof equipment, information is given on fluorescent lighting.

The Scientific Research Laboratory studied various aspects of the combustion of methane.

Annexed to the report are studies on dust masks, the ignition of methane in an ionised atmosphere and the humidification of explosives.

A New Safety Magazine

In January 1947 the Antwerp Safety Museum began the publication of a small safety magazine called *Doe het veilig* (Do It Safely). It is issued in Flemish every two months and each number contains 16 pages. The contents comprise articles, notes, reviews of books, etc., and posters.

The purpose of the magazine is explained in an introductory note which refers to the large numbers of accidents that occur every year, their social and economic costs, and their unhappy consequences for the victims. Regulations and inspection alone have not sufficed to make accidents infrequent; a large part must be played by education and propaganda, and it is to these that the magazine intends to make a contribution.

The International Labour Office welcomes the appearance of *Doe het veilig* and wishes it every success in the fulfilment of its mission.

Twenty-First Congress on Industrial Chemistry [2]

The Congress, organised by the Association of Industrial Chemistry in collaboration with the

[1] *Annales des Mines de Belgique*, Année 1947-48, Tome XLVII, 1e livraison, p. 1 ; for 1944-45, see *Industrial Safety Survey*, Vol. XXIV, No. 2, p. 70.

[2] *Chimie et Industrie*, Special Number, Sept. 1948.

Federation of Belgian Chemical Industries, was held at Brussels from 11 to 19 September 1948. It was composed of 24 sections divided into seven groups.

More than 200 papers were read during the Congress. A brief mention of those dealing with hygiene and safety (Section 23) is given below:

"Organisation of a First Aid Service for Persons Suffering from Paralysis of the Respiratory Organs", by G. COPPEE.

"Carbon Disulphide Poisoning", by E. MERLEVEDE and F. POTTIEZ. (New methods for measuring carbon disulphide in the air and in physiological liquids; new researches on the mechanism of carbon disulphide poisoning and biological results; the problem of the antidote for CS_2.)

"Reflections and Comments on Four Thousand Cases of Systematic Radiographic Diagnosis in a Group of Workers Employed in Various Industries", by J. DETHIER.

"Safety in the Chemical Industry", by M. LEPAGE. (Analysis of typical accidents; risks inherent to maintenance work; housekeeping; education of the personnel; the problem of newly employed persons.)

"Non-destructive Application and Testing of Materials in the Chemical Industry", by Y. VERWILST. (Nature and importance of defects found in the materials used in the chemical industry; defects of homogeneity: cracks, flaws, blisters, pipes, inclusions, etc.; structural defects: strain hardening, brittleness, fatigue; methods and equipment used; examples of industrial application.)

"Occupational Poisoning by Beryllium", by H. BASTENIER.

A number of visits to plants and various excursions were included in the programme of the Congress, which was a great success.

TWO-WEEK CAMPAIGN FOR SAFETY, HEALTH AND EMBELLISHMENT OF WORKPLACES, 5-19 OCTOBER 1947

The papers read during this campaign, which has already been mentioned in the *Industrial Safety Survey* [1], have recently been published as a volume of 369 pages. [2]

The 33 papers forming the volume are grouped under four headings: general topics, safety, health and embellishment.

An introduction mentions the vastness of the field of industrial safety and health and explains that the campaign was conceived as a means of spreading enlightenment, which is something that even the most comprehensive regulations cannot do. This theme was developed by the Minister of Labour and Social Welfare, Mr. TROCLET, who quoted accident statistics, explored accident causes and explained what had been done and what still remained to be done in Belgium to improve conditions of employment in general and safety and health conditions in particular.

Most of the general papers were largely concerned with safety. Special mention may be made of those by Mr. DREES, Netherlands Minister of Labour, who gave a general outline of safety activities in his country; Mr. VAAGE, Chief of the Safety Section of the International Labour Office, who dealt with national and international collaboration in the safety field, with special reference to the work of the International Labour Organisation; Mr. LAFARGE, of the French Ministry of Labour and Social Security, who traced the growth of French industrial safety and health legislation; and Mr. FINET, Secretary General of the Belgian General Confederation of Labour, who dealt with the role of the trade unions in the domains of safety, health and embellishment.

The following papers were wholly concerned with industrial safety:

"Organisation of Safety", by Mr. LEPAGE, Belgian Manufacturers' Association.

"Importance of the Human Factor in the Prevention of Industrial Accidents", by Mr. DE SAINT HUBERT, Belgian Industrial Federation.

"The Technique of Industrial Accident Prevention", by Mr. NICAISE, Belgian Chemical Union.

"The Lighting of Industrial and Commercial Premises", by Mr. DE REES, Director of the journal *Prevention des Accidents et Contrôles Techniques*.

"The Importance of the Human Factor in Protection against Industrial Accidents", by H. VERSCHUEREN, Belgian Industrial Federation.

"Is Safety a Necessity?", by H. VAN DEN BULCKE, Chief of the Central Safety Service of the Fabelta undertaking.

"Work and the Main Aspects of Safety", by Dr. A. SALMONT, Professor at the National Conservatoire of Arts and Crafts, Paris.

"Psychic Enemies of Safety in Factories" by Mr. H. J. LAST.

The general standard of the papers is high and the volume is a valuable addition to safety literature.

FRANCE

FRENCH MANUFACTURERS' ASSOCIATION FOR THE PREVENTION OF INDUSTRIAL ACCIDENTS

General Assembly of 24 March 1948 [1]

The minutes of this Assembly include a report on the work undertaken by the French Manufacturers' Association during its 64th year of activity ending 31 December 1947.

As in the past, the Association carried out inspections in the undertakings of its members. It intensified its activity within the safety committees of the member factories and succeeded

[1] Vol. XXIV, No. 2, p. 49.

[2] *Quinzaine de la sécurité, de l'hygiène et de l'embellissement des lieux de travail, 5-19 octobre 1947.* Brussels, 1948.

[1] *Protection, Sécurité, Hygiène*, May-June 1948, p. 41.

in putting into effect a number of safety programmes of interest to large undertakings and various unions.

In addition to the existing service for the testing of ropes and chains, of oxy-acetylene installations and of fire extinguishers, a service for the testing of hoists and lifts and a service for the testing of presses were created to give effect to recent decrees.

The Association continued the publication of its pamphlets and safety posters.

It should be added that the Safety Congress of the Association, which meets every two years, took place in June 1947. A number of foreign delegates took part and the Congress was very successful.

ITALY

Italian Centre for Safety Officials [1]

An Italian Centre for Safety Officials *(Centro italiano degli addetti alla sicurezza)* was founded in Rome in 1948 under the auspices of the National Institute for Accident Prevention Propaganda.

The Centre unites safety committees and safety officials of small, medium and large industries. By 30 June 1948 it had a membership of 2,578 safety officials and 119 safety committees. The principal aims of the Centre are to encourage the appointment of safety officials or safety committees within industrial undertakings (this is not compulsory in Italy) by using its influence with employers and workers and to ensure the technical training of its members by means of special courses, etc.

The Centre publishes a monthly periodical entitled *Foglio Notizie* containing information respecting industrial safety and hygiene. In addition the Centre holds periodic meetings of its members to examine problems of common interest. The first inter-regional congress for Northern Italy was held at Milan from 17 to 19 October 1948; for Central, Southern and Insular Italy a congress was held at Naples from 7 to 9 November.

In view of the very rapid development of the Centre and the necessity of continuing to extend safety organisation, a Provisional Administrative Committee has been set up. This Committee is composed of representatives of the Ministries of Labour and Industry, of the General Confederation of Italian Industry, of the Italian General Confederation of Labour, the National Accident Insurance Institute, the Federation of Industrial Managers and the Italian National Rationalisation Institute.

[1] Information communicated by the I.L.O. correspondent in Rome.

LUXEMBOURG

Accident Insurance Association

Report for 1947

The Accident Insurance Association recorded 12,264 accidents in 1947 (of which 752 occurred on the way to or from work) as compared with 9,589 in 1946.

In 1947, 8,370 undertakings were affiliated to the Association.

The number of fatal accidents rose to 34 (of which 10 occurred on the way to or from work).

The Association's activity in the field of accident prevention consisted in making inspections, undertaking investigations, giving lectures and beginning the revision of safety provisions which date back to 1929.

NETHERLANDS

Veiligheidsmuseum, Amsterdam

Annual Report, 1947

During the year Mr. R. A. Gorter, who had been director of the museum since 1921, retired, and was replaced by Mr. R. C. van Ree, Labour Inspector. A warm tribute is paid to Mr. Gorter for his services both to the museum and to industry generally during his 26 years of office.

Numerous additions were made to the exhibits, the library and collections of lantern slides and blocks.

De Veiligheid, the safety journal published by the museum, was restored to its pre-war size of 16 pages.

The museum continued to furnish advice to industrial undertakings in matters of safety and health. Some 200 requests for advice were dealt with in 1947.

There were 266 collective and 4,723 individual visits to the museum, the total number of visitors being 11,214. The corresponding averages for 1935-1939 were 166, 4,997 and 9,016. Groups came from ordinary and technical schools, industrial undertakings, the Labour Inspectorate, the Police Force, and cultural and recreational societies.

The Advisory Committee on Safety and Health, attached to the museum, continued to hold discussion meetings, and a group of safety technicians was formed to study questions within their field and to exchange views.

SWEDEN

Industrial Accidents in Engineering Undertakings in 1947 [1]

The Swedish Engineering Trades Association has compiled statistics of industrial accidents

[1] *Verkstäderna*, No. 9, 1948, p. 182.

that occurred in the undertakings of its members in 1947. These statistics indicate an increase in the frequency of accidents. In 1945, the frequency rate of accidents was 15 for every 100 full-time workers (man-years); this rose to 16 in 1946 and to 16.9 in 1947.

The causes of the 14,495 accidents examined are distributed as follows: knocking against objects and objects falling, 18.6 per cent.; slipping, 14.6 per cent.; sharp objects, 12.9 per cent.; machine tools, 19.6 per cent.; hot substances 6.7 per cent.; hand tools, 5.1 per cent.

The number of accidents due to machine tools decreased thanks to the improvements made in protective devices. In fact, in 1943, 23.9 per cent. of all accidents were caused by machine tools.

Association for the Supervision, etc., of Pressure Vessels [1]

The Pressure Vessel Committee set up four years ago for the purpose of drawing up standards for the calculation, manufacture, testing and inspection of pressure vessels was converted in June 1948 into a permanent association in order to enable it to undertake the steadily increasing tasks entrusted to it.

Labour Protection Committee: Enquiry concerning Works Safety Organisation [2]

An enquiry undertaken by the Labour Protection Committee among 3,751 undertakings employing 445,000 workers, or about two thirds of the total, shows that there are 14,320 workers' safety delegates in these undertakings. It is estimated that the number in all Swedish industries is between 25,000 and 30,000.

Only a few undertakings among those covered by the enquiry have no safety committee and they are ones with low accident risks. Of the other undertakings where the setting up of safety committees is not compulsory, 271, or about 10 per cent. of the total, have a committee. Somewhat over half the members of the committees are workers, usually safety delegates.

Regulation meetings seem to have been held by about 70 per cent. of the committees.

There appears to be a general desire among smaller undertakings for more effective official inspection with more frequent visits by inspectors than hitherto. In some undertakings the safety delegates desire to collaborate with those of neighbouring undertakings. In 484 undertakings there is a special safety inspector.

The general conclusion drawn from the enquiry is that safety services are fairly well organised in undertakings employing over 100 workers.

[1] *Verkstäderna*, No. 9, 1948, p. 184.
[2] *Gjutaren*, Christmas No. 1948, p. 3.

UNITED KINGDOM

National Industrial Safety Conference, 1948

The proceedings of the Conference, which have already been reviewed in the *Industrial Safety Survey* [1], have been published as a booklet of 64 pages by the Royal Society for the Prevention of Accidents. It contains the text of the papers read on management's responsibility for accident prevention, safety officers, the maintenance of chains and lifting tackle, material handling, and chemical risks in non-chemical works.

UNITED STATES OF AMERICA

The National Sand and Gravel Association [2]

Safety Competition, 1947

The winners in the Association's annual safety competition are the Marquette plant of the Marquette Cement Manufacturing Company at Memphis, Tennessee, in the group working 100,000 man-hours or more, and the Works No. 9 plant of the Pittsburgh Plate Glass Company at Crystal City, Missouri, in the group working less than 100,000 man-hours. The former worked 126,483 and the second 88,238 man-hours without any disabling injuries.

Out of 68 competing plants, 20 are reported to have operated during the whole year without any lost-time accident. Tables included in the report show that, since the inception of the contest plan 19 years ago, for all the competing plants the frequency rate dropped from 74.350 to 28.169, and the severity rate, from 9.713 to 3.338 in 1947. The average frequency and severity rates for this same period of years are 33.197 and 4.672 respectively.

During the year 1947, 132 lost-time injuries were recorded for the 68 plants, the most prolific causes being falls of persons (14 injuries), handling objects (9 injuries), falling objects (8 injuries) and machinery (8 injuries).

President's Conference on Industrial Safety

In September 1948, the President of the United States, deeply concerned about the heavy yearly financial and human loss caused by industrial injuries, called a preliminary conference of representatives of State Governments, labour, management and safety organisations to plan concen-

[1] Vol. XXIV, No 3, p. 93.
[2] U.S. Bureau of Mines: *Mineral Industry Surveys*, U.S.S., No. 380.

trated and co-ordinated action for the promotion of an effective nation-wide accident prevention programme.

As a result of this organisational conference, a Co-ordinating Committee was formed to sketch a plan of proceedings. Among other suggestions, the Committee proposed to broaden the scope and extend the protection of workmen's compensation laws, to foster closer co-operation between labour and management in accident prevention, to hold training courses for State factory inspectors and to revise State accident prevention laws and enforcement procedures for the safeguard of the nation's manpower supply.

Seven committees were appointed, to deal with Programmes and Services; Education; Labour-Management Co-operation for Safety; Laws and Regulations; Accident Records, Analysis and Use; Engineering; and Research. These committees in turn were subdivided into working units, the reports of which were to constitute the basis for further study by all committees in their respective fields of endeavour during interim sessions held before a General Safety Conference to be convened by the President in March-April 1949.

Congress of Industrial Organizations: Resolution on Industrial Safety and Health [1]

The National Convention of the Congress of Industrial Organizations which met at Portland, Oregon, in November 1948 adopted the following resolution on industrial safety and health:

The appalling toll of life and limb levied every year on the American people through lack of adequate industrial safety and health programs, constitutes an indictment of American industry. More than 17,000 workers are killed each year; an additional 90,000 are more or less permanently disabled; two million more workers are injured to an extent that takes them away from their jobs. The accidents that kill and maim these American workers do not just happen; they are caused.

Directly involved in the pain and hardship of the victims are their wives and children.

Wholly aside from these paramount human considerations is a loss in production that challenges the boasted efficiency of American industrial management.

When the monetary loss is considered, we find lost wages, medical expenses and workmen's compensation running close to one billion dollars per year.

This indecent toll of life, limb, human suffering and money cannot be eliminated merely by the enactment of laws. The record reveals that 99 per cent. of all industrial accidents and diseases involve no violation of statutory law. While it is imperative that we have adequate legislation to provide mechanisms for insuring the safety and well-being of workers, such laws will not, of themselves, effect a solution.

Direct participation of all the people in proper industrial safety programs will provide the only solution to this national problem.

The Congress of Industrial Organizations has consistently urged upon industrial management the need for full co-operation between management and labor for the enactment and carrying out of sound industrial safety programs, but too many employers deliberately blind themselves to one side of the problem.

They maintain that industrial safety is a sole prerogative of management, and they cite their money expenditures to support their contention. They completely ignore the expenditures that workers make each year in lives and limbs and blood for lack of adequate co-operative safety programs.

President Truman has already given full recognition to the need for co-operative effort by all the people to solve these problems of industrial health and safety. Early this year, the President called a National Conference on Industrial Safety.

The preliminary meeting of the Conference was held in September, at which time plans were drafted for the full national conference to be held in the City of Washington next March under the auspices of the United States Department of Labor.

THEREFORE, BE IT RESOLVED

1. That we call upon American management to join with us wholeheartedly through joint management-labor committees at the plant level to institute safety and healthful working conditions throughout all industry.
2. That we commend President Truman for assembling the first national Conference on Industrial Safety in the history of our country.
3. That we call upon the 81st Congress to restore to the Bureau of Standards, U.S. Department of Labor, the appropriation that was eliminated by the 80th Congress for the training of State Factory Inspectors, and to provide additional appropriations to expand the training program.
4. That we call upon the respective State Legislatures to enact needed industrial safety and health laws to be administered by an adequate and qualified staff of inspectors.
5. That we urge all of our C.I.O. affiliates to participate as fully and directly as possible in the President's Conference on Industrial Safety to be held in the City of Washington in March 1949.

[1] *International Woodworker*, 29 Dec. 1948, p. 5.

LAWS AND REGULATIONS, SAFETY CODES

ARGENTINA

Decree No. 23660 respecting Safety Measures in the Glass Industry Dated 7 August 1948 [1]

This Decree, consisting of 61 Sections, lays down safety requirements for ventilation, lighting and cleanliness, and the conditions to be fulfilled by workplaces allotted for the preparation and mixing of raw materials used in the manufacture of glass, as well as the measures to be taken for the protection of machinery and the collection of dust and particles.

With respect to the ventilation of premises where melting ovens are installed, the Decree provides that the area of the natural ventilation openings of such premises shall be equivalent to at least one fourth of the floor area.

BELGIUM

Belgian Manufacturers' Association

The Belgian Manufacturers' Association has published the following safety codes for the use of workers:

Safety and Health Code for the use of Spray Painters (No. 021).
Safety Code for the Use of Workers employed at Circular Saws (No. 026).
Safety Code for the Use of Workers employed at Band Saws (No. 027).
Safety Code for the Use of Workers employed at Overhand Planers (No. 028).
Safety Code for the Use of Workers employed at Spindle-Moulding Machines (No. 029).
Safety Code for the Use of Workers Called Upon to Move along Rail Tracks (No. 030).
Safety Code for the Use of Workers employed at Presses (No. 031).
Safety Code for the Use of Goods Hoists Attendants (No. 033).
Safety Code for the Use of Lift Attendants (No. 034).
Safety Code for the Use of Grinders (No. 035).
Safety Code for the Use of Persons employed along Rail Tracks (No. 036).
Safety Code for the Use of Level-Crossing Keepers (No. 037).
Safety Code for the Use of Attendants of Oil-Fired Steam Boilers (No. 038).
Safety Code for the Use of Firemen for Coal-Fired Industrial Boilers (No. 039).

Each Code is divided into four chapters: A. Regulations (list of the principal legislative texts concerning the subject dealt with); B. General Recommendations; C. Safety Code; D. Dangers resulting from the non-observance of the Safety Code.

[1] Information communicated by the I.L.O. correspondent in Buenos Aires.

Decree of the Regent amending the Provisions Governing Calcium Carbide Depots, Acetylene Generators and the Use of Blowpipes, forming the Subject of Sections 284 to 319 inclusive of the General Regulations for the Protection of Labour. Dated 17 August 1948 [1]

The provisions governing calcium carbide depots, acetylene generators and the use of blowpipes, forming the subject of Sections 284 to 319 inclusive of the General Regulations for the protection of labour approved by the Decree of the Regent dated 27 September 1947, have been replaced by the provisions of the present Decree.

The sections concerning limits of pressure and temperature to which acetylene installations may be subjected are partly reproduced below.

Section 292.

. . . . . .

For the purposes of this Decree generators shall be divided into the following categories:

1. low-pressure generators in which the maximum effective pressure in no case exceeds 50 g/cm²;

2. medium-pressure generators in which the maximum effective pressure is between 50 and 500 g/cm²;

3. high-pressure generators in which the effective pressure of the acetylene exceeds 500 g/cm².

. . . . . .

Section 295.

Generators shall be constructed:

. . . . . .

(b) in such a manner that under any conditions of operation and at any moment during the consumption of the charge, the temperature in the mass of calcium carbide in the process of decomposition cannot exceed 120° C. and the temperature of the cooling water of the generators can never, at any point, exceed 80° C.

. . . . . .

Section 299.

All parts of medium and high-pressure generators subjected to gas pressure shall be calculated in such a manner that the tensile stress in the metal shall at no point exceed a tension of 25 kg/mm², for steel of an ordinary quality, at an internal pressure equal to eleven times the absolute maximum operating pressure. High-pressure generators shall be capable of withstanding, without leakage or permanent deformation, a hydraulic test under an effective pressure of 6 kg/cm².

[1] *Moniteur belge*, No. 238, 25 Aug. 1948, p. 6889; for the General Regulations for the Protection of Labour, see *Industrial Safety Survey*, Vol. XXIV, No. 1, p. 17.

ORDER AMENDING SECTION 549 OF THE GENERAL REGULATIONS FOR THE PROTECTION OF LABOUR RESPECTING THE MARKING OF WEIGHT ON HEAVY PACKAGES TRANSPORTED BY VESSELS [1]

This Order amends Section 549 of the General Regulations for the Protection of Labour so as to bring it into line with the provisions of the Convention (No. 27) concerning the marking of the weight on heavy packages transported by vessels, adopted by the International Labour Conference in 1929.

Section 549 did not require the weight to be indicated on objects and has not been amended to make the marking compulsory.

BRITISH DEPENDENT TERRITORIES

Mauritius

THE FACTORIES (GENERAL HEALTH PROVISIONS) REGULATIONS, 1947. DATED 21 NOVEMBER 1947 [2]

These Regulations contain a number of provisions respecting cleanliness, cubic air space, ventilation, lighting, sanitary installations, dressing rooms, messrooms and first aid.

THE FACTORIES (ALOE FIBRE) REGULATIONS, 1947. DATED 21 NOVEMBER 1947 [3]

The provisions of these Regulations deal with the protection of machinery used in the manufacture of aloe fibre and in particular the arrangement of the feed openings of the machines.

THE FACTORIES (TANNING) REGULATIONS, 1947 DATED 21 NOVEMBER 1947 [4]

These Regulations contain general provisions respecting first aid, sanitary installations and messrooms. They are accompanied by an annex indicating the various processes employed in tanning and the protective clothing that the employer is required to provide for each process.

THE FACTORIES (AERATED WATERS) REGULATIONS, 1947. DATED 21 NOVEMBER 1947 [5]

These Regulations lay down the safety measures to be taken by employers and employees in factories where aerated water is manufactured.

[1] *Moniteur belge*, No. 296, 22 Oct. 1948, p. 8647; for the General Regulations for the Protection of Labour, see *Industrial Safety Survey*, Vol. XXIV, No. 1, p. 17.
[2] *Legal Supplement to the Government Gazette of the Colony of Mauritius*, No. 90, 6 Dec. 1947, p. 441.
[3] *Idem*, p. 446.
[4] *Idem*, p. 448.
[5] *Idem*, p. 450.

Trinidad and Tobago

BOILERS REGULATIONS. DATED 24 AUGUST 1948 [1]

The Regulations provide for the establishment of a Boiler Examiners Board and for the appointment of boiler examiners who are to examine and test steam boilers. Rules are also laid down for the examination of boilers and for the reporting of boiler explosions.

BULGARIA

ACT AMENDING AND COMPLETING THE INDUSTRIAL SAFETY AND HYGIENE ACT DATED 27 SEPTEMBER 1948 [2]

This Act, consisting of eight sections, modifies and supplements the Act on Industrial Safety and Hygiene.

The amendments, required by the new social structure of the country, are of an administrative nature.

The new provisions deal with the compulsory supplying of working and personal protective clothing, medical examination at the beginning of employment, the transfer of workers from one job to another when their health requires it, and the establishment of a dental surgery in industrial undertakings.

In conclusion, the Act deals with the election and duties of the labour inspectors chosen from among the workers.

CUBA

DECREE No. 2318 RESPECTING INDUSTRIAL HYGIENE. DATED 5 JULY 1948 [3]

This Decree brings into force industrial hygiene regulations, which are divided into eleven Parts and 133 Sections.

The first Part lays down general measures of hygiene for workplaces and determines the classification of workplaces and the requirements which installations and buildings must fulfil.

Part II is devoted to natural and artificial ventilation, the temperature and humidity of workrooms, work in compressed air, and lighting both for day and night work.

With respect to noise at workplaces (Part IV) the regulations lay down a number of general provisions dealing with the installation of machines in workrooms; isolation with noise-proof substances; selection of personnel, taking into

[1] Government Notice, No. 154 ; Supplement to the *Royal Gazette*, Vol. 117, No. 76, 16 Sept. 1948.
[2] *Drjaven Vestnik*, No. 226, 27 Sept. 1948 ; for the Act concerning Industrial Health and Safety, see *Industrial Safety Survey*, Vol. XXIII, No. 3, p. 94.
[3] *Gaceta Oficial*, Vol. XLVI, No. XIV, dated 16 July 1948.

account the possibility of injury to hearing; prohibition of the use of whistles or sharp or penetrating sounds to signal working hours; location of the hospitals, clinics and other centres for treatment and of the living quarters for workers with regard to the noises of the factories; transportation of raw material; and the provision by the employer of equipment for the protection of hearing.

The regulations include the following provisions respecting noisy industries:

Sec. 58. The National Board for Industrial Hygiene shall determine in the case of each particular worker the appropriate measures to be taken for protection against noise, including the reduction of working hours in industries particularly requiring it.

Sec. 59. The Department of Hygiene and Social Insurance of the Ministry of Labour shall make a study of the influence of the wave length or intensity of sound waves on industrial hygiene, and in particular, the effect of noise on the human organism through the air and the outer ear and through the bone structure of the skull, and shall compile all possible clinical data on the injuries that such noise might cause to the hearing and to the nervous system. Among the former injuries is degenerative cochlear neuritis to which employment for many years in noisy occupations contributes. In the second group fall functional disturbances of the nervous system caused by the constant nervous excitement incited by disagreeable noises, vibrations through the bone structure and by the effort of concentration resulting in irritability, loss of energy and fatigue.

The provisions respecting sanitation (Part V) include measures concerning the cleanliness of the personnel, drinking water, sanitary conveniences, change of clothing, lunch rooms, temporary dormitories, living quarters for permanent workers, the disposal of waste, and warning signals for noxious substances and unpleasant odours.

Part VI deals with hygiene measures for particular workplaces or occupations such as tobacco and cigar factories, foundries, public performances, and transportation. Provisions are also included in this Part for the drawing up of occupational aptitude certificates.

The provisions concerning medical services (Section VII) determine the number of resident doctors and male and female nurses in accordance with the number of persons employed in the working centres, the duties of the industrial doctors and of the auxiliary medical personnel.

The organisation and function of the National Board of Industrial Hygiene are laid down in Section VIII.

The remaining Parts of the Regulations deal with enforcement, declaration in cases of non-compliance, posting of the regulations, and the places in the working centres where the regulations should be posted.

Decree No. 3104 respecting Safety Measures for Cinematograph Operators' Cabins. Dated 23 September 1948 [1]

This Decree provides that cinematograph operators' cabins shall consist of three rooms: a projection room, a room for winding and examining the film, and a room for equipment and motors.

Section 2 deals with specifications for the construction of projection rooms. The dimensions of these rooms, in accordance with the number of projectors, and the minimum distance to be maintained between each, are established in Section 3.

The projection room shall have two exits and Section 4 lays down specifications for the doors and escapeways which must lead, by the shortest route, to the exits from the building. It is also laid down that the floor under the equipment shall be covered with material absorbing vibrations and which in addition shall be impermeable and incombustible.

With respect to the film gates and windows in the projection rooms, Section 6 determines the dimensions of these and the methods of covering them. Metallic shutters shall be used for the film gates and glass of a specified thickness for other openings in the projection rooms. With regard to the film gates, the Decree provides that the shutters shall be closed by hand and in addition by means of a fusible or other adequate device.

It is prohibited to employ spiral stairways as means of access to the projection rooms (Sec. 8) and it is provided that stairways leading to these rooms shall be constructed of incombustible material and shall have strong railings.

Sections 9 and 10 deal with provisions respecting ventilation and the removal of combustible gases from the carbon electrodes of the projectors and specify the area of the cross-section of the exhaust duct.

Measures to be taken in rooms for the winding and examination of films are contained in Sections 11 to 15.

With respect to rooms for motors and equipment, such as transformers, rectifiers and other apparatus for controlling the electric current for technical purposes and for lighting, the Decree deals with construction, location, electrical installations and fire-fighting equipment.

The Decree concludes with provisions respecting fire extinguishing equipment and the duties of the personnel charged with the operation of projectors.

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[1] *Gaceta Oficial*, No. 231, 2 Oct. 1948.

FRANCE

Resolution fixing Safety Principles for the Certification of Grinding Machines Dated 1 April 1948 [1]

Accidents occurring at grinding machines are caused largely by: (1) the bursting of the wheel; (2) accidental contact with the wheel; (3) the inhalation of dusts; or (4) the projection of particles.

In order to prevent these accidents, the present Resolution specifies a number of conditions for the certification of various types of grinding machines.

Section 2, subsection A, contains the following provisions respecting the spindles of machines for outside grinding, ring wheels and sectional ring wheels:

The spindle shall be of steel of great toughness.

The diameter of the spindle shall be proportionate to the dimensions of the wheels.

The direction of the thread at the end of the spindle shall be such that by inertia the nut will tend to tighten on the wheel while it is in rotation.

The length of the threaded part of the spindle shall exceed the length of the threaded part of the tightening nut.

The speed of rotation of the spindle shall be suited to the nature of the bonding and the dimensions of the wheel to be used. In no case shall this speed exceed the speed limits fixed by approved French standards.

The dimensions of the spindle shall conform to the French approved standards and shall not be less than the dimensions laid down in the French Safety Code for the Use of Grinding Wheels.

The provisions respecting the mounting of wheels are contained in Subsection B of Section 2.

The text of Sections 3, 4 and 5 is as follows:

Sec. 3. The grinding machines referred to under Section 2 shall be equipped with a protective shock-resisting hood, capable of retaining the fragments of the wheel in case of bursting.

The dimensions of the hood shall be proportionate to the diameter of the wheel, its thickness and its peripheral speed.

The hood shall be fixed to the frame at several points. The fixing devices shall be capable of withstanding any shearing stress that may occur in case of bursting of the wheel.

The dimensions of the hoods and the angle of the opening shall comply with the French approved standards or with the dimension laid down in the French Safety Code for the Use of Grinding Wheels.

The hoods of wheels used on their periphery shall expose only the working part and shall not permit any moving part to project from them.

These hoods shall be equipped at the top with a nozzle for the collection of dusts and at the bottom with a feeder that can be regulated in accordance with the use that is made of the wheel.

Ring wheels and sectional ring wheels shall be guarded along their entire periphery.

Sec. 4. Grinding wheels referred to under Section 2 and driven by an engine with varying speeds (electric or pneumatic) shall be equipped with a speed governor.

[1] *Journal officiel*, No. 81, 3 Apr. 1948, p. 3260.

Sec. 5. Independently of the provisions laid down in the preceding Sections, grinding machines shall comply with the following supplementary provisions:

(1) They shall be equipped with a data plate conspicuously placed on the frame and containing the following information:

(a) the type of wheels that may be used;

(b) the minimum and maximum diameters of the wheels;

(c) the maximum speed of rotation.

(2) They shall be equipped with an easily adjustable work rest so designed that it will not touch the wheel or hit against it.

(3) They shall be equipped with a device permitting the installation on the machine of a transparent screen for the protection of the eyes.

(4) They shall be equipped with a terminal on the frame, for earthing purposes, in cases where the machine is driven by an electric motor.

Grindstones or abrasive wheels rotating at a peripheral speed of less than 12 m/sec. as well as automatic machines for precision grinding (sharpening, gear-cutting, tapping, trueing) and cutting-off wheels are not subject to this Resolution (Sec. 7).

Beginning on 1 January 1949, the sale and hire of grinding machines not complying to the safety principles laid down in this Resolution shall be prohibited (Sec. 11).

A subsequent Order [1] fixes the form of the certificate to be delivered by the manufacturer, seller or lessor of certified grinding machines.

Act No. 48-1106 concerning the Sale and Use of Harmful Products for Industrial Purposes. Dated 10 July 1948 [2]

Chapter IV of Title II of Book II of the Labour Code dealt only with the use of lead compounds in painting work. It is replaced by the present Act containing more general provisions respecting the sale and use of harmful products for industrial purposes.

Vendors or distributors of harmful products for industrial purposes as well as heads of undertakings where such products are used shall affix to all containers, bags or wrapping containing these products, a label or an inscription indicating the nature of the products. This indication shall also be reproduced on the bills or invoices (Sec. 78).

The Act provides that special orders will subsequently determine the nature of the products and the percentage making it compulsory to affix labels or inscriptions of a specified kind (Sec. 79).

It is provided, in addition, that the use of certain harmful products for carrying out certain work, even if this work is done by the head of the under-

[1] *Journal officiel*, No. 101, 26 and 27 Apr. 1948, p. 4082.

[2] *Idem*, 11 July 1948, p. 6739.

taking himself or by independent workers, may be prohibited by public administrative regulations.

Section 105 of Book II of the Labour Code, giving inspectors the right of inspection, is supplemented by a provision of the present Act empowering labour inspectors as well as officials of the judicial police and inspectors and officials concerned with the purity of products, to take samples, for purposes of analysis, of the products used or distributed.

Algeria

ORDER RESPECTING THE EXAMINATION OF ELECTRICAL INSTALLATIONS IN UNDERTAKINGS EMPLOYING ELECTRIC CURRENT. DATED 23 AUGUST 1948 [1]

This Order is concerned with the enforcement of Section 37 *bis* of the Order of 4 August 1935 as amended, which Section deals with the examination of electrical installations.

Premises are divided into three groups for which the intervals between examinations are fixed at one, three and ten years respectively.

The first group includes premises where there are special risks of explosion or deterioration due to dampness, conductive liquids or corrosive fumes; premises where flammable materials or substances liable to burn without a supply of oxygen or liberate dusts forming an explosive mixture with air are handled or stored; temporary installations at building sites and other outdoor installations; and premises where there are installations working at a pressure exceeding 600 V direct current, or 250 V alternating current.

The second group includes premises where highly flammable substances are handled or stored and undertakings employing or liable to be occupied by more than 100 persons.

The third group comprises all the other undertakings covered by the Decree of 4 August 1935 as amended.

The Order also contains directives concerning applications for approval by bodies seeking the power to undertake verification and the composition of the committee appointed to examine these applications.

In conclusion the Order defines the duties of the bodies approved.

HUNGARY

ORDER No. 4970/1948 KORM. REGULATING CERTAIN MATTERS RESPECTING ACCIDENT INSURANCE UNDER ACT No. XXI OF 1927 DATED 30 APRIL 1948 [2]

This Order makes it compulsory for all undertakings employing more than 50 workers on an average to entrust to a competent person the task of directing and supervising the enforcement of industrial accident prevention measures.

An employer who fails to apply the safety provisions laid down in the regulations or to appoint a safety delegate and who, in spite of a formal order from the National Institute for Social Insurance, fails to remedy these omissions, shall be compelled to pay an additional premium the amount of which may reach the aggregate of the normal premiums payable in respect of the entire body of workers.

When the financial situation of the Institute permits, establishments whose protective installations and safety services go beyond the legal requirements will receive a reimbursement on their accident insurance premiums.

PAKISTAN

PAKISTAN DOCK LABOURERS' REGULATIONS, 1948 DATED 26 FEBRUARY 1948 [1]

These Regulations comprise 63 Sections divided into eight Parts.

Part I contains definitions of a number of terms and deals with the duties and powers of inspectors.

Part II concerns the fencing and lighting of working places, first aid, ambulances and the reporting of accidents.

Part III deals with the means of access to ships and to the holds, beams and hatch coverings, and the protection of workers from the toxic or dangerous fumes liable to be present in the hold.

Hoisting appliances are dealt with in Part IV.

The provisions of Part V concern the use of hoisting equipment, the guarding of hatches, work on various decks, the lifting of bales and barrels, the stacking of the cargo, operating signals, etc.

Parts VI and VII contain provisions respecting the responsibilities of workers and occupiers and Part VIII provides for the posting of extracts from the Regulations at conspicuous places.

Annexed to the Regulations are a list of the contents of first-aid boxes, directives for the testing of hoisting appliances, and a number of model forms to be used in connection with the inspection of hoisting appliances and their parts.

SPAIN

NATIONAL LABOUR REGULATIONS FOR VARIOUS INDUSTRIES

This national labour legislation regulates conditions of work in the following industries: woodworking [2]; manufacture of fibre sandals [3];

[1] *Journal officiel de l'Algérie*, No. 70, 31 Aug. 1948, p. 861.
[2] *Magyar Közlöny*, 30 Apr. 1948.

[1] *Gazette of Pakistan*, No. 10, 5 Mar. 1948, p. 84.
[2] *Boletín Oficial del Estado*, No. 40, 9 Feb. 1947, p. 940.
[3] *Idem*, No. 81, 22 Mar. 1947, p. 1829.

manufacture of cement [1]; manufacture of wine [2]; the "various fibres" branch of the textiles industry [3]; the manufacture of flax fibre [4]; the manufacture of resin [5]; the manufacture of phosphorus [6]; manufacture of chalk and lime products [7]; vegetable canning [8]; industrial refrigeration [9]; the manufacture of chocolate, sweets and caramels [10]; all branches of road transport [11]; and the manufacture of biscuits.[12]

All the Regulations include provisions respecting general health and safety measures and provide that special measures for each particular industry shall be laid down in the working rules. These rules shall also prescribe the penalties to be imposed on the personnel for non-compliance with the safety measures laid down.

SWITZERLAND

Regulations of the Swiss Federal Railways concerning the Prevention of Eye Injuries. Dated 1 July 1947

These regulations, issued by the Swiss Federal Railways for their employees, comprise a list of the various equipment provided for the protection of the eyes and an enumeration of the jobs for which it must be used. It contains a number of provisions respecting the maintenance and replacement of the equipment and a number of general provisions on eye protection.

UNITED KINGDOM

The Radioactive Substances Act, 1948 Dated 30 June 1948

This Act, which regulates the importation, manufacture, sale, storage and use of radioactive substances, includes provisions empowering the appropriate Minister to issue regulations for the prevention of injuries to health caused by ionising radiations and for securing the safe disposal of radioactive waste products.

The Jute (Safety, Health and Welfare) Regulations, 1948. Dated 21 July 1948

The matters dealt with in these Regulations include the lifting and carrying of loads by women and young persons, ventilation, temperature and humidity, welfare, construction and use of machinery and sale and hire of machinery.

The maximum weight that may be lifted or carried by a woman or young person is—

(a) in cases where a woman or young person lifts or carries the weight by herself or himself, the weight indicated in the following table:

Persons employed	Maximum weight where material, yarn, cloth, tool or appliance is a reasonably compact or rigid body	Maximum weight where material, yarn, cloth, tool or appliance is not a reasonably compact or rigid body
	lb.	lb.
(a) Woman aged 18 years or over . .	65	50
(b) Male young person aged over 16 and under 18 years .	65	50
(c) Female young person aged over 16 and under 18 years	50	40
(d) Young person aged 16 years or under	40	35

(b) in cases where a woman or young person lifts or carries the weight in conjunction with another person or persons, the lowest of the weights indicated by the table in paragraph *(a)* for any of the persons who participate in the lifting or carrying, multiplied by the number of persons who participate in the lifting or carrying.

The ventilation provisions relate to the proportion of carbonic acid in the air of workrooms, the suppression and removal of dust and the removal of steam or vapour.

The provisions concerning temperature and humidity prescribe minimum temperatures for workrooms, and deal with the separation of workrooms from boiler houses, engine rooms and boiler flues, artificial humidification and the provision of hygrometers. The conditions as regards the construction and maintenance of hygrometers are given in the Second Schedule to the Regulations.

Detailed requirements are laid down concerning the construction and safeguarding of opening machines, softening machines, carding and teasing machines, drawing frames, roving frames, spinning frames, cop winding machines, dressing machines, looms, calenders, cropping machines, cloth cutting machines and lapping machines.

The provisions of the Factories Act concerning the sale and hire of machinery apply to the abovementioned machines.

UNITED STATES OF AMERICA

American Standard Safety Code for Wood Ladders. ASA. A.14.1-1948

This is the latest edition of the standard safety code published by the American Standards Asso

[1] *Idem*, No. 84, 25 Mar. 1947, p. 1878.
[2] *Idem*, No. 89, 30 Mar. 1947, p. 1969.
[3] *Idem*, No. 114, 24 Apr. 1947, p. 2405.
[4] *Idem*, No. 127, 7 May 1947, p. 2715.
[5] *Idem*, No. 217, 5 Aug. 1947, p. 4422.
[6] *Idem*, No. 219, 7 Aug. 1947, p. 4453.
[7] *Idem*, No. 226, 14 Aug. 1947, p. 4571.
[8] *Idem*, No. 274, 1 Oct. 1947, p. 5408.
[9] *Idem*, No. 276, 3 Oct. 1947, p. 5443.
[10] *Idem*, No. 316, 12 Nov. 1947, p. 6077.
[11] *Idem*, No. 323, 19 Nov. 1947, p. 6182.
[12] *Idem*, No. 351, 17 Dec. 1947, p. 6621.

ciation on the subject of wood ladders and constitutes a revision of the American Standard Safety Code for Construction, Care and Use of Ladders, of 11 April 1935. It is divided into five parts: general provisions; definitions; materials, arranged in five groups according to the species of wood and lumber sizes used in commercial ladder manufacture; construction requirements; and care and use of ladders.

The Code has been designed as a guide to State authorities, other regulatory bodies and manufacturers and users of ladders, and contains highly valuable information presented in a clear and concise text.

YUGOSLAVIA

Regulations No. 8,673 concerning Technical Measures of Safety and Hygiene to be Taken in the Manufacture of Gunpowder and Explosives. Dated 7 June 1948 [1]

Part I of these Regulations contains general provisions.

Part II deals with the safety measures to be taken with regard to buildings, fixed installations and equipment of undertakings where gunpowder and explosives are prepared and manufactured. The different manufacturing processes must be carried out in separate buildings located at least 20 m apart (Sec. 3). Drying houses and warehouses for gunpowder, explosives or explosive components shall be situated at least 50 m from the factory (Sec. 4). Section 5 deals with the construction of doors and windows. Wagons shall not be moved in the factory yard by means of steam locomotives (Sec. 6). Section 8 provides for the installation of prime movers in premises separate from those containing machinery and equipment for the manufacture of explosives and prohibits the use of electrical material unless it is absolutely flame-proof. Installations, vessels, tools, etc., shall be constructed of non-sparking material, and all installations shall be earthed.

The maximum quantity of explosives which it is permitted to store in a workroom and the number of persons who may be in the workroom at any time shall be posted (Sec. 12). Section 13 provides that pressure vessels shall be equipped with pressure gauges and safety valves. Section 14 deals with the cleaning of installations and Section 15 with lighting of workrooms where gunpowder and explosives are manufactured and prepared. Fire-prevention is dealt with in Sections 16 to 20. Section 19 lays down that small tubs filled with water shall be installed near the doors of factories so that workers may throw themselves in if their clothes should catch fire.

Part III concerns the manufacture of smokeless gunpowder (Secs. 24 to 31). A number of preventive measures must be taken: workers must wear clogs or leather or cloth slippers and use wooden, bronze or brass tools. In addition, adequate ventilation for the removal of noxious vapours must be provided.

Part IV deals with the manufacture of black powder (Secs. 32 to 50); Part V with the manufacture of black powder cartridges (Secs. 51 to 64); Part VI with the manufacture of safety explosives (Secs. 65 to 70); Part VII with the manufacture of priming explosives (Secs. 71 to 76); and Part VIII with the manufacture of detonators (Secs. 77 to 85).

Warehouses and storage places are dealt with in Part IX (Secs. 86 to 89).

Part X (Secs. 90 to 95) contains health measures and Part XI final provisions.

[1] *Službeni list*, No. 53, 23 June 1948, p. 745.

Regulations respecting Safety and Hygiene in Quarries, in the Brick Manufacturing Industry and in the Working of Clay, Sand and Gravel Deposits. Dated 14 July 1948 [1]

These regulations comprise 64 Sections classified under 10 headings.

Chapter I contains general provisions.

Chapter II deals with the baring of deposits.

Stone-quarrying and, in particular, the dimensions to be given to quarry stopes, the use of suspended scaffolds and of pneumatic tools are dealt with in Chapter III.

A number of provisions respecting the working of clay, sand and gravel deposits are contained in Chapter IV.

General provisions respecting safety and health in quarries are included in Chapter V.

Chapter VI deals with the transportation of materials, the construction and maintenance of rail tracks and cars and the operation of the latter.

Chapter VII contains provisions respecting the machinery and tools used for the working of stone. It is provided, *inter alia*, that dusts shall be collected at the point of origin.

Provisions respecting the installation and protection of machines for the manufacture of bricks and tiles are contained in Chapter VIII.

Under Chapter IX (Industrial Hygiene) the Regulations deal with the protection of eyes and hands, the protection of workers against the weather, the provision of drinking water, sanitary conveniences and huts for workers.

Chapter X contains final provisions.

[1] *Službeni list*, No. 69, 14 Aug. 1948, p. 1046.

OFFICIAL REPORTS, ETC.

BRAZIL

Industrial Accidents in 1947 [1]

In 1947, 124,317 industrial accidents were recorded in Brazil. They caused a loss to the national economy of 7,956,288 hours of work.

The number of accidents is, in fact, higher as the cases not reported were probably numerous and, on the other hand, accidents which occurred in the State of São Paulo were not included in the above-mentioned figures.

The Division of Hygiene and Safety of the Department of Labour successfully undertook an education campaign for the prevention of accidents. As a result, the number of injuries occurring in the Federal District decreased from 67,026 in 1943 to 48,903 in 1947.

BULGARIA

Industrial Accidents from 1938 to 1944 [1]

Between 1938 and 1944 the number of accidents dropped from 7,069 to 2,367. In 1938, however, 2.1 per cent. of all accidents were fatal; this percentage had risen to 6.5 in 1944.

Table I shows the distribution of accidents by severity and table II by cause.

Although the proportion of female workers reached 27 per cent. of the total number of workers in 1944, only 6.75 per cent. of the accidents occurred to women. Of the male workers 8.64 per 1,000 suffered accidents as compared with 1.66 female workers. This difference is largely due to the fact that the work carried out by women involved less risks. Table III shows the distribution of accidents by sex.

TABLE I

Year	Accidents										
	Fatal		Total disability		Partial disability		Temporary disability		Results unknown		Total
	No.	Per cent.	No.	Per cent.	No.	Per cent.	No.	Per cent.	No.	Per cent.	
1938	154	2.2	4	0.1	129	1.8	6,782	95.9	—	—	7,069
1939	147	2.1	6	0.1	142	2.0	6,699	95.8	—	—	6,994
1940	175	2.8	18	0.3	197	3.1	5,871	93.0	49	0.8	6,310
1941	134	2.7	18	0.4	155	3.1	4,660	93.8	—	—	4,967
1942	175	3.3	25	0.5	132	2.5	4,876	92.4	64	1.2	5,272
1943	175	3.9	18	0.4	88	2.0	4,081	90.9	128	2.8	4,490
1944	156	6.5	15	0.6	124	5.2	2,030	84.7	72	3.0	2,397

TABLE II

Causes	Accidents during the year						
	1938	1939	1940	1941	1942	1943	1944
Transmissions	79	76	74	60	53	36	68
Machine tools	1,249	1,239	1,225	1,193	1,106	1,005	576
Transport equipment	1,139	1,200	894	589	654	582	324
Boilers and steam pipes	15	10	6	5	3	2	4
Explosions	114	115	68	56	79	109	59
Fire and incandescent material	191	196	243	188	185	177	90
Electricity	25	19	23	22	19	18	19
Toxic substances and gases	78	59	10	28	17	14	7
Falls of persons	591	575	571	489	518	454	238
Slipping and knocking against objects	243	256	428	195	208	252	65
Falls of objects, demolition	546	572	866	707	810	659	278
Installations without prime movers	1,592	1,520	1,194	909	1,122	825	481
Hand tools	1,089	1,052	500	322	285	187	96
Other causes	118	105	208	204	213	170	92

[1] Information communicated by the I.L.O. correspondent in Rio de Janeiro.

[1] *Otchet za deinosta na direktsiata na truda*, Sofia, 1948.

TABLE III

Year	Accidents				
	Men		Women		Total
	Number	Per cent.	Number	Per cent.	
1938 . .	6,673	94.4	396	5.6	7,069
1939 . .	6,577	94.0	417	6.0	6,994
1940 . .	5,955	94.4	355	5.6	6,310
1941 . .	4,579	92.2	388	7.8	4,967
1942 . .	4,991	94.7	281	5.3	5,272
1943 . .	4,312	96.0	178	4.1	4,490
1944 . .	2,235	93.2	162	6.8	2,397

The report of the Department of Labour also contains information respecting boilers and pressure vessels; 3,063 of the 5,164 installations of this kind in existence were inspected in 1944.

DENMARK

Annual Report of the Labour and Factory Inspectorate, 1947 [1]

At the end of 1947, 50,666 undertakings were liable to inspection; of these, 15,864 were subject to all the provisions of the Factory Act, 33,201 only to the provisions respecting power-driven machinery and other dangerous apparatus, and 1,601 were dairies. During the course of the year, 42,884 undertakings were inspected.

In 1947, the enforcement of the Factory Act was extended to undertakings working bones and horn and to those manufacturing powders and capsules containing various insecticides.

The Labour Inspectorate issued circulars, instructions, etc., dealing with the prevention of accidents. The subjects included the lighting of gas or oiled-fired furnaces, the floors of spray-painting rooms, the use of cranes for the transportation of persons in shipbuilding yards (suspension of swinging scaffolds along the hull of the ship), the mounting of certain electric converters, protection against accidental contact between hoisting cables and electric conductors (impairment of the resistance of the rope by the ensuing electric arc), the explosion risks inherent in the welding of tank-cars for ammonia, etc. In addition, the Inspectorate issued a number of circulars, instructions, etc., dealing with protection against occupational diseases.

The annual meeting of the Labour Inspectorate was held at Copenhagen on 10 and 11 September 1947. A number of papers were read on the particular dangers of eccentric presses, and means to avoid them, the importance of two new plastic materials in safety technique, the mining of lignite in Denmark since 1940, rationalisation and accident prevention in industry, etc.

The main body of the report is again taken up with descriptions of accidents, safety devices, exhaust installations and achievements in the field of embellishment of workplaces.

The report also contains statistical and other information respecting lifts and boilers as well as an outline of the recommendations and provisions respecting the enforcement of legislation on boilers issued by the Labour Inspectorate. The section dealing with the inspection of bakeries also contains some statistics.

The reports made by the inspectors as a result of their visits deal with the fight against silicosis in stone-crushing plants, the enforcement of the pottery regulations, electric welding fumes, the dangers of poisoning in chrome plating work and in the treatment of seed with mercury compounds, the use of certain liquids for atomising in printing establishments, etc.

During the year 1947, 629 cases of occupational diseases were reported; of these 70 were cases of silicosis, 229 lead poisoning; 44 poisoning by solvents; 33 poisoning by carbon monoxide; 77 skin disturbances, etc.

In conclusion, the report outlines the activity of the laboratory of the Labour Inspectorate.

DOMINICAN REPUBLIC

Industrial Accident Statistics in 1946 [1]

During 1946, 14,399 industrial accidents, including 22 fatal, were reported as compared with 10,565 in 1945. This represented an increase of 3,334 accidents.

Of the injured persons, 14,291 were men and 108 women, as against 10,468 and 97 women in 1945.

With regard to the age of the victims, the largest number of accidents (2,440) occurred in the 25 to 29 age group.

Of the total number of accidents, 1,094 occurred in agriculture and stock-breeding; 205 in mines and quarries; 11,356 in industrial undertakings; 513 in transport and communications; 271 in commerce and 960 in other activities.

The following table shows the number of accidents by cause and industry.

The parts of the body most often affected by industrial accidents were the eyes, with 17.93 per cent. of the accidents (2,582), hands with 10.42 per cent. (1,500), legs with 8.20 per cent. (1,181) and feet with 16.58 per cent. (2,387).

[1] *Beretning om Arbejds- og Fabriktilsynets Virksomhed i Aaret 1947;* for 1945, see *Industrial Safety Survey*, Vol. XXIII, No. 1, p. 23.

[1] Dirección General de Estadística: *Estadísticas de los Accidentes del Trabajo, 1946.* Ciudad Trujillo, 1948. For 1944 see *Industrial Safety Survey*, Vol. XXIV, No. 4, p. 140.

Causes	Industries							
	Agriculture and stock-breeding	Mines and quarries	Industrial under-takings	Transport and communications	Commerce	Other activities	Total	Per cent.
Machinery	7	2	116	6	2	11	144	1.00
Transmissions	9	3	99	19	12	10	152	1.06
Hoisting appliances	3	5	100	7	10	11	136	0.94
Machine tools	34	16	502	33	8	45	638	4.43
Railways	2	—	130	7	—	2	141	0.98
Ships	—	—	3	—	—	2	5	0.03
Other vehicles	51	7	452	19	11	68	608	4.22
Explosions	3	2	30	—	4	1	40	0.28
Fires	4	1	33	—	—	1	39	0.27
Toxic, hot and corrosive substances	7	6	46	4	—	1	64	0.44
Electricity	—	—	26	3	—	2	31	0.22
Falls of persons	107	22	1,034	59	35	114	1,371	9.52
Slipping or knocking against objects	191	43	1,901	61	51	147	2,394	16.63
Handling goods	311	68	2,121	166	81	305	4,052	28.15
Collapse	—	2	86	3	9	20	120	0.83
Hand tools	278	15	2,433	72	18	74	2,890	20.07
Animals	44	1	475	7	8	5	540	3.75
Other causes	38	12	672	46	15	132	906	6.29
Unknown	5	—	97	1	7	18	128	0.89
Total	1,094	205	11,356	513	271	960	14,399	100.00

Both in 1945 and in 1946 the largest number of accidents occurred on the plantations: 2,946 in 1945 and 3,931 in 1946—an increase of 985 accidents.

INDIA

Bengal

Administration of the Factories Act during 1946 [1]

In the Province of Bengal, 2,208 factories were registered at the end of 1946, as against 2,174 in the preceding year. The number of workers employed, however, fell from 744,518 in 1945 to 705,777 in 1946.

The accidents reported numbered 15,836 (18,493 in 1945) of which 76 were fatal and 2,495 serious. Compared with the figures for the preceding year, this was a decrease of 27.6 per cent. for fatal accidents, 16.8 per cent. for serious accidents and 13.8 per cent. for minor accidents. This decrease is due, at least in part, to strikes and disturbances of a political nature, which involved the suspension of work.

The principal causes of accidents were machinery, falls of objects and falls of persons.

During the year under review, 1,021 factories were inspected. Some progress was made with regard to housekeeping, cleanliness, ventilation and lighting. However, as a result of the lack of material and of the unstable political situation, many employers were unable to improve the protective devices in their plants and were forced to continue to use old machinery, which led to the occurrence of accidents.

[1] Information communicated by the I.L.O. Branch Office, New Delhi.

Central Provinces and Berar

Administration of the Factories Act during 1947 [1]

During 1947, the number of factories on the registers increased from 1,258 to 1,261. While 104 new factories, mostly rice mills, engineering workshops, saw mills and oil mills were registered during the year, 101 factories, most of which were cotton gins and presses and saw mills, were removed from the registers. The number of factories actually working during the year was 938, of which 642 were perennial and 296 seasonal.

The average daily number of persons employed in the working factories decreased from 101,355 in 1946 to 97,219 in 1947. Of these, 20,360 were women and 1,668 were adolescents or children.

The largest industry was textiles with a daily average of 29,277 workers employed in perennial factories and 22,636 employed in seasonal ginning and pressing factories.

The total number of accidents rose from 1,835 in 1946 to 2,152 in 1947, including 811 in ordnance factories as against 579 in 1946. The 1947 total included 19 fatal and 73 serious accidents.

[1] *Indian Labour Gazette*, Sept. 1948; for 1946, see *Industrial Safety Survey*, Vol. XXIV, No. 2, p. 61.

The general frequency rate was 22.8 per 1,000 workers employed; in railway workshops the rate was 176.2, in ordnance factories 59.3 and in power houses 61.4.

Five of the fatal accidents were caused by machinery and four by an explosion. Most of the serious accidents were caused by machinery, while the minor accidents were mainly due to falling or flying objects and hand tools.

Considerable difficulty was experienced in maintaining the standards of fencing and safety devices at the required levels, partly owing to shortages of material and skilled labour.

New construction conformed to the desired standards of lighting and ventilation, but no substantial improvements could be made in old factories, owing to shortage of material.

The rapid growth of saw mills in big cities such as Nagpur without any regard to the adequacy of the space available created new problems of sanitation, and the mills also lack water mains for fire extinction.

During the year 1,191 inspections were made in 910 factories.

Orissa

Administration of the Factories Act during 1947 [1]

The number of registered factories rose from 179 in 1946 to 221 in 1947, and the average daily number of persons employed, from 7,443 to 10,592, including 2,649 women and 516 adolescents and children. The largest perennial industries were food, drink and tobacco with a daily average of 6,461 workers (3,364 in 1946) and paper and printing with 1,562 (1,587 in 1946).

Accidents totalled 132, including 9 serious. There were no fatal accidents. Most of the accidents occurred in the railway workshops. The chief causes of the serious accidents were machinery and rolling stock; most of the minor accidents were caused by falling objects and machinery. Sanitary arrangements, drinking-water supplies, ventilation and lighting were generally satisfactory.

In all, 95 inspections were made in 67 factories. The smallness of these numbers is accounted for by a shortage of trained inspectors.

NORWAY

Report of the Explosives Inspectorate in 1947 [2]

The Explosives Inspectorate recorded 84 accidents in 1947, of which 55 were attributable to commercial explosives and 29 to explosive mixtures and flammable liquids. These accidents resulted in 16 deaths and 103 injuries. There were also 88 explosions and fires the effects of which were limited to material damage and minor injuries.

The report contains information and recommendations respecting the manufacture, transportation, storage, sale and use of various explosive and flammable substances.

Annexes deal, *inter alia*, with the properties of propane and butane and the ventilation of premises where flammable gases or vapours are present.

SWEDEN

Annual Report of the Labour Inspectorate, 1945 [1]

During the year under review the State Insurance Institute issued instructions concerning the marking of gas cylinders and the protection against risks in the use of stationary gas generators; memoranda respecting the guarding of woodworking machinery, the risks of poisoning in the treatment of seed with mercury compounds, and plans for lift machinery rooms; and safety posters dealing with crane trolley wires.

At the end of 1945, 20,294 undertakings employing 861,844 workers were registered with the State inspectors, and 49,316 undertakings employing 173,759 workers with sub-inspectors. These figures include 19,263 agricultural undertakings employing 65,491 workers. In addition, 66,432 were registered with communal inspectors.

During the year under review, the State inspectors and engineers inspected 6,753 undertakings employing 222,090 workers and the sub-inspectors 21,604 undertakings employing 128,331 workers; the communal inspectors made 64,199 inspections in workplaces employing a total of 179,411 workers.

The State inspectors received 3,797 plans for the construction, reconstruction or alteration of workplaces. In this connection the inspectors made 238 proposals and took part in 14,529 conferences or consultations.

At the end of the year, 11,693 undertakings had safety delegates and 561 had safety committees.

In all 159,000 industrial accidents (including 397 fatal) were reported. The number of cases of occupational disease reported was 2,040, including one fatal case.

As in the previous years, the report includes statistical information on the inspection of boilers and pressure vessels, docks, forestry work, mines and quarries, explosives factories, electrical installations and railways.

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[1] *Indian Labour Gazette*, Sept. 1948; for 1946, see *Industrial Safety Survey*, Vol. XXIV, No. 2, p. 62.

[2] *Årsberetning fra Sprengstoffinspeksjonen om Virksomheten i 1947*. Oslo, 1948.

[1] Riksförsäkringsanstalten: *Yrkesinspektionens verksamhet år 1945*; for 1944 see *Industrial Safety Survey*, Vol. XXIII, No. 3, p. 105.

The greatest part of the report is devoted to descriptions of accidents, safety devices, industrial hygiene and the embellishment of workplaces. The following devices are described and illustrated: a platform movable vertically for the maintenance of an alcohol distillation column, a protective barrier for goods lifts in brick factories, a guard for the driving gear of bucket hoists, an automatic brake for cranes, a guard for cloth-winding machines, a two-hand tripping device for eccentric presses, a device preventing the inadvertent starting of lathe motors, a truck for the transportation of gas cylinders, a safety device for boilers fired with wood shavings or sawdust, etc.

Once again the inspectors drew attention to the great number of accidents caused by slipping, particularly in restaurants, and to the difficulty of persuading female workers to wear protective head-coverings.

In the logging and timber-floating industry, the number of accidents rose from 14,501 in 1944 to 18,049 (including 18 fatal) in 1945. This increase is due to intensive production necessitated by the restrictions in the import of coal and to the lack of experience of the personnel which had to be employed to make up for the lack of qualified manpower.

The explosives inspector reported 628 accidents, of which one was fatal. Two explosions due to cyclopropane (anæsthetic gas) occurred during the course of surgical operations and in both cases caused the death of the patient. The explosions were set off by electric scalpels.

The electrical inspectors reported 283 accidents, including 37 fatal.

A total of 6,412 accidents (including 24 fatal) to State railwaymen were reported to the inspectors. The majority of these accidents occurred to shunting personnel as a result of slipping. In addition, private railway companies reported 1,504 occupational accidents of which 11 were fatal.

The section of the report dealing with industrial hygiene describes various types of exhaust installations.

Accidents in the Loading and Unloading of Ships in 1947 [1]

The number of man-hours worked in Swedish ports increased from 10.5 million in 1946 to 11.57 million in 1947; 2,227 accidents (including 5 fatal) were reported in 1947 as against 1,806 in 1946. The accident frequency rate per 10,000 man-hours was 1,925 in 1947 and 1,718 in 1946.

Of the total number of accidents, 67.85 per cent. occurred on board ship or on barges or other boats moored to ships, while 32.15 per cent. occurred on shore.

[1] Information communicated by the Swedish Ministry of Social Affairs.

The following table shows the distribution of accidents by cause:

Cause	Accidents in 1947	
	Number	Per cent.
Tools	36	1.62
Transportation equipment (wagons, carts, etc.)	162	7.27
Hatch covers and beams	55	2.47
Slings	43	1.93
Grab buckets	114	5.12
Mooring equipment	7	0.31
Scaffolding, ladders, etc.	34	1.53
Hooks, miscellaneous instruments	79	3.55
Cranes	148	6.64
Winches	148	6.64
Loading and unloading by hand:		
Falls of persons	119	5.34
Falls of objects	138	6.20
Other causes	401	18.02
Falls of persons	266	11.94
Falls of objects	382	17.15
Unknown or unclassified	73	3.28
Accidents on the way to or from work	22	0.99
Total	2,227	100.00

SWITZERLAND

Electrical Accidents 1947 [1]

The Heavy-Current Inspectorate recorded in 1947, in installations within its jurisdiction, 244 accidents involving 250 persons, of whom 28 were killed, 185 injured by the passage of current through the body and 37 injured by short-circuit arcs.

Seven accidents occurred to the operating personnel of power stations, 103 (11 fatal) to other power station employees and contractors' fitters, and 112 (17 fatal) to third parties.

Table I shows the distribution of low-tension accidents by cause. The number of fatal accidents is shown in brackets.

TABLE I

Cause	Operating personnel of electrical undertakings	Third parties
Parts of live installations or apparatus in service	45 (4)	17 (2)
Parts of installations or apparatus not conforming to the regulations; faulty manipulation by third parties	17 (2)	27 (8)
Insulation defects and inadequate protection of live parts	21	61 (5)
Total	83 (6)	105 (15)

[1] *Accidents dus à l'électricité survenus en Suisse au cours de l'année 1947.* Communication de l'Inspectorat des installations à courant fort. *Bulletin de l'ASE*, 1948, No. 18.

TABLE II

Equipment	Up to 250 V	251-1,000 V	Over 1,000 V	Total
Power stations and large substations	1	2	7 (2)	10 (2)
Lines	13 (3)	8 (1)	7 (3)	28 (7)
Transformer stations	3	6	13 (1)	22 (1)
Testing laboratories	2	6	4 (1)	12 (1)
Provisional installations	12 (2)	5	—	17 (2)
Industrial undertakings	30 (2)	23 (1)	1	54 (3)
Transportable motors	30 (2)	3	—	33 (2)
Portable lamps	9 (5)	—	—	9 (5)
Fixed lamps	6	—	—	6
Domestic apparatus	7 (1)	—	—	7 (1)
Other indoor installations	18 (2)	4 (2)	—	24 (4)
Total	131 (17)	57 (4)	34 (7)	222 (28)

Defective trailing lamps caused 5 deaths and injured 9 other persons.

Table II shows the distribution of accidents by equipment and voltage. Fatal accidents are shown in brackets. As the table indicates, nearly two thirds of the fatal accidents were caused by current below 250 V.

The report concludes with a number of descriptions of typical accidents.

UNITED KINGDOM

Report of the Chief Inspector of Mines for the Years 1939-1946 [1]

During the war years publication of the Chief Inspector's annual reports was suspended; the present report reviews changes and developments, and provides statistics, covering the whole period, although detailed discussions of accidents are confined to the years 1945 and 1946.

The inspection divisions have been rearranged by splitting the Northern Division into two *(a)* Northumberland and Cumberland, and *(b)* Durham, and amalgamating the Cardiff and Forest of Dean Division with the Swansea Division to form the South Wales Division; some of the divisions have been divided into districts, each in charge of a District Inspector. The inspection staff now comprises the Chief Inspector; 2 Deputy Chief Inspectors; the Electrical Inspector; 2 Deputy Electrical Inspectors; the Mechanical Inspector; 11 Divisional Inspectors; 19 District Inspectors (Grade I); 28 District Inspectors (Grade II); 8 Senior Training Inspectors; 1 Senior Inspector at Headquarters; 61 Assistant Inspectors; 4 Assistant Training Inspectors; 6 Junior Electrical Inspectors; 6 Sub-Inspectors of Mines; 6 Sub-Inspectors of Quarries; 7 Inspectors of Horses in Mines.

Table I gives the number of mines at work under the Coal Mines Act, 1911 *(i.e.*, mines of coal; stratified iron stone; shale and fire clay), the number of persons employed and the number of inspections made at these mines for the years 1944, 1945 and 1946.

In 1945 and 1946, 1,356 and 1,167 mines, respectively, were completely inspected.

An instructional course has been arranged for newly appointed inspectors. The subjects comprise roof control, ventilation, explosions and fires, winding and haulage gear, shotfiring practice, dust suppression and accidents generally.

Workmen's examiners made 5,676 inspections at 583 mines in 1945 and 4,982 inspections at 565 mines in 1946; in addition, inspections at a considerable proportion of the mines were made by full-time examiners of the District Safety Boards, and in most cases a copy of the report on these inspections was forwarded to the Divisional Inspector concerned. Where the reports on these inspections revealed defects they were followed up by the staff of the Inspectorate until they were remedied. These inspections on behalf of the workmen serve a useful purpose, and it is evident that the standard of inspection (parti-

TABLE I

Year	No. of mines at work	Number of persons employed			No. of inspections made underground				
		Underground	Surface	Total	Day	Afternoon	Night	Total	Average per mine
1944	1,840	556,506	179,345	735,851	17,908	3,196	2,470	23,574	12.8
1945	1,781	553,493	172,460	725,953	17,846	2,838	2,359	23,043	12.9
1946	1,785	541,368	174,262	715,630	20,428	2,555	2,098	25,081	14.1

[1] Published by H.M. Stationery Office, London, 1948.

TABLE II

Year	Underground						Surface all causes	Total underground and surface
	By explosions, fires and suffocation by natural gases	By falls of ground	Shaft accidents	Haulage accidents	Miscellaneous accidents	Total		
				(a) Persons killed				
1938	103	408	15	194	62	782	76	858
1939	57	406	24	172	63	722	61	783
1940	45	513	21	193	64	836	87	923
1941	85	502	19	190	42	838	87	925
1942	103	446	22	168	60	799	78	877
1943	31	380	27	159	58	655	58	713
1944	29	335	19	146	44	573	50	623
1945	20	305	21	116	44	506	44	550
1946	27	277	11	136	42	493	50	543
				(b) Persons injured and disabled for more than 3 days				
1938	118	45,301	312	36,776	37,859	120,366	11,410	131,776
1939	72	46,121	353	34,102	41,054	121,702	12,370	134,072
1940	88	52,027	263	34,106	45,169	131,653	14,735	146,388
1941	75	55,423	213	35,322	51,522	142,555	15,890	158,445
1942	105	56,985	227	37,003	55,688	150,008	16,631	166,639
1943	71	59,626	232	36,858	60,390	157,177	16,539	173,716
1944	96	57,120	283	39,293	63,088	159,880	16,967	176,847
1945	75	56,617	238	40,243	65,928	163,101	17,958	181,059
1946	68	52,368	231	36,491	61,273	150,431	16,779	167,210

cularly by the whole-time examiners) is improving as the men who undertake them become more experienced in the work. Frequently, the workmen's examiners accompanied the Inspector of Mines, especially when accidents were being investigated.

TABLE III

Year	By explosions, fires and suffocation by natural gases	By falls of ground	Shaft accidents	Haulage accidents	Miscellaneous accidents	Total
			Death rates			
1938	0.07	0.26	0.01	0.12	0.04	0.50
1939	0.03	0.26	0.02	0.11	0.04	0.46
1940	0.03	0.33	0.01	0.12	0.04	0.53
1941	0.06	0.34	0.01	0.13	0.03	0.57
1942	0.07	0.30	0.02	0.11	0.04	0.54
1943	0.02	0.26	0.02	0.11	0.04	0.45
1944	0.02	0.24	0.01	0.11	0.03	0.41
1945	0.02	0.23	0.01	0.09	0.03	0.38
1946	0.02	0.21	0.01	0.10	0.03	0.37
			Injury rates			
1938	0.07	29.17	0.20	23.69	24.37	77.50
1939	0.05	29.20	0.20	21.64	26.02	77.13
1940	0.06	33.33	0.17	21.88	28.89	84.33
1941	0.05	38.02	0.15	24.24	35.27	97.73
1942	0.07	38.61	0.15	25.09	37.65	101.57
1943	0.05	41.55	0.16	25.67	41.94	109.37
1944	0.07	41.03	0.20	28.25	45.11	114.66
1945	0.06	42.80	0.18	30.46	49.75	123.25
1946	0.05	39.68	0.17	27.65	46.40	113.95

Table II shows the number of persons killed and injured at mines under the Coal Mines Act in the years 1938-1946.

The death and injury rates underground in these mines (excluding certain stratified ironstone mines) are shown in table III.

There has been a general decline in fatal and serious accidents; it is attributed, among other things, to concentration of work in smaller units

TABLE IV

Year	At the working face				On roads	
	Roof		Face or side			
	Killed	Seriously injured	Killed	Seriously injured	Killed	Seriously injured
1938	241	674	80	513	87	202
1939	250	660	82	487	74	164
1940	350	753	83	517	80	207
1941	352	734	82	482	68	148
1942	297	639	74	446	75	167
1943	252	646	61	395	67	163
1944	202	599	54	345	79	152
1945	205	563	51	320	49	135
1946	189	563	41	339	47	114

with larger roads and better supervision, advance of technical knowledge, more widespread application of principles of roof control and support, greater use of steel supports, inspection, and education and training of the workers. The number of relatively minor (3-day) accidents, however, has shown a rising tendency. This may in part be due to greater regularity of employment, income tax arrangements, larger compensation, a greater tendency to take minor accidents more seriously, and the higher average age of the workers.

Figures showing the number of persons killed and seriously injured in accidents due to falls of ground are given in table IV.

In connection with these accidents, the Chief Inspector particularly mentions the importance of support at roadheads, the danger of relying on the soundness of the strata, and the use of long-handled rakes for getting stones from the waste. Steel props, although increasing in numbers, are not always used efficiently. On 30 June 1946 there were 15,125 miles of roadways in use below ground; 5,148 miles were supported by steel arches, 284 by cambered girders, 2,872 by straight girders, bars, etc., and 5,132 by timber and other means; 1,689 miles were unsupported.

Figures of fatal and serious accidents are also given for underground haulage and transport accidents. Those relating to mechanical haulages are reproduced in table V.

TABLE V

Year	Breakage of ropes or draw-gear		Runaways		Derailments or while re-railing		While coupling, uncoupling, attaching, detaching or spragging tubs		While otherwise manipulating tubs		By contact with machinery ropes or pulleys		Others	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
1938	22	35	35	60	19	76	11	69	10	28	6	82	41	129
1939	16	6	36	70	6	86	9	68	6	32	8	97	45	111
1940	10	29	37	75	18	89	11	63	5	25	5	85	53	128
1941	10	20	41	77	11	72	7	60	7	17	8	65	46	118
1942	11	24	39	71	13	73	14	61	5	26	7	58	48	101
1943	12	17	37	66	16	72	11	33	3	17	6	56	41	107
1944	10	18	34	67	17	75	7	35	6	21	5	52	38	91
1945	6	13	28	59	11	62	4	38	4	15	6	44	24	104
1946	7	5	41	44	9	73	7	42	6	22	5	40	36	86

A = Killed ; B = Seriously injured.

A thorough study of haulage accidents in all the divisions led to conclusions that are summarised as follows:

1. *Roads* should be of ample size, straight, and well graded.

2. *Tracks* should be well laid with rails of suitable section, properly sleepered and ballasted, curves should have ample radius, and points and crossings should be so designed as to avoid the necessity for manual guidance, suitable provision being made at all times for proper maintenance.

3. *Rolling stock* should be kept in good condition and more attention given to the design, examination and maintenance in good order of all drawgear.

4. *Safety devices* need to be positive and automatic in action as far as practicable, frequently examined and tested to ensure their proper functioning at all times.

More detailed attention should be given to the provision and proper siting of safety devices, especially at the tops and bottoms of inclines, at junctions and at both ends of pass-byes.

Signalling arrangements should be so placed as to be operated from a position of safety.

5. *At loading points* it is particularly necessary to have adequate height and width with suitable provision for the effective control of the tubs.

Tension and delivery ends of conveyors should be adequately guarded, precautions being taken to ensure that any guard temporarily removed for purposes of inspection or repair is replaced before the machinery is restarted.

6. *Better lighting* of haulage roadways.

7. Everything possible should be done to keep men off the haulage roads when travelling to and from work or when tubs are in motion.

8. *Supervision.* An official should be made specially responsible for the supervision of all haulage arrangements.

9. *Training and propaganda.* Since many accidents are associated with failure of the human element, improvement should result from the better training of haulage operatives; talks and discussions with officials and workmen on haulage practice and accidents should also be undertaken.

Brief descriptions are given of a number of explosions, fires and cases of suffocation.

The numbers of persons killed and seriously injured in various other kinds of accidents are given in table VI.

Under the head of coal dust the Chief Inspector touches on wet cutting, water infusion, water sprays, cutting with foam, dust at conveyor transfer and loading points, consolidation of dust on mine roadways and rock drills.

TABLE VI

Year	Shaft accidents		Explosives				Electricity		Machinery				Stumbling, falling or slipping			
			Blows from projected materials		Others				Coal cutters		Others		At the working face		Elsewhere	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
1938 . . .	15	37	11	181	3	37	5	39	9	34	5	17	3	14	5	77
1939 . . .	24	113	14	193	2	28	6	22	7	28	2	20	5	18	2	52
1940 . . .	21	32	15	188	1	36	8	26	8	38	3	17	2	19	6	53
1941 . . .	19	42	10	195	1	27	3	30	5	32	—	19	—	10	3	51
1942 . . .	22	36	13	216	3	15	7	24	3	31	2	10	3	13	5	49
1943 . . .	27	43	11	206	5	25	3	39	6	23	3	10	1	11	5	31
1944 . . .	19	43	14	251	2	18	2	42	5	29	3	11	1	10	3	44
1945 . . .	21	33	14	228	1	16	1	44	3	31	1	16	—	16	7	37
1946 . . .	11	24	12	262	2	19	3	36	4	45	3	11	—	10	—	33

A = Killed ; B = Seriously injured.

New regulations for the training of mine workers came into force on 1 January 1947, and a college has been established for the education of training officers.

The number of safety helmets sold rose from 106,116 in 1940 to 142,036 in 1946. The Chief Inspector remarks that more use could be made of safety boots and gloves.

During 1946, 36,339,817 pounds of explosives were used for shotfiring; of the total 30,751,806 pounds were permitted explosives and 15,803,443, sheathed explosives.

Ventilation is reported to be generally satisfactory, but in many instances improvement could be effected by reducing excessive leakages between intake and return airways. Means to this end include the judicious use of air splits, reduction in the length of the circuits, greater use of overcasts, effective sealing-off of old roads, and the duplication and tightening of doors and sheets. Attention is drawn to the need for care in the installation of auxiliary fans.

A number of mines have reorganised their first-aid systems, but many first-aid rooms are not satisfactory from a medical point of view; and many persons in charge of first-aid rooms are unsuitable. A scheme is being put into effect in all the coalfields for the establishment of medical centres at the larger mines.

In connection with mechanisation of the mines the Chief Inspector mentions the introduction of haulage locomotives, power-loading machinery and mechanical stowing. A mechanisation training centre was formed at Sheffield in 1943.

UNITED STATES OF AMERICA

Accidents in the Pulpwood Logging Industry in 1943 and 1944 [1]

Of a total of 1,933 accidents which occurred in the pulpwood-logging industry in 1943 and 1944, 12 were fatal. The frequency rate of fatal accidents in this industry is double that reported for manufacturing industries as a whole.

Causes	Accidents			Total	
	Fatal	Permanent partial disability	Temporary total disability	Number	Per cent.
Yarding equipment	—	3	59	62	3.2
Vehicles	3	8	133	144	7.5
Animals and insects	—	—	43	43	2.2
Chemicals and poisonous vegetation	—	—	16	16	0.8
Hand tools . .	—	9	463	472	24.7
Working surfaces	—	8	266	274	14.3
Logs (chips, limbs, etc.) . .	1	10	471	482	25.2
Trees (chips, limbs, etc.) . .	3	8	198	209	10.9
Other	5	9	201	215	11.2
Unclassified, insufficient data .	—	—	16	16	—
Total . .	12	55	1,866	1,933	100.0

The preceding table shows the distribution of accidents by cause and severity.

Accidents in the Pacific area are not included in these figures.

Steam Railway Accidents in 1947 [1]

Railway accidents in 1947 killed 4,165 persons and injured 48,797; 287 of the injured persons died within the 24 hours following the acci-

[1] U.S. Department of Labor, Bureau of Labor Statistics, *Bulletin No. 924.*

[1] Interstate Commerce Commission, Bureau of Transport, Economics and Statistics: *Accident Bulletin, No. 116.* Washington, 1948; for 1946, see *Industrial Safety Survey*, Vol. XXIV, No. 2, p. 67.

Causes	Accidents to railwaymen	
	Fatal	Non-fatal
Train accidents:		
Collisions	59	514
Derailments	41	379
Locomotive boilers	11	20
Other locomotive accidents	—	6
Miscellaneous	20	71
Total	131	990
Train-service accidents:		
Coupling or uncoupling — Cars or locomotives	19	741
Air hose or safety chains	12	342
Operating locomotives	9	2,218
Operating hand brakes	7	1,420
Operating switches	1	806
Coming in contact with fixed structure	16	262
Getting on or off locomotives	33	4,454
Accidents at highway grade crossings	6	50
Struck or run over, not at public crossings	159	285
Miscellaneous	154	6,967
Total	416	17,545
Non-train accidents:		
Explosives and flammable, hot or corrosive substances	52	543
Maintenance of way and structure of motor cars	29	758
Falls of persons	25	2,712
Falls of objects	11	1,716
Electricity	8	38
Handling rails, ties, bridge timbers	2	1,844
Use of hand tools, apparatus, etc.	2	1,437
Handling freight or supplies	1	2,759
Miscellaneous	32	5,390
Total	162	17,197
Grand total	709	35,732

dents. In train accidents 340 persons were killed and 2,649 injured; in train-service accidents 3,604 were killed and 24,496 injured, and in non-train accidents 221 were killed and 19,652 injured. The fatality rate per million train miles was 4.04 and the non-fatal injury rate 47.3.

There was considerable improvement in 1947 as compared with the preceding year: the number of persons killed and injured, and of victims who died as a result of their injuries decreased by 4.52, 6.17 and 18.0 per cent. respectively, while the number of million train miles decreased by only 0.77 per cent.

A total of 709 employees were killed and 35,732 injured while on duty. In train accidents 131 were killed and 990 injured; in train-service accidents 416 were killed and 17,545 injured; and 162 were killed and 17,197 injured in non-train accidents.

The accompanying table shows the distribution of accidents by cause.

There were 28,223 accidents to railwaymen entailing one to three days' employment disability and 32,183 (including fatalities) entailing more than three days' disability. The average accident frequency rate was 18.2 per million man hours. This represents a decrease from the 1944 rate which was 20.6.

Of the total of 16,816 train accidents which occurred in 1947, 7,090 are attributed to negligence of employees, 4,912 to defects in or failures in equipment (1,664 in wheels and axles); 2,382 to defects in or improper maintenance of way and structures (1,061 in rails and joints), and finally 2,432 to miscellaneous causes.

Of the 4,451 collisions, 3,125 were due to faulty switching; 3,044 of the 9,404 derailments were caused by defects in locomotives and cars; 2,361 by defects in the permanent way or the signals, and 2,253 by negligence, errors or other defects.

Illinois

Industrial Accidents in 1946 [1]

During 1946, 52,525 compensable injuries were reported to the Industrial Commission of Illinois. The number of injuries had risen to 54,638 in 1945. Fatal accidents decreased in number from 385 in 1945 to 332 in 1946; of these, 91 were caused by vehicles, 41 by falls of persons, 40 by falls of objects, 35 by hoisting appliances, 20 by explosions, etc.

Once again, handling objects gave rise to the greatest number of injuries — 27.6 per cent. of all accidents; machinery accounted for 18.8. per cent.; falls of persons for 15.9; vehicles for 7.1; falls of objects for 6.1; hand tools for 4.9, etc.

The following table shows the percentage distribution of accidents by cause for the various industry groups, together with the total number of accidents for each group.

[1] Illinois Department of Labor, Division of Statistics and Research: *Annual Report on Industrial Accidents in Illinois for 1946;* for 1945, see *Industrial Safety Survey*, Vol. XXIII, No. 3, p. 111.

Cause group	Industry group								
	Agriculture	Mining	Construction	Manufacturing	Trade	Finance, etc.	Transportation, etc.	Public services, hotels, etc.	Total
Non-machine causes:									
Handling objects	21.9	19.3	26.0	28.9	31.9	22.0	33.1	22.6	27.6
Falls of persons	0.2	6.5	30.0	12.2	20.7	38.5	17.9	26.3	15.9
Vehicles	19.0	20.6	3.7	2.9	7.8	3.2	19.3	7.9	7.1
Falling objects	4.8	20.6	7.2	4.7	2.7	3.0	4.0	3.2	6.1
Hand tools	4.1	7.7	5.9	4.3	5.9	2.6	3.3	4.7	4.9
Striking against objects	5.8	2.8	4.5	5.1	4.7	6.4	5.2	4.2	5.8
Hot substances, flames	1.0	1.4	2.8	4.0	4.8	1.3	1.5	4.4	3.5
Occupational diseases	1.2	1.0	0.5	2.2	0.9	1.5	0.4	0.9	1.4
Poisonous, corrosive substances	2.5	0.7	1.5	1.2	0.6	0.4	0.5	0.9	1.1
Explosions	0.8	0.7	0.4	0.4	1.1	0.6	0.7	0.9	0.6
Electricity	—	1.4	0.4	0.2	0.2	0.4	1.0	0.4	0.5
Stepping on objects	—	0.1	1.0	0.2	0.4	1.1	0.3	0.3	0.3
Animals and insects	5.6	0.5	0.1	0.1	0.4	0.2	0.5	0.3	0.3
Non-specified	5.2	4.6	4.5	4.0	6.1	7.7	6.9	10.2	5.1
Machine causes:									
Working machines, power driven	6.7	5.0	5.2	22.5	5.7	0.9	1.7	6.7	14.3
Hoisting appliances	1.4	2.3	2.8	2.5	1.8	6.6	1.7	1.4	2.3
Conveyors	0.6	3.6	0.2	1.0	0.9	—	0.5	0.2	1.0
Non-working machines	0.4	0.7	0.9	0.6	0.6	0.6	0.7	1.1	0.7
Working machines, not power driven	—	—	—	0.4	20.0	—	—	0.1	0.2
Power transmission apparatus	0.6	0.2	0.1	0.3	0.2	—	0.1	0.1	0.2
Prime movers	0.2	0.6	0.1	0.1	0.2	0.4	0.2	0.1	0.1
Kind not reported	0.8	0.6	2.2	2.2	2.4	2.6	1.5	2.1	2.0
Total all causes	484	5,247	4,600	27,689	6,447	469	3,965	3,624	52,525

REVIEW OF PERIODICALS

La prévention des accidents du travail. By E. WEYMANN. (*Bulletin du Comité national de l'organisation française*, No. 3, March 1948, p. 1.)

The author of the article examines the problems arising from the new functions assigned to the Social Security Services under the Act of 30 October 1946 respecting the prevention and compensation of industrial accidents and occupational diseases. [1]

He outlines, first of all, the causes of industrial accidents and emphasises the fact that three quarters of these can be attributed to the human factor — a point which should be studied without delay. This study should be undertaken by an industrial hygiene service and a psychotechnical service working in close collaboration.

These services should also be responsible for vocational guidance and selection and for the re-grading of persons disabled by the war or industrial accidents and of the physically defective. This work is at present entrusted to various bodies and results in a dispersal of effort and overlapping of services that undertake, with the limited means at their disposal, studies and tasks exceeding their competence.

In cases of serious accidents, three different services undertake more or less the same investigation. The Registrar of the Office of the Justice of the Peace or a sworn representative undertakes an investigation of an administrative nature, the purpose of which is to determine the facts of the accident and the rights of the victim. He is followed by the Labour Inspector, who is a technical expert and whose investigation is also intended to help prevent future accidents. Finally, the inspector of the Social Security Fund also undertakes an investigation. This overlapping of services causes a considerable loss of time and money.

The author proposes a reorganisation of the services of investigation. The problem consists of: (1) reducing to one the number of services undertaking the investigation of an accident; (2) entrusting the investigation to the service which appears

[1] See *Industrial Safety Survey*, Vol. XXIII, No. 2, p. 54.

to be the most competent; and (3) organising this service rationally.

The first point does not seem to give rise to any difficulties: one investigator only would collect all the necessary information. With regard to the second point, the Labour Inspection Service is by far the best qualified. As to the third point, the following services should be set up in each province: occupational training service, employment service and labour service. The activities of these services should be co-ordinated and controlled by the provincial authorities. On the other hand, it would be necessary to decentralise the work of these services.

Special report forms would be drawn up for the use of investigators and would contain a section on the human factor, which would eventually be filled in by the plant medical service and the person in charge of vocational selection, after examination of the victim from the point of view of psychological and physiological aptitudes.

The new French legislation provides for the creation of many national and regional technical committees, the number of which could no doubt be reduced. The author adds: "The experience of safety committees whose work is similar has been by no means conclusive. This is due to the fact that the committees are composed of persons who have other occupations and who devote to safety only a very small part of their time even when they have the necessary technical qualifications".

It is a question of separating the administrative from the technical work in matters of accident prevention and compensation; this would greatly improve the effectiveness of the various services and would considerably reduce their expenses.

Emploi des extincteurs d'incendie sur des circuits ou appareils électriques sous tension. (*Bulletin des associations françaises de propriétaires d'appareils à vapeur*, No. 81, January 1948, p. 18.)

French legislation provides for the installation in all undertakings of fire extinguishers containing a product suited to the risks.

In the choice of extinguishers for use with electrical installations, the following three factors must be considered: (1) the risk of electrocution for the operator; (2) the risk of asphyxiation for the operator and his assistants; and (3) deterioration of the electrical equipment. A distinction is made between fixed and mobile extinguishers. The use of fixed extinguishers practically eliminates the risks of electrocution and asphyxiation since they do not require the presence of an operator on the scene of fire.

With regard to mobile extinguishers, the French Federation of Fire Insurance Associations has approved the following appliances for the extinction of fires originating electrically: for voltages of the second class (direct current not exceeding 60,000 V or alternating current not exceeding 35,000 V) extinguishers using carbon tetrachloride, methyl bromide and carbon dioxide snow; for voltages of the first class (direct current not exceeding 600 V or alternating current not exceeding 150 V) extinguishers using powder and atomised water, in addition to the types approved for the second class.

Carbon tetrachloride has a high dielectric strength. It presents however, a number of disadvantages. The projection of this compound in enclosed premises makes it necessary to wear a mask for protection against possible emanations of chlorine and phosgene. In addition, chlorine compounds are liable to damage certain parts of installations. Methyl bromide has the same dielectric strength as carbon tetrachloride. It is advisable to wear a mask when using it. Carbon dioxide snow is insulating; it liberates only carbon dioxide. Its effect on equipment is nil.

Extinguishers using powder do not present any danger of electrocution, but the substance projected tends to maintain electric arcs. This disadvantage limits their use to installations of the first class. Atomised water is also insulating but it is not used in the internal installations of the first class because of the streams of water that result. As for foam extinguishers, they have not been approved for the extinction of fires of electrical origin.

In conclusion the article gives, for information purposes, a number of figures on the capacity of the various types of fire extinguishers.

Un danger de la peinture benzolique: l'explosion. By Dr. JULIEN and H. LOUSTAU. (*Cahiers des Comités de prévention du bâtiment et des travaux publics*, No. 3, May-June 1948, p. 37.)

A serious accident caused by benzol vapours occurred at Marseilles on 26 July 1947, killing two workers and injuring five others. The tank of a tanker exploded with great force during the application of an internal coat of paint with a benzol hydrocarbons base. The explosion was probably set off by an electric spark. This accident shows that benzol paints, whose toxic properties are well known, can when used for certain specific purposes become particularly powerful explosives.

Laboratory tests have proved that the vapours given off by benzol products can form an explosive mixture with air when the proportion of vapour is between 1 and 8 per cent. The optimum mixture is 4.5 per cent. vapour and 95.5 per cent. air. Explosions do not occur unless there is contact with a flame or an electric spark.

Various methods have been studied with a view to preventing disasters of this kind. Recourse might be had to filling the tank with an inert gas, a method which presents rather important technical difficulties and which makes it compulsory to provide the worker employed inside with a respiratory device with fresh air supply. Ventilating the tank would prove an easy method but it presents certain difficulties. Agitating the air-vapour mixture, in fact, risks increasing the possibility of explosion. In painting work inside the tanks, it is often considered sufficient to introduce fresh air in the upper part. Such ventilation is not only insufficient but, as has been shown, dangerous. The method offering the best guarantee of safety is to collect in the lower part of the tank the heavy vapours which have accumulated and introduce fresh air naturally through the upper manhole without provoking any agitation liable to form an explosive mixture.

Fume and Dust Exposure. By V. J. CASTROP. (*National Safety News*, February 1948, p. 20.)

By way of introduction to his subject the author discusses the functions and mutual relationship of the works medical director and the safety engineer, and also the definitions of fumes and dust. He then considers the various ways in which fumes and dust may injure the human body and methods of ascertaining and measuring the severity of exposure.

The bulk of the article is taken up with fume and dust risks in welding, grinding and polishing, machining, abrasive cleaning, heat treating, the use of asbestos and iron foundries.

In connection with welding, the author deals more specially with risks in confined spaces, the use of fluoride compounds for brazing, the presence of cadmium in silver solders, the welding of metals with toxic coatings, and means of removing welding fumes.

Under the head of abrasive cleaning, the author deals with sandblasting, blasting with steel shot or grit, vapour blasting (blasting with fine silica and water under pressure), and work on lead-bearing compounds such as solder.

Skin Lesions in Persons exposed to Beryllium Compounds. By Robert S. GRIER, Peter NASH and David G. FREIMAN. (*Journal of Industrial Hygiene and Toxicology*, No. 4, July 1948, p. 228.)

This article deals briefly with skin lesions due to beryllium and beryllium compounds used in industry. The most generally known types of such lesions are : contact dermatitis ; skin ulcers ; lesions arising spontaneously in patients with the chronic type of lung disease (pulmonary granulomatosis). The authors also give a more detailed account of a less known type of lesion classified as subcutaneous granuloma occurring in persons who cut themselves on fluorescent lamps.

After reviewing some of the work done since 1938 on the effects in workers exposed to beryllium compounds, the authors present five case histories, in three of which cuts from broken fluorescent lamp tubes were sustained and subcutaneous granulomas developed in the victims, the compound involved being zinc manganese beryllium silicate.

It is advised that excision of the granulomas be practised to prevent recurrence and, most important of all, that more effective safety measures be taken to eliminate the hazards involved in handling beryllium phosphor powder and in disposing of the burnt out tubes, to avoid children or other persons coming into accidental contact with the contaminated glass.

Absenteeism and Injury Experience of Older Workers. By Max D. KOSSORIS. (*Monthly Labor Review*, July 1948, Vol. LXVII, No. 1, p. 16.)

In this article, comparison is made of absenteeism, injury and welfare medical visit rates between groups of workers of various ages.

The working capacity of young and middle-aged workers has a different value from that of older workers. Both groups possess inherent characteristics but the data available do not permit comparison between them with respect to output. Comparison, may however, be made on other grounds such as attendance at work, injury records, time lost because of illness or injury. An all-age group study of the performance of 17,817 workers was made and the general conclusion drawn that disabilities of older workers, although less frequent, are more severe in nature.

Absenteeism.

It was found that the absenteeism rate (number of days lost per 100 normally scheduled work days) for men was highest for workers under 20 years of age and lowest for groups between the ages of 55 and 64. As for women, the rate of 6.5 for the groups taken together was fairly stable, being slightly more than twice that of the corresponding figure for men, which was 3.2.

Work Injuries.

Disabling injuries : the age group below 20 years shows a high frequency rate, 19.8, as compared with a rate of 9.7 for all age groups. For this age group, however, the figures are based on the experience of too few workers. The highest accident rates in the groups between 20 and 74 years were found in the 35-44 year group ; the rates for the groups above 45 years compared favourably with those of the groups under 35 years.

Non-disabling injuries : in this class, a significant fact is noted when comparing rates for the various age groups : the highest rate of injuries was recorded for the 25-29 year group ; from this age upward, there was a steady and rapid decrease in the number of injuries sustained. When the whole group was divided in two at the 45-year mark, a higher frequency was recorded for the first group than for the second. The author also points out for the benefit of safety engineers that the ratio of non-disabling injuries to disabling injuries is 100 to 1.

Severity of all injuries : severity rates were highest for workers in the higher age groups. Days lost per disability averaged between 6½ and 9 for the 30-39 year group and from 16 to 19 for the 45-59 year group ; this is due to the lower recuperative powers of the workers within the latter group. The same comparison holds true for non-disabling injuries, as older workers require longer healing periods.

Welfare Medical Visits.

Medical visits for non-occupational ailments were more numerous in the lower age groups up to 34 years, where they averaged 1.8 per person, and decreased steadily to 0.6 for workers within the ages of 65-69. As for women, the rates of visits were generally higher for all groups than those for men, and showed the same tendency towards a decrease with increasing age.

Los accidentes del trabajo y sus estadísticas. By Guillermo de ANDA. (*Revista del Trabajo*, Mexico, Vol. XXXI, No. 121, February 1948, p. 71.)

This article deals primarily with the principal purposes of industrial accident statistics. Such statistics should be examined together with statistics of occupational and non-occupational diseases, since they reflect the circumstances affecting the worker, national economy and social welfare. The author also discusses the development of statistics in Mexico, including the general classification for the grouping of industrial accidents drawn up by the Statistics Office of the Department of Labour and the Department of Statistics.

Les accidents et leurs causes. By Dr. A. MORALIDA-NINOS and Miss D. SOLOMONODIS. (*Cahiers des comités de prévention du bâtiment et des travaux publics*, No. 3, March-April 1948, p. 4.)

After dealing with the various types of accidents, dangerous acts and accidents attributable to faulty organisation of work, the authors study the human factor, analysing, *inter alia*, the influence of the personality and organic disturbances on accident proneness. This study leads them to the conclusions that the belief in chance must be eliminated and that a strictly scientific method of studying accidents can be followed.

The article is concluded with a model accident report card and a bibliography.

Causas psicológicas de los accidentes y modo de eliminarlas. By José MALLART. (*Revista del Instituto Argentino de Seguridad*, Vol. VI, No.72, April 1948, p. 10.)

The author begins by discussing industrial statistics which show the worker only as the victim and not as the cause of accidents.

He continues with an analysis of accidents occurring in transit to vehicle drivers and which must be counted as occupational accidents since they occur during employment.

From questionnaires filled in by candidates for driving permits, 284 were chosen giving the causes of the accidents that the applicants had previously incurred, and it was found that 53.17 per cent. of the accidents were due to psychological causes. The investigation showed that there was a great difference between the number of persons who had incurred only one accident and those who had incurred two or more, a fact that seems to indicate that for many the one accident immunised them against having more. The occurrence of the second and third accident seems to indicate that the person concerned was accident prone. It is therefore advisable that even for non-hazardous occupations it be ascertained whether the person who has had more than one accident is accident prone.

Laboratory tests have shown that in occupations requiring complex reactions, the initial rapidity of reaction ceases to be of importance and is replaced by the safety and continuing rapidity of the reaction process, which permits the person to have control over the situation at the so-called " moment of fright "—the determining factor in the occurrence or avoidance of an accident.

A Review of Our 1947 Safety Program. By P. B. NIBECKER. (*Safety Review*, U.S. Navy Department, Vol. 5, No. 3, March 1948, p. 4.)

The article reproduces an address delivered by Rear Admiral Nibecker at the U.S. Navy's Second Annual East Coast Safety Conference in February 1948.

The number of accidents occurring in the Navy in 1947 decreased by almost 50 per cent. as compared with 1946. It is estimated that the cost of the Navy safety programme is less than the savings effected by reducing accidents. This improvement is the result of more rational organisation and above all the creation of the Navy Department Safety Council and the appointment of safety engineers responsible to the Council in the various bureaux of the Navy. The distribution of certificates and other awards has also played an important role.

It is hoped to reduce accidents still further by the use of a standard colour chart for the painting of working places and equipment. The wearing of protective goggles has recently been made compulsory for certain jobs, and goggles with corrective lenses are supplied to workers whose sight is defective.

Even if the frequency and severity rates, however, were reduced to a level never before attained, any reduction in the safety personnel would be extremely dangerous. In fact, such an improvement can only be attained and, more important, maintained, by an intense effort that is never slackened.

Teamwork for Safety. By W. A. STANBURY Jr. (*Coal Age*, April 1948, p. 92.)

The author describes a safety scheme carried out jointly by the mine operators and the United Mine Workers of America in a part of West Virginia.

The first step was taken when the U.M.W.A. appointed a former State mine inspector to study federal inspection reports on mines in the area. As a result of his studies the Union established a Safety Department for the whole area, and local safety meetings, which management representatives and inspectors attend on invitation, are held monthly. At these meetings the safety committee arranges discussions on compliance with the Federal Safety Code, the accidents that have occurred since the last meeting, and provisions of the Federal Code, the State Mining Law and company safety rules. The meetings have proved successful. The Union Safety Director supplements these meetings by holding discussions with mine officials on ways and means of improving safety and by coaching the local miners' safety committees. He has also called upon the U.S. Bureau of Mines to give first-aid training courses.

By the spring of 1947 the activities of the Safety Department had expanded so much that smaller Departments were opened in each of the four coalfields of the area. When broader powers were vested in local safety committees by the Krug-Lewis agreement of 1946 and the wage agreement of 1947 it was felt necessary to give members of the committees more technical training and the Safety Director asked the Bureau of Mines to give courses in accident prevention.

Safety committees report all accidents to the area headquarters of the Union and fatal accidents are investigated jointly by inspectors and the safety Committee. The results of the investigations are given publicity by the committee and Union officials with a view to avoiding similar accidents in the future.

These safety activities were intensified by special monthly campaigns, begun in June 1947 and carried on by agreement between the mine operators and the Union. In one of the coalfields the first month's campaign succeeded in reducing the number of lost-time injuries to 49 from the 1946 average of 115. A further 10 per cent. reduction was achieved in July. Similar campaigns in neighbouring coalfields reduced accidents by 50 per cent. and more. The costs of the prizes and other expenses of the campaign are shared by the operators and the Union. Over the whole area concerned the Union is spending $15,000 a month on safety work.

The success of this scheme has been very considerable and the U.M.W.A. is instituting further safety schemes in other parts of the United States.

Some lessons to be learned from the West Virginia scheme are that safety pays both managements and men; better safety records also mean better public relations for the company and the industry as a whole, and greater prestige for the Union; giving the miner some authority and responsibility for safety gets results; recourse to Federal and State authorities for safety training purposes lends authority to the safety programme and ensures that the very best teaching is given; and unremitting safety work eventually makes the miners safety-conscious.

The Medical-Safety Team. By R. Ralph BRESLER, M.D. (*National Safety News*, May 1948, p. 18.)

The author advances reasons why the safety engineer should co-operate with the plant doctor and with the foremen, and gives safety engineers advice on how to make this co-operation successful. He also mentions some ways in which doctors and nurses can make a contribution to safety.

The Safety "Engineer" — The Man Without a Training. By Jean Spencer FELTON, M. D. (*Industrial Medicine*, April 1948, p. 123.)

It is pointed out in this article that safety engineers seldom have had specific education in

safety. Experience in industry is not sufficient to prepare the safety engineer adequately to cope with the many and varied problems of his job. The author recommends that special comprehensive courses be given in safety engineering in vocational schools, colleges, and universities with a view to providing for industry engineers adequately trained to deal with safety and accident prevention problems.

Nouvelles notices scientifiques et méthodes de traitement pour les accidents par courant à haute tension. By Drs. H. FISCHER and R. FRÖHLICHER. (*Bulletin de l'Association suisse des électriciens*, No. 16, 1947, p. 496.)

This paper makes a useful contribution to the knowledge of the processes of electrocution by high tension current and describes the methods of treatment and first aid to be given in case of accidents of this kind. The first-aid treatment, which has in several cases saved the victims of accidents, is remarkably simple.

Electrocution by high tension current does not produce the same effects as low tension current. The passage of high tension current through the body causes muscular lesions which are scarcely visible externally but which are liable to result in death within several days by auto-intoxication. It has been determined that this poisoning of an internal origin is caused by the presence in the blood of muscular colouring (myoglobine), a toxic substance released from the injured muscles and resulting in the stoppage of the functioning of the kidneys. All means liable to stop myoglobine from reaching a concentration in the blood sufficient to endanger the kidneys must be used. On the other hand, since myoglobine and other substances cause the victim's urine to become very acid it is necessary strongly to alkalify the tissues.

In addition to complying with the instructions in force respecting rescue and first aid to be given in case of electrical accidents, the following procedure should be followed in the case of accidents caused by high tension current.

Administer immediately to the victim if he is conscious and, if not, as soon as he regains consciousness: 1 teaspoonful of bicarbonate of soda in $^1/_3$ of a litre of water. Repeat the administration of bicarbonate *every hour* for 24 hours, unless the doctor prescribes another treatment. In addition, get the victim to drink a lot of slightly salted water (1 soupspoonful of salt for 1 litre of water) or sweetened water (3 soupspoonfuls of sugar for 1 litre of water), tea, fruit juices or alkaline water (Vichy). This abundantly liquid diet should be continued for 5 to 6 days whereas the administration of bicarbonate of soda should not continue after the first 24 to 36 hours.

Keep the victim's urine, in particular that of the first urination, and put it at the disposal of the doctor for purposes of analysis.

RECENT BOOKS

Industrial Safety in the United States. By L. N. DUGUID and R. E. TUGMAN. Published by the Royal Society for the Prevention of Accidents. London, 1948. 31 pp. Price 3s. 6d.

In this booklet two prominent British safety experts record their impressions, derived from a visit to the United States, of some of the features of the American safety movement.

Mr. Duguid deals briefly with numerous matters including legislation and inspection, trade union activities, guarding of machinery, hoists and lifts, ventilation and building operations.

Mr. Tugman is more concerned with the voluntary safety movement and especially works safety organisation.

The booklet is very interesting reading.

Seasonal Variation of Daylight Illumination. Department of Scientific and Industrial Research. Illumination Research, Technical Paper No. 17. Published by H.M. Stationery Office. London, 1935, reprinted 1948. 8 pp. Price 6d.

Gives data on the average daylight illumination to be expected at any given time of day throughout the year. These data, the results of ten years' observations, are of interest to architects and all concerned with the natural lighting of buildings.

Safety Achievements of the Continental Mine, Continental-Archbald Coal Co., Scranton, Lackwanna County, Pa. U.S. Bureau of Mines, I.C. 7468, Washington, D.C., June 1948. 18 pp.

The mine in question produced 1,276,381 tons of anthracite under extremely adverse mining conditions, and worked 4,320,085 man-hours without a fatal injury between 16 March 1942 and 1 August 1947. The paper briefly describes the mine and then deals with the surface arrangements and equipment: methods of mining and timbering; explosives, detonators and blasting; ventilation and mine gases; haulage; electricity; mechanical equipment; underground fire prevention; and safety organisation.

Breaking Coal with Airdox. U.S. Bureau of Mines, I.C. 7480. Washington, D.C., August 1948. 9 pp.

Describes, with numerous illustrations, the construction and use of Airdox devices for breaking down coal and discusses their advantages from the safety standpoint. The chief hazard in their use lies in the possibility of rupture of the steel or copper air lines.

Ignition of Firedamp by Explosives. U.S. Bureau of Mines, R.I. 4382, Washington, D.C., September 1948. 11 pp.

Briefly discusses numerous matters including the role of compression, heat conduction and diffusion in the ignition process; unstemmed shots; formation of firedamp pockets by solid particles; limit charges; effects of free borehole space, detonator position, greatly increased charges and obstacles; nature of primary flame; and shock waves. Comments on various theories of firedamp ignition.

Control of Roof and Prevention of Accidents from Falls of Rock and Coal. U.S. Bureau of Mines, I. C. 7461. Washington, D.C., April 1948. 8 pp.

This pamphlet gives an outline of the problem of roof control and support in mines. The authors emphasise in particular the necessity of instilling into the mining personnel the fundamental principles of safety which they should apply when they encounter a dangerous roof.

Control of Roof and Prevention of Accidents from Falls of Rock and Coal. Suggested Roof Supports for Use at Faces in Conjunction with Mechanical Loading. U.S. Bureau of Mines, I. C. No. 7471, Washington, D.C., May 1948. 9 pp.

This pamphlet describes, with the help of numerous illustrations, various methods for temporarily or permanently supporting the roof in the neighbourhood of the working face. [1]

Review of Bureau of Mines Work on Use of Diesel Engines Underground. U.S. Bureau of Mines, R.I. 4381, Washington, D.C., September 1948, 28 pp.

The review is mainly concerned with factors affecting the composition of Diesel exhaust gas and the ignition hazards of Diesel engines. It also deals briefly with the removal of aldehydes from the exhaust gas. The factors affecting the composition of the exhaust gas include the surrounding atmosphere, fuel injection, barometric pressure, manifold pressure and fuel properties.

The hazards and the means of eliminating them are enumerated in a final summary. The review is copiously illustrated with graphs, diagrams and photographs.

A Mine Air-Conditioning Chart. U.S. Bureau of Mines, R. I. 4165. Washington, D. C., December 1947. 23 pp.

This pamphlet describes in detail the method of drawing up and using a psychrometric chart for the solving of problems respecting the air conditioning of mines.

The value of this chart is enhanced by the fact that altitude is represented as a variable.

Consolidation of Dust on Floors of Mine Roadways. Ministry of Fuel and Power, Safety Circular No. 164. H.M. Stationery Office, London, 1948. 8 pp. Price 2d.

Discusses the circumstances in which dust should be consolidated, the principles and methods of consolidation, and the maintenance of stone dusting. The most suitable consolidating agent is flake calcium chloride and it should constitute from 2 to 7 per cent. of floor dust. Before the calcium chloride is applied, roadways should be well wetted, either with water alone or with water and a wetting agent. The amounts of calcium chloride required in various conditions of humidity are indicated in tables.

Tests in the Experimental Coal Mine to Determine Requirements for Preventing Propagation of Coal-Dust Explosions in Rooms. U.S. Bureau of Mines, R.I. 4195. Washington, D.C., February 1948. 12 pp.

The tests that form the subject of this paper were designed to compare rock-dusting requirements in short, wide rooms with those in long, narrow entries, to ascertain the effects of crosscuts between rooms and to investigate the efficiency of bag-type dust barriers.

The paper describes the test arrangements and discusses the results under the following heads: tests without rock dust in a narrow room, tests with rock dust in a narrow room, effect of widening a room from 10 to 21.5 feet, tests with rock dust in three wide connected rooms and tests of bag-type devices.

The testing arrangements are illustrated by numerous photographs and plans.

The conclusions are as follows:

1. Propagation of coal-dust explosions originating in single narrow or wide coal-mine rooms or workings of relatively short length can be prevented by generalised rock dusting carried up to within 40 feet of the working face, if the incombustible content of the dust is maintained above 65 per cent. *Rock dust carried up to within 80 feet of the working face will not prevent propagation of coal-dust explosions in such workings.*

2. To prevent the propagation of coal-dust explosions in wide connected workings or rooms, *a minimum of 65 per cent. incombustible in the dust must be maintained up to within 40 feet or less of the working faces.*

3. Bag-type rock-dust protective devices that have been tested so far are ineffective in preventing the propagation of explosions either between connected rooms or from rooms into entries. The chief cause of failure of these devices is that the rock dust is not adequately dispersed into the air stream at the proper moment. The arrangements tested are those that can be installed readily in commercial mines. They leave the trackway in rooms unprotected. To be effective, any improved form of these devices must *(a)* have a more positive means of operation, so as to cause good dispersion of at least 70 per cent. of the rock dust at the right time, and *(b)* be capable of installation over track or other haulageways, so that the entire width of a room is protected.

Mine Gases and Methods for Detecting Them. U.S. Bureau of Mines, Miners' Circular 33, Washington, D.C., Revised 1948. 67 pp. Price 30 cents.

Discusses the sources, characteristics and physiological effects of mine gases, and methods of detecting methane, carbon monoxide, hydrogen sulphide and various other gases. Furnishes information on various types of detector and gives advice on the care and use of flame safety lamps.

Protection Against Mine Gases. U.S. Bureau of Mines. Miners' Circular 35. Washington, D.C., 1948. 56 pp. Price 20 cents.

The subjects dealt with are barricades, self-rescue respirators, self-contained oxygen breathing apparatus, hose masks and rescuscitation.

The circular gives a set of rules for the construction of barricades and quotes instances in which they have saved lives in fires and explosions. The various types of respiratory apparatus are described in detail, with numerous illustrations; advice is given on their use and maintenance and instances quoted of their employment for life-saving purposes.

Emergency Escapeways from Coal Mines. U.S. Bureau of Mines, I.C. 7478, Washington, D.C., August 1948. 11 pp.

Describes some mine fires in which many lives were lost owing to the inadequacy of escapeways

[1] See also "Roof Support with Suspension Rods", *Industrial Safety Survey*, Vol. XXIV, No. 3, p. 109.

and others in which escapeways avoided loss of life. Gives advice on the construction of escapeways, and refers to the utility of large-diameter boreholes from the surface and of self-rescue apparatus.

Analyses of Complex Mixtures of Gases. U.S. Bureau of Mines, Bulletin 471, Washington, D.C., 1948. 202 pp. Price 75 cents.

The volume deals with gas analyses for the purpose of controlling and extinguishing fires, and preventing explosions in mines, tunnels and hazardous industrial processes.

There are two parts. The principal matters dealt with in Part I are calculation of factors affecting explosibility of complex gas mixtures; use of charts to determine explosibility of complex mixtures of gas, inert gas and air; calculation of volume of additional inert gas necessary to render an atmosphere non-explosive; method of calculating volume of carbon dioxide required as a diluent; and use of a mixture of air and inert gas as a diluent.

The second part of the volume discusses examples of practical applications of data relating to the explosibility of mixed gases. The examples are an anthracite mine fire, a fire in inaccessible old mine workings, and an explosion caused by fuel gas in a manufacturing plant.

The treatment of the subject is largely mathematical and the volume provides very numerous equations, tables and graphs. It concludes with a short bibliography.

Hazards of Entering Old Mine Workings. U.S. Bureau of Mines, I.C. 7479. Washington, D.C., August 1948. 18 pp.

Describes numerous accidents due to people entering old mines, quarries and pits, and reproduces a leaflet on the risks involved, prepared for school children by the Arizona Small Mine Operators' Association.

Veiligheid en Chemie. By Dr. H. A. J. Pieters and J. W. Creyghton. 2nd Edition. Published by the Safety Service of the State Mines. Heerlen, 1947. 306 pp.

The nature of this volume is indicated in the subtitle "Hints and Rules for the Promotion of Safety in the Chemical Laboratory".

The volume is divided into six parts as follows: A. Discussion of the risks associated with work in a chemical laboratory and the means of avoiding them; B. Physiological and toxicological data of importance to the chemists; C. Safety equipment (including personal protective equipment and rescue apparatus); D. Safety rules for laboratory work and the handling of chemicals; E. Detection and determination of small quantities of substances injurious to health; and F. Tables, notes, diagrams, etc.

The volume is both a general safety manual for laboratory work and a detailed compilation of information on the characteristics of a large number of different chemicals. It is concisely written, clearly arranged, profusely illustrated and compresses a vast quantity of knowledge into a comparatively small space.

Accident Prevention in Brick, Pipe and Tile Manufacture. Factory Department, Ministry of Labour and National Service. H.M. Stationery Office, Safety Pamphlet No. 17. London, 1948. 96 pp. Price 2s.

This profusely illustrated pamphlet is devoted to the prevention of accidents in the manufacture of bricks, pipes and tiles. It comprises the following chapters: guarding of the machines used in the preparatory processes; guarding of brickmaking machines; guarding of brick presses; guarding of pipemaking machines; guarding of tilemaking machinery; general precautions against machinery accidents; and prevention of accidents not caused by machinery. The work concludes with a number of extracts from the Factories Act, 1937, applicable to the brick, pipe and tile manufacturing industry.

Building Regulations Handbook. Published by the Royal Society for the Prevention of Accidents, London, 1948. 28 pp. Price 10s.

The handbook is described as a guide and index to British safety legislation applying to building operations. It deals mainly with the Building (Safety, Health and Welfare) Regulations 1948 [1], the provisions of which, together with others quoted, are arranged in groups and subgroups according to subject and summarised in tabular form.

The main group headings are: General requirements, Scaffolding; Lifting appliances; Hoists; Routine inspections, etc.; Excavations; Explosives; Demolition; Storage of petrol; Painting; Machinery; Woodworking machinery; Steam boilers and air receivers; Electricity; and First aid, etc.

The handbook is intended for practical use by contractors, foremen and others engaged in building operations. To such people it must commend itself highly by its thoroughness and exceptionally clear arrangement.

The Pier Fire Problem in the Port of New York. New York Board of Fire Underwriters. New York, June 1948. 14 pp.

After briefly describing how fire prevention has been disregarded in the design and construction of piers, the pamphlet goes on to define the two types of fire which experience has shown that piers are subject to.

One, known as a substructure fire, originates below the deck in the wooden cross members and piling, burns out the cross members and the top of the piles and drops the pier into the water. The other, known as a superstructure fire, originates above the deck, generally in the goods or merchandise storage on the pier and quickly spreads throughout the pier shed. Therefore if a pier is to be free of the possibility of destruction by fire the substructure and superstructure must each receive individual attention.

The substructure fire is due to the existence of a large quantity of wooden members, many of which are in a dried-out and sometimes splintered condition, covering a large area without barrier to the horizontal spread of fire and in locations not readily accessible to the fire brigades. A pier is also a warehouse for all types of goods which are over water, thus making it more difficult to reach and extinguish any fire in the substructure.

In fighting substructure fires there are locations that cannot be reached without cutting holes through the deck, through which various kinds of nozzles can be inserted to get water on the fire. This process it not an easy one especially if the deck consists of asphalt on six inches of reinforced concrete on four-inch wood planks, as in several piers.

[1] See *Industrial Safety Survey*, Vol. XXIV, No. 4, p. 136.

In order to prevent the conflagration types of pier-substructure fire it is necessary to provide: *(a)* a means of preventing the horizontal spread of fire and confining it to within certain predetermined limits; *(b)* a means of reaching the seat of the fire so that the water can be applied to it.

For the first requirement, two different means are proposed; one a barrier in the substructure in the form of a wall, and the other the provision of a water curtain installation. Of the two, the wall seems to be the better because it requires no particular action or training on the part of the fire-fighting brigades and very little, if any, maintenance.

As to the second requirement, the provision of means of readily bringing water on to the fire may be accomplished in several ways. Openings in the pier deck properly arranged appear to be a reliable, simple and economical means of providing a path for the extinction of a substructure fire. Such an arrangement is described in great detail.

Superstructure fires have been found to spread very rapidly because pier sheds act like flues. One way of preventing this type of fire is by means of transverse walls across the pier, provided with large openings which need to be protected by fire doors, if the wall is to be effective. However, it appears that these walls may not be entirely necessary in the superstructure if adequate sprinkler protection is provided, coupled with draught stops and automatic skylights. On piers handling flammable substances, walls are a definite necessity to reduce excessive risk areas.

The pamphlet goes on to describe the various difficulties in the way of fighting fires on piers, and concludes with an appeal for improvement of the present condition of the piers in New York Harbour.

National Electricity Safety Code. National Bureau of Standards, Handbook H. 30. U.S. Government Printing Office, Washington, D.C. March 1948, viii + 408 pp. Price $1.25.

This manual, published by the National Bureau of Standards, is the fifth edition of the American National Safety Code for Electrical Installations. The different parts, published previously as separate manuals, were approved by the American Standards Association. They are as follows:

I. Rules for the installation and maintenance of electrical supply stations.
II. Rules for the installation and maintenance of electric supply and communication lines.
III. Rules for the installation and maintenance of electric utilisation equipment.
IV. Rules for the operation of electric equipment and lines.
V. Rules for radio installations. (These rules also contain directions for earthing.)

Effect of Hydrocarbons and Other Gases upon the Explosibility of Acetylene. U.S. Bureau of Mines. R.I. 4198. Washington, D.C., January 1948. 8 pp.

This pamphlet describes an experimental study on the effect of hydrocarbons and other gases on the explosibility of acetylene.

It is well known that acetylene will explode under pressure in the absence of air when subjected to certain agents. In order to reduce this risk, an attempt was made to stabilise acetylene by adding various gases. The following gases were used: butane, propane, natural gas (composed of methane ethane and nitrogen), carbon dioxide, nitrogen, helium and hydrogen. The best results were obtained with carbon dioxide. It was determined that an explosion can be set off in a generator containing dry acetylene at a pressure of 0.43 kg/cm². By mixing with the acetylene 21 per cent. of its volume of butane, the pressure can be increased to 7.0 kg/cm² without risk of explosion.

Dust and Its Effects on the Respiratory System. By George H. GILL H. K. Lewis & Co., Ltd., London, 1947. 50 pp.

This profusely illustrated booklet describes in simple language the physiological mechanism and action of dusts on the respiratory organs.

The author deals first of all with the anatomy and the physiology of the respiratory organs. He then reviews occupational diseases such as pneumoconiosis, silicosis, asbestosis, byssinosis, etc. Finally, he describes the different technical methods employed for the sampling and measuring of dusts.

The work is accompanied by a brief bibliography.

Le benzolisme. By V. RAYMOND and A. VALLAUD. Published by the National Safety Institute for the Prevention of Industrial Accidents and Occupational Diseases. Paris, 1948, 174 pp. Price 250 francs.

This work comprises the first instalment of a series devoted to the study of the main problems of industrial hygiene which the National Safety Institute proposes to publish.

The study is in four chapters. The first two deal with the general properties of benzols, their toxicology, occupational benzol poisoning, and the medical prevention and compensation of this disease. The third chapter discusses methods of discovering the presence of benzol and determining its concentration in industrial products, in the air, the blood and the organs. Finally, the fourth chapter includes the technical protective measures to be applied in various industries with a view to avoiding the risks of poisoning and recommends the use of less toxic products to replace benzols. A substantial bibliography completes the book and the texts of official regulations concerning the prevention of benzol poisoning in force in France are also annexed.

Contrôle de l'efficacité de différents masques filtrants. Mine Hygiene Institute, Hasselt, Belgium. Communication No. 49. 10 pp. (Roneoed.)

An account is given in this pamphlet of the tests carried out by the Mine Hygiene Institute with a view to determining the technical characteristics of various types of respiratory masks with filter cartridges.

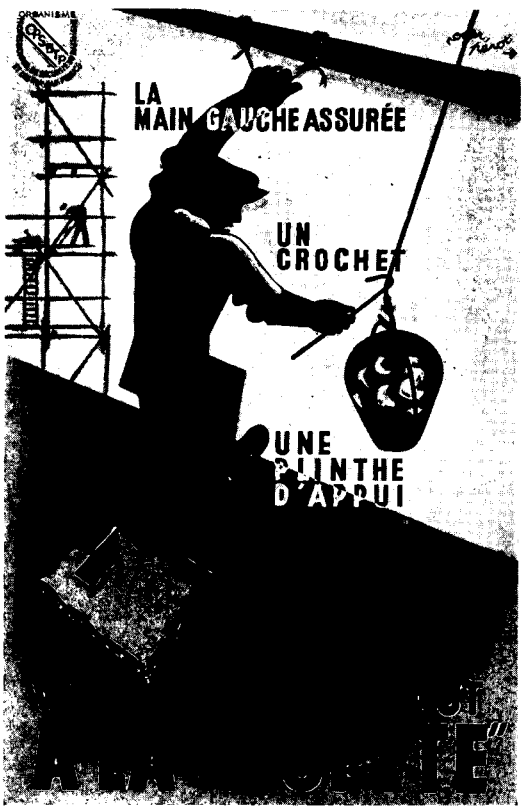
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The ACCIDENT even affects them.
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Don't jump on scaffolding.

(Trade Association for the Building and Public Works Industries, Paris.)

INDUSTRIAL SAFETY SURVEY

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LABOUR-MANAGEMENT CO-OPERATION IN ACCIDENT PREVENTION IN THE UNITED STATES

By Ernest DALE, Columbia University, New York, N.Y.

Labour participation in accident prevention is one of the most important forms of co-operation, and one with considerable possibilities of accomplishing tangible results. In safety, the employee is deeply interested for his own sake [1]; the union can render real service to its members; and management has economic, social and legal responsibilities. The likelihood of conflict is more limited than in most other spheres of co-operation. As a labour leader explained it: "I can say without fear of contradiction that safety is a sphere in which management and labour can co-operate without rancour, without fear and without the usual procedures and preliminaries ordinarily part of collective bargaining". Successful co-operation in accident prevention has been helpful in laying the foundation for co-operation in other fields.

ORGANISATION

The organisation of co-operation for accident prevention shows great variety. Important variations in membership of safety committees arise from differences in the basic type of co-operation, and the size of the plant. There is also a wide variety in the degree of co-operation. Some examples of these major variables are given in the following paragraphs.

In departmental co-operation stress is laid on the relationship between management and groups of employees. The employees usually are hourly-rated workers, who serve in rotation. Less frequently membership of committees is confined to skilled employees, such as machinists, electricians, toolmakers and maintenance men; and in a number of the larger plants union representatives are added. Management representatives usually include foremen and superintendents, somewhat less frequently the safety engineer, and occasionally the personnel director.

In plant-wide co-operation, management representatives usually include foremen, the personnel director and the safety engineer, less often the plant manager, superintendent or the plant nurse. Union representatives frequently include the president of the local, members or the bargaining committees, or union stewards. In practically all instances employees other than union officials participate.

In plant-wide co-operation, stress is more on recommendation than on discussion, and the jurisdiction of the committee naturally covers a wider area. Management representatives are usually higher up in the organisation scale than those serving under departmental co-operation. This applies even where the titles are the same, *e.g.*, foremen participating in plant-wide co-operation generally have greater responsibility and supervise more men than the foremen who participate in departmental co-operation. The participating safety engineer in departmental co-operation may be anyone concerned with safety in the plant, less often than not a technician who, through training and experience, is able to provide engineering revision. In plant-wide co-operation the safety engineer is likely to be just such a technician or a non-technical specialist who will be able to recognise areas where accident-prevention activities of an engineering, educational or enforcement nature are required, and contact the proper person in the plant organisation.

Labour participation is mostly of an informational character; efforts are often confined to unilateral attempts at improving knowledge of safety rules through lectures or discussions, films, bulletins, etc. [1], less frequently through joint

[1] The management of a large East Coast shipyard issued a questionnaire to all newly hired employees at the start of their orientation course on the first day of employment. Each was asked to indicate which one of the ten listed factors affecting his job was of most concern to him. Thirty-three per cent. of 10,000 employees so questioned over a 12-month period picked safety in preference to good wages, a good boss, pensions and six other factors which are usually considered to be of first-line interest to any job holder. (F. G. LIPPERT: *Accident Prevention Administration*, McGraw-Hill Book Co., New York, 1947, p. 42.)

[1] Informational material may be found in the *Topics for Safety Meetings*, National Safety Council, Safe Practices Pamphlet No. 93, Chicago, 1940; *Supervisors' Safety Suggestions*, General Motors Corporation, Detroit, Mich., no date; *Accidents Don't Happen*, Canadian Department of Labor; a series of four films dealing with the organisation and working of safety committees, and various types of accidents caused by machines, handling and falls.

fact-finding and inspection. Consultative or constructive co-operation involves labour participation in two fields: *(a)* in policy-making, that is, in developing standard methods of guarding equipment or standard operating practices, such as safety rules and methods of rewards and punishments; *(b)* in techniques of promoting safety, which include:

1. Development of a safety programme (eye protection, provision of safety shoes, employee instruction in specific safety practices such as proper lifting, etc.), appointment of safety guides for individual departments.
2. Plant inspection, checking unsafe habits and practices, recommendations of preventive measures, encouragement to use personal safety equipment, investigation of important accidents, attendance at formal hearings, opinion on the exercise of important responsibilities, refraining from contesting discipline in case of broken rules.
3. Discussion of employees' safety suggestions and of hazards pointed out by insurance representatives; supervision of safety contests, awarding of prizes.
4. Spreading the news of accident prevention through the plant magazine, posters, slogans, exhibits, compilation of a safety manual, acting as a clearing house for new ideas.
5. Orientation sessions with new employees; interviews with accident-prone employees.
6. Supervision of housekeeping and maintenance in relation to safety.
7. Reviews and reports on previous recommendations.

Joint determination is the least frequent degree of co-operation and applies to matters mentioned under Point 2. If there is disagreement between the labour and management representatives (*e.g.*, foremen or the safety director), provision may be made for discussion at a higher level of management (superintendent, personnel director). Union representatives may jointly formulate with management penalty clauses for application to offending employees. Such clauses may be found in the contracts of the United Electrical, Radio and Machine Workers, the United Rubber Workers and the Chemical Council of the American Federation of Labor. [1]

The union contract may also provide for joint enforcement: "This agreement between the International Brotherhood of Boiler Makers, Iron Ship Builders, Welders and Helpers of America, A.F.L., and ... Company, establishes a programme for the wearing of safety glasses, obligates the union and the company in the enforcement of the said programme ...".[2]

An actual organisational set-up may be given to illustrate how plant-wide co-operation is conducted, and the largest chemical plant of the Koppers Company, Inc., of Pittsburgh, may be chosen as an example. The safety organisation is divided into three major types of committees:

(1) the General Safety Committee;
(2) the departmental committees;
(3) employees' committees.

The General Safety Committee includes the plant manager as chairman, the safety director, the chief union steward, and eight department superintendents. Its jurisdiction extends to the plant as a whole. Its major functions are formulation of safety policy; approval of procedures proposed by the other committees; development of educational and publicity work; review of lost-time accidents so that corrective action may be taken or discipline administered (in exceptional cases), or a change made in disciplinary policy; appointment of special subcommittees to study and report on specific problems.

Each *departmental committee* consists of the superintendent as chairman, all departmental supervisors, the representative of the safety department, and one or more union stewards. Its jurisdiction is department-wide, and it includes a number of sections. It carries out the policies, procedures, and educational efforts planned by the General Committee, and recommends safe practices and procedures to this Committee. It reviews all incidents in the department, investigates all lost-time and near-lost-time cases, and recommends to the General Committee methods of eliminating the hazards involved. It makes regular departmental inspections for unsafe practices and conditions, and acts on suggestions of the employees' committees in the department.

Each *employees' committee* consists of a supervisor as chairman and all employees in that supervisor's section. It studies, observes and reviews the rules set up by the General Committee. It presents its views and suggestions on practices and conditions as they affect safety. It participates in safety meetings and other safety training activities.

The organisation of safety co-operation at the Koppers Company is of the line type, and provides for a two-way flow of information and ideas. Enlisted are the authority of the supervisor, the technical assistance of the safety director, and the co-operation of all union and non-union employees.

Sectional co-operation has made possible full participation of the employees. The union has gained an appreciation of management problems arising from accidents, and has been encouraged to give full support and co-operation in the prevention programme. For 1947, the plant had an accident frequency rate of 2.5 and a severity rate of 0.11.

[1] U.S. DEPARTMENT OF LABOR, DIVISION OF LABOR STANDARDS: *Joint Safety Committees at Work; A Report on Union Participation*, Washington, D.C., 1944, p. 7.
[2] Frederick G. LIPPERT, *op. cit.*, p. 70.

Evaluation

A small sample was studied intensively to discover, as far as possible, the effect of labour-management co-operation on accident rates. A detailed questionnaire was sent to 150 companies which had reported some experience in co-operation to reduce accidents. Of these, only 13 answered all questions, but there were 39 replies which were full enough to be used for purpose of analysis, and the experience reported extended over a number of years. Industries covered included iron and steel, chemicals, automobiles, oil, textiles, shipbuilding, and aircraft.

Various methods of analysis were used to find out whether labour-management co-operation effectively influences accident rates. The following appear to be the principal findings:

Number of plans in existence. The very fact that regular meetings are held between management and labour representatives appears to some as evidence that the influence of co-operation is beneficial. One hundred and sixty-three committees were reported altogether, 87 on a departmental basis, 76 plant-wide. (Union participation, however, is still relatively rather infrequent.)

It seems that in most industries the plant-wide committee is relatively rare. For example, in the textile industry the Textile Workers Union of America has over 1,600 contracts, covering over 500,000 people. Only 40 labour-management committees of any type were found. A number of these do not include participation by the union. A number are inoperative. Some are being short-circuited.[1]

Plant-wide safety committees are widespread in coal mining, steel, and the pulp and paper industries. Since May, 1946, the International Brotherhood of Paper Makers [2] and the International Brotherhood of Pulp, Sulphite and Paper Mill Workers representing 15,000 workers have been working jointly on safety with the Pacific Coast Association of Pulp and Paper Manufacturers, representing 32 member plants in the Northwest region. Provision for plant-wide safety committees is also found in contract clauses of the International Association of Machinists, the United Automobile Workers, the Industrial Union of Marine and Shipbuilding Workers of America, the United Rubber Workers of America, the United Electrical, Radio and Machine Workers, the Textile Workers Union of America, the International Woodworkers of America and others. A fairly typical safety clause reads as follows: "A safety committee consisting of three employees designated by the union and three management members designated by the company shall be established in each plant." [1] A union leader reports that "a few international unions already have a nucleus of accident specialists to service their industries".

Length of operation. Another indication of the success of co-operation is the length of time it has existed. A small sample consisting of 37 accident-prevention committees showed a high degree of longevity:

Length of operation	Number of committees
Less than 2 years	8
From two to 5 years . . .	12
From five to 10 years . . .	6
Over 10 years (started before 1937)	11

Four fifths of the committees had operated for more than two years; almost half date back before the second World War, and have definitely survived short-run enthusiasms and difficulties.

Reduction of accident rates directly traceable to co-operation. A number of specific tests were applied to gauge the value of the prevention work: "before and after" figures for the same company, comparisons with industry averages, comparisons in the same industry. (It should be noted, however, that many of the following data are in the nature of estimates.)

The accident frequency of 29 companies was examined by this survey over a period of several years. Of these, 23 reported that labour-management co-operation had been a factor in reduction of accident frequency; in six, management stated that it had been a factor in an increase. Specifically, the contribution of co-operation to the reduction of accident frequencies was said to be "much" by six companies and "moderate" by 15. Two failed to give an opinion.

Only eight companies stated whether the *rate* of reduction of accidents was greater or smaller after the introduction of co-operation. Of these, five said it was greater, one it was less, and in two cases it was held to be the same. To give some examples: Joseph E. Seagram and Sons, Inc., reported that its accident frequency was 17.65 in 1942 and 2.79 in 1947, and had been consistently maintained at a low level for the last four years, in good part directly because of co-operation; improvements in accident frequency resulting from the introduction of labour-management co-operation were reported by the A. O. Smith Company, the White Motor Company, the air-

[1] Solomon Barkin: *A Labor View of the Safety Problem: Address before the 17th Annual Safety Convention, March 26, 1947* (mimeographed), pp. 2-3.

[2] See the union's pamphlet *Digest of the Three Joint Labor-Management Safety Conferences* on the conferences held during 1946 by the Pulp and Paper Industry, Washington, Oregon, California.

[1] Agreement between the Carnegie-Illinois Steel Corporation and the United Steelworkers of America, C.I.O., 22 Apr. 1947.

craft industry, the Westinghouse Electric Corporation. As John A. STEPHENS, Vice-President in Charge of Industrial Relations at the United States Steel Corporation of Delaware, put it: "These provisions (right to speedy arbitration of a safety grievance, right to be relieved of a job considered unsafe, and small joint safety committees at each plant to review hazards and to consult with management) have by practical example demonstrated that the slogans 'Safety First' and 'Safety of Our Employees is Our First Consideration' are much more than slogans. I believe also that our action had already touched a responsive and co-operative chord in the moral fibre of the men who make United States Steel."

Since the joint safety programme was started in 1946 in the pulp and paper industry, the unions have reported that the accident frequency of this industry in the State of Washington was reduced by 55 per cent. in 1948 (partially due to co-operation), and though compensation benefits increased 40 per cent. compensation insurance rates were lowered.

Another test of the effectiveness of labour-management co-operation is the comparison of the records of companies having co-operation with those companies in the same industry which have none. In the small sample referred to, 17 of the companies improved their rank, *i.e.*, bettered their position as regards accident frequency as compared with the other companies in the industry; in five the position remained the same, and in four it worsened. A comparison with others in the same industry showed that on the whole, firms with co-operation appear to have obtained greater reductions in accident frequency than those without co-operation. For companies with co-operation the following improvements in their rank in their industries were recorded (the rank first indicated was recorded when labour-management co-operation began):

Wolverine Tube: From 25th to 2nd in seven years.
Globe Forge, Inc.: From 33rd to 2nd in four years.
American Gas Machine Co.: From 30th to "close to the top" in five years.
Howard Smith Paper Mills: From 12th to 1st in four years (place maintained for the last four years).

When Lukens Steel Co. introduced co-operation in 1937 its accident frequency was twice the average for the whole industry; in 1946, the frequency was down to 20 per cent. below the industry average. A study of accident frequencies from the accident records of the forging industry tends to show that from 1943 to 1946 companies with labour-management co-operation had on the whole lower accident frequencies than those without co-operation, and the two top records were held by companies with co-operation.

Another comparison may be made of the accident frequencies of two woollen mills reporting co-operation with the experience of 25 woollen and worsted mills wholly or almost wholly without co-operation reporting to the National Safety Council from 1944 to 1947. (It should be noted that the experience of these 25 mills is probably better than that for the industry as a whole, because of their membership of the National Safety Council.) The accident frequency of the 25 mills was rising slightly from 1944 to 1946, that of the two mills with co-operation was falling rapidly over the same period (by 13 per cent. in one case, by 63 per cent. in the other). In 1947 all three frequencies showed a decline, but the reduction at the two co-operating mills was much greater and their final frequency much lower than that at the 25 mills.

ACCIDENT FREQUENCY IN 1947

	Accident frequency	Degree of co-operation
Fieldcrest Mills . .	0.90	Departmental
Forstman Woollen Company	1.46	Departmental and plant-wide
North Star Woollen Mill Co.	5.34	Plant-wide
25 mills reporting to the National Safety Council . . .	10.1	Little or none
Nation-wide average for the whole woollen industry . .	16.3	

Experience of three steel companies which reported that they were using co-operation in accident prevention was compared with that of 142 steel firms reporting to the National Safety Council for 1936-1937 and 1946-1947. Of the entire group, the best safety record was achieved by a firm with departmental co-operation, which now has a frequency rate of 3.22, and had achieved a reduction of 6.1 points, or 66 per cent., in the ten years. (For the industry group, the final rate was 6.64, and the reduction 1.56.)

Second place was held by a firm without co-operation, which had a frequency rate of 5.83, but this represented a reduction of only 1.0 point. A firm practising plant-wide co-operation was third, with a rate of 7.50, and a reduction of 1.35. (In this last company, the rate had doubled between 1936-1937 and 1942, when co-operation was introduced, and had been subsequently cut in half.)

It seems, therefore, justifiable to draw the conclusion that the introduction of co-operation has improved companies' records, and their ranks in their industries.

Opinions. Interviews with six top safety engineers from insurance companies revealed in each case that in their experience and observation labour-management co-operation in accident prevention made definite and tangible contributions toward accident reduction. H. W. HEINRICH, Assistant Superintendent, The Travelers Insurance Co., and an outstanding authority on accident prevention said: "I am wholly in sympathy with and a firm believer in the idea of drawing workmen into the accident prevention picture. . . The idea of direct employee participation is sound and worthwhile if only because of the broader aspects of the matter, such as the effect upon employee morale, goodwill and the bringing together of management and employees with regard to a non-controversial subject". On the other hand, the same authority found "quite a number of cases where worker participation proved of little or no value". Company and union opinions were divided. The reasons for different attitudes may become clear from the summary on page 47 of the advantages and disadvantages of labour-management co-operation.

Case Study: Successful Departmental Co-operation

An example of successful departmental co-operation is furnished by the Colonial Beacon Oil Refinery.

In 1920, shortly after the company started operations, a safety committee was formed, consisting of foremen, higher supervisors and the two departmental chiefs, to help reduce the alarmingly high accident frequency. The committee was headed by the plant superintendent. It met monthly and performed routine duties, such as investigating injuries, conducting plant inspections, making recommendations for the installation of guards on moving parts and equipment. However, from 1921 to 1936 the number of injuries (minor and disabling) continued to run to between 600 and 950 a year, that is, roughly from one to 1.5 injuries per employee per annum.

Resorting to other devices, the committee sponsored a course of instruction in first aid for all employees. It made more frequent inspections, consulted outside safety engineers, held safety contests. Some improvements resulted. The total number of injuries in 1927 and 1928 was half that of 1925 and 1926, and was reduced to less than a quarter in 1929. The number of disabling injuries was also reduced.

Late in 1929, a member of the line production department (who is now employee relations manager and a member of the board of the largest subsidiary of the Esso Standard Oil Co.) suggested that the men who actually did the work knew more about the hazards of the job than anyone else. Their aid should be enlisted to offer advice on the prevention of accidents. He held that the exclusive management approach to safety had been a failure.

After considerable debate and much opposition, a Workmen's Safety Committee was finally started in January 1930. The members consisted of one employee from each of the larger maintenance departments and one from each of the larger processing departments. The employee members, seven in all, served for six months, in rotation from 1930 to 1944; now the period of rotation is four months. The permanent chairman of the meetings is the safety supervisor, whose post was created at the time the committee was established. The plant superintendent and personnel manager attend occasionally.

The duties of the Workmen's Safety Committee include:

1. Regular inspection tours.
2. Training.
3. A thorough investigation of all injuries and all the circumstances pertaining to them. Recommendations are made to prevent repetition.
4. Five-minute group meetings of employees for safety instruction.

A Foremen's Safety Committee discusses the suggestions of the Workmen's Safety Committee and adds its own. The safety supervisor, who is chairman of the latter, follows up the suggestions which have been adopted and sees to it that they are put into effect. The general superintendent usually attends the meetings and makes the final decision in case of difference between the two committees. He also checks up on each individual foreman to find out whether the adopted suggestions have been put into operation. His very presence and the influence he has on promotion and salary increases for the foremen have been important factors in stimulating the Foremen's Safety Committee.

The results accomplished in this refinery (which employed an average of about 500 to 700 persons over the period considered) are remarkable:

(1) The total annual number of minor and disabling injuries between 1930 and 1946 never exceeded 80 save in 1930, a reduction of approximately 90 per cent. on the annual number that occurred between 1921 and 1926. From 1940 to 1947 the total annual number of injuries ranged from 18 to 29, a mere 3 per cent. of the average from 1923 to 1927.

(2) The average number of lost-time injuries which used to average 84 a year before employee participation, fell to 3½ a year from 1940 to 1946. There were more than 1,000 days without any disabling accident at all.

(3) From 1930 to 1946 there were four fatal accidents (one in 1936 and three in 1946) as against 25 fatal accidents from 1921 to 1929.

(4) The number of employee safety suggestions which were first counted in 1930, rose from an annual average of 86 for 1930-1937 to 171 for 1938-1946.

(5) The high degree of employee participation was also evident from the great interest which they showed at the committee meetings, from the employee attitude toward safety on the job, and by the great confidence placed in the safety supervisors. By 1947 each of the 440 employees had had six months' committee service. In interviews the employees made comments on the safety meetings such as: "It was a privilege to serve." "Since they consulted us, we've really gone to town on safety."

(6) In 1943, the company received top national honours in the 15th Annual Nation-Wide Petroleum Industry Safety Contest for Group B plants. In the Massachusetts Safety Council Contest the refinery surpassed other contestants in 1931, 1932,

1933, 1937, 1939, 1941, 1942, 1943, and 1944. It won the first place in national safety contests in 1934, 1937, 1938 and 1939, and second place in 1941 and 1942.

Of course these results are only partly due to employee participation. "Other things" have not remained equal.

(1) There were important changes from 1930 to 1947 in the nature of the work and the degree of work hazards. Equipment has been made "safer" and more "fool-proof". Hauling is done by cranes, no longer by men. Materials withstand pressure better and are much less likely to fail. Concrete cutters rather than sledge hammers are used.

(2) The average annual number of employees and hours of work were reduced by about one-third from 1925-1929 to 1942-1946.

(3) A better qualified safety engineer was hired in 1930; probably twice as much money is being spent on accident prevention (much of this used to go for accident compensation); both foremen and employees are much better trained in accident prevention; and more widespread use is made of safety clothing.

(4) Stricter self-discipline has taken the place of general autocratic discipline, which prevailed before 1930 and was resented by the men.

In relation to the above major contributions to accident reduction, it should be remembered that many accidents which would be counted today were not counted before 1930. At that time many men were afraid to disclose their injuries for fear of dismissal, or loss of earnings, since some of the injured used to be taken off their regular jobs and put on others which they could perform in spite of their injury.

Case Study: Successful Plant-Wide Co-operation

A case of successful plant-wide co-operation is furnished by the Howard Smith Paper Mills, at Cornwall, Ontario.

The company has over 1,000 employees, and since 1937 it has been organised by the International Brotherhood of Paper Makers and the International Brotherhood of Pulp, Sulphite, and Paper Mill Workers. A joint union-management safety committee was formed in 1939 as a result of management's realisation that a bad accident record over many years had shown no signs of improvement, even though the usual accident prevention methods had been used. An aggravating factor was the increased wartime labour turnover.

The Safety Committee was given information, inspection and advisory functions with the possibility of appeal to higher management ranks. It was also given the right to judge and classify accidents.

The annual average frequency rate was reduced from 30.0 (1926 to 1940) to 13.75 (1941 to 1945). Among 17 paper mills in Ontario employing 200 or more workers, the average standing of the Cornwall plant from 1926 to 1945 was slightly lower than eighth; from 1941 to 1945, it was third. These results are especially interesting because they permit comparison of the effectiveness of foremen and superintendents' committees (formed in the early 30's) and the union-management committee.

The following data show the reduction in accident frequency rates and the improvement in relative standing of the company since the start of union-management co-operation:

Year	Frequency rate	Relative standing
1939	14.8	8th
1940	20.9	12th
1941	12.6	6th
1942	17.6	2nd
1943	16.5	5th
1944	13.4	1st
1945	9.2	1st
5-year average	13.75	3rd
1946	5.4	1st
1947	4.8	1st

Case Study: Successful Plant-Wide Co-operation

E. H. VAN DELDEN, Director of Industrial Relations, Libbey-Owens-Ford Glass Company, reports:

The glass industry is naturally an operation where safety is important. We are not satisfied with our record and have not been for some time and have been trying to improve. Our major problem was that the handling of glass of great weight requires rather awkward, heavy and hot safety equipment. The men wear heavy padded shoulder pads and gloves, stiff sleeve and ankle cuffs. They also wear goggles and in some operations wear safety shoes. In many plants, notably in the summer time when it is hot and particularly in our Southern plants where it is especially hot, the workers simply do not wear the equipment provided or strip it down to the point where it is not providing proper protection. Our biggest problem was that disciplinary measures to enforce safety rules were almost always fought by the union and hence were too often neglected.

The first attempt to correct the situation was in the union contract, through a clause requiring the company to provide safety equipment. But there was no clause requiring the workers to wear it or the union to compel them to do so. After years of getting nowhere despite promises made in collective bargaining, it was decided to build up pressure upon union officials from the local level. We started out organising safety committees in the plants with the worst records (East Toledo Plate plant and Charleston, W.Va.). We organised plant-wide committees with representation of each major department and with the superintendent, foremen, and safety engineer as management members on the committee. The worker members were all union members but were not selected by the union. Each man serves for six months and then nominates his successor.

The first task to which we put the committees was the formulation of safety rules and regulations for each department. In this way departmental subcommittees came into being. Agreement was reached that employees who violated these regulations after they were printed and distributed to

them would receive a warning notice and then be disciplined. When this was done there was so much pressure put upon union wage committeemen and local officials that the disciplinary action began to "stick". Conditions in these two plants have improved so much that now Charleston is third from the top in our company, and East Toledo Plate has moved to third from the bottom. This programme has been under way for approximately a year and a half, and progress is slow. But we feel encouraged enough now that our safety director and his assistant are installing the same programme in our Shreveport, La., plant, which is now listed as the worst plant, and plans are under way to utilise the same plan elsewhere. We are now having the committees review all accidents and make recommendations. We are also utilising their assistance in an educational campaign on safety.

Case Study (Failure): Plant-Wide Committee

An illustration of how co-operation may fail is provided by the case of a company which tried it for a short time during the war.

The firm in question employs 5,000 workers and is engaged in fairly hazardous work. During the war the union representatives agreed to inclusion in the contract of a statement declaring it the union's duty to co-operate with management in improving the safety record and a plant-wide committee was organised. However, the meetings were discontinued immediately after the end of the war. Several reasons were given for this:

(1) Militant shop stewards elected to the committee by union members dominated the meetings which degenerated into heated discussions. These union representatives were well versed in the grievance procedure. It was their job to argue with and get concessions from management. They continued this practice in the co-operative meetings, were outspoken in criticising management, and attempted to push the expenditure of large sums of money which the management did not consider feasible.

(2) Too little provision was made for proper communication up and down the line. No departmental committees were set up. Foremen were poorly trained in accident prevention (chiefly because the personnel department lacked the time to train them). They were slow in reporting accidents. In any case, the safety department rarely had the time or the staff to follow up reports except in case of major injuries. The safety director was blamed for poor leadership. The suggestion system was centralised and the foremen circumvented. Department heads were not allowed sufficient authority to install safety devices as they saw fit.

The neglect to promote co-operation between the foremen and their subordinates is illustrated by the case of one department in which eye injuries rose for several months because the employees failed to wear protective equipment. Efforts by the plant-wide committee, the safety director and even the company president failed until the foreman got instructions and authority to handle the matter.

Advantages and Disadvantages in General

It can be seen that while some companies have achieved excellent, even spectacular, results through the group approach to accident prevention, others have been less successful with it. The advantages and disadvantages of co-operation in the field, as they were reported, may be summarised as follows:

Advantages stressed were:

1. Group work may enlist the interest of the individual employee more successfully. The individual employee knows the hazards of his job and so is able to make original suggestions. This is confirmed by one of the most authoritative sources: "give a workman some active part in safety work, some recognition, some responsibility —and you will secure his interest. This has been the experience of all members of the National Safety Council who have properly organised safety committees." [1] Or as one of the experts of the United Steelworkers explained: "If the fellow at the bottom of the heap can talk in safety, you find out plenty about what is wrong in a plant. And this is the kind of information management never gets." [2] Participation gives the employees a sense of importance and pride.

2. Group action may contribute more than the sum of the actions of each individual. Teamwork in accident prevention may be more comprehensive, educational and systematic, just as individuals in a good football team give more together than each would have given singly. That is because in accident prevention the frame of mind is usually much more important than purely technical execution. Only about 10 per cent. of accidents are said to be due to non-human factors, and reducible by the more adequate safeguarding of existing machinery and the development of safer machines.[3] As one company writes: "The problem is not so much equipment, since safety is 'engineered' into machinery, but rather the human factor involving education. In this field great progress has been made." A good many accidents arising from the human factor can be prevented by mechanical methods.[4] Nevertheless the possibilities of controlling the human element are considerable. Here again group effort may be superior to individual efforts.

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[1] National Safety Council: *Safe Practices Pamphlet* No. 72, p. 4.

[2] Joseph Scanlon, quoted in "U.S.A., United Steelworkers of America is Unionism at Its Biggest" (*Fortune*, Nov. 1946, p. 258).

[3] H. M. Vernon, quoted by P. H. Cook in *The Psychology of Management-Worker Relations*, Lecture on the Realities of Reconstruction, No. 8 (Melbourne, University Press and Oxford University Press, London, 1943), p. 15.

[4] Research proves that, in the average case, the person who suffers a serious injury because he acted unsafely has violated the safe practice rule over 300 times. An alert supervisor therefore has over 300 opportunities to observe and correct unsafe performance before the injury finally occurs. This one illustration should be sufficient. (H. W. Heinrich: "Supervisory Control in Safe and Efficient Production", Bulletin No. 3309.)

3. Group effort may be superior to managerial discipline. To quote one company official: "Enlightened management today recognises that discipline alone will not accomplish much in a safety programme. True, it may produce some immediate results, but these will be more than offset by employee and union resistance." [1] In a group an employee may pay more attention to the prodding of his fellow employees than to the foreman and be more willing to use self-discipline. According to a number of companies reporting on co-operation to the A.M.A. survey, group action has resulted in "greater participation" and "more regularity", "is necessary in an accident prevention programme", "is responsible for much progress" and "helps tremendously in maintaining interest".

4. Group action may increase the effectiveness of management action. The safety engineer may be changed from an authoritarian to a consultative supervisor. Engineers and maintenance men, often already heavily burdened, may find their work loads reduced. A widely experienced trainer remarks: "The sooner the safety engineer realises that he learned most from the men about detrimental situations in his own field and the sooner he gets their help in working out solutions, the sooner he will find his own specialised activity climbing." [2] Prompter consideration may be given to employees' suggestions and action taken on them. Possible suspicion of management's motives may be dispelled.

5. The union may gain by showing tangibly that it is doing something for its members, especially if it gets public recognition for its contributions. It may be placed in a less embarrassing position in refusing to take up what it considers to be an unjustified grievance, if it has itself supported or issued warnings to offending members. Also, less time may have to be spent in handling grievances.

However, a great many companies believe or have found that the approach by management to the employee as an individual is superior to the group approach. Many have objected to the whole idea of the joint labour-management safety committee and have given the following reasons:

1. If an employee is to co-operate in accident prevention, he must do so himself. He cannot delegate this responsibility to someone else, acting for him as a member of a committee, nor is a committee required to obtain the co-operation of the individual employee. One large company states this point of view as follows: "Under any realistic analysis the rights of the individual employee are better protected where responsibility and authority are clear-cut, where there is none of the confusion and misunderstanding which so frequently results from the establishment of a joint committee, where the action is free from the union's internal political pressures, and where the union has full recourse, under the grievance procedure, to seek redress for any individual employee."

2. Safety is management's sole responsibility (and not one that can be shared with the employees or the union). Workmen's compensation laws hold the company responsible financially. Other laws require management to provide certain safety measures, with the threat of penalty for omission. Management also feels it has a moral responsibility to safeguard the employee in the public interest. Management's responsibility is exercised through the establishment of safety rules, the enforcement of the rules through discipline, by the foreman dealing with the individual employee. "We do not believe there is any better way of promoting safety than to build up this relationship between the individual worker and his supervisor", writes a large company with low accident rates in its industry.

3. The job of preventing accidents is a highly technical one and few employees may have enough knowledge and experience to make a real contribution. H. W. HEINRICH writes to the survey from his long and varied experience: "The average workman of necessity has a limited amount of knowledge and ideas to bring into safety discussions. This must be so because his work is confined to a limited part of the overall production schedule. Also the great number of individual workmen as compared to the number of executives and supervisors makes it difficult to bring them all directly into the accident prevention picture, even when use is made of the 'rotating principle'. In many cases the potential improvement through the introduction of safer equipment and the stricter enforcement of working rules may be greater than the results of labour participation. Not only management, but also labour, may be too occupied with other problems. Said one labour leader: 'For too many years we in labour have been too busy with other problems to pay sufficient attention to safety.' "

4. Co-operation may involve too much red tape and wasted time, and produce a false sense of security. To illustrate: the president of a drop forging company pointed out to railroad officials that the crossing running through his property might easily cause accidents to his employees unless a warning bell was installed. The railroad officials promised to take it up with their safety committee. It took a number of days before the committee met, and there was a

[1] J. F. DONEGAN: "Failures of the Safety Program", in *Personnel*, Nov. 1945, p. 194.
[2] Jack WOLFF: *The Production Conference* (Boston, Houghton Mifflin Co., 1944), p. 107.

good deal of discussion. Before effective action had been taken, an employee of the drop forge company had been seriously injured at the railroad crossing.

5. Many workers, especially younger ones, underestimate the danger of their work and are reluctant to use safety devices which involve a little more trouble or a somewhat lower rate of output. Hence the advice of employee participants in safety may fall on unresponsive ears. Committee members may be told or deem it wise not to interfere with the actions of fellow workers.

In addition, unions have complained of the way in which co-operation is carried out in some cases, and managements have raised several specific objections to the participation of unions in accident prevention.

Opinions of unions. The unions say that management has prevented progress by refusing to permit joint inspection, and neglecting suggestions. They declare that some safety engineers take a too narrow and technical view of their duties, that the committees are too large and their authority is not adequate. A union observer summed up his objections as follows:

> The greatest handicap to an all-out national safety movement in this country is management's fear of co-operating as equals with worker agencies. Even in existing employee safety committees, there is an aversion to securing direct union co-operation. Frequently the employer mans the employee committee with persons of his own selection. The result is that the union has to maintain its own contacts with the safety committee, in a *sub rosa* manner of course, in order to assure itself that the group is not being used to undermine the union. Complaints on safety continue to be funnelled through the grievance machinery. Such committees are generally worthless. They fail to capitalise on group participation. In many instances where these committees are in existence, management has left them inoperative and has truly short-circuited them. In these instances they become paper organisations. The only creative groups are those which are really accepted by management. A prerequisite to any committee is a willingness on the part of management to accept true joint handling of the safety and health problem. A positive attitude must pervade their deliberations. Their decisions must be given effect except in unusual circumstances. Management cannot let down the committee and expect it to continue to function. In most instances the success is dependent upon management. It must be willing to accept freely the flow of ideas from its employees. [1]

Opinions of management. On the management side, the following objections to union representatives on safety committees were noted.

The union's suggestion may call for too much expenditure of time or money, or may be too trivial to act upon; yet, having been asked for its ideas, it may insist that they be put into effect. It may use joint safety as a pretext for causing disturbances. Thus one steel company pointed to the miners' "safety strike" and feared a possible repetition in steel; a safety engineer told of a union president who used obstructionist tactics on a safety committee because the company would not certify him for compensation. It was charged that the union may insist on the exclusion of non-union men from participation, even though co-operation is held to imply the participation of all employees. On this point H. W. ANDERSON, Vice-President in Charge of Personnel at the General Motors Corporation, says: "In the development of our safety programme our position has been that it is not a matter of union members and the management being interested in safety, it is the entire organisation that is interested in safety—from the manager down." [1]

Companies also point out that if the union were a party to the establishment of safety rules or in disciplinary action taken under those rules, by this very concurrence it would prejudice itself as an advocate for the employee.

But even those companies which strongly oppose union-management committees stress that the union can make a distinct contribution to the general safety movement by doing an educational job for its members. It can do this through union publications, at union meetings, through motion pictures (such as the one recently produced by Local 1031 of the International Brotherhood of Electrical Workers, A.F.L.). The union might also encourage safety suggestions by individual employees. One company which has 350,000 workers gets 12,000 safety suggestions a year. Of these, 25 per cent. are accepted and monetary rewards paid for them. The union, it is proposed, should broaden the scope of its educational approach "to encourage its members to practise accident prevention not only in the plant, but in the home, on the farm and on the highway".

CONCLUSIONS

Labour-management co-operation in the reduction of accidents is clearly one of those joint efforts that is most likely to be successful. It will probably result in smaller losses in income and fewer injuries. All concerned can make a tangible contribution, and it provides a real chance for participation. Moreover, it can pave the way to other types of co-operation which may

[1] Solomon BARKIN, *op. cit.*, pp. 2-3.

[1] *General Motors Corporation Conference for College and University Educators, Personnel Administration and Industrial Relations, June 17, 1946, through June 27, 1946*, Morning Session, June 27, p. 6.

lead to an increase in productivity and to a general improvement in industrial relations.

On the other hand, co-operation may involve union leaders in responsibilities which they may not want to assume. Their first function is the protection and advancement of union members. Close participation in accident prevention may lead union members to blame their leaders for failures and shortcomings. Management's major objection to such participation is the possible expense involved in safe but slower working speeds, the cost of holding meetings and carrying out the suggestions for safer working. A possible objection to accident prevention co-operation by both parties is that it is not a big enough field, for unless co-operation is undertaken on a large scale, it might perhaps be better not to attempt it at all. Yet co-operation in accident prevention has been more successful than any other kind of co-operation. More likely the road to success is a slow one; experience has shown that in co-operation it is the long haul which counts.

THE EMERGENCY RUNG

By J. S. MILLET, St. John, New Brunswick

The proportion of longshoremen falling into the holds of ships is shockingly large, and, therefore, every precaution should be taken for their safety. One common man-trap is the steel ladder with one or more missing rungs. A Norwegian ship had two missing on one set of ladders; an Italian freighter had at least three missing in one place; an American Liberty ship had eight missing from one set of ladders and one from another. Often these ladders are never repaired until the ships return to dry-dock; indeed they cannot be repaired while there is flamnable cargo in the holds.

A model of a ladder with a rung missing is shown in fig. 1; the emergency rung shown in

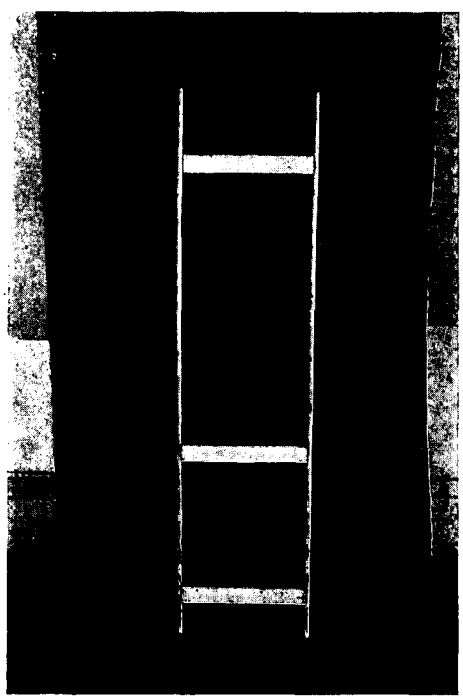


Fig. 1.

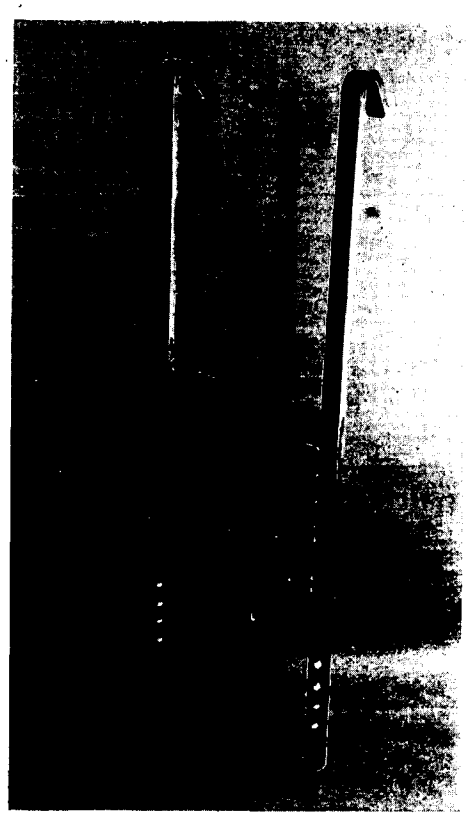


Fig. 2.

fig. 2 is designed to make such ladders safe. It consists of steel side pieces 1″ by 3/8″ to which are riveted or welded one or more rungs 1 1/2″ by 3/8″. The standard unit, which fits a 12″ rung, is 11 1/2″ wide. At the top of each side piece is a hook 2″ long, with a clearance of 1 1/4″ at the mouth. This hook is angular so that it will fit any width of rung. The bottom of each side piece extends 16″ from the inserted rung and has four holes 10″, 11″, 12″ and 13″ respectively from the bottom of the inserted rung. Through one of these holes a 3/8″ rope is inserted with a knot at the end. This rope passes over the side piece and fastens it by three or more half hitches to the rung immediately below the gap. The holes allow for centre-to-centre variations between rungs. Fig. 3 shows the unit lashed in place on the model ladder.

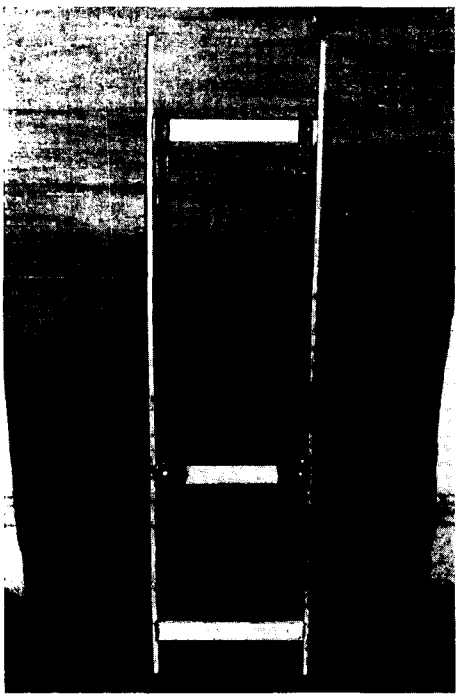


Fig. 3.

The standard unit will fit all rungs 12″ or more in length. For short-rung ladders (the Manchester Line has 10″ rungs) a narrower ladder will be made with 3/4″ by 3/8″ side pieces, to economise space.

Units containing one, two or three rungs (more if necessary) can be built after the pattern shown in the illustrations. The cost of a set is insignificant.

All ships should carry a set of units, and contracting stevedores should have available sufficient sets for the maximum number of ships under their jurisdiction. Missing rungs should be promptly reported to supervisors and remedied as promptly as possible.

CARL H. FRY †

It is with deep regret that the International Labour Office announces the death, on 6 February 1949, of Mr. Carl H. Fry, former Chief of the Division of Industrial Safety, California Department of Industrial Relations, and member of the I.L.O. Correspondence Committee on Accident Prevention.

From the time of his graduation from the University of California in 1907, Mr. Fry worked directly or indirectly to develop the industrial safety movement. He began his career as a mine superintendent and later became a safety engineer with the California Industrial Accident Commission. He had been Chief of the Safety Division of the Department of Industrial Relations for 18 years when he retired in 1946 owing to ill health.

During that time Californian industry increased tremendously and the safety problems multiplied accordingly. Mr. Fry attacked these problems with great energy and dealt with them in a way that won him the esteem and affection of his staff and the co-operation of industry throughout the State of California.

He played a leading part in the adoption and revision of most of the safety regulations at present in force in California. He was an active member of the American Society of Safety Engineers, the National Safety Council and the Advisory Committee on Motor Vehicle Legislation, and the founder of the Western States Safety Conference.

During the war he served on the National Committee for the Conservation of Manpower in Defence Industries.

He was appointed to the Correspondence Committee on Accident Prevention in 1945, and the International Labour Office benefited greatly from his vast technical knowledge. His outstanding qualities gained him the goodwill and respect of everyone with whom he came into touch.

SAFETY INSTITUTIONS, ASSOCIATIONS AND MUSEUMS

INTERNATIONAL

International Labour Office: Correspondence Committee on Accident Prevention

Composition of the Committee

Members Reappointed.

The following members of the Committee were reappointed by the Governing Body of the International Labour Office for another period of three years:

(1) At the 107th Session (Geneva, December 1948): Mr. N. C. Winkel (Netherlands), Principal Inspector of Factories, The Hague.

(2) At the 108th Session (Geneva, March 1949): Mr. R. Harvey (Australia), National Safety Council of Australia, Melbourne; and Mr. L. D. Wright (Australia), Controller, Factory Standards and Design Branch, Department of Labour and National Service, Canberra.

New Members.

At its 107th and 108th Sessions respectively the Governing Body also appointed the following new members, for a period of three years: Mr. H. de Sousa Reis (Portugal), Engineer, Lisbon; and Mr. A. E. Järvenpää (Finland), Chief Inspector of Labour, Helsinki.

ARGENTINA

Technical School of Industrial Safety

The National University of Cuyo, Argentina has established a Technical School of Industrial Safety. Courses will be given on (1) accident prevention and safety; (2) compensation of industrial accidents; (3) care and rehabilitation of accident victims.

BELGIUM

National Institute of Mines

Report for 1947 [1]

During 1947 the Institute was engaged on various researches in connection with explosives and shotfiring, Cardox, flameproof electrical equipment, portable electric lamps, compressed-air piping, Diesel locomotives, dust masks, and the combustion of methane.

As regards explosives and shotfiring, the report deals with the testing of various explosives and detonators, investigations concerning sheathing, investigations of irregularities that had occurred in shotfiring, and the testing of permitted explosives by shotfiring in stone.

Experiments were carried out not only with inert sheaths but also with sheaths containing an explosive—nitroglycerine. The report discusses the advantages of carbonate and bicarbonate of soda and confirms the superiority of bicarbonate. The experiments with explosive sheaths are described in details. This type of sheath adds considerably to the power of the cartridge, which is very useful in hard ground, having regard to the rapid advances in the workings required by modern methods of mining.

The conclusions relating to portable lamps are as follows:

The ignition of an explosive mixture in a portable lamp by switching it on and off requires a combination of special conditions relating to the accumulation of hydrogen above the battery and the state of the contacts.

The achievement of such a combination of conditions is improbable when the lamps are properly used.

Since it is practically impossible to make the battery casing tight against the flame of an explosive gas, everything must be done to prevent the possibility of an internal explosion. In particular:

(a) Use should only be made of batteries in a good condition, having plates carrying their full dose of active substances and capable of maximum retention as regards the gases generated by electrolysis.

(b) It should be ensured that the valves for evacuating the gases generated by electrolysis work freely.

(c) The maker's instructions as to the magnitude of the charge of the batteries should be followed.

The lamp should be left dismantled for as long as lamp-room operations permit. This time should never be less than three hours.

Any traces of friction that appear on the contact surfaces of the disconnecting devices should be removed.

A caplamp with a switch on the reflector is absolutely immune from the risk of an internal explosion. It is therefore desirable to take these lamps into general use.

[1] *Annales des mines de Belgique*, Vol. XLVII, Part 4, p. 945.

Second Two-Week Campaign for Safety, Health and Embellishment of Workplaces [1]

While the purpose of the first two-week campaign in 1947 [2] was to arouse public opinion in matters of safety, health and embellishment of workplaces, the object of the second campaign, held from 18 September to 2 October 1948, was to interest in these same questions all those who held responsible positions in the various fields of national work.

The campaign, which was held simultaneously throughout Belgium, was attended by a larger number of organisations and institutions than the previous year. It was opened by Mr. Léon-Eli Troclet, Minister of Labour and Social Welfare, followed by a large number of speakers representing various groups.

In his closing speech, Mr. Hertsens, President of the Technical Section of the Superior Council for Safety, Health and Embellishment of Workplaces, mentioned the work achieved during the previous year thanks to the collaboration of the public authorities, the employers and the workers. He outlined the role of the safety and hygiene services created in 1947 and emphasised the vastness and complexity of their tasks and the need to facilitate their mission by large-scale education schemes. To this end, it was essential to include in the course of study of technical and professional institutions, the principles of industrial hygiene and safety.

The campaign included lectures, film shows, visits to factories and congresses. The exhibition organised in Brussels was visited by 60,000 persons.

The Belgian trade union organisations, including the General Federation of Labour, the Confederation of Christian Trade Unions and of Liberal Trade Unions, met at Brussels on 28 September 1948, the "trade union day" of the campaign. They adopted a number of joint resolutions expressing the attitude of the organisations with respect to existing legislation and its development, safety and hygiene committees, the organisation of safety services within industrial undertakings, the activity of the Superior Council for Safety, the creation of national and regional occupational councils and finally, the activity of labour inspection services.

GERMANY

German Acetylene Committee

The German Acetylene Committee for Bizonia was re-established on 15 September 1948 at Frankfort-on-Main. Mr. Möckel of Hanover was once again appointed chairman. The Committee decided that the most urgent task that lay before it was the compilation of draft regulations for acetylene.

[1] *Revue du Travail*, Oct. 1948.

[2] See *Industrial Safety Survey*, Vol. XXIV, No. 2, p. 49, and Vol. XXV, No. 1, p. 11.

UNITED STATES OF AMERICA

National Society for the Prevention of Blindness

Annual Report, 1948

The Annual Report of the National Society for the Prevention of Blindness for 1948—the fortieth anniversary of its foundation—includes a brief account of its activities during the last forty years in the field of industrial eye protection.

As early as 1910 the Society began its research on methods of reducing eye hazards in industry. In 1930 it completed a study of eye safety practices in 583 undertakings and prepared a broad programme for industry that included such subjects as eye safety, vision testing, medical and nursing care, first aid for eye injuries, lighting and colour standards, etc.

During the second World War, the advisory and information services of the Society were used by more than 2,800 war plants employing about 8,000,000 workers.

In 1944 the Society organised a Seminar on Industrial Aspects of Ophthalmology. This led to the Society's participation in a conference of senior ophthalmologists and medical officers of Government agencies. As a result of the conference many medical schools were led to include the subject of industrial ophthalmology in their regular courses.

At the 1948 National Safety Congress the Society launched a campaign to honour the workers who avoid eye injuries by conscientiously wearing eye-protective equipment.

The report concludes with the statement that although much has been accomplished, much still remains to be done in the field of industrial eye protection.

Fifteenth Conference on Labour Legislation [1]

The Fifteenth Conference on Labour Legislation was held at Washington from 30 November to 2 December 1948. It examined a number of reports dealing with the relations of the individual States with the International Labour Organisation, child labour, industrial relations, wages and hours, workmen's compensation and safety and health.

With respect to safety and health, the Conference recommended: the provision of federal grants-in-aid to States, Territories and possessions

[1] *Monthly Labor Review*, Jan. 1949, Vol. 68, No. 1, p. 15.

of the United States to help foster the welfare and safety of wage earners; provision by the U.S. Department of Labor, at the request of the States, of training courses for factory inspectors; the framing of safety codes for all industries (special attention being called to the urgent need in some States for development of an adequate code on boilers and pressure vessels); the establishment of methods for obtaining adequate accident data in States not having such statistics; the insertion of provisions in workmen's compensation laws making the prompt reporting of accidents compulsory.

It was pointed out that in order to be able to reach small undertakings the staff of State labour departments would have to be increased. It was also emphasised that the co-operation of organised labour was essential in the establishment of safety programmes.

Finally, it was recommended that funds be granted to the U.S. Department of Labor to enable it to give effective assistance in the following fields:

(1) the collection and dissemination of comprehensive and adequate accident statistics;
(2) the development of more complete State safety codes for each type of industry;
(3) the development of State safety programmes to meet the needs of high-hazard industries and the small establishments not reached ordinarily through general safety programmes;
(4) the preparation of safety engineering data for use by labour law administration agencies in promoting joint labour-management safety programmes and other activities designed to reduce accident losses materially.

Technical safety training facilities available to State labour departments had recently been discontinued. The Conference felt that this was detrimental to the best public interest and strongly recommended their immediate restoration.

URUGUAY

Course on Industrial Safety [1]

At the Labour University, the Director of the Uruguayan Safety Institute in Montevideo recently gave a course on industrial safety, which was attended by a large number of industrial students.

The State Insurance Bank has also organised an industrial safety course for all workers in Uruguayan industry.

LAWS AND REGULATIONS, SAFETY CODES

AUSTRIA

Act respecting the Employment of Children and Young Persons. Dated 1 July 1948

This Act replaces existing legislation respecting the protection of young workers under 18 years of age. A very detailed summary of the Act has already been published by the International Labour Office [1] and it need only be mentioned here that the Act determines the list of occupations prohibited to children and young persons, and provides that young workers shall receive instruction respecting the risks to which they might be exposed during the course of their work and the safety measures to be taken.

CANADA

Alberta

Regulations governing the Operation of Strip Pit Mines. Dated 8 July 1948 [2]

These Regulations made under the Coal Mines Regulation Act, 1945 deal with the supervision of strip pit mines and the qualifications required for certificates of competency, and also contain detailed provisions respecting the safe transportation, handling and use of explosives.

The conditions under which certain types of detonating fuse may be used are described, and section 15 provides that all shots must be fired electrically.

Provisions respecting excavating and the disposal of overburden, roadways and general haulage and some general matters are also included.

FRANCE

Decision determining the Safety Principles for the Certification of Thicknessing Machines with Rotary Cutter Blocks for Work with Wood and Similar Materials Dated 19 May 1948 [2]

Accidents caused by thicknessing machines with rotary cutter blocks are due principally to accidental contact of the hand with the tool.

[1] See *Industry and Labour* (New Series), Vol. I, No. 10, 15 May 1949, p. 395.
[2] *Alberta Gazette*, Vol. 44, No. 13, 15 July 1948, p. 718.

[1] Information communicated by the I.L.O. correspondent in Montevideo.
[2] *Journal officiel*, No. 124, 27 May 1948, p. 5091.

The present Decision lays down, in Section 2, the following measures respecting the guarding of these machines:

1. *Machine Table*

Both parts of the table shall be provided throughout their width, on either side of the cutter block and parallel to it, with steel lips.

The vertical adjustment of the table shall make it possible to reduce to a minimum the space between the lips and the cutter block.

2. *Cutter Block and Mounting of the Knives*

The cutter-block spindle and the knives fixed to it shall be constructed of highest grade materials and shall be carefully balanced.

The cutter-block spindle shall have a circular cross-section.

The knives shall be firmly secured by devices sunk in the cutter block. They shall project only slightly.

3. *Guarding of the Knives*

(a) Non-automatic guards shall be vertically and transversally adjustable in accordance with the dimensions of the piece to be thicknessed without more than two operations being necessary.

The mounting device for the guard shall not interfere with the handling of the piece on the table.

The guard over the spindle shall be wide enough to cover the space between the two lips.

The guard shall be strong enough to resist the impact of the piece being worked and as far as possible to withstand, without suffering any deformation, the weight of the piece should it fly back.

(b) Automatic guards shall be provided with a device for removal and return protected from any jamming caused by shavings or waste.

The movement of the guard shall be controlled by the passage of the piece being worked.

The part of the guard covering the knives shall be so designed that it will have no point of contact with them.

The guard shall be strong enough to resist the impact of the piece being worked and as far as possible to withstand, without suffering any deformation, the weight of the piece should it fly back.

The use of the guard shall not hamper the worker.

(c) Mechanical feeding devices shall not be considered as guards unless they make the tool inaccessible throughout its length, are sufficiently strong, and do not hamper the worker.

They shall be so designed as to make the mechanical feeding parts inaccessible so as to prevent the hand from being caught between them and the piece being worked.

The subsequent sections (3 to 7) determine the conditions required for definitive and provisional certification and for certification in principle. The sale or hire of thicknessing machines not complying with the above provisions is prohibited from 1 January 1949.

Decision determining the Safety Principles for the Certification of Single-Unit Planing Machines with Rotary Cutter Blocks for Work with Wood and Similar Materials. Dated 20 May 1948 [1]

Accidents caused by these machines are due principally to:

(1) accidental contact with the cutters;

(2) dragging in of the hand by the feeding device;

(3) kicking back of the work.

Sections 2 and 3 of the present Decision lay down the following measures for the guarding of single-unit planing machines [2]:

1. *Guarding of the Cutters*

The top of the planing machine between the grooved feed roll and the smooth ejection roll shall be entirely encased.

The casing shall be strong enough to hold back the cutters should they fly out.

A device over the cutter block shall permit the removal of shavings and the installation of a suction hood for the removal of dust.

This device may also serve as a guard for the top of the cutter block.

2. *Guarding of the Feeding Device*

Access to the grooved feed rolls or to any other feeding device shall be prevented by:

(a) a bar placed in front of the roll and parallel to its axis; or

(b) extending the casing over the roll; or

(c) any other equivalent device.

3. *Kicking back of the Work*

In the case of machines of a width exceeding 40 cm and not equipped with segmented rolls, kicking back caused by the passage of several pieces of work through the machine shall be prevented either by the installation in front of the feeding device of an anti-kickback device of which the surface coming into contact with the wood shall be serrated, or by any other mechanical device affording equivalent protection.

Independently of the provisions laid down in the preceding sections, planing machines shall comply with the following additional provisions:

(1) they shall be provided with an individual clutch for the feeding device;

(2) the gears and driving mechanism shall be enclosed in perfectly sawdust-tight casings;

(3) in cases in which the drive is electric, they shall be equipped with a terminal fixed on the framework for earthing purposes.

Sections 4 to 7 lay down the conditions required for definitive and provisional certification and for certification in principle.

From 1 January 1949, the sale and hire of single-unit planing machines which do not comply with the safety principles laid down is prohibited.

[1] *Journal officiel*, No. 124, 27 May 1948, p. 5092.

[2] For multi-cutter planing machines, see below, p. 56.

Decision fixing the Safety Principles for the Certification of Protective Devices for Power Presses used for the Cold Working of Metal. Dated 16 July 1948 [1]

Sections 2 and 10 of this Decision contain general provisions respecting the protection of presses.

Sections 4 to 9 lay down the particular characteristics required for each type of protective device. There are six types of safety device, as follows:

1. Fixed or static protective cages enclosing the entire danger zone of work and prohibiting any penetration of the hand. These devices are intended, in particular, for presses used in the manufacture of mass produced products (Sec. 4).

2. Mobile or positive protectors prohibiting access to the working zone during the dangerous part of the down-stroke of the ram. These protectors include screens and sweep-away guards (Sec. 5).

3. Devices removing the worker's hands from the working zone throughout the down-stroke of the ram: these are permissible only for slow-moving presses (a maximum of 60 strokes per minute) with a long stroke (over 10 cm) (Sec. 6).

4. Mechanical or electrical control devices requiring the continuous employment of the hands outside the danger zone throughout the down-stroke of the ram. If they are two-hand control devices they shall only be permitted for fast-moving presses (over 60 strokes per minute) with a short stroke (a maximum of 10 cm) and only if, for technical reasons, screens cannot be installed. If they are electrical controls with push buttons (it shall be compulsory to have two at each operator's stand) they are intended, in particular, for heavy presses operated by several workers (Sec. 7).

5. Photo-electric cell devices isolating the danger zone by means of an infra-red beam, the interception of which will cause the press to stop immediately, or any other device constituting a non-material barrier (Sec. 8).

6. Remote feeding and ejection devices allowing the removal of the hands from the danger zone are not considered as protectors unless both the worker's hands are employed outside the danger zone during the down-stroke of the ram or unless the working part of the press is inaccessible (Sec. 9).

It should be noted that the present decision is not applicable to presses used exclusively for the working of hot metal. In such cases the machine must be provided with a plate fixed to the frame and bearing the words "This press is constructed exclusively for the working of hot metal" (Sec. 12).

Section 13 provides that screw presses with a friction drive shall be protected either by a screen or sweep-away guard, or by a two-hand control device.

[1] *Journal officiel*, 24 July 1948, p. 7247.

Decree No. 48-1253 amending and supplementing, with Respect to Dangerous Machinery, the Decree of 10 July 1913 concerning General Measures of Safety and Health Applicable to All Undertakings Covered. Dated 5 August 1948 [1]

The following amendments respecting presses have been made to Section 12a of the Decree of 10 July 1913.

All types of automatic power presses with an alternating movement shall be so arranged, protected, controlled and used that the operators cannot, from their stand, reach the working parts in motion even intentionally.

In the case of the repair of any mechanical part of the press or of the devices for protection, control or operation, the stopping of the machine shall be ensured in every case, by disconnecting the press from the driving power and, wherever the nature of the work permits by blocking of the clutch or the flywheel as well as of the ram, if necessary. The same shall apply with respect to cleaning operations and the placing in position of the mechanical parts when the press is stopped.

Decision determining the Safety Principles for the Certification of Multi-Cutter Planing and Moulding Machines for Work with Wood and Similar Material. Dated 5 November 1948 [2]

Accidents caused by these machines are due principally to: (1) accidental contact with the tool; and (2) dragging in of the hand by the feeding device.

This Decision lays down a number of measures for preventing such accidents:

Sec. 2. Planing and moulding machines for woodworking, such as so-called two-cutter, three-cutter, four-cutter machines, parquet machines and moulding machines shall be guarded as follows:

1. *Guarding of the Tool*

The non-working part of the tools shall be guarded by an enclosure strong enough to hold the cutter should it fly out of the spindle.

Unless the machine is equipped with a general exhaust for sawdust and dust, the guard shall permit the installation of an individual exhaust for each tool.

The guard shall extend far enough to make the tool inaccessible during the work.

Guards of vertical tool-holders shall enclose the end.

2. *Feed Devices*

Feed devices: grooved feed rolls, pressure feed rolls and other devices within the worker's reach shall be provided with a guard making them inaccessible.

Sec. 3. Independently of the provisions laid down in the preceding sections, planing and moulding machines shall comply with the following additional provisions:

[1] *Journal officiel*, No. 187, 8 Aug. 1948, p. 7816.

[2] *Ibid.* No. 265, 8-9 Nov. 1948, p. 10907; *rect.* No. 271, 17 Nov. 1948, p. 11145.

(1) They shall be equipped with an individual clutch for the feeding device.

(2) The gears and driving mechanism shall be enclosed in perfectly sawdust-tight covers.

(3) They shall be equipped with a terminal fixed on the framework for earthing purposes.

Sec. 4. The safety principles with which models of planing and moulding machines other than those provided for in this Decision shall comply, in particular machines used in cooperage and in the manufacture of sabots, shall be laid down in subsequent decisions.

Sections 5, 6 and 7 determine the conditions required for certification.

From 1 July 1949, the sale and hire of multi-cutter planing and moulding machines which do not comply with the safety principles laid down is prohibited.

Ministerial Circular respecting Vertical Field-Tube Boilers and Additional Supervision and Safety. Dated 10 September 1948 [1]

This Circular gives a brief analysis of the circumstances and causes of a number of accidents that occurred with vertical Field-tube boilers, with a view to deducing suitable preventive measures.

In the majority of the eight accidents described the flue collapsed, in some cases with fracture. Subsequent examination of the boilers led to the conclusion that in most of them the nominal thickness of the flue ring was insufficient.

For the calculation of this ring, the Circular advocates the use of the classic Bach formula with an extra thickness of 3 mm for safety. It also recommends, for the longitudinal mounting of the ring, butt welding rather than riveting, which by covering the edges impairs the curvature and conduces to collapse.

Other recommendations deal with the provision of a sufficient number of inspection openings to permit the detection of corrosion, the aptitudes of the personnel in charge of boilers, inspection, and retesting.

The provisions of this Circular also apply to other types of less well-known vertical boilers (vertical cross-tube boilers, vertical multitubular boilers, etc.).

Decision determining the Safety Principles for the Certification of Vertical Spindle Moulding Machines for Work with Wood and Similar Materials. Dated 21 December 1948 [2]

After pointing out that the accidents caused by spindle moulders are due principally to accidental contact of the hand with the cutters and to the projection of the cutters, this Decision lays down a number of conditions for the certification of these machines, as follows:

Sec. 2. Vertical spindle moulding machines for work on tables with or without guides shall be so constructed as to be rigid and to ensure the perfect stability of the adjusting devices.

The cutters shall be properly mounted in the tool-holder, which shall ensure perfect safety during operations.

Sec. 3. The working part shall be guarded, as required by the nature of the work undertaken, by suitable devices falling into one or more of the following categories:

(a) *Automatic Feeding Devices*

Automatic feeding devices shall be considered as guards only if they prevent access to the working part of the tool.

The cylinders and mechanical drives shall be guarded in order to prevent the hand from being jammed between them and the wood.

(b) *Horizontal and Vertical Spring or Roll Presser Guards or the Two Together*

The pressure exerted by these devices on the piece of wood shall be sufficient to hold it. It shall be possible to adjust them easily and rapidly. Their adjustment shall not require special tools.

(c) *Fixed Protective Shields*

Fixed protective shields shall be horizontally and vertically adjustable without requiring more than two operations or any special tools.

The supporting rods shall be strong; the arm supporting the shield may be articulated.

These devices shall be mounted outside the working surface of the table.

The devices shall be delivered with a set of shields of different shapes and dimensions suitable for the commonest operations on the machine so that, according to the nature of the work carried out, the distance between the shield and the table and its position in relation to the cutters will prevent access to the cutters.

(d) *Rotary Protective Shields*

Rotary protective shields composed of discs mounted on the spindle shall be considered as guards for operations in which the position of the cutters, or the distance between the disc and the table with regard to the dimensions of the cutters, prevent access to the latter.

Sec. 4. Independently of the provisions laid down in the preceding sections, spindle moulders shall comply with the following supplementary provisions:

(1) They shall be provided with a non-reversible clutch if they are sold with a shaft for operation from a transmission drive.

(2) They shall be equipped with a terminal fixed on the framework for earthing purposes.

(3) The non-working part shall be provided with a device permitting the installation of a suction hood for the removal of dusts, sawdust and shavings.

Sec. 5. Protective devices which, when being fitted or adjusted, are liable to come accidentally into contact with the cutters shall be covered with suitable material.

[1] *Bulletin des Associations françaises de propriétaires d'appareils à vapeur*, Vol. 29, No. 84, Oct. 1948, p. 42.

[2] *Journal officiel*, 30 Dec. 1948, p. 12642.

The subsequent Sections deal with methods of certification.

From 1 October 1949 the sale and hire of vertical spindle-moulding machines which do not comply with the above safety principles are prohibited.

INDIA

Indian Government Railway Standard Code of Practice for Electric Arc Welding of Locomotive Boilers (Maintenance) Adopted in 1948 [1]

The Code contains six sections, two appendices and 25 diagrams. The sections deal with the following subjects; scope; definitions; welding technique; material; application; and testing the quality of welding. The appendices describe a qualification test for operators engaged in welding locomotive boilers and give a standard method of indicating arc welds on drawings. The welding methods prescribed are conveniently illustrated by means of the 25 diagrams included in the Code.

SWITZERLAND

Order of the Federal Department of Public Economy concerning Technical Measures to be taken for Protection against Silicosis Dated 8 September 1948 [2]

This Order applies to the following work in rock containing 10 per cent. or more of quartz:

(a) driving of tunnels and galleries, mining operations;

(b) sinking of shafts or pits;

(c) excavation for the construction of dams and similar work: in narrow trenches and excavations where the amount of dust liberated is considerable in the working area.

It lays down that the measures to be taken for protection against dust are wet drilling, collection of dust at its point of origin together with effective filtering and moistening of the waste materials.

The Order also contains provisions respecting ventilation and the period of waiting after shot-firing.

UNION OF SOUTH AFRICA

South African Bureau of Standards: Specification for the Guarding of Power-Driven Woodworking Saws Approved 20 December 1948

Sections 1 and 2 of this Specification define its scope and lay down the general constructional requirements for woodworking power saws with regard to safety. Special requirements respecting circular bench saws, swing and other circular cross-cut saws, portable circular saws, band saws and other saws, are included in Sections 3 to 7.

South African Bureau of Standards: Code of Practice for the Prevention and Treatment of Occupational Dermatitis Approved 20 December 1948

The purpose of this Code is to describe means of preventing and methods of combating dermatitis likely to arise from industrial operations or processes. After determining the field of application and defining the technical terms employed, the Code deals with the definition of primary irritant dermatitis, contact dermatitis, occupational dermatitis and eczema; the factors in the development of occupational dermatitis; the action of irritant substances; and contact with the irritant. Skin irritants are listed, and prevention, investigation of cases of occupational dermatitis and treatment are dealt with in detail. The education of employees is mentioned in a final section.

The Code includes two Appendices, one containing formulae for barrier creams and the other describing skin cleansers.

South African Bureau of Standards: Code of Practice for the Protection of Eyes

After defining various types of eye protectors, this Code lays down requirements respecting the classification of processes and operations requiring eye protection, classification of goggles, lenses for persons with defective vision, replacement of lenses, specifications for lenses and cover glasses, sterilisation, tests for protectors, etc.

UNITED KINGDOM

Imperial Chemical Industries Engineering Codes and Regulations, Safety Series

During the period 1933-35 Imperial Chemical Industries prepared a series of Engineering Safety Standards for use within its organisation. These standards proved to be of considerable value and were of material assistance in reducing the accident frequency rate to less than one half of its former level.

This experience has encouraged the Company to revise and extend these safety manuals which are now being issued under the title of "I.C.I. Engineering Codes and Regulations (Safety)". Twenty codes will be issued in all. These will fall into four groups: Group A, Civil Engineering; Group B, Mechanical Engineering; Group C,

[1] *Government of India, Ministry of Railways (Railway Board).*
[2] *Recueil des lois fédérales*, No. 33, 16 Sept. 1948.

Electrical Engineering; and Group D, Miscellaneous.

The original safety standards were issued as recommendations, but the present engineering codes will be used by Imperial Chemical Industries in all new construction work or major alterations, and will also be applied to existing installations as far as possible.

Three of the codes have already been published. The first, "Sites and Services" (Group A, Vol. 1.1) deals with factory sites; general arrangement; canteens, medical services, etc.; external factory lighting; railways, roads and footpaths; bridges and culverts; water mains; drains; disposal of waste produets; and notice boards.

"Lighting Appliances" (Group B, Vol. 1.3) contains sections on definitions; design and ordering; issue, maintenance and records; application and use; and detailed regulations. The Factory Department Statutory Forms referred to in the Code are dealt with in a special section. The Code is illustrated and includes a bibliography.

"Periodic Examination and Registration of Pressure Vessels" (Group B, Vol. 1.4) is in five sections: I. Object and Scope; II. Definitions; III. Classification of Pressure Vessels; IV. Inspection Procedure; V. Prescribed Forms. The Code also includes two appendices, one on K-values for various metals and alloys, and the other on special methods of testing pressure vessels.

Agreement concerning Fencing of Machinery, First Aid, and other Safeguards in Cotton Weaving Factories [1]

The Cotton Weaving Agreement, 1929, as amended up to 1948, together with a number of recommendations made by the Joint Advisory Committee for the Cotton Industry, has been reproduced by the Ministry of Labour and National Service in pamphlet form. Annexed to the Agreement are sketches of nip guards, a list of guards approved by the shuttle-guard subcommittee, and a report on the weighting of looms.

OFFICIAL REPORTS, ETC.

AUSTRALIA

Queensland

Report of the Chief Inspector of Machinery, Scaffolding, and Weights and Measures, 1 July 1947 to 30 June 1948

Under the head of Inspection of Machinery, mention is made in the report of the efforts expended by way of engineering to pave the way to accident prevention. At the present time, recourse to engineering is only needed in connection with new machinery and installations. Stress is now laid upon the ways and means of correcting the hazards due to the human element as the main factor of accident causation.

Strict adherence on the part of the worker to basic safety rules; training of operators to work on machines, coupled with the elimination of those who are found to be unfit for machine operation; thorough knowledge on the part of the worker of the way accidents happen and of the risks he may be subjected to in the course of his work; further development of the work of shop safety committees; all of these points must be given greater consideration if accident prevention is to undergo further progress.

Fatal and non-fatal accidents due to machinery increased during the period under review, as shown in the following table.

MACHINERY ACCIDENTS (FATAL AND NON-FATAL)

	1946-47		1947-48	
	Fatal	Non-fatal	Fatal	Non-fatal
Engineering and metal trades	1	11	2	16
Entertainment	1	—	—	—
Farming	—	—	2	1
Lifts	—	—	1	1
Manufacturing	2	86	1	70
Mining	—	—	—	3
Printing	—	—	—	6
Shipping	—	1	—	—
Timber	3	51	5	63
Transport	1	2	4	2
Works and construction	—	—	1	4
Totals	8	151	16	166

Analysis of the fatal accidents also discloses that they were all avoidable and are chargeable to the lack of care and forethought on the part of individuals.

Compliance with the requirements of the Inspection of Scaffolding Acts is reported to have been very satisfactory. The standard of scaffold

[1] H.M.S.O., 1948.

erection is uniformly high and there is a gradual shift to the use of tubular steel for larger and higher structures. As a result of a conference arranged during the year, uniformity of spacing of battens or purlins for asbestos cement corrugated roofs was secured, which will make for greater safety in the future.

However, scaffolding was the source of one fatal accident and of injury to two other men, while two other non-fatal accidents in the building trade occurred when the workers were using ladders and two when the men fell through an asbestos cement roof.

in agriculture and stock-breeding (1,094 in 1946); 188 in mines and quarries (205); 13,982 in industrial undertakings (11,356); 414 in transport and communications (513); 354 in commerce (271); and 1,993 in other activities (960).

The following table shows the number of accidents by cause and industry.

The parts of the body most often affected by industrial accidents were the hands (28.74 per cent. of the total); the feet (20.34); and the eyes (17.31).

The largest number of victims (4,031, or 22.1 per cent.) was in the 20 to 24 age group.

INDUSTRIAL ACCIDENTS IN THE DOMINICAN REPUBLIC

Causes	Industries							
	Agriculture and stock breeding	Mines and quarries	Industrial undertakings	Transport and communications	Commerce	Other activities	Total	Per cent.
Machinery	4	—	20	2	—	2	28	0.15
Transmissions	5	—	16	—	1	2	24	0.13
Hoisting appliances	18	—	64	6	7	12	107	0.59
Machine tools	60	4	593	30	25	62	774	4.24
Railways	5	—	120	3	—	3	131	0.72
Ships	—	—	7	—	—	2	9	0.05
Other vehicles	53	2	259	13	5	54	386	2.12
Explosions	2	—	26	3	3	2	36	0.20
Fires	1	—	24	1	—	6	32	0.18
Toxic, hot and corrosive substances	6	36	194	17	6	50	309	1.69
Electricity	—	—	14	—	—	2	16	0.09
Falls of persons	124	8	1,146	49	57	176	1,560	8.55
Slipping or knocking against objects	245	13	2,631	51	71	365	3,376	18.50
Falls of objects	335	76	3,390	137	91	707	4,736	25.95
Handling goods	154	24	1,544	50	53	288	2,113	11.58
Collapse	11	—	39	3	1	18	72	0.39
Hand tools	221	11	2,670	26	16	86	3,030	16.61
Animals	39	—	587	5	2	6	639	3.50
Other causes	25	14	459	13	11	123	645	3.53
Unknown	8	—	179	5	5	27	224	1.23
Total	1,316	188	13,982	414	354	1,993	18,247	100.00

DOMINICAN REPUBLIC

Industrial Accident Statistics in 1947 [1]

The number of industrial accidents rose to 18,247 (including 27 fatal) in 1947 as compared with 14,399 (including 22 fatal) in 1946.

Of the victims 18,144 were men and 103 women, compared with 14,291 men and 108 women in the preceding year.

Of the total number of accidents 1,316 occurred

As in 1946, plantations made the largest contribution (5,221 or 28.61 per cent.) to the accident total.

FRANCE

Accidents in Mines and Quarries, 1946 [1]

The numbers of accidents on the surface and underground involving more than four days' disablement in different kinds of mines and quarries in 1946 are shown in table I.

[1] For 1946, see *Industrial Safety Survey*, Vol. XXV, No. 1, p. 23.

[1] Ministère de l'Industrie et du Commerce, Conseil général des Mines: *La Sécurité des Mines, Minières et Carrières en 1946*, Paris, 1948. For 1945, see *Industrial Safety Survey*, Vol. XXIV, No. 4, p. 140.

TABLE I

Category	Reported accidents	Fatalities	Permanent disablement
Coal and lignite mines	225,857	290	4,801
Iron mines and workings . . .	9,575	26	147
Other mines. . .	6,183	21	96
Prospecting for mines	414	3	8
Underground quarries	3,389	16	35
Surface quarries .	5,128	35	63
Total . .	250,546	391	5,150

The causes of accidents underground in coal and lignite mines are shown in table II.

TABLE II

Cause	Accidents		
	Fatal	Permanent disablement	Temporary disablement
Fires	—	—	5
Ignition of firedamp and dusts . .	16	11	17
Sudden outbursts; asphyxiation by natural gases .	10	2	21
Explosives . . .	3	16	35
Electricity . . .	—	—	30
Falls of ground .	122	1,465	76,286
Shafts and staple pits	22	51	981
Inclines	15	45	2,136
Haulage	32	681	20,328
Miscellaneous . .	26	1,664	91,041
Total . .	246	3,935	190,880

The principal causes of underground accidents in iron mines and workings were falls of ground (10 killed, 33 permanently disabled and 1,582 temporarily disabled) and haulage (5 killed, 30 permanently disabled, 799 temporarily disabled).

The special difficulties mentioned in 1945 continued in 1946, but showed signs of diminishing. In the northern coal mines greater use is being made of steel props, which have proved very satisfactory in mines worked by caving. This development has unfortunately been hampered by a shortage of steel.

Winding ropes were usually difficult to obtain in spite of the priority enjoyed by the coal mines; ropes had to be imported from Belgium and the United Kingdom.

The average quantity of air at the face generally varies from 50-100 litres per second per man, although in some mines it is as much as 220 litres and in others less than 50.

In the Loire mines the injection of water into the coal face is being tried with the double object of reducing the amount of dust in the air and the amount deposited on the floor and sides. Progress is being made with the spraying of water at the face and at loading points.

The introduction of electro-pneumatic lamps has been hampered by shortage of material. Lamps with a bare flame are gradually disappearing. Substitution of portable electric lamps for flame-lamps was resumed in 1946. Electric cap-lamps have been imported from the United Kingdom and the United States, and their use is likely to spread rapidly.

The rescue teams of a number of small mines have been reconstituted and trained.

INDIA

Bombay

INDUSTRIAL ACCIDENTS, 1939-1947 [1]

Industrial accidents increased from 10,025 in 1939 to 20,561 in 1947 in the Province of Bombay. The number of fatal accidents likewise increased from 36 in 1939 to 61 in 1947, and the accident frequency rate per 100 operatives employed daily rose from 2.16 to 2.95.

The following table shows the number of accidents by cause in 1939 and 1947:

Cause	Total		Fatal	
	1939	1947	1939	1947
Machinery . . .	3,061	5,901	13	26
Transport. . . .	74	223	1	3
Falls	2,164	4,246	7	15
Hand tools . . .	1,024	2,186	1	—
Electricity . . .	28	122	1	3
Poisons	141	273	1	2
Explosions and fires	412	1,042	6	4
Miscellaneous . .	3,121	6,568	6	8
Total . .	10,025	20,561	36	61

Classification by industry for the years 1944-1946 showed that of the 65,694 accidents that occurred during the three years, 22,857 were in the textile industry, 37,621 in engineering industries and 5,216 in other industries.

[1] *Labour Gazette* (Bombay), Vol. XXVII, No. 11, July 1948, p. 1483.

NORWAY

Annual Report of the Labour Inspectorate, 1947 [1]

During 1947, 26,355 undertakings employing 359,130 workers were registered with the Labour Inspectorate. About 79 per cent. of these undertakings employed less than 11 workers and only 2 per cent. had more than 100. The major industries were the metal-working and machine-manufacturing industry (4,210 undertakings with 82,284 workers), building (3,073 undertakings with 51,497 workers), food and drink (5,004 undertakings with 47,775 workers) and woodworking (7,145 undertakings with 45,244 workers).

Inspectors, district engineers and their assistants undertook 9,379 inspections during the year. The inspectors issued 12,561 written instructions of which 4,440 dealt with ventilation, hygiene, cleanliness, lighting, heating, etc.; 2,213 with buildings, canteens, dressing-rooms and toilet rooms; 1,296 with woodworking machinery; and 983 with lifts, hoists, transport equipment, transmissions, gearing, belts, etc. The greater part of these instructions were issued to undertakings engaged in working wood or metals.

The reports of inspectors containing information on the activities of the various industries and on the general conditions of safety, health and welfare existing in a number of undertakings, are included in the Annual Report.

Industries	Total number of accidents	Fatal accidents
Extraction of metals	693	4
Stone and earth	537	1
Metalworking	3,355	13
Chemicals	566	1
Oils and fats	185	—
Electricity and gas	318	4
Woodworking	1,581	6
Wood pulp, cellulose and paper	944	2
Leather and rubber	115	1
Textiles	287	1
Clothing	131	—
Food and drink	850	—
Printing and publishing	74	3
Building	3,538	36
Other industries	54	—
Forestry and agriculture	2,485	13
Commerce	366	4
Transport	1,433	17
Liberal professions	81	—
Total	17,593	106

The Labour Inspectorate recorded 17,593 industrial accidents (including 106 fatal) during the year. The corresponding figures for 1946 were 12,693 and 99. The increase was due to the rise in the number of workers employed in undertakings liable to inspection and to the improvement in the accident-reporting system. The Report describes numerous accidents.

The foregoing table indicates the distribution of accidents by industries.

The Inspectorate expanded its Industrial Hygiene and Medicine Service in 1947, thus laying the foundation for an organisation capable of exercising greater activity in the field of prevention, discovery and control of occupational diseases.

During the year under review, 683 cases of occupational disease were reported. Of these 214 were cases of pneumoconiosis, 160 diseases due to overwork, 85 skin diseases, 81 cases of poisoning, 72 cases of eye-flash and 63 cases of deafness.

The Industrial Hygiene Institute was inaugurated in September 1947. Its tasks include making analyses for the Labour Inspectorate and for industry and undertaking systematic studies in the health field. In addition an Industrial Polyclinic was opened in October 1947.

SWEDEN

Annual Report of the Industrial Inspectorate, 1946 [1]

During the year 1946 the State Insurance Institute issued instructions concerning portable gas generators, qualities of steels, the fitting of automobile tires, fodder hoists, threshing machines, straw conveyors, and crushers.

At the end of the year, 21,035 undertakings employing 886,404 workers were registered with the State inspectors, and 51,465 undertakings employing 188,399 workers with the sub-inspectors. These figures include 19,533 agricultural undertakings employing 68,580 workers. In addition, 77,520 undertakings were registered with communal inspection authorities.

The State inspectors inspected 6,524 undertakings employing 254,823 workers during 1946 and the sub-inspectors 22,830 undertakings employing 152,912 workers. The communal inspection authorities visited 73,323 undertakings employing 203,976 workers.

Plans for the construction or alteration of workplaces and the modification of existing working methods submitted to inspectors numbered 4,835. In this connection the inspectors made 223 pro-

[1] *Årsberetninger fra Arbeidstilsynsrådet og Arbeidstilsynet 1947*. Utgitt ved Direktören for Arbeidstilsynet, Oslo; for 1945 see *Industrial Safety Survey*, Vol. XXIII, No. 3, p. 104.

[1] Riksförsäkringsanstalten: *Yrkesinspektionens verksamhet år 1946*; for 1945, see *Industrial Safety Survey*, Vol. XXV, No. 1, p. 25.

posals and took part in 16,973 conferences or consultations.

The Industrial Inspectorate recorded 13,965 undertakings with safety delegates, 298 with safety engineers and 726 with safety committees.

The total number of accidents reported in 1946 was 174,572, of which 380 were fatal. Cases of occupational disease numbered 1,357, one of which proved fatal.

In the logging and timber-floating industry the number of accidents fell from 18,049 in 1945 to 14,914 (including 24 fatal) in 1946. The explosives inspector reported 680 accidents, two of which, caused by an explosion in an oil tanker, were fatal.

The electrical inspectors reported 271 accidents (22 fatal), railway inspectors 8,187 (39 fatal), and mine and quarry inspectors 3,805 (19 fatal).

The report contains numerous descriptions of accidents and of safety devices. Among the devices illustrated are a rack for the storage of pipes and bars, a limit switch for dock cranes, a safety device for guided hoists used in building, a ladder permitting the drivers of overhead travelling cranes to leave the operating cabin at any point during the run, a protective casing for unenclosed chain hoists, a guard for spindle-moulding machines, a guard for hand-operated paper guillotines and two release devices for wire-drawing benches which prevent the dragging in of workers by any loops in the wire.

The part of the report dealing with industrial hygiene contains descriptions of various exhaust systems and sanitary installations.

UNION OF SOUTH AFRICA

Report of the Chief Inspector of Factories for 1946 [1]

The Chief Inspector reports that during the war years considerable improvement was made in working conditions in South African factories. In order to comply with the Factories, Machinery and Building Work Act of 1941 a number of undertakings appointed personnel managers and welfare officers who organised works safety committees, and it is interesting to note that where such appointments were made the accident rate decreased and absenteeism was reduced to a minimum.

A total of 1,506 plans for factories were approved in 1946, as compared with 742 in 1939. Of these, 520 were for new premises and 986 for alterations and additions.

Due to the acute shortage of sheet metal not much could be accomplished in the way of mechanical ventilation. Most new buildings were so designed that this type of ventilation was not necessary. In most cases occupiers considered that because of the high cost of such plant the installation of air-conditioning equipment was not warranted.

Natural lighting conditions greatly improved since the enforcement of the Factories Act in 1941.

Industrial expansion was so great that many factories were overcrowded and the building of welfare facilities could not keep pace with the increase in the number of employees, particularly in cases where there was no room for additions to be made to the factory.

Inspectors reported that many occupiers were more intent on production than on general cleanliness. During the year 5,993 notices were served by inspectors in respect of ventilation, lighting, disposal of dusts and fumes, overcrowding, unclean sanitary conveniences, washing facilities, protective clothing, changerooms, drinking water, etc.

The report contains descriptions of new installations and a brief account of inspections of boilers.

Under the Factories Act all accidents which result in the injured person being unable to earn full wages for 14 days or more must be reported. The Chief Inspector mentions that there was again an improvement in the prompt reporting of accidents.

During the year, accidents numbered 4,352 involving injury to 3,652 persons and including 96 fatalities. This was an increase of 849 injuries and 12 fatalities as compared with the previous year. This increase is partly accounted for by the industrial expansion.

The largest number of casualties (1,329 including 12 deaths) occurred in the metal and motor engineering and allied industries, an increase of 274 over the previous year.

Falling objects caused the greatest number of accidents—1,078 including 18 deaths (616 and 22 deaths in 1945), followed by working machinery with 982 and 8 deaths (765 and 11 in 1945), elevators and lifting machinery 86 and 5 fatalities (58 and 5), electricity 49 and 23 fatalities (24 and 15), and transmission machinery 40 and 2 deaths (46 and 5).

The Chief Inspector includes a brief account of the fatal electrical accidents and states that most of them would have been prevented if the electrical apparatus had been in good order and if the apparatus and metal roofs had been properly earthed.

An analysis of the personal causes of all accidents investigated during the year shows that 80 per cent. of the casualties were due to misadventure or danger inherent in the work and 12 per cent. due to ignorance, carelessness or disobedience to orders on the part of the victim.

[1] *Report of the Department of Labour for the Year ended 31st December 1946* (U.G. No. 62, Pretoria, 1948), p. 51.

An increasing number of factories had well equipped first-aid stations with qualified nurses in charge. Some occupiers, however, had no interest in first aid. In centres where first-aid classes were started the majority of employees lacked the interest and energy to attend. In spite of this lack of interest there were a number of factories where safety committees were active, and the Chief Inspector reports that there is no doubt that considerable progress was made in first aid and safety during 1946.

The report also discusses working conditions, industrial diseases, protective clothing, etc., and contains brief descriptions of unusual fatal accidents.

UNITED STATES OF AMERICA

Work Injuries in the United States during 1947 [1]

Nearly 52,000 establishments participated in the survey on which the accident figures quoted in this report by the U.S. Department of Labor are based.

The number of disabling injuries in 1947 was estimated at 2,059,000 as compared with 2,056,000 in 1946, and in view of the expansion in most industrial activities during the year, this may be regarded as an improvement. Fatal injuries, however, rose from 16,500 in 1946 to 17,000 in 1947; the rise is largely due to the Texas City explosion and the Centralia mine disaster. Permanent total disability cases totalled 1,800, permanent partial disability cases 90,000, and temporary disability cases (at least one day's lost time) 1,950,200.

Actual time lost because of disabling injuries was estimated at about 44,700,000 days or 150,000 man-years (142,000 in 1946); and the ultimate time lost, taking into account deaths and permanent disabilities, 233,700,000 days or 780,000 man-years (765,000 in 1946).

Table I shows the distribution of injuries among the main industrial groups.

Table II gives figures for the industries that made the largest contributions to the accident total; figures for branches of industry with the highest frequency and severity rates are given in table III (page 66).

The frequency rate for manufacturing industries as a whole dropped nearly 6 per cent., from 19.9 in 1946 to 18.8 in 1947.

The Bureau points out that in spite of expansion only 23 industries had higher frequency rates in 1947 than in 1946, the most pronounced increases being from 80.4 to 102.8 for logging and from 35.1 to 42.3 for planing mills.

In general, the severity of injuries reported in the manufacturing industries was less in 1947 than in 1946. The proportion of fatalities and permanent-total disabilities was unchanged at 0.3 per cent. of the total volume of injuries. The proportion of permanent-partial disabilities, however, dropped from 4.9 per cent. in 1946 to 4.4. in 1947 and the average time charge for these disabilities fell from 938 to 863 days. The average number of days lost per temporary-total disability also declined from 17 to 16 days. The severity rate likewise dropped from 1.6 to 1.4.

The report includes statistical tables on the changes in accident experience, 1946-1947; extent of disability, manufacturing industries, 1947; part of body affected, all industries, 1947; duration of temporary-total disabilities, 1947; and frequency rates, manufacturing industries, 1926-1947.

TABLE I

Industry group	All disabilities		Fatalities		Permanent-total disabilities		Permanent-partial disabilities		Temporary-total disabilities	
	Total	To employees	Total	To employees	Total	To employees	Total	To employees	Total	To employees
Agriculture [1]	298,000	70,600	4,300	1,000	400	100	14,900	3,500	278,400	66,000
Mining and quarrying [2]	92,900	88,300	1,500	1,400	200	200	4,100	3,900	87,100	82,800
Construction [3]	151,700	105,100	2,400	1,800	300	200	4,300	3,000	144,700	100,100
Manufacturing [4]	539,000	530,100	2,700	2,600	200	200	27,200	26,800	508,900	500,500
Public utilities	27,700	27,700	400	400	[5]	[5]	600	600	26,700	26,700
Trade [3]	360,600	287,700	1,500	1,300	100	100	8,600	6,900	350,400	279,400
Railroads [6]	71,900	71,900	800	800	300	300	5,000	5,000	65,800	65,800
Miscellaneous transportation [3]	135,200	116,200	900	700	100	100	7,400	6,400	126,800	109,000
Services, Government, and miscellaneous industries [3]	382,000	337,000	2,500	2,300	200	200	17,900	15,700	361,400	318,800
All groups	2,059,000	1,634,600	17,000	12,300	1,800	1,400	90,000	71,800	1,950,200	1,549,100

[1] Based on fragmentary data.
[2] Based largely on Bureau of Mines data.
[3] Based on small sample studies.
[4] Based on comprehensive survey.
[5] Less than 50.
[6] Based on Interstate Commerce Commission data.

[1] United States Department of Labor, Bureau of Labor Statistics: Bulletin No. 921. Washington 1949. Price 15 cents.

For 1946, see *Industrial Safety Survey*, Vol. XXIV, No. 4, p. 145.

TABLE II

Industry	Average number of employees	No. of disabling injuries	Percentage of disabling injuries resulting in			Average days lost per disability		Injury rates	
			Death and permanent total disability	Permanent partial disability	Temporary total disability	Permanent partial disability	Temporary total disability	Frequency	Severity
Manufacturing:									
Chemicals and allied products	580,115	13,963	0.5	4.1	95.4	1,189	15	12.6	1.7
Electrical machinery, equipment and supplies	680,126	12,192	0.2	6.9	92.9	714	17	8.8	0.8
Food products	536,754	29,036	0.3	3.0	96.7	1,118	14	24.0	1.6
Breweries	53,898	4,399	0.3	4.9	94.8	1,295	13	38.4	3.7
Slaughtering and meat packing	135,977	8,929	0.2	1.4	98.4	684	11	29.9	1.3
Furniture and finished lumber products	232,493	14,366	0.2	5.4	94.4	743	12	29.5	2.0
Furniture, except metal	95,069	5,569	0.2	6.3	93.5	774	12	28.2	2.1
Iron and steel and their products	1,469,141	61,828	0.5	4.9	94.6	836	18	22.3	1.9
Foundries, iron	138,438	12,644	0.3	2.1	97.6	1,028	12	44.5	2.3
Iron and steel	539,887	8,880	1.7	7.0	91.3	949	36	8.2	1.7
Lumber and timber basic products	141,714	16,660	0.6	2.8	96.6	1,102	17	66.0	5.9
Machinery, except electric	1,105,450	41,897	0.2	5.1	94.7	672	13	19.7	1.2
Textile machinery	27,247	1,036	—	3.4	96.6	550	14	18.4	0.8
Non-ferrous metals and their products	209,820	7,844	0.1	5.7	94.2	642	18	17.1	0.8
Foundries, non-ferrous	32,029	1,737	0.2	3.9	95.9	742	12	27.0	1.5
Paper and allied products	315,126	15,295	0.3	4.6	95.1	1,039	15	22.1	1.9
Paper and pulp	204,191	10,630	0.4	3.2	96.4	1,061	17	23.6	1.9
Stone, clay, glass products	247,714	11,814	0.5	2.5	97.0	904	14	24.3	1.9
Textile and textile-mill products	769,821	20,767	0.2	3.9	95.9	1,014	16	13.2	1.0
Cotton yarn and textiles	305,369	7,423	0.2	3.8	96.0	1,030	17	12.2	1.0
Woollen and worsted textiles	140,593	5,132	0.3	2.3	97.4	938	16	18.6	1.3
Transportation equipment	884,495	23,803	0.3	6.3	93.4	717	22	14.2	1.1
Motor vehicles	312,084	5,843	0.1	8.8	91.1	713	25	9.5	0.7
Motor vehicle parts	199,257	6,924	0.1	6.7	93.2	622	12	17.6	0.9
Shipbuilding and repairs	85,667	4,849	0.9	3.0	96.1	896	37	28.1	3.2
Non-manufacturing:									
Construction	[1]	11,384	0.8	2.2	97.0	1,259	14	40.9	3.6
Building construction	[1]	6,351	0.6	2.3	97.1	1,348	13	38.7	3.0
Transportation	220,204	15,169	0.4	2.1	97.5	1,453	20	27.5	2.1
Heat, light and power	334,560	12,597	1.3	2.1	96.6	1,608	15	18.1	2.3
Gas	88,237	4,201	0.5	2.3	97.2	1,573	12	23.0	1.8
Trade	363,769	11,263	0.3	2.0	97.7	1,063	12	16.4	0.8
Coal mines:									
Bituminous	390,500	46,690	2.1	[1]	[1]	[1]	[1]	59.8	[1]
Anthracite	78,500	12,675	1.4	[1]	[1]	[1]	[1]	83.4	[1]

[1] Not available.

ILLINOIS

Industrial Accidents in 1947 [1]

A total of 52,979 compensable injuries were reported to the Industrial Commission of Illinois during 1947, as compared with 52,525 in 1946.

It should be noted that under Illinois law only compensable injuries (*i.e.*, those causing some impairment or involving disability for more than 7 days) are reportable.

The number of fatal accidents rose from 332 in 1946 to 471 in 1947. Explosions accounted for 165 of the fatal accidents, vehicles for 100, falls of persons for 46, falling objects for 36, electricity for 21 and hoisting appliances for 20.

Handling objects led to 27.8 per cent. of the accidents, machinery to 18.9 per cent. and falls of persons to 16.3 per cent.

[1] Illinois Department of Labor: Division of Statistics and Research: *Annual Report on Industrial Accidents in Illinois for 1947*; for 1946, see *Industrial Safety Survey*, Vol. XXV, No. 1, p. 31.

TABLE III

Industry	Average number of employees	No. of disabling injuries	Percentage of disabling injuries resulting in			Average days lost per disability		Injury rates	
			Death and permanent total disability	Permanent partial disability	Temporary total disability	Permanent partial disability	Temporary total disability	Frequency	Severity
Manufacturing:									
Breweries	53,898	4,399	0.3	4.9	94.8	1,295	13	38.4	3.7
Wooden containers	42,180	3,610	0.4	4.1	95.5	734	13	41.9	2.8
Iron foundries	138,438	12,644	0.3	2.1	97.6	1,028	12	44.5	2.3
Logging	19,742	3,895	0.8	1.9	97.3	1,424	17	102.8	9.7
Sawmills	37,593	5,096	0.5	2.7	96.8	1,122	18	66.6	5.3
Sawmills and planing mills combined	20,302	2,416	0.4	3.5	96.1	990	18	56.7	4.0
Planing mills	14,893	1,359	0.8	5.0	94.2	1,013	13	42.3	4.1
Clay products (structural)	43,426	3,892	0.6	1.5	97.9	737	13	43.9	2.7
Cut stone and cut-stone products	2,793	216	2.3	2.8	94.9	400	13	36.8	6.0
Non-manufacturing:									
Heavy engineering	[1]	2,411	1.3	2.5	96.2	1,269	19	41.8	5.4
Stevedoring	[1]	2,971	0.5	5.8	93.7	1,553	28	72.4	10.6
Wholesale and retail building supplies	16,433	1,238	0.5	4.7	94.8	914	15	34.7	3.0
Coal Mining:									
Bituminous	390,500	46,690	2.1	[1]	[1]	[1]	[1]	59.8	[1]
Anthracite	78,500	12,675	1.4	[1]	[1]	[1]	[1]	83.4	[1]
Copper mining	16,100	1,767	1.8	[1]	[1]	[1]	[1]	44.7	[1]
Lead and zinc mining	16,800	3,233	1.0	[1]	[1]	[1]	[1]	91.0	[1]
Gold and silver mining	5,600	1,254	1.1	[1]	[1]	[1]	[1]	108.4	[1]
Non-metal mines	12,300	1,347	0.9	[1]	[1]	[1]	[1]	46.0	[1]
Limestone quarries	25,600	1,987	1.4	[1]	[1]	[1]	[1]	44.6	[1]
Lime quarries	9,400	1,236	0.5	[1]	[1]	[1]	[1]	54.5	[1]
Granite quarries	5,700	767	0.3	[1]	[1]	[1]	[1]	62.5	[1]
Traprock quarries	2,600	271	0.4	[1]	[1]	[1]	[1]	51.2	[1]
Slate quarries	1,700	243	1.2	[1]	[1]	[1]	[1]	53.9	[1]
Sandstone quarries	3,900	461	1.3	[1]	[1]	[1]	[1]	58.3	[1]

[1] Not available.

The percentage distribution of accidents by cause in the various industries together with the total number of accidents in each group is shown in the following table:

Cause group	Industry group								
	Agriculture	Mining	Construction	Manufacturing	Trade	Finance, etc.	Transportation etc.	Public services, hotels, etc.	Total
Non-machine causes:									
Handling objects	16.7	19.6	25.2	29.7	31.7	16.8	31.2	21.4	27.9
Falls of persons	19.3	7.2	26.5	11.9	20.2	44.2	18.1	27.1	15.9
Vehicles	22.6	18.7	4.5	3.0	9.3	3.0	20.1	8.0	7.2
Falling objects	4.1	17.5	7.4	4.6	3.0	2.6	4.4	2.8	5.8
Hand tools	8.1	8.4	6.8	4.9	6.6	2.8	3.5	5.1	5.6
Striking against objects	4.3	2.6	3.4	4.4	4.3	4.2	3.1	4.5	4.0
Hot substances, flames	1.4	1.2	2.5	3.9	4.1	2.6	2.0	4.3	3.3
Occupational diseases	0.2	0.1	3.7	1.9	0.9	1.6	0.6	0.7	1.6
Poisonous,corrosive substances	2.0	0.7	1.6	1.2	0.9	1.8	0.6	1.3	1.2
Explosions	0.6	3.9	0.5	0.6	1.1	0.6	0.9	1.2	1.0
Electricity	0.4	1.3	0.4	0.3	0.3	0.2	1.3	0.4	0.5
Stepping on objects	0.2	0.2	1.3	0.4	0.4	—	0.2	0.4	0.4
Animals and insects	4.9	0.5	0.1	0.1	0.2	0.2	0.9	0.8	0.3
Miscellaneous	5.1	4.7	4.5	4.1	5.8	7.2	7.4	10.5	5.1

(Table continued on next page.)

Cause group	Industry group								
	Agriculture	Mining	Construction	Manufacturing	Trade	Finance, etc.	Transportation etc.	Public services, hotels, etc.	Total
Machine causes:									
Working machines, power driven	4.7	4.1	5.4	22.3	5.0	2.4	1.5	6.4	13.7
Hoisting apparatus	1.6	2.2	2.4	2.8	1.7	5.8	1.6	1.5	2.4
Conveyors	0.4	4.6	0.5	0.9	1.0	—	0.5	0.1	1.1
Non-working machines	0.8	1.1	1.0	0.7	0.6	1.2	1.1	1.1	0.8
Working machines, not power driven	—	—	[1]	0.4	—	—	—	[1]	0.2
Prime movers	0.2	0.7	0.1	0.1	0.2	0.2	[1]	0.1	0.2
Power-transmission apparatus	0.2	0.1	0.1	0.2	0.1	0.2	0.1	[1]	0.1
Unclassified	2.2	0.6	2.1	1.6	2.6	2.4	0.9	2.3	1.7
Grand total	492	5,025	5,652	27,355	6,484	501	3,881	3,589	52,979

[1] Less than 0.05 per cent.

The Illinois Industrial Commission is making a determined effort to reduce accidents and to this end has adopted a revised accident report form which will be in general use in 1949. It is emphasised, however, that statistics alone will not prevent accidents, and that when the causes of an accident have been determined and investigated, adequate measures must be taken to avoid the recurrence of similar accidents. Unless such measures are taken, the reporting of accidents is of little value.

REVIEW OF PERIODICALS

L'éclairage artificiel des ateliers. By M. CORU. (*La pratique des industries mécaniques*, No. 7, July 1948, p. 209.)

The artificial lighting of workplaces is a factor the value of which is not always given the importance it merits. It is becoming more and more evident, however, that good lighting is a matter of great importance and that it cannot be achieved except on the basis of scientific investigations.

The author outlines the elements of the problem in this article. In order to achieve suitable lighting, consideration must be given to the fineness of the details and the reflective qualities of the objects worked, the shape of the machines, the surroundings, etc. Recent studies have shown that, contrary to the belief up to the present, visual acuity increases continuously with the increase of brightness. The result is, in the opinion of Mr. Coru, that lighting at present in use in France is too weak and that in use in the United States is not excessive.

In conclusion the author cites a number of examples of the practical application of his theory for which he recommends the use of fluorescent lamps.

Sicherheitstechnische Einrichtungen bei Zentralheizungen. (*Technische Rundschau*, Vol. 40, No. 29, 23 July 1948, p. 17.)

The purpose of the safety devices on installations for central heating by hot water is, in low pressure systems, to prevent any overpressure in the circuit in cases where the boiling temperature is reached in the boiler, and in medium pressure systems (maximum temperature of 108° C. at the outlet of the boiler) to limit the pressure to a permissible level. It is essential to ensure at all times communication with the atmosphere, whatever the position of the stop valves that may be fitted at the outlet of the boiler.

This article reproduces, with four diagrams and a number of commentaries, the text of the technical safety provisions laid down by the German Association of Manufacturers of Central Heating Equipment at Düsseldorf. As far as is known, these are the only provisions in existence regulating this type of installation.

In the most simple types of installation, where only the outlet piping is connected to the expansion tank by an expansion pipe (called a safety pipe), the diameter of this pipe should not be less than

$$d_1 = 14.9\ H^{0.5 \cdot 6}\ (1)$$

when d_1 is the internal diameter of the pipe in mm and H the total heating surface of the boiler in m². This safety pipe can serve, entirely or in part, as outlet piping for the supply of the heating elements.

If a stop valve is fitted as the outlet of the boiler on the pipe leading to the expansion tank, it must be provided with a by-pass with a three-way cock and a drain pipe. The by-pass and the drain pipe, as well as the corresponding ports of the cock, must have an internal diameter equal to or exceeding:

$$d_2 = 13.8\ H^{0.435}\ (2)$$

d and H having the same meanings as in (1). The

length of the by-pass must not exceed 3 m and of the drain pipe, 15 m. If it is impossible, for any reason, to fit a by-pass on existing installations, all the shut-off devices must be removed.

In the larger central heating installations, where the outlet and return piping are both connected to the expansion tank by safety pipes, the minimum internal diameters of these must be as follows:

(a) for the safety pipe of the outlet piping

$$d_3 = 15 + \sqrt{20\ H} \quad (3) \text{ and}$$

(b) for the safety pipe of the return piping

$$d_4 = 15 + \sqrt{10\ H} \quad (4).$$

In these formulae, d and H have the same meaning as in (1). Thus safety pipes may likewise serve, entirely or in part, as outlet piping and, respectively, as return piping. Their installation forms the subject of various provisions.

The text of the general provisions applicable to heating installations of all types are reproduced below.

C-1—The expansion tank shall be fitted with a cover and a vent pipe which it shall be impossible to block and the internal diameter of which shall be at least equal to the figure given in formula (3).

C-2—The expansion tank and the safety pipes shall be protected against freezing unless the local conditions exclude this risk.

C-3—The water level in the system shall be indicated in the furnace room by means of a suitable device; the boiler itself shall be equipped with an emptying device.

C-4—When the system has been installed it shall be submitted to a hydraulic test with cold water. The test pressure shall exceed the static pressure existing in the boiler by 1.5 atmospheres but shall not exceed 4.5 atmospheres.

Education des élèves agents de maîtrise du fond. By M. F. Bizouard, Chief Engineer at the Bassin de Lorraine Collieries. (*Revue de l'Industrie minérale*, July 1948, p. 489.)

The author makes the three following statements:

(1) It is not the newly-employed workers who have the greatest number of accidents; on the contrary, older and experienced workers have the greatest percentage of injuries and serious injuries.

(2) There are accident peaks during the periods of the year when the heaviest agricultural work is carried on, since persons working in the fields are tired.

(3) Accidents are more numerous than before the war.

He then enumerates what he considers to be the principal causes of accidents, as follows: familiarity with danger leading experienced workers to neglect elementary safety precautions; a great deal of inattention and imprudence, in particular in haulage accidents; much clumsiness or thoughtlessness during transport operations; ignorance and non-compliance with the regulations and instructions (almost always in cases of accidents involving shotfiring, inclines, landings and shafts); fatigue of workers having another occupation at home; and decreasing conscientiousness of the personnel.

In conclusion, the author emphasises the role of the supervisory personnel who should set a good example in order to be able to demand compliance with the regulations; know the instructions and regulations, and explain to the personnel with patience and perseverance the reasons why they were compiled and their use; take every opportunity during visits underground to instruct the personnel, rectify errors, report defects, be severe when necessary, and stop the work until the necessary precautions have been taken; see that signal and instruction boards are provided and maintained in good condition; demand if necessary, the removal from underground of personnel who might prove dangerous because of their clumsiness, carelessness or lack of intelligence; question, from time to time, the persons who are working under special instructions to be sure that they understand them well; know the type of first aid to be given to the injured; know where the stretchers, blankets and bandages are to be found; pay attention to newcomers who are unfamiliar with the work and the dangers of the mine and put them with serious workers who can instruct, advise and guide them.

Mine Safety. (*Coal Age*, June 1948, p. 114.)

In a special number of *Coal Age* on "The Coal Mines of Tomorrow" this article describes what new mines are doing or propose to do to improve safety. The matters discussed comprise timbering, grounding of electrical equipment, the use of flameproof equipment, rock dusting, reduction of coal dust, fire fighting, safety committees, underground travel, personal protective equipment, education and training, first aid and safety campaigns. The policy of the new mines is succinctly described as "Safety education plus modern equipment and methods". A substantial number of these mines have achieved safety records appreciably better than the average for the industry.

La Station d'essais de matériel à air comprimé de Montluçon. By R. Loison. (*Annales des Mines*, Vol. 136, No. 8, p. 67.)

A description is given in this article of the Montluçon Experimental Station where the characteristics of compressed air engines and of ventilators are determined.

This station was organised to permit collieries to have their compressed-air equipment tested with precision. The methods of testing used at the Station are briefly described.

Suspension Roof Support. By Edward Thomas. (*Coal Age*, July 1948, p. 87.)

After discussing the characteristics of an ideal roof support for mechanised mining, the author describes a type that appears to approach the ideal. This is based on the principle of reinforcing the roof by anchoring steel bars in it at points where it is least affected by the stresses set up by mining operations. Illustrations show such a suspended system. The bars are secured by slotted rods wedged into holes driven 7½ feet into the roof at an angle of 45°. Practical advice is given on the drilling of the holes and the installation of the supports.[1]

Safety Around Belt Conveyors. (*Coal Age*, June 1948, p. 136.)

Gives advice on repairing belt carriers, cleaning up dust, removing lumps of fine coal, sanding slipping belts, guarding and grounding electrical

[1] See also: "Roof Support with Suspension Rods", *Industrial Safety Survey*, Vol. XXIV, No. 3, p. 109.

equipment, riding on belts and training belt operators.

Les câbles d'extraction en acier et leur contrôle du point de vue de la sécurité. By Yvon VERWILST. (*Protection, Sécurité, Hygiène*, January-February 1948, p. 8 and March-April 1948, p. 23.)

This study, made by the Chief of the Chains and Ropes Service of the French Manufacturers' Association is in four parts:

I. Tough steel wire (manufacture, properties, tests and causes of deterioration).
II. Winding ropes (composition, properties).
III. The behaviour of winding ropes on winding equipment (causes of deterioration).
IV. The supervision of winding ropes (supervision during manufacture and use).

The purpose of supervision of ropes in service is to discover external and internal broken wires, corrosion, denting and deterioration due to the installation itself. Strict supervision usually entails taking out test wires at doubtful points and opening the rope. The samples taken are submitted to mechanical and metallographic tests permitting the establishment, in a sufficiently precise manner, of the safety factor of the section of the wire from which the samples were taken.

The Consolidation of Floor Dust on Mine Roadways. By F. BRADSHAW and F. V. TIDESWELL. (*The Colliery Guardian.* 13 August 1948, p. 199.)

This article brings up to date information related to the treatment of roadways with deliquescent materials for the purpose of consolidating floor dust. It describes experiments conducted in four collieries in South Yorkshire with modifications in the mode of application of the most suitable deliquescent material used, which was calcium chloride.

The tests were made to determine the possible reduction in the amount of airborne dust raised by heavy traffic on each shift. The variation in the application of the treatment consisted basically in the use of various types of dust-wetting solutions sprayed over the roadways in varying concentrations and quantities before spreading calcium chloride in flakes or in solution. Spraying the dusty roadways with a wetting agent and calcium chloride in the same solution was also tried.

The results obtained in consolidating the dust were found to be good in all cases but the method consisting in the successive application of a wetting solution and calcium chloride proved to be more economical and caused less inconvenience to the workmen.

General advice is also offered with regard to the preparation of the roadway, the wetting of floor dust, the spreading of calcium chloride, the precautions during treatment and the maintenance of the roads. A rough estimate of the cost of the treatment and a report of the results obtained in terms of the reduction of airborne dust raised in travelling over the roadways were made and are reproduced in the paper.

In conclusion, the authors warn the users of floor consolidation methods against relying on them for the suppression of fresh sources of dust created at the face or by spillage during haulage. The production of dust should be well under control by approved methods and the maintenance of a heavy layer of stone dust on the roof and sides should be ensured before the consolidation of the floor dust is undertaken.

Fire Extinguishers. Their Application to Underground Fire Fighting. By W. PARK. (*The Colliery Guardian*, 6 August 1948, p. 169.)

This paper constitutes an interesting study of efficient fire-fighting equipment, fire protection and organisation. Emphasis is placed on the recognition by colliery officials of the important substantial economical losses involved.

Of prime importance is the most practical selection of extinguishers, to which end the following suggestions are offered:

(1) standardisation for general purpose application;
(2) instruction of workmen in the characteristics and salient features and in the art of applying equipment available;
(3) proper maintenance.

The time factor is considered of critical importance for the effective extinction of fires, as the lag of a very few moments between the discovery of the fire and the proper application of ready extinguishing agents will constitute the difference between success and failure.

Types of Extinguishers

The author gives five general types, with a brief analysis of the features of each one.

(a) Soda acid. A powerful jet, obtained from the mixture of an alkaline and an acid substance, the force and cooling action of the jet driving flames away and causing penetration beneath the surface of the burning material. The main disadvantage of this type is that its use is limited to fires other than electrical or oil.

(b) Chemical foam. When the mechanism of the extinguisher is actuated, CO_2 in a condition of foam is released in sufficient quantity to cover a relatively large area of irregular burning surfaces, oil or electrical equipment. The quantity of foam obtained from a two-gallon fire extinguisher is 16 gallons.

(c) Water and compressed air or CO_2. In this case water is the extinguishing agent by virtue of its powerful jet obtained when it is expelled under the pressure of compressed air or carbon dioxide released inside the extinguisher. This type is not suitable for all classes of fires.

(d) Dry powder. This extinguishing agent is shot out of a pistol in a cone-shaped gush by means of a detonator set off by a trigger mechanism. Although the nature of the agent would render it suitable for all classes of fires, its reduced quantity limits its application to small fires.

(e) Carbon dioxide (CO_2). This liquid is stored under high pressure (750 lb. per sq.in.) and is discharged in the form of a cloud over the burning area when it is released from its heavy container. A dependable non-conductor, it is safe for use on electrical equipment and because of its rapid oxygen diluting effect it is especially recommended for flammable liquid fires and gaseous fires in the undercuts on the coal face.

Comparison of Types

A further grouping is made of the various types, to facilitate the selection of the most practical extinguishers for an intended purpose:

(1) Where the striking power and cooling action of the jet is important.

This group comprises the soda acid and water types. The unfavourable features of both these types, namely, the difficulty encountered in putting them into action, their unsuitability for electrical

and oil fires, the possibility of insidious leakage occurring in storage, all concur to curb their use.

(2) Where the governing factor is the smothering action and non-conductivity of the fire-fighting medium.

This group includes the chemical foam and dry powder types. Both these types are ideal for fighting electrical fires as their extinguishing media are non-conductors and their oxygen diluting effects are great; further, they offer suitable means of killing flames by forming a non-combustible cloud over and around the burning material. The ease with which the pistol type especially may be handled makes it the most practical for machinery fires at the coal face.

Foam and Fires involving Electrical Equipment at Potential

Proof of the usefulness of foam producing extinguishers has been furnished in the past by experts, but usefulness depends on maintenance, which is the sole responsibility of the purchaser.

The author recommends:

(1) intelligent training and instructing of the fire-fighting personnel;
(2) inaugurating and pursuing an effective system of maintenance.

Success in extinguishing electrical fires will depend also on factors such as proper methods of application, operating condition of the equipment, protection of the operator against electric shocks and especially on the assurance that the extinguishing stream effectively reaches the burning equipment.

Fire Protection

Attention is drawn here to the fact that fire fighting implies protection against the start of a fire as a basis for sure success. The two processes are complementary and very intimately related to each other. To achieve practical results in this respect, the author advises the following:

(1) standardisation of equipment;
(2) sufficient supply of equipment;
(3) development of fire-consciousness among employees;
(4) collection of combustible refuse;
(5) encouragement of co-operation between maintenance staff and machine operators.

Mr. Park concludes by offering some important suggestions on the subjects of organisation and procedure in the event of fire, calling the attention of colliery officials to the fact that proper equipment, good maintenance and a definite policy will not go a very long way on the road to reducing losses caused by fires, if a competent organisation of trained personnel is not included in the underground fire protection and fire-fighting plan. Production time must be spent on instruction of workmen, visible and audible means of education must be provided and some practical experience acquired before the responsible official will be able to get maximum efficiency from his fire-fighting organisation.

Mesures de sécurité concernant les travaux de décoffrage. (*Bâtiment et Travaux publics*, No. 7, 8 April 1948, p. 10 and No. 8, 22 April 1948, p. 12.)

The dismantling of falsework for concrete or reinforced concrete can give rise to accidents caused by falls of persons, falls of objects, collapse of the falsework or of the structure, and injuries caused by sharp points or splinters in cases of wooden falsework.

Although the diversity of structures and falsework makes it impossible to indicate definite rules for the removing of falsework, this article gives a number of general principles which, if strictly followed, will considerably improve the safety of the workers. In the first place, the dismantling of falsework should never be left to the initiative of the personnel on the working site. It should be carried out rationally in accordance with a previously worked-out plan and taking into account the stresses to be borne by the structure as a whole when some of the supports are removed. Further, the work should be entrusted to experienced and agile experts who will not be dispensed, however, from observing elementary precautionary measures. These workers should have at their disposal suitable tools and equipment: pliers, nail extractors, ropes, hoisting equipment, safety belts, shoes suited to the type of work, etc. Finally the persons working at the dismantling of falsework should be sufficiently numerous so that the parts removed can be handled and transported easily and without bringing about any falls, knocks or jolts.

Since nine times out of ten falsework is assembled by means of nails, in prising the falsework loose the workers should avoid the use of any force liable to tear the nails out. They should have at their disposal the necessary means to move on and stand on. As for hoisting equipment, it should only be used to support the parts that are being removed and to take them to the storeplace. Any effort to pull off parts obliquely or vertically should be strictly prohibited.

It should likewise be prohibited to work simultaneously on working sites placed one above the other, to throw materials, and to move under or too near a structure being dismantled.

The time limit for the dismantling of falsework fixed by the building manager and the contractor should be respected. The dismantling work itself should be carried out slowly and methodically, without any jolts, so that the structure will not suddenly be subjected to the stresses resulting from the application of the load. The behaviour of the structure should be carefully and continuously watched during the dismantling operations.

To avoid injuries caused by sharp points and splinters, the workers should ensure control over their movements, the stability of their position, and the support of the parts removed. Convenient work places and judicious distribution of workers and material are also of importance. Nails in boards which are set down should be removed or knocked over. It is advisable to make one or more persons responsible for this work.

The article concludes by drawing attention to a number of regulations applicable to the dismantling of falsework.

Ventilation of Long Tunnels during Construction. By W. P. Harris. (*Monthly Review*, Division of Industrial Hygiene and Safety Standards, New York State Department of Labor, Vol. 27, Nos. 1 2 and 3, January-March 1948.)

This illustrated article comments on the experience with ventilation over a period of two years during the driving of an aqueduct tunnel for the water supply of the City of New York. The tunnel in question is about 150 km (90 miles) long, from 4.2 to 6.1 m (13.5 to 19.5 ft.) in diameter and at an average depth of 120 m (400 ft.).

In order to eliminate the dust produced by compressed-air drilling, mechanical and loading opera-

tions, and the gases and fumes produced by blasting, it was necessary to provide strong ventilation. It is impossible to fix beforehand the exact quantity of air necessary; the quantity is dependent on a number of factors each of which has a wide range of variation. In the case of the tunnel under consideration experience showed that it was necessary to supply 0.57 m³/sec. (1,200 cu.ft./min.) of air per drill to control efficiently the dust produced during drilling and to permit the workers to return to the working face less than 30 minutes after blasting.

It is advisable to place the mouth of the ventilation pipe at a distance of 18 to 25 m (60 to 90 ft.) from the working face, if efficient ventilation is to be obtained and damage to the pipe by blasting avoided. The installation should allow air to be blown in or exhausted at will. In general, the method giving the most satisfactory results was that of exhausting the air for 40 minutes (10 before the blast and 30 after) and to blow it in for the remainder of the cycle. In one section, it was necessary to exhaust continuously because of methane-producing strata.

It was found that for the pipes, the diameters of which varied between 60 to 70 cm (24 and 28 inches), only heavy gauge steel was capable of withstanding the stresses to which it was put without excessive loss. Joining the pipes, however, was a considerable problem. The tightest joint was obtained with a U-section bolted ring. Surprisingly enough, welded joints gave the least satisfactory results, probably because of the difficulty of welding a clean joint in the necessary position. In the opinion of the author, if adequate ventilation is to be assured for work in tunnels of this magnitude, at least 0.3 l/sec. (0.2 cu. ft./min.) per foot of pipe length must be added to the ventilation rate, for leakage.

Where the distance from the working face to the outside air is short, the air blown in will reflect outside air conditions.

This is not the case if the ventilation pipe is of some considerable length. It was found that when the pipe exceeded 600 m (2,000 ft.) in length, the temperature and the humidity of the air blown in are unaffected by the external conditions. The air in such cases was almost saturated and had the same temperature as the rock.

As auxiliary equipment for fighting dust, use was made of a high-pressure nozzle spray installed near the working face and put into action immediately before blasting and when workers returned on the job. It was possible with this device, to reduce from 40 to 20 minutes the time lapse before men could return to work after blasting. It also resulted in a rapid decrease in the dust concentration and, more interesting, in that of noxious gases.

With respect to the use of Diesel locomotives underground, the workers registered complaints when the concentration of carbon monoxide reached 20 parts per million in the air downstream of the engine.

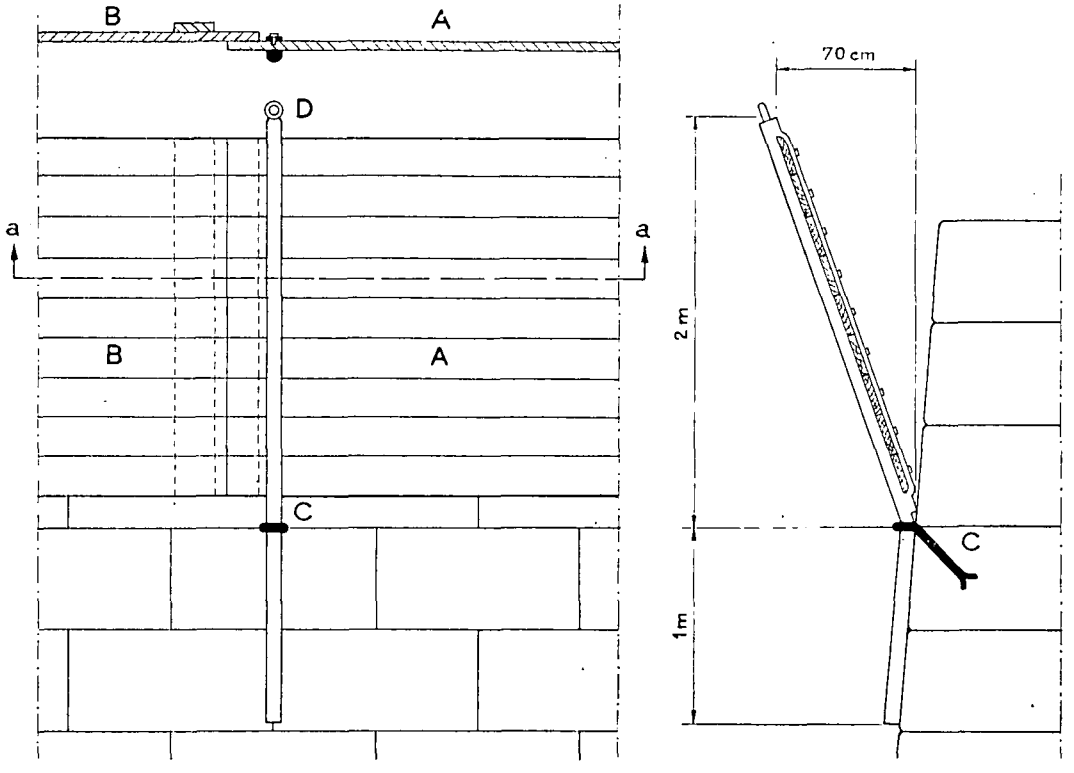
In conclusion, the author points out that too much reliance must not be put on natural ventilation in open tunnels. This is effective only where a strong chimney is present. In other cases it is difficult to predict the direction of the air flow before holing through.

A short bibliography concludes the article.

Auvent de garantie pour travaux de maçonnerie à grande hauteur. By M. CHAMBON. (*Cahiers des Comités de prévention du Bâtiment et des Travaux publics*, January-February 1948, p. 6.)

The construction of stone masonry dams presents a problem which does not always exist when dams are built of concrete. In fact ashlar masonry dams are constructed without falsework and the falls of workers or building material usually have very serious consequences.

Mr. Chambon has perfected a movable protective apron which can also be used successfully in the construction of piers and abutments for ashlar masonry bridges.



The apron is composed of two kinds of alternating panels, A and B (see fig.). The B panels consist of ordinary planks held together by strong oak cross-beams.

The A panels consist of two bent metal bars of large cross-section on which has been welded a flat bar fitted with a slot to accommodate the planks of the panel. These planks are fixed by means of strong screws.

On the other hand, iron rings are sealed horizontally into the blocks of stone at suitable intervals and the lower extremity of the bent bars of the A panels are passed through. These rings can also be used subsequently as anchors for the swinging scaffolds used for pointing the stone blocks.

The A panels are put into place with the help of an eye (C) at the upper extremity of the bent bars. The B panels are then placed between the A panels and rest on these.

The removal of the panels from the lower level, their transportation and their installation on the upper level are effected by means of hoisting equipment.

This simple device, easily modified for use under various conditions will no doubt help to prevent serious accidents.

Podnoszenie i przenoszenie ciezarów a wydajnosc i bezpieczenstwo pracy. By A. MAZURKIEWICZ. (*Miesiecznik Bezpieczenstwo i Higiena Pracy* No. 6/13, June 1948, p. 1.)

The purpose of this article on safety and efficiency in the lifting and transport of loads is to encourage physiologists to solve the problems of the relationship between physiological characteristics and physical work. The author approaches these problems from the technical and mathematical standpoints, dealing *inter alia* with the effect on efficiency of heat radiation, uncomfortable postures, body equilibrium, and position of the body's centre of gravity. Other factors that cannot be ignored are mental and nervous strains. Particular attention is paid to lifting loads and turning crank handles.

Safe Upending of Steel Drums. (*Chemical and Engineering News*, 2 August 1948, p. 2316.)

The accompanying illustration shows a universal drum-upending bar designed to enable heavy drums to be safely lifted by one man. With this bar, the lifting force required is only 30 per cent. of the weight of the full drum.



All-Purpose Safety Car on Canadian Pacific. (*Railway Age*, 31 July, 1948, p. 36.)

The article describes the equipment installed in two railway cars used primarily for the purpose of spreading safety education to Company employees and the general public, and, occasionally, for carrying entertainment to workers in remote towns of the Canadian Pacific Lines.

Each car furnishes complete travelling accommodation for two permanent operators and may comfortably receive 60 persons at a sitting while films are projected, safety instructions given or rules examinations held. It also contains a two-way public address system with a series of hand microphones, a projection room, an independent electric power generator and a forced-draft ventilation system. In the period of one year, 22,000 employees were given safety instruction through visual aids at gatherings held in one car.

Photographs accompanying the article give a good idea of the arrangement of the equipment in the cars.

Zasady Bezpieczenstwa Transportu Recznego. By S. FILIPKOWSKI. (*Miesiecznik Bezpieczenstwo i Higiena Pracy*, No. 6/13, June 1948, p. 12.)

This article discusses the risks inherent in land transport. Work of this kind must be carefully organised and the workers well trained. Particular attention has to be paid to the human factor. Precautions will vary according as the transport operation is carried out by one man or by a team. With team work, the manner of lifting the load is of primary importance. Safety will largely depend on the efficiency of supervision, but to some extent also on the psychological and physiological characteristics of the members of the team.

Practical Safety Considerations in Oxy-Acetylene Applications. By J. I. BANASH. (*Safety*, June 1948, p. 114.)

Safety in operations involving the use of oxygen and acetylene cylinders is centred on three main factors: pressure, chemistry and flame.

Users are reminded of the hazards connected with the use of both oxygen and acetylene because of the pressure under which they are stored, and are warned to use only equipment accepted by the Interstate Commerce Commission.

Oxygen cylinders under a pressure of 2,200 p.s.i. at 70° F., possess several hazardous characteristics and should be handled with the greatest care. Use should be made of a regulating and reducing valve when the cylinder is employed. Acetylene cylinders must also be used with a regulating valve and must always be stored standing on end. The two types of cylinders should not be stocked together.

The high-temperature flame which results from the use of oxy-acetylene torches may give rise to unhealthy fumes against which the workers should be protected, and the chemical reaction between oxygen and oil is so violent that every precaution should be taken to avoid it. Even the workers' gloves should be absolutely oil or grease-free. As acetylene is a highly combustible gas, care should be taken to avoid its being mixed with air and forming explosive mixtures. The wide explosive range of acetylene mixtures is from about 2.5 per cent. acetylene with 97.5 per cent. oxygen to 83 per cent. acetylene with 17 per cent. oxygen.

Adequate fire-prevention measures should be taken against oxy-acetylene flame, sparks or molten metal coming into contact with flammable substances or combustible materials generally.

Accidents et incidents de chaudières équipées pour le chauffage au mazout. (*Bulletin des associations françaises de propriétaires d'appareils à vapeur*, No. 81, January 1948, p. 14.)

A Babcock and Wilcox boiler with a heating surface of 268 m² and an authorised pressure of 18 kg/cm² had been converted to oil firing. After it had been in continuous operation for six months, it was discovered that the front wall had settled and the supports had become deformed. The floor and walls had to be repaired. In addition 70 badly bent tubes of a total of 135 were replaced. It should be noted that the volume of the combustion chamber was too small for oil firing and that in addition the rate of evaporation had been increased.

The greatest care is recommended in the use of boilers particularly with respect to increased evaporating capacity as a result of oil firing.

A Babcock and Wilcox boiler of 250 m² heating surface also with an authorised pressure of 18 kg./cm², previously equipped with a mechanical grate, had been converted to liquid fuel firing. The furnace comprised two burners. An explosion occurred one hour after starting up when the pressure gauge showed a pressure of 2 kg/cm². The explosion was attributed to the accidental ignition of an explosive mixture which had accumulated in the flues between the boiler and the economiser.

In an installation equipped with a Babcock and Wilcox boiler with a heating surface of 68 m² an explosion occurred as a result of the failure of safety devices. A reduction in the voltage of the system made it impossible to re-establish the arc at the tip of the burner at the time the installation automatically started up after a normal stoppage. The boiler firemen noticed the irregularity by the dark colour of the smoke coming from the chimney. They then cut the current at the main switch which caused a spark on the electrodes which in turn set off an explosion in the flues. The pressure relief devices functioned, the inspection door of the front header was torn away, the flues torn open for 3 metres and 10 metres of the upper part of the chimney destroyed.

Although this explosion was the result of rather exceptional circumstances, it nevertheless proves the necessity for providing a device to prevent this type of accident.

Sencillas pero peligrosas. (*Prevención de Accidentes*, No. 2, February 1948, p. 20.)

This is a brief outline of the history of hand tools such as axes, hammers, chisels, etc., and the role they have played in the progress of civilisation.

Various statistics are quoted showing that after the handling of materials and machinery, hand tools are the most common cause of industrial accidents.

The article concludes with a description of experience in shipyards with chisels, punches, etc., and their tendency to form fins according to the kind of steel used for their manufacture.

Bezpieczenstwo Pracy w Transporcie Przy Uzyciu Lin Stalowych. By Józef HELBRECHT. (*Miesiecznik Bezpieczenstwo i Higiena Pracy*, No. 6/13, June 1948, p. 8.)

Discusses the construction and characteristics of various kinds of wire rope and rope attachment and emphasises the need for proper inspection and maintenance.

Inside That Coil of Rope. By Capt. Aylmer R. HATCH. (*National Safety News*, February 1948, p. 38.)

In this article many useful hints are given on the selection of fibres, uncoiling of new ropes, rope storage, causes of rope failures, inspection of ropes, precautions in use, making knots and splices, and making ropes proof against fire, water and bacteria, and other growths.

La prévention des accidents dus aux bétonnières. (*Bâtiment et Travaux publics*, No. 2, 29 January 1948, p. 12.)

Accidents involving concrete mixers are caused by the following principal parts: *(a)* the bucket; *(b)* the drum; *(c)* the engine and its transmissions.

The typical accident at concrete mixers is caused by the fall of the bucket stopped at the top of its run. This fall may be due to careless operation on the part of the driver, the accidental release of the brake or the blocking device or by the breaking of the rope or an attachment. To prevent this, the control lever should be blocked by an efficient device and only the worker exposed to the risk of accident should have the right of removing it. When a worker is employed under the bucket it is essential to protect him against the possible breaking of the ropes or their attachments by firmly propping the bucket or holding it by means of safety chains.

The rotating drum may cause all kinds of accidents by contact with moving parts. The most serious is having a limb or the trunk caught between the driving gear and the girth gear by a loose end of clothing. It is therefore essential to wear closely fitting clothing.

The engine, the transmission belts or chains and the gears are usually well guarded. Only the man in charge of the engine should be permitted to come near the moving parts. In other respects, the precautions to be taken are the same as for other power-driven machinery.

Nagot om dammexplosioner. By C. F. WESTRELL. (*Arbetarskyddet*, No. 5-6, 1948, p. 130.)

A series of dust explosions have occurred in Sweden in undertakings manufacturing and working aluminium powder.

Since the mechanism of dust explosions is not well known it is difficult to prevent them. However the following measures will help to increase safety.

The mixing and polishing drums should be three-quarters or four-fifths full and their speed of rotation should not exceed 120 revolutions per minute. The drums should be very carefully emptied to avoid the formation of dust clouds. In the publication entitled "The Technology of Industrial Fire and Explosion Hazards" it is recommended that the work of pulverising aluminium should be interrupted when the temperature of the air exceeds 30° C. Likewise, mills in which the temperature exceeds 40° C. should be stopped.

In addition, measures should be taken to limit as much as possible the effects of any explosion. A strong wall should separate the premises where the various mixing, sifting, etc., operations are carried on, from the control stations. All the walls of premises containing the machinery in question, with the exception of the dividing wall, and the roof should be constructed of light material in order to act as an explosion relief space.

In certain circumstances, explosions can be prevented by placing the dust-producing parts of installations within tight enclosures filled with an inert gas or a suitable mixture of gases in which the proportion of oxygen does not exceed 10 per cent.

The spontaneous ignition of aluminium powder due to the catalytic action of certain foreign bodies, as well as sparks from discharges of static electricity can set off explosions. Various compounds with an aluminium powder base used in the manufacture of hair curlers are particularly dangerous because of the thermal reaction initiated when the compounds come into contact with water. Numerous small undertakings manufacturing such articles ignore the dangers inherent in the work and fail to report their activities to the authorities.

Care and Selection of Correct Safety Harness. (*Safety First*, July 1948, p. 42.)

Practical information is furnished in this article on the use, care and necessary material strength of safety belts and harnesses.

Types of materials used for different kinds of exposures are also given with recommendations as to the precautions which should be taken for conserving them in good condition.

La fatiga y los accidentes del trabajo. By Francisco QUERALT ROGE. (*Revista del Instituto Argentino de Seguridad*), No. 76, August 1948, p. 7.)

In this brief but interesting article the author shows, by means of a detailed analysis, the influence of fatigue on the occurrence of accidents.

Accidents in industry and agriculture occur most frequently at the end of the week; however, the beginning of the week is conducive to accidents since so-called "Sunday fatigue" occurs at this time.

In the analysis of the percentage of accidents occurring at the beginning and end of the week as compared with that of accidents occurring in the middle days, the author points out that it should be much higher than it is since many industries begin their working week in the middle for various reasons.

The article concludes by pointing out that while the time devoted to work increases in arithmetical progression, fatigue or accident risk increases by geometrical progression.

La psicología aplicada al trabajo. By José MALLART. (*Revista del Instituto Argentino de Seguridad*, Vol. VII, No. 74, June 1948, p. 1.)

After discussing the various terms used in the field of industrial psychology, the author considers psychology as applied to industry under the following headings:

(a) vocational guidance;
(b) occupational selection;
(c) apprenticeship;
(d) organisation of work in the workplace;
(e) treatment of the personnel; and
(f) industrial accident prevention.

The results of psychotechnical examinations in vocational guidance vary according to whether the candidate is interested in one specific occupation or is indifferent and takes the aptitude tests without any definite interest one way or another.

In the first case, the examination can be limited to specific tests to discover whether there is any reason why the candidate should not be placed in the occupation he desires. In the second case, the candidate should take all the tests so as to obtain a cross-section of aptitudes permitting him to be included in an occupational group.

With respect to occupational selection, the purpose is either to accept or reject the candidate. Selection work is easier than vocational guidance work and moreover it meets more immediate requirements because every industrial undertaking requires the personnel it selects to meet its requirements.

With regard to apprenticeship the author indicates the principal requirements it should fulfil and points out that the work should consist not only of presenting and solving problems or reconstructing situations, but in discovering new ways of perfecting methods of work which will surpass even those taught by the instructor.

The rapid development of industry in recent times has created new situations to which the individual has not succeeded in adapting himself completely. Often the worker has been compelled to adapt himself to the work, whereas in many cases the work should have been adapted to the worker.

It is at this point that physiology and psychology enter into the scientific organisation of work. The activity of psychotechnical experts in factories and workshops was concentrated, on the one hand, on adapting the machines, tools, etc., to the general psycho-physiological conditions of the workers and, on the other, on studying the workers individually and grading them according to their sensitivity to the rhythm of work, their power of concentration, etc., with a view not only to increasing output but also improving the conditions of work and welfare.

In discussing psychology in the treatment of personnel, the author emphasises that the management, engineers and foremen have been instructed in the control of machines, but that in matters respecting the personnel, they themselves must learn, usually by trial and error. If the management cannot deal with industrial psychology, either because of lack of time or knowledge, it should enlist the collaboration of a psychotechnical expert.

Psychology applied to the field of accident prevention is dealt with at some length. Attention is drawn to the fact that accidents due to causes of a psychological nature occupy a prominent place in accident statistics. One of the most interesting activities in the field of accident prevention is the organisation of campaigns undertaken in most countries on the basis of posters aiming at producing in the worker a state of mind in which he will be constantly alert to the dangers of a particular job or of work in general. In the beginning, accidents were depicted in horrible forms, but later psychologists pointed out the error of presenting the negative aspect of accident prevention. At present, campaigns are generally directed towards the positive aspect, that is to say, they point out the means of preventing the accident and depict the danger, but not in a terrifying form.

Quelques précisions sur les services de sécurité à la Société nationale des chemins de fer français. (*Le Creuset — La Voix des Cadres*, No. 83, 1 September 1948, p. 3.)

The safety organisation in operation in the French National Railways (S.N.C.F.) since the end of 1938 has been as follows.

In each region and in each of the large departments (operation, rolling stock, locomotive, per-

manent way, and building) an inspector is specially charged with the prevention of occupational accidents.

During the course of frequent visits, he keeps in contact with the supervisory and operational staff whom he directs, guides and advises.

In the central services, questions relating to safety are dealt with by the Central Staff Service in co-operation with the Central Train-Movement Service in so far as concerns operation, with the Technical Service for Rolling Stock in so far as concerns rolling stock and locomotives, and with the Technical Service for Fixed Installations in so far as concerns permanent way and buildings.

The central safety committees, composed of the inspectors, meet once each month at the corresponding central department. These committees study the serious accidents which have occurred with a view to learning from them the best accident prevention methods and to finding appliances or devices which will reduce the number of accidents.

The Inter-Departmental Safety Committee is composed of the directors of the Central Departments mentioned above and is under the Chairmanship of an Assistent Director-General. This Committee is entrusted with the examination of important questions relating to the safety of the staff, which are submitted to it either by the Director-General or by a Central Safety Committee.

Finally, under the Decree of 22 May 1935 workers' safety delegates were appointed whose task, in the case of accidents which caused the death or serious injury of one or more employees or which might have endangered their safety, is to undertake an investigation and to establish a report on the circumstances in which the accident occurred.

Employees whose work involves special risks receive, as soon as they are accepted for employment, a pamphlet containing the measures they should observe. In addition, the training of the staff is supplemented by lectures and posters with slogans.

A penalty may be imposed for infringement of safety provisions even if this does not result in an accident. The seriousness of the penalty will vary in accordance with the seriousness of the offence and the number of reported offences attributable to the same employee.

Industrial accident statistics are compiled and placed at the disposal of the special bodies enumerated above.

The protection of employees circulating along the tracks has been very carefully studied.

Employees whose work has a direct bearing on safety are submitted to periodical medical examination with a view to ensuring that they continue to possess the physical aptitudes necessary for the performance of their duties. These examinations may be supplemented by psychotechnical tests.

Getting Management's Participation. By Williams Smith. (*Safety First*, June 1948, p. 17.)

The author offers eight suggestions on how to win the support of management for a plant safety programme, the most important of which are that the programme should be practical and be designed to save money, increase production and provide the most efficient plant layout.

RECENT BOOKS

Règlement général pour la protection du travail. Published by the Ministry of Labour and Social Insurance, Brussels, 1948. 318 pp.

The *Industrial Safety Survey* [1] has already analysed the Belgian general regulations for the protection of labour first published in 1946 and 1947 in the *Moniteur belge*. The present work assembles in one volume the five Titles of the Regulations and, as annexes, a number of laws, ministerial orders, instructions and recommendations related to various matters dealt with in the regulations.

The volume includes a subject index.

Fire Fighting Equipment and Methods in Germany during the Period 1939-1945. British Intelligence Objectives Sub-Committee Overall Report No.18. H.M. Stationery Office, London, 1949. 23 pp. Price 6d.

A number of British and American Missions visited Germany immediately after the end of the war in 1945 with the object of investigating the progress of German technique. The present report gives a brief outline of the work done in the field of fire fighting and fire protection, and deals with such matters as fire research; pumps, appliances, fire boats, etc.; hose and hose equipment; ladders; light alloy equipment; extinguishers and hand pumps; fixed fire protection apparatus; fire alarms; protection of personnel; foam compounds and equipment, etc.

From the information available no particularly outstanding contributions to the knowledge of fire and fire fighting appear to have been made by Germany during the war years.

Sicurezza del Lavoro e Prevenzione degli Infortuni in Agricultura. Published by the Istituto Nazionale per l'Assicurazione contro gli Infortuni sul Lavoro, Rome, 1948. 22 pp.

This pamphlet reproduces a brief course of lectures on safety in agriculture for use in rural schools and in the technical training of agricultural workers.

The first lecture contains a general outline on accident prevention in agriculture and deals also with safety consciousness and hazards involved in the use of various implements and in the preparation of the soil.

The application of fertilisers; toxic, caustic and

[1] See Vol. XXIII, No. 1, p. 16 and Vol. XXIV, No. 1, p. 17.

flammable substances; wine cellars, silos, and barns; eye injuries, etc.; are dealt with in the second lecture.

The last lecture discusses harvesting, falls of persons, ladders and the transportation, conservation and processing of agricultural products.

Maestri e Contadini. Published by the Istituto Nazionale per l'Assicurazione contro gli Infortuni sul Lavoro, Milan. 1948. 173 pp.

A booklet on the prevention of agricultural accidents for the use of teachers in rural schools. The work is in two parts; the first, mainly theoretical, deals generally with the teaching of safety in rural areas, while the second sets out a definite teaching programme for the school year.

Safety in agricultural operations, from the time the soil is prepared for planting until the crop is harvested, is discussed, and a special section is devoted to farm implements.

The regulations of the National Industrial Accident Insurance Institute and other information on accident insurance are included in an Appendix.

The booklet is profusely illustrated.

Stress Analysis Applied to Underground Mining Problems. Part II; Stress Analysis Applied to Multiple Openings and Pillars. U.S. Bureau of Mines. R.I. 4387, Washington 1948, 11 pp.

This paper describes with numerous diagrams tests made with models having various numbers of circular and ovaloid openings in them and draws conclusions applicable to mining conditions.

Possibilités d'emploi de l'éclairage fluorescent en mines grisouteuses. Centre d'Études et Recherches des Charbonnages de France, Note Technique No. 49/6, February 1949, 7 pp.

Considers the construction and risks of types of lamps lit by pre-heating of the electrodes, by means of auxiliary electrodes, and by direct discharge between the electrodes.

Quotes the following conditions for the approval of fluorescent lamps, drawn up by the Firedamp Committee:

(1) The lamp should be connected to the mains by means of a cable inlet or a plug and socket connection complying with the general rules for the approval of electrical equipment.

(2) Whatever the method of lighting the lamp, the fluorescent tube should be enclosed in a tube of which the resistance to impact is determined by a special test; the ends should be protected by a metal sheath extending beyond the level of the electrodes to a distance at least equal to the diameter of the protective tube. If lighting is effected by means of auxiliary electrodes, the tube should be protected against impacts over its whole length by metal bars unless it is provided with a device ensuring that the lamp is made dead if the protective tube breaks. This last requirement is compulsory for tubes equipped with a device for pre-heating the electrodes.

(3) It should be verified at the testing station whether the sudden breakage of a fluorescent tube in a gaseous mixture composed of 12.5 per cent. methane, 25 per cent. oxygen and 62.5 per cent. nitrogen ignites the mixture.

Safe Equipment, Guards and Practices, Lake Superior District Iron-Ore Mines. U.S. Bureau of Mines I.C. 7454. Washington, October 1948. 98 pp.

This is a collection of 180 annotated photographs illustrating safety and health devices and practices in connection with matters such as supports, hoisting, haulage, explosives, fires, gases, ventilation, electrical and mechanical installations, and change houses.

Safety and Performance Characteristics of Liquid Oxygen Explosives. U.S. Bureau of Mines, Bulletin 472. Washington, 1949. 88 pp. Price 30 cents.

Describes methods evolved for assessing the following behaviour characteristics of various liquid-oxygen explosives: burning behaviour characteristics, impact sensitivity, frictional impact sensitivity, detonator initiation sensitivity, sensitivity to electrostatic discharges, fire resistance of wrappers, ignitibility of absorbents dispersed as dust clouds. Also describes tests for determining the performance characteristics of strength and rate of detonation, and finally discusses the accident record of liquid-oxygen explosives.

Safety Practices in Dredging and Hydraulic Mining. U.S. Bureau of Mines, Bulletin 470. Washington, 1948. 76 pp. Price 25 cents.

An illustrated description of dredging and hydraulic mining equipment and operations, followed by a discussion of accident risks and means of eliminating them. In dredging the principal accident causes are machinery, falls of persons, handling materials and hand tools; and, in hydraulic mining, falls of persons, handling materials, hand tools, handling rock, caving of banks, and hydraulic giants. The Bulletin includes various sets of safety rules for the prevention of accidents due to these and other causes.

Manual sobre Practicas de Seguridad en las Cervecerías. Inter-American Safety Council, New York, 1948, 16 pp.

This pamphlet summarises the principal safety practices to be taken into account in the various departments of breweries, including putting of beer into barrels and the crating of bottles. It also includes general safety rules for warehouses and power plant.

Sawing and Planing. By A. H. Haycock. The Technical Press Ltd., London, 1948. 132 pp.

Methods of machine woodworking and the fundamental principles of the operation of saws, knives and cutters are discussed in this useful manual. The book is intended primarily for apprentices and newcomers to the industry, and although the text is not exhaustive it is very detailed and comprehensive. It is divided into five chapters dealing with circular rip saws, circular cross-cutting saws, dimension saws, band saws and planing machines.

The value of the book is enhanced by a large number of good illustrations and a useful index.

Air Conditioning in Textile Mills. Technical Report of the Research Department, Textile Workers Union of America. New York, 1948. 60 pp.

This study, prepared by the Research Department of the Textile Workers Union of America,

C.I.O., emphasises the importance of air-conditioning as a means of increasing production and improving working conditions in the textile industry.

The manual describes various methods of controlling atmospheric conditions effectively and makes a number of recommendations for the selection of air-conditioning systems suited to the particular needs of various branches of the industry.

Appendix I comprises a Model Act "to regulate the ventilation, temperature and humidity in textile mills and to provide for the enforcement thereof", and technical notes and data respecting output under various atmospheric conditions are included in Appendix II.

The manual is illustrated and contains a number of relevant graphs and tables.

Guide to the Building (Safety, Health and Welfare) Regulations, 1948. Ministry of Labour and National Service. Factory Department, Form 105, H.M. Stationery Office, London, October 1948. 27 pp.

The pamphlet is arranged in eight parts corresponding to the eight parts of the Regulations. These are I Interpretation and General; II Scaffolds and Means of Access; III Raising and Lowering; IV Excavations; V Demolition; VI Health and Welfare; VII Miscellaneous; VIII Sale or Hire of Machinery.

Safety in Sandblasting. A Manual. Prepared by the Industrial Hygiene Foundation of America, Inc., for the National Industrial Sand Association, Washington, D.C., 1948. 32 pp. Price $1.00.

This is a very useful manual on sandblasting operations which includes sections on blasting rooms, blasting cabinets, self-operating blasting units, auxiliary equipment, exhaust systems, dust-collectors, measuring air flow in ducts and respiratory protection.

The pamphlet is well illustrated.

La sécurité et l'hygiène dans les industries de la soudure. By J. DANNA and Drs. P. THEIL and L. GRANJON. Published by the Institut national de sécurité, Paris, 1948. 192 pp.

The volume is divided into three sections. The first two, dealing with safety and hygiene in welding operations, were compiled by an engineer, while the third section dealing with pathology, is the work of two doctors.

Chapters of interest to technicians deal with the risks inherent in welding operations and means of combating them. The volume is extremely well documented and in certain fields describes very recent experience.

The third section is destined for factory doctors. After reviewing the various complaints caused by welding, the authors deal with the physical aptitudes of welders.

The book includes a short bibliography and an annex reproducing the text of various French Orders dealing with the prevention of accidents in the use of calcium carbide and acetylene.

Safety in Design and Operation of Gas-Heated Ovens and Furnaces. Ministry of Labour and National Service, Factory Department, Form 1856, H.M. Stationery Office, London, October 1948. 24 pp. Price 6d.

The purpose of this memorandum is to provide information on explosions and gassing accidents which occur at gas-heated ovens and furnaces and to outline the precautions which should be adopted to prevent them.

The fundamental danger is the accumulation of dangerous mixtures of unburnt gas or flammable vapour and air. This risk can be greatly reduced by the provision of automatic pilots or "flame-failure devices", low pressure cut-off valves, and adequate ventilation. If, in spite of all precautions, an explosion does occur, the likelihood of serious damage is much reduced when explosion reliefs have been provided.

The first part of the memorandum contains a section on each of these four methods of reducing the risk, and these sections are followed by summaries of the precautions recommended in connection with "box" ovens and mechanically ventilated ovens.

The second part of the memorandum is devoted to furnaces.

An analysis of the causes of one hundred explosions in ovens and furnaces is given in the Appendix.

The pamphlet is well illustrated.

Die Pressenfibel. Compiled by a Sub-Committee of the Press Committee of the Federation of Mutual Accident Insurance Associations for the Iron and Metal Trades. Published by Erich Schmidt Verlag, Berlin, Bielefeld, Detmold, 1949. 39 pp.

The first part explains various press terms, such as "repeating", "coupling", "two-hand control", and "gate guard"; the second discusses sources of danger and means of eliminating them; and the third quotes examples of accidents with presses.

The precautionary measures considered include fixed and movable fencing, enclosure of the tools, two-hand controls and safety couplings. A set of safety rules is provided.

Investigations of Explosion Hazards of Perchloric Acid and Mixtures of Perchloric Acid and Organic Materials. U.S. Bureau of Mines, R.I. 4169, January 1948. 17 pp.

The results of investigations on the explosive character of perchloric acid mixed with oxidisable materials such as wood meal, paper, raw cotton, coal, carbon, high and low volatile pitch, rubber, linoleum and sulphur, are given in this pamphlet. The sensitivity of the mixtures to ignition by heat, their burning behaviour, their sensitivity to sparks and to impact, etc., are discussed.

The results of the tests indicated that both the stoichiometric mixture of 60 per cent. perchloric acid with wood meal and the slightly under-oxidised mixture were stronger than T.N.T. The strength of other perchloric acid mixtures was either approximately the same or slightly less than that of T.N.T. The tests seemed to indicate that many of the mixtures were more hazardous as regards sensitivity to impact and heat than many common explosives.

Die Ergebnisse der Staubuntersuchungen in silikosegefährdeten Betrieben. By H. GESSNER, F. de QUERVAIN, and H. BÜHLER. Published by the Laboratoire fédéral d'essai des matériaux, Zurich, 1948. 69 pp.

The authors—a chemist, a mineralogist and a specialist in the study of dusts—decided to elucidate a number of points concerning the production and characteristics of dusts in undertakings involving

a risk of silicosis. Their study was directly related to the activities of the Research Group created in Zurich in 1945 with a view to studying silicosis and the means of combating it.[1]

The plan of research was the following: (1) to analyse the various characteristics of siliceous dusts (concentration in air, granulation, chemical and mineralogical composition); (2) to study the production of dusts and their properties in relation to the raw materials handled and worked and the nature of the work carried out (drilling, grinding, etc.); (3) to examine the efficacy of the measures laid down for combating dusts and to scrutinise the dust-removal devices in use in industry.

It would be extremely useful to be able to determine, on the basis of a large number of experimental data, the relation between the characteristics of a dust as defined by its concentration in air, its granulation and its mineral components on the one hand, and the risk of silicosis involved in industrial use on the other. If this relation were known it would be possible to discover the dangers in an undertaking immediately without having to wait several years before cases of silicosis occur.

The present study goes into great detail and the researches and analyses have been carried out with praiseworthy method and care. Technicians will be particularly interested in the results of tests carried out in four undertakings:

(1) a sand-blasting installation for objects of large dimensions (railway wagons, pylons, etc.);
(2) an underground quarry of marly shale (dry drilling and cutting with pneumatic picks);
(3) the gallery of a hydro-electric plant driven by wet drilling in sericitic liassic shale and having artificial ventilation; and
(4) a workshop where shale slabs were ground and their edges filed.

On the basis of systematic research undertaken in these four undertakings the authors arrived at a number of conclusions to which, however, they do not attribute any general validity:

(1) The quantity of dust of a diameter smaller than 10 microns, its granulation and its silicic acid content are determining factors in the estimation of the risks of silicosis present in a dusty atmosphere.
(2) The aggregate concentration in air (including all diameters) depends above all on the method of production of the dusts.
(3) The granulation curves of the dusts analysed have a characteristic peak corresponding to the most common diameter.
(4) The number of particles per cm^3 does not vary greatly and does not satisfactorily characterise the dusts.
(5) The average diameter of the particles gives a good idea of the fineness and quality of a dust.

The publication contains, in an appendix, a description of the special methods of dust analysis elaborated by the authors during the course of their work.

Industrial Air Sampling and Analysis. By Leslie Silverman. Chemistry and Toxicology Series, Bulletin No. 1. Published by the Industrial Hygiene Foundation, Pittsburgh, 1947. 72 pp.

In preparing this manual the author's aim was to gather the most recent data in the field of air sampling and analysis and arrange this material in brief form for the easy and complete reference of industrial hygiene field workers. It contains much valuable information and convenient illustrations on the various methods which may be applied in the determination and appraisal of atmospheric contaminants. Several tables judiciously inserted in the text will provide the users with readily accessible data to facilitate field work. A lengthy list of literature references is also inserted in the manual.

Equipment for Eye and Face Protection during Welding. British Standard 1542:1949. British Standards Institution. London, February, 1949. 12 pp. Price 2s.

This Standard supplements British Standard 679 "Protective filters for welding and other industrial operations". It specifies standard dimensions for filter-glasses for goggles, helmets and similar equipment and requirements intended to provide for safety and efficiency in use, while avoiding undue restriction of design.

Section I of the Standard contains general requirements; Section II deals with spectacles, goggles and face-masks; Section III with helmets, hand shields and fixed shields; and Section IV with the marking of equipment.

A method of testing for inflammability is described in an Appendix. The booklet also contains a number of illustrations.

Essais pratiques de différents masques antipoussières. Institut d'Hygiène des Mines, Hasselt, Belgium. Communication No. 48. 14 pp. (Roneoed.)

This pamphlet gives the results of practical tests respecting the use of respiratory equipment for protection against dust in mines. Various types of respiratory equipment with fresh-air supply and with filters were tested by the Mine Hygiene Institute in fifteen collieries.

With respect to masks with fresh-air supply, the tests attempting to generalise their use met with strong resistance on the part of the miners. Their principal complaint was that their freedom of movement was impeded by the flexible air-supply pipes. On the other hand, masks with filter cartridges were, in general, favourably received by the personnel. The percentage of miners wearing masks varied from one colliery to another and in accordance with the type of mask used.

Norme per "Primi Soccorsi". Published by the Istituto Nazionale per l'Assicurazione contro gli Infortuni sul Lavoro, Rome, 1948. 48 pp. and diagrams.

Short booklet of first-aid rules, written in simple language. Although concise, the booklet is quite comprehensive and apart from discussing ways of administering first aid in different eventualities, it contains a list of the material that should be kept in a first-aid box and a number of illustrative figures.

An Examination of Attitudes about Industrial Safety in Germany. By Ted. F. Silvey. U.S. Office of Military Government for Germany, (Fiat Final Report 1115, 3 June 1947.)

The information contained in this report is based on a number of interviews with German industrial personnel of various ranks, and indicates the importance given to safety matters in Germany before, during and after the war. The general attitude of the German people towards industrial accident prevention throughout these periods is described

[1] See *Industrial Safety Survey*, Vol. XXIII, No. 1, p. 30.

as highly favourable and is characterised by the fact that industrial safety has received the same attention as any other factor of production. In spite of several adverse conditions brought about by the accession of Hitler to power, considerations of accident prevention continued to receive high priority from employers. This has made possible significant accomplishments in the industrial safety field which have not yet been equalled in the United States of America.

Work and Effort. By Thomas Arthur RYAN. The Ronald Press Company, New York, 1947. 323 pp.

This book deals with the productivity of men and women at work. Particular consideration is given to the psychological aspects of the problems encountered in the training of workers, the control of accidents, the establishment of pay levels for various jobs and of efficient methods of work, and the motivation of the worker in relation to problems of efficiency. It is intended for the use of all those who wish to deal scientifically with such problems as merit rating and job evaluation, establishment of production standards and improvement of morale and efficiency of workers. Throughout the thirteen chapters, an extensive study is made of the factors which contribute to production and noteworthy conclusions are arrived at especially with respect to environmental conditions in workrooms.

Chapter twelve, "Psychological Problems in Accident Control", deals especially with the general problems encountered in accident control and outlines several approaches to the problems. This text may serve as a basis for further research work in this field. The more frequently used tests of accident-proneness are also described and the value of these tests in predicting accident rates is given practical consideration.

The book is enhanced by a large number of illustrations, graphs and tables and includes a detailed index and numerous literature references.

Small Plant Safety Committee Manual. U.S. Department of Labor, Bureau of Labor Standards Washington, D.C., 1948. 12 pp. (Roneoed.)

Short manual for the guidance of safety committees in small undertakings. It describes what a safety committee should do, discusses the calculation of frequency rates, safety programmes, accident report forms, etc.

Normas para uma Campanha de Prevenção de Acidentes do Trabalho. By F. NORBE DE LACARDA FILHO. Publication No. 11 of the Industrial Accident Department of the Instituto de Aposentadoria e Pensões dos Marítimos. Rio de Janeiro. No date. 21 pp.

After briefly touching on the origins of accident prevention activity and discussing the causes of industrial accidents and means of preventing them, the author goes on to describe the ways in which safety committees are composed in Brazil, France, Spain and the United States of America.

He pays a tribute to Dr. Decio Parreiras who was largely responsible for the creation of safety committees in Brazil.

The pamphlet also deals with the duties of safety committees, describes methods of organising safety campaigns (radio talks, films, posters and other publications, etc.), and of calculating accident frequency rates. A concise classification of accident causes is also included.

History of Factory and Mine Hygiene. By Ludwig TELEKY, M.D. Columbia University Press, New York, 1948. 342 pp. Price $4.50.

An interesting book giving a brief history of factory and mine hygiene legislation and pertinent scientific progress in Germany, the United Kingdom and the United States of America.

After tracing the development of industrial hygiene from its earliest beginnings and reviewing industrial health legislation in Europe and the United States, the author discusses organisations and associations co-operating in industrial hygiene; institutions in factories for promotion of industrial hygiene; methods of preventing injuries to health; the prevention of accidents; education, propaganda, safety first, research and studies; progress in other sciences and its influence on industrial hygiene; special problems such as respiratory and skin diseases and caisson and tunnel work; mines and miners, etc.

The book contains an extensive bibliography and a useful index.

Industrial Hygiene and Toxicology. Volume I. Edited by Frank A. PATTY. Interscience Publishers, Inc., New York, 1948. xxvii + 531 pp. Price $10.00.

This interesting and useful book consists of a collection of papers by experts, on various aspects of industrial hygiene and toxicology. It is in fifteen chapters, written in plain language readily understandable by the layman.

Among the subjects dealt with are "Personal Factors in Competence and Fatigue", "Radiant Energy and Radium", "Fire and Explosion Hazards of Combustible Gases, Vapours and Dusts", "Sampling and Analysis of Atmospheric Contaminants", "Occupational Dermatoses", "Physiological Effects of Abnormal Atmospheric Pressure", "Environmental Factors in Fatigue and Competence", etc.

The volume also includes a table of atomic weights, a conversion table for gases and vapours and a table of useful equivalents and conversion factors.

Corrigenda

Vol. XXV, No. 1, p. 16, column 1, 2nd paragraph, 2nd line: for "not" read "now";
p. 33, column 1, 14th line from bottom: for "35,000 V." read "33,000 V.";
p. 33, column 2, line 12: for "first" read "second".

NEW POSTERS



Don't let your arm be caught — You can't save it.



Don't look around left or right. Look straight ahead.

(Sümerbank, Ankara)



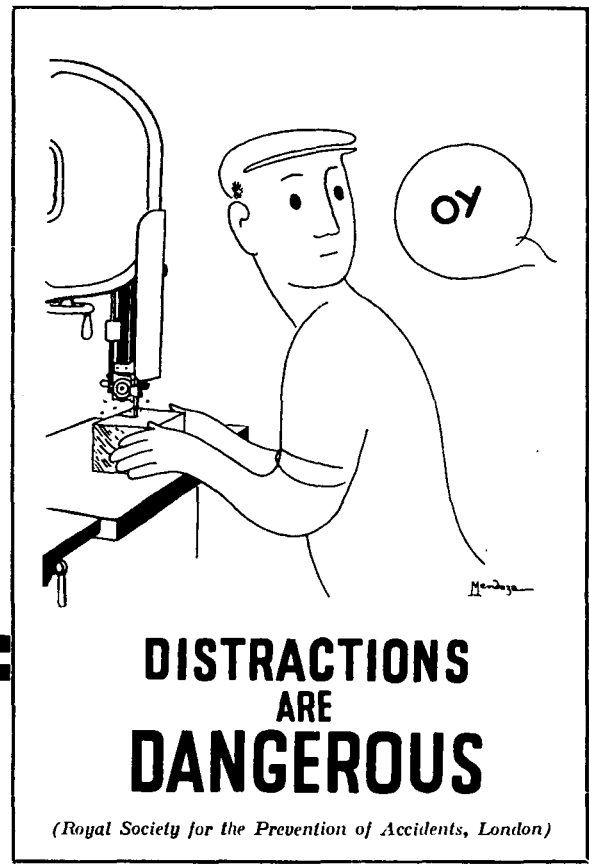
(Royal Society for the Prevention of Accidents, London)



Block the carriages—it will prevent accidents.
(Argentine Safety Institute, Buenos Aires)

INTERNATIONAL LABOUR OFFICE

INDUSTRIAL SAFETY SURVEY



DISTRACTIONS ARE DANGEROUS

(Royal Society for the Prevention of Accidents, London)

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CONTENTS

Page

Electricity in Factories under Conditions of Special Flammability, By H. W. SWANN 81

Erik V. Gabrielson † 89

Safety Institutions, Associations and Museums

INTERNATIONAL: Meeting of Safety Experts of the Northern Countries 89
Tripartite Technical Conference on Safety in Coal Mines 89

BELGIUM: Mining Health Institute Activities in 1948 91

FINLAND: Safety Days in Helsinki 91

FRANCE: National Safety Institute 91
French Association for Industrial Medicine 92
National Safety Week, 1948 92

GERMANY: Ground-Pressure Research Committee of the German Coal-mining Administration . 93

UNITED KINGDOM: Conference on Laboratory Accidents 93

Laws and Regulations, Safety Codes

ARGENTINA: Decree No. 6,891 changing the Name of the Directorate-General of Industrial Inspection and Health. 23 March 1949 94

CUBA: Decree concerning Radiological, etc., Services. 5 February 1949 94

FRANCE: Order respecting Regulations for Acetylene Generators. 26 October 1948 94
Decree and Orders concerning Methyl Bromide Poisoning. 10 December 1948 95
Decree and Orders concerning Lead Poisoning 95
Decree and Circular respecting Solvents containing Benzene Hydrocarbons 95

GERMANY: Mutual Accident Insurance Association for Inland Water Transport. Accident Prevention Regulations. Effective 1 July 1948 96

INDIA (Travancore): The Travancore Factories Act, 1124. 7 March 1949. 96

NETHERLANDS: Safety Decree concerning Electric Fences. 2 November 1948 96
Regulations for Building Hoists, 1948 96

SWEDEN: Workers' Protection Act. 3 January 1949 96
Royal Notification concerning Lead Paint. 6 May 1949 97
Royal Notification concerning Medical Examination and Re-examination. 6 May 1949 . . 97
Royal Notification concerning the Medical Examination and Re-examination of Young Workers. 6 May 1949 98

UNITED KINGDOM: British Standard 487: 1949. Fusion Welded Steel Air Receivers. 98

UNITED STATES OF AMERICA (New York): Rules relating to Underground Mining Operations. Effective 1 March 1949 98

Official Reports, etc.

AUSTRALIA (South Australia): Report of the Factories and Steam Boilers Department, 1947. . 98

CANADA: Fatal Industrial Accidents, 1948 98

DENMARK: Explosion of Sugar Dust 99

FRANCE: Research Centre of the French Coal Board. Report for 1947. 99

NORWAY: Statistics of the State Social Insurance Administration for the Years 1943-1945 . . . 100

SWEDEN: Annual Report of the Industrial Inspectorate, 1947 100

SWITZERLAND: Swiss Acetylene Association. Annual Report, 1948 101

UNITED KINGDOM: Safety in Mines Research Board. Annual Report for 1947. 101
Electrical Accidents, 1947 102
Annual Report of the Chief Inspector of Factories, 1947 103

UNITED STATES OF AMERICA: Injuries and Accident Causes in Fertiliser Manufacturing 106

Review of Periodicals 108

Recent Books 117

New Posters 120

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INDUSTRIAL SAFETY SURVEY

VOL. XXV JULY-SEPTEMBER 1949 No. 3

ELECTRICITY IN FACTORIES UNDER CONDITIONS OF SPECIAL FLAMMABILITY

By H. W. SWANN, H.M. Senior Electrical Inspector of Factories, London

HISTORY

Special precautions against the risk of electrical ignition of flammable gas were taken in coal mines some time before safeguards of a comparable character were adopted above ground. Up to the year 1920 the use of electricity in factories carrying out some process involving special risk was comparatively small, and it was thought that the conditions were sufficiently met by enclosing lamps in well-glass fittings and providing complete enclosure for motors, the intention being to exclude the flammable vapour. These enclosures were commonly described as "airtight" although it is most unlikely that they were. The change of temperature within such an enclosure, resulting from the differences between standing and running conditions, caused "breathing", and thus when a lamp was switched off and cooled down the enclosure sucked in the surrounding vapour and was therefore filled with something not much different from the general surroundings. The occurrence of fires traced to electrical origin focused attention on the disparity between mines and factory practice and led to the indiscriminate use in factories of fittings and enclosures approved for mines, without realisation of the higher degree of flammability which usually obtains in factory processes. Enclosures suitable for use in firedamp underground are not necessarily safe in petrol vapour, and thus it became necessary to develop a new technique, based on mine practice, but involving enclosures designed for, and tested in, vapours more easily ignitable than firedamp. The process of development took a good many years, and the special requirements were not well understood either by users or manufacturers. Hence mistakes were inevitable, but the increasing demand from factories applied the stimulus necessary, and there is today a much more general recognition of the precautions desirable and the technique which should be adopted.

DEGREE OF RISK

In factory processes the degree of risk varies greatly, and there has always been difficulty in deciding *(a)* whether electrical precautions are justified, *(b)* their nature, and *(c)* the extent to which they should be adopted. There are few, if any, processes which involve use of electricity under conditions of constant risk in the sense that an electrical failure, such as a short circuit, would inevitably cause ignition whenever it occurred. Such conditions would usually be toxic and make the process impossible, but in many cases the risk of some abnormality of working, of spillage, or leakage of vapour, cannot be disregarded, and it justifies electrical precautions against those contingencies. The need arises particularly when plant repairs, renewals and general overhauls are carried out, because this work involves departure from normal operational running. For instance, the risk in a coal-gas booster house may be negligible until one machine is dismantled, when a leaky valve or an insecure blank flange may allow the escape of sufficient gas to form a flammable concentration. In many cases the view is taken that no risk that can be avoided or minimised should be taken in view of the grave consequences, and accordingly electrical precautions are now widely adopted in Great Britain.

PRECAUTIONS EVOLVED

Precautions generally fall under one or other of the following headings and selection will depend on the conditions and relative cost:

(1) ventilation of the process area;
(2) flameproof enclosure of electrical equipment;
(3) intrinsically safe electrical circuits;
(4) segregation of electrical equipment;
(5) pressurisation of enclosures.

Ventilation

This is a first consideration, and may take the form of semi-open construction of the plant, as in oil refining and coal-gas purifier houses. Natural ventilation may be relied on where quantities of flammable substances are small, but there are many cases where motor-driven extraction plant is required for more reasons than the

risk from electricity above. Where no purely electrical precaution is adopted, and reliance is placed entirely on the ventilation to prevent a dangerous concentration of vapour, it is desirable that there should be a form of interlock between the control of the process and the motors driving the extraction fans; then should the latter fail for any reason, warning is given and some reduction or alteration made in the process which will prevent an accumulation of vapour or other flammable condition. For instance, in a drying process by infra-red heat, after spray painting with cellulose lacquer, failure of the powerful extraction plant required should result in automatic switching off of the source of infra-red heat.

Where very large motors are required it may be cheaper to arrange for forced-draught ventilation than for flameproof construction, the motor enclosure being connected by pipework or trunking to the open air. This method also provides a volume of cooling air for the motor and may therefore achieve a reduction of size.

The efficiency of ventilation may be checked by some form of instrument capable of indicating the presence of vapour. There are several types now available capable of giving reliable and accurate indication, and it is probable that, as a result of further research and testing now proposed in Great Britain, this form of indicator will be more widely used.

Flameproof Enclosure

Flameproof enclosure is defined in British Standard Specification 229 (1946) as follows:

A flameproof enclosure for electrical apparatus is one which will withstand, without injury, any explosion of the prescribed inflammable gas that may occur within it under practical conditions of operation within the rating of the apparatus (and recognised overloads, if any, associated therewith), and will prevent the transmission of flame such as will ignite the prescribed inflammable gas which may be present in the surrounding atmosphere.

The general features of enclosures constructed to meet this definition are shown in the accompanying illustrations. The dimensions of the joint surfaces and the gaps between them vary according to the nature of the flammable gases and vapours, and as in the early stages of development it was soon recognised that certain groups, or classes, of gases or vapours possessed similar characteristics of flammability, research and experiment were undertaken to determine the corresponding maximum permissible dimension for gaps and other openings in the enclosure, such as the shaft glands of electric motors. The result of this work has been tabulated in B.S. 229 (1946) which shows that the various gases and vapours commonly encountered in industry can be divided into four groups. Of these Group I

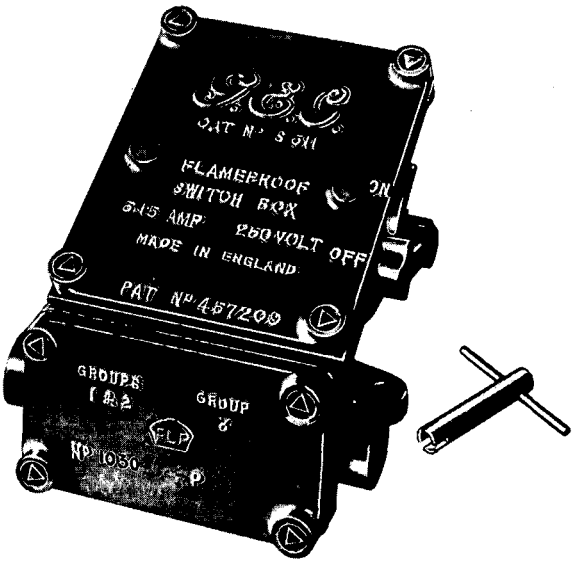


Fig. 1.

provides for methane (firedamp) and covers a wide range of electrical equipment used in coal mining. Group II includes risks such as blast-furnace gas, propane, benzene, acetone, the alcohols, and ethyl ether. In Group III are coal gas (towns gas) and coke oven gas. Group IV gives a list of gases and vapours (acetylene, carbon disulphide and hydrogen) for which no enclosure considered flameproof has yet been constructed in Great Britain, since it is considered that none would possess an adequate factor of safety.

A system of testing, certification and marking of flameproof enclosures has been built up in Great Britain by the Mines Department of the Ministry of Fuel and Power. Under it manufacturers may submit drawings and prototypes of enclosures designed to be flameproof for purposes of use in one or other of the three groups. These are examined for compliance with the relevant British Standards Specification, and if satisfactory the enclosure is tested by causing an explosion of gas or vapour within it at a time when it is surrounded by the most easily ignited mixture of the same combustible. This test is repeated several times and if no external ignition occurs, and the enclosure suffers no deformation or other injury, it is certified and marked for use in the group of gases or vapours covered by the test.

There is some difference between the method of test and certification adopted in Great Britain and that carried out in other countries. In the United States for instance more reliance is placed on testing than on compliance with a specification, and thus an enclosure which successfully passes a large number of tests without ignition, or defor-

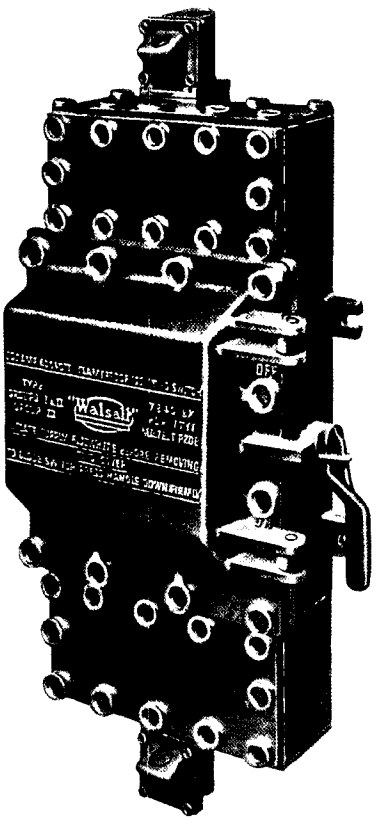


Fig. 2.

mation, is considered satisfactory. This principle is extended to Group IV gases, such as acetylene and hydrogen, and there is evident need for international standardisation covering factors of safety and method of test. This has been recognised by the British Standards Institution and efforts are being made towards a closer degree of uniformity.

In addition to B.S. 229 (1946), which is of a general character, there are specifications covering flameproof plugs and sockets, electric motors, air-break switches and circuit breakers and electric lighting fittings. The Ministry of Fuel and Power have also issued testing memoranda which are of value to manufacturers because of their explanatory nature as regards both technicalities and procedure leading to certification.

Whilst the testing of lighting fittings for tungsten-filament lamps, including the application of hydraulic pressure and impact tests to glassware, is now of a standardised character, the introduction of luminous tubes (fluorescent lamps) has brought new problems both below and above ground. The hot-cathode type, with its control equipment, required flameproof enclosure, but it was hoped that the cold-cathode tube, if divorced from its transformer and other controlling appliances, would prove non-incendive if broken. The intention would be to house the control gear in an area free from risk separated by a wall from the space to be illuminated. The tubes, mounted in ordinary fittings on the wall, can be shaped so that the glass ends are led through the wall in sealed cavities to the control units on the other side, and in this way the risk would be confined to that resulting from breakage of the glass. Tests in acetylene-air mixtures have shown, however, that breakage can result in ignition, and hence this arrangement cannot be regarded as satisfactory, although further testing in other vapours is desirable and may be undertaken.

Apart from the technique of constructing a flameproof enclosure for electrical equipment, there are a number of points which need attention in installation for use. It is possible, for instance, to construct a flameproof enclosure for a lighting distribution fuse box, but as it would be necessary to make it completely dead by means of an interlocked isolating main switch before opening for fuse renewal on one circuit, it is usually found more convenient to use ordinary types of enclosure, the fuse box being fixed outside the area of risk. There are difficulties also in connection with portable electric lamps and portable electric hand tools. The former can be of flameproof construction and used in conjunction with

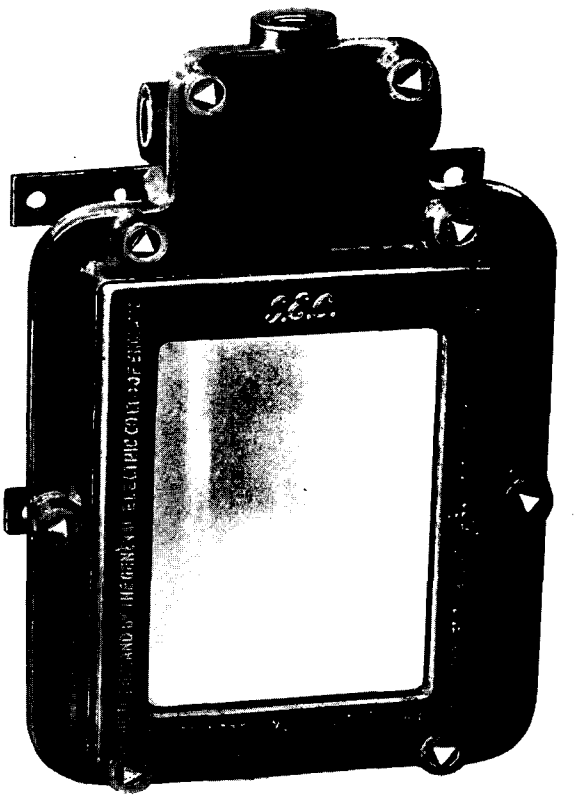


Fig. 3.

mining-type trailing cable and interlocked flameproof plugs and sockets, but the fittings are heavy and fracture of the glass may result if they are accidentally dropped. It is often found better to use light forms of battery lamps resembling those used in coal mining, but approved by the testing authority for use in factories under specified conditions.

No flameproof portable hand tools such as electric drills, have been made in Great Britain, but some special assemblies for vacuum cleaning, comprising flameproof motors and control equipment have been mounted on trucks.

Whilst electric heaters of the radiant pattern are inadmissible, flameproof tubular heaters and connectors are available at ratings specially designed for surface temperatures below that which can inflame vapour, dust or cinematograph film.

It is necessary to be consistent where reliance is placed on flameproof construction, and attention must be given to the cables, wiring, conduit, couplings, draw boxes and especially to the points

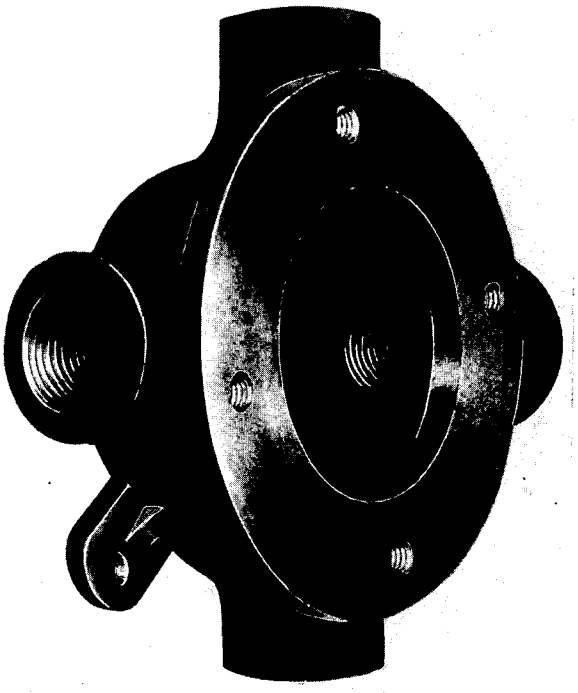


Fig. 5.

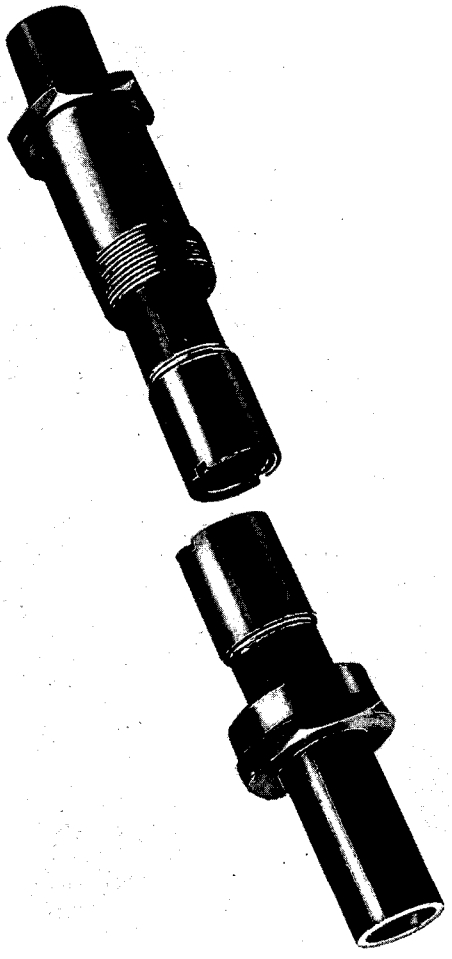


Fig. 4.

of connection to motor plant and other equipment. An explosion originating in, say, a switch box may expel hot gas into a conduit carrying the wiring, and therefore the conduit fittings should be flameproof, and stopper boxes should be inserted where conduit of larger diameter than one inch is used.

Intrinsically Safe Electric Circuits

There are definitions in B.S. 1259 of "Intrinsically Safe", with guidance as to the application of the principle, which relies on the use of electrical energy at values too low to cause an incendive spark. This principle may be utilised for signal circuits, the construction of measuring instruments, or for low-intensity lighting, such as barrel inspection lamps and certain surgical instruments.

Whilst there seems to be a growing demand for apparatus falling within this category, there are limitations such as the difficulty of prescribing standardised electrical conditions that can be regarded as safe in a number of different vapour mixtures. Thus the possibility of group certification is not yet regarded as feasible, although exploratory research is being undertaken in that direction. Circuits for different types of instruments or signalling devices possess different values of current, voltage and induction, which affect the incendivity of a spark resulting from a broken wire or a short circuit, and thus it is considered at present advisable to test each such

circuit in the vapour or gas in which use is intended.

Certification even under this latter condition does not provide against risk from a partial break in a flexible conductor. The last fine strand may fuse before it breaks, or get sufficiently hot to pre-heat the surrounding vapour, and thus render it more susceptible of ignition when the break spark occurs. Whilst these possibilities cannot be ignored, careful maintenance with testing should go far to render them remote.

It should also be realised that the incandescent filament of a tungsten lamp is likely to be incendive if the glass is broken, even though it may be supplied by way of an intrinsically safe circuit. For this reason some form of mechanical guard, with a tough glass outer globe, is desirable for inspection lamps designed for lighting the interiors of vessels which have contained a flammable liquid. During the war a number of explosions (some causing fatalities) resulted from the use of improvised inspection lamps for aircraft fuel tanks. In these cases the little lamp was usually dropped, or in some other way broken inside the vessel under examination.

Circuits can be rendered intrinsically safe by the addition of suitable values of resistance or they may be derived from a source, such as a highly reactive transformer, of limited output. Combinations of dry batteries with little lamps may be self-contained, but where mains transformers are used they should be outside the area of risk unless of flameproof construction. Assemblies comprising a switch, fuses and reactive transformer in one casing or enclosure are available for use in conjunction with an inspection lamp, non-interchangeable plugs and sockets being provided for the latter.

Where the principle of intrinsic safety is adopted, bare conductors are admissible and sparking at contacts, such as the trembler of a bell, can be tolerated. In factory practice, however, there is not much advantage in bare wiring, and conductors are usually insulated and laid up together, as in flexible cords.

The restriction of circuit characteristics to non-incendive values leads of course to limitations of performance. For instance a bell may not ring loudly enough to be heard at a distance, or the light from a lamp may be insufficient. These, however, are matters for trial and balancing of results against the cost of other methods of achieving the degree of safety required.

Segregation of Electrical Equipment

The principle here is that of excluding electrical equipment from the area of risk and there are many cases where it is cheaper than adopting flameproof enclosure. For instance, where large motors are required for driving oil pumps in refineries, the pump house may be divided into two chambers by a separating wall. The coupling shaft between motor and pump is taken through the wall by way of a suitably packed bushing, and a separate entrance is provided for each chamber. In this arrangement the electrical equipment in the motor chamber, including the control gear, may be of normal industrial type — flameproof enclosure being required only for the emergency stop push switch fixed near the pump.

Large-scale equipments for pumps or gas compressors have been constructed on this plan, a number of large motors being erected in a gallery or corridor running parallel to the process building but divided from it by a longitudinal wall.

Electric lighting fittings for process areas may be flameproof or, where the risk, such as hydrogen or acetylene, does not permit of this safeguard, they may be placed outside windows. Where fluorescent lighting fittings are proposed for new buildings, provision may be made to fix them in permanently glazed wall cavities accessible from

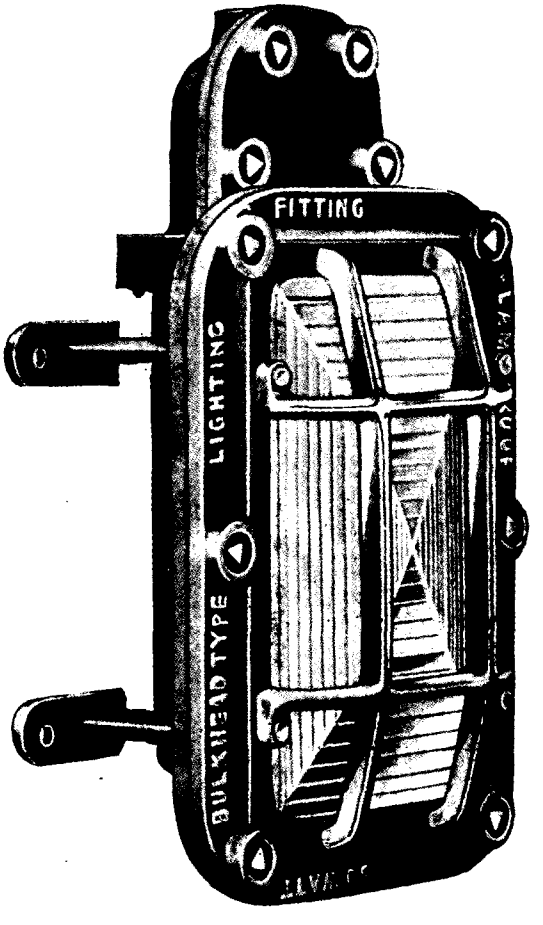


Fig. 6.

the outside of the building, the whole of the wiring with control switches and distribution fuse boards being segregated from the area of risk.

Pressurisation of Enclosures

The principle here is that of maintaining a slight positive air pressure within an electrical enclosure which will prevent the admission of vapour or gas from outside. Application is restricted usually to cases where other safeguards such as flameproof enclosure cannot be arranged, such as the interiors of electrical recording and indicating instruments.

A large volume of air (or inert gas) is not required, provided that the enclosures to be pressurised are not unduly leaky, and small fans, or in some cases storage cylinders, are sufficient to maintain the low pressure necessary. It is, however, essential that the air should be quite dry, and silica gel, or an equivalent absorbing medium, should be provided at the intake. Indication that pressure is maintained may take the form of a simple tube of liquid through which air from the enclosure is allowed to bubble slowly. Some automatic device is desirable to give warning that a fan has stopped or pressure has failed.

A number of instruments may be required in certain processes, for instance to record gas or oil pressures in remote situations. This may involve small diameter pipes to the instruments which have electrical features, or there may be electrical instruments in the immediate vicinity of others from which an escape of gas or vapour may be possible. These cases require specialised consideration to decide the appropriate precaution, and it may be possible to reduce risk by interposing an inert liquid in a short length of the pipe leading to an oil pressure recorder. Intrinsically safe electrical instruments may be chosen, but alternatively pressurisation of the instrument enclosures may be arranged, and with careful maintenance prove a successful safeguard.

Where Group IV conditions obtain, *e.g.*, acetylene, for which flameproof electrical enclosures are not available, pressurisation has been proposed for lighting fittings and motors, the respective control equipment being excluded from the area of risk. Whilst in principle this precaution should be effective, there is little experience in Great Britain of actual working under such conditions, and caution would seem advisable.

CINEMA FILM

Fires involving loss of life have occurred in factories where flammable cinematograph film is manufactured or stripped. These were not attributable to electricity, but Regulations made in Great Britain in 1928 include electrical requirements designed to ensure a safe standard of construction and the limitation of surface temperature to a value less than that required to inflame the film.

POWDERS AND DUSTS

The safeguard recommended where there may be flammable powders and dusts is to prevent admission to electrical enclosures. This implies some form of dust-tight enclosure, and consideration has been given to the possibility of defining the term and preparing a specification for construction. There are, however, difficulties of degree, and in Great Britain these proposals have been dropped, reliance being placed on a common-sense interpretation of what is meant by "dust-tight" or "dust-proof". In Sweden enclosures are tested in water, which seems a useful check on construction.

Risk arises where there may be starch, sugar, flour, cork and similar organic dusts and also where finely divided aluminium or magnesium powders are manufactured, stored or used. Electrical mishaps, such as the breakage of a portable electric lamp, or a short circuit in the flexible cable, may ignite dust. The operation of a switch causing a spark, or the blowing of a fuse, may have the same result, and thus electrical equipment must be consistently enclosed and examined at regular intervals to ensure that there is no accumulation of dust within, or on, protective enclosures. The risk is at a maximum where dust clouds are caused by handling, and limitation of surface temperatures to values not exceeding 180° F. is desirable. Electric heaters should therefore be of the convector or tubular pattern of low rating per foot run, and attention should be given to the surface temperatures of motor starters and electric lamp fittings. Although flameproof construction is essentially a precaution against the risk of igniting a flammable vapour, it has been adopted in factories making aluminium and magnesium powders because of the robust and reliable form of enclosure.

The manufacture of explosives involves special risks from dust in corning-houses, guncotton and cordite stores, or guncotton drying houses, and no electrical conductors or apparatus should be permitted in such places. In dusty external areas electrical equipment must be dust-tight and precautions taken to prevent deposits.

TESTING AIRCRAFT ENGINES

The testing on load of aircraft engines using petrol involves the storage and use of large quantities of petrol. Where special buildings are erected for the purpose there may be underground storage, electrically driven pumps, electric oil heaters, electrical loading of the engines and

control boards involving an assembly of switches, wires and instruments. Petrol vapour may result from leakage and there have been cases of fire with loss of life.

Chief reliance should be placed on adequate ventilation, supplemented by flameproof enclosure of electrical equipment. Both overcurrent and earth leakage protection of circuits is desirable, with frequent test of insulation resistance.

Electrostatic Paint Spraying

A departure from the ordinary methods of spray-gun painting of recent introduction depends on the principle of electrostatic attraction of the sprayed paint to the article to be covered. Electrostatic pressures of the order of 130,000 volts are required, and where a flammable paint (*e.g.*, cellulose base) is used, there will be risk of ignition should there be a flashover or other defect resulting in open sparking. A combination of precautions has been evolved comprising ventilation by air flow with a calculated margin of safety, a spark guard designed to cut off the electrical pressure in event of the article to be painted approaching too closely to the electrodes, with interlocks, signal lamps and flameproof enclosures of lighting fittings or other electrical appliances in or over the area of risk. The process has been extended to effect the removal, also by electrostatic attraction, of excess paint which may accumulate on low edges in the form of globules or "tears".

The electrical and other precautions are of a highly specialised character and require expert advice for their successful adoption.

Static Electricity

This subject covers a wide range and is rather outside the scope of the present article. It is difficult to prescribe precautions of general application for the many and varied conditions. For instance artificial humidification of the air in the area of risk may be suitable in some cases but inadmissible in others because of the nature of the process. Direct earthing or grounding is not always a complete solution, and in some cases incendivity of spark is reduced by inclusion of specified values of resistance in the earth connection. High voltage neutralising devices have been used successfully in the printing and spinning of textiles, the current being controlled by suitable means to values less than that at which electric shock would be dangerous.

The transfer of volatile fluids, such as petrol, from storage tanks to road vehicles will cause electrification of the latter which may be overcome by inter-bonding or by the use of conductive rubber tyres. The movement of metallic powders, on which an insulating oxide film has formed, will have a similar effect especially in pneumatic transfer systems of pipework or ducting. Stripping of rubber from the outside of self-sealing fuel tanks for aircraft causes strong electrification of the tank which may be dangerous if the interior is not quite empty.

Radioactive substances are effective in dissipating static charges but large-scale use introduces problems of protection of the person.

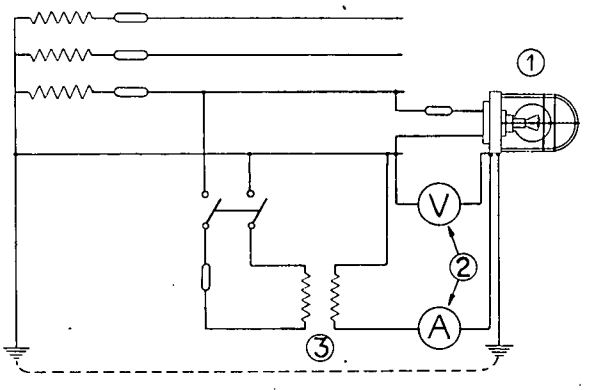
The principal need in the investigation of conditions causing electrification is that of suitable measuring instruments in the hands of competent specialists, and there will be more justification for the cost of service of this description in warm dry countries than where damp weather prevails. The exception arises where the air is continuously cleaned and warmed by special plant, as, for instance, in the operating theatres of hospitals.

Earthing or Grounding

In its relation to flammable conditions, this precaution should be designed to prevent a rise of potential in metallic casings, conduit or enclosures resulting from failure of the insulation of electrical plant or equipment.

To be effective the resistance of the earth continuity path must be low enough to ensure the passage of sufficient fault current to cause operation of the automatic devices, such as fuse or circuit breaker, protecting a faulty circuit. This cannot be assumed without measuring the resistance and relating it to the setting of the protective devices.

Measurement is best made by means of a small battery, or transformer, used with voltmeter and ammeter of a range suitable for an injected current of about 10 ampères. The test should be applied so that the resistance of the whole of the path that the fault current must traverse in its return to the source of supply is measured. This can be arranged by connecting between metal casings and the neutral or earthed conductor of the supply system (see diagram).



If the test shows that the value of fault current would be restricted to less than that required to operate main or circuit automatic protective devices, then, if the resistance cannot be sufficiently decreased by attention to earthing electrodes, an additional earth leakage protective device is required.

Motors coupled by direct drive to oil pumps or gas compressors inevitably establish connection between electrical system and pipework, tanks, storage reservoirs, or other plant used in the process, and thus fault current will be transferred in proportion to the relative resistances. In some cases which have been investigated, underground storage tanks for petrol were of much lower resistance to earth than the factory earthing electrodes, and thus carried most of the fault current resulting from the various electrical breakdowns. Transfer of this character is not free from risk, because it may be unknown and hence cause unexpected sparking should the continuity of a pipe line be broken during repairs.

It is difficult to effect reliable separation of the systems, and the risk can be minimised by the installation of earth leakage indicators and multiple bonding between electrical casings and the system to which current may be transferred, so that breaks in the latter are likely to be bridged.

Maintenance and Repairs

Experience has shown that risk increases when there is some abnormality in the process, such as an electrical or mechanical breakdown, which entails repair work. Operational routine is modified in an unforeseen manner and natural anxiety to deal with a stoppage quickly may lead to taking chances. If a flameproof enclosure is opened where flammable conditions may obtain, the safeguard of design is lost, and a mechanical failure which results in spillage may cause an excess of vapour with which the ventilating plant cannot at once cope.

Work involving the use of portable electric tools may be started inside a storage tank before it has been properly purged, or a circuit which has been made dead for repairs may be inadvertently switched on. Cases like these have occurred, and it is only by realising such possibilities that they can be anticipated and guarded against.

REFERENCES

(1) Flameproof Enclosure of Electrical Apparatus	B.S.229 — 1946.
(2) 100 ampère Flameproof Plugs and Sockets	B.S.279 — 1947.
(3) Flameproof Electric Motors	B.S.741 — 1937.
(4) Air-Break Switches (including Flameproof)	B.S.861 — 1939.
(5) Air-Break Circuit Breakers (including Flameproof)	B.S.862 — 1939.
(6) 30 ampère Flameproof Plugs and Sockets	B.S.1395 — 1948.
(7) Flameproof Electric Lighting Fittings	B.S.889 — 1947.
(8) Installation and Maintenance of Flameproof and Intrinsically Safe Electrical Equipment	B.S. Code of Practice C.P.1003 — 1948.
(9) Test and Certification of the Flameproof Enclosure of Electrical Apparatus	Ministry of Fuel and Power Testing Memo. No. 4 — 1946.
(10) Test and Certification of Intrinsically Safe Electrical Apparatus and Circuits	*Idem*, No. 10 — 1946.
(11) Manufacture of Cinematograph Film Regulations	Factories Act, 1937; *S.R. & O.*, 1928, No. 82.
(12) The Cinematograph Film Stripping Regulations	Factories Act, 1937; *S.R. & O.*, 1928, No. 84.
(13) The Factories (Testing of Aircraft Engines Carburettor and Other Accessories) Order	Factories Act, 1937; *S.R. & O.*, 1944, No. 495
(14) Electric Light and Power in Factories and Magazines for Explosives	Home Office Memo. No. 5, 1948.

ERIK V. GABRIELSON †

The International Labour Office announces with deep regret the death, at the age of 65, of Mr. Erik V. Gabrielson, former Chief of Section in the Swedish State Insurance Institute and former member of the Correspondence Committee on Accident Prevention of the I.L.O.

Mr. Gabrielson was educated at the Chalmer Technical Institute at Göteborg and the Federal Polytechnic at Zürich. He worked in various industrial establishments in Sweden and the United States of America, and entered the service of the Swedish Labour Inspectorate in 1928. In 1930 he was appointed Chief of the Accident Prevention Section in the Social Welfare Administration, where he also had the task of directing and supervising the activities of the Labour Inspectorate. When in 1938 the Inspectorate was attached to the State Insurance Institute, he continued to fulfil the functions of Chief of the Accident Prevention Section until 1948, when he retired.

Since 1931, Mr. Gabrielson had been an editor of the periodical *Arbetarskyddet* of which he became editor in chief in 1946. He had been secretary of the Swedish Accident Prevention Association since 1933 and Chief of the Exhibition Service of the Association. He was, in fact, the originator of the travelling exhibition.

In the international field, Mr. Gabrielson attended various sessions of the International Labour Conference and from 1934 to 1947 was a member of the Correspondence Committee on Accident Prevention of the I.L.O.

The tasks entrusted to Mr. Gabrielson in the course of his fruitful career were extensive, difficult and often delicate, but he was successful in all of them, thanks to his vast technical knowledge, his capacity for hard work and his great skill in reconciling conflicting points of view. His death is a great loss to the industrial safety movement.

SAFETY INSTITUTIONS, ASSOCIATIONS AND MUSEUMS

INTERNATIONAL

Meeting of Safety Experts of the Northern Countries [1]

A meeting of safety experts from Denmark, Finland, Norway and Sweden was held at Oslo on 13 and 14 September 1948.

During this meeting a programme for collaboration between the countries was drawn up and the exchange of exhibition material, films, posters and safety publications planned. In addition, it was agreed that the associations represented at the meeting could reproduce, without previous authorisation, the articles published in their respective periodicals.

It was decided to hold a similar "northern" meeting each year with a view to strengthening collaboration in the field of accident prevention.

Tripartite Technical Conference on Safety in Coal Mines

A Tripartite Technical Conference on Safety in Coal Mines was held at the International Labour Office, Geneva, from 12 to 23 September 1949 to discuss and adopt a Model Code of Safety Regulations for Underground Work in Coal Mines.

The preliminary draft of the Code was prepared by the Office and revised by committees of experts which met in 1938 [1], 1939 [2] and 1948. [3] It was the intention of the Office to submit the Code to a tripartite technical conference in 1940, but owing to the war this intention could not be carried out and no further progress with the Code could be made until peace was restored. In view of the technical changes that had occurred in coal mining since 1939, it was considered necessary to have a fresh revision of the Code undertaken by experts before submitting it to a Tripartite Conference, and it was not until 1949 that the text was ready for such a conference.

The Conference which met in September was preceded by a Committee of Experts on Electricity in Coal Mines. This Committee, consisting of 16 delegates and advisers to the Conference, sat for three days under the chairmanship of Mr. G. M. Harvey, Chief Electrical Inspector, Ministry of Fuel and Power, London, to revise the chapter of the Code dealing with electricity in coal mines, a chapter that the previous Committees of Experts did not feel themselves fully competent to examine.

The Tripartite Technical Conference was attended by over 50 delegates and advisers from the

[1] *Arbetarskyddet*, No. 9, 1948, p. 246.

[1] See *Industrial Safety Survey*, Vol. XV, No. 1, p. 5.
[2] *Ibid.*, Vol. XV, No. 4, p. 99.
[3] *Ibid.*, Vol. XXV, No. 1, p. 8.

following 15 countries: Belgium, Canada, Chile, China, Czechoslovakia, France, India, Italy, Mexico, Netherlands, Norway, Poland, Turkey, the United Kingdom and the United States, and was presided over by Mr. A. M. BRYAN, Chief Inspector of Mines of the United Kingdom.

In the course of 16 plenary sessions and numerous meetings of the Government, employers' and workers' groups of delegates, the provisions of the Code underwent a searching scrutiny and over 200 amendments were presented, but eventually agreement was reached on all points and the Code was unanimously adopted by the Conference.

The general structure of the Code has already been described in the *Survey*.[1] The Conference did not alter it fundamentaly but improved and strengthened numerous provisions, in particular those relating to shafts, explosives, shotfiring, supports, haulage, travel of workers, winding, ventilation and precautions against firedamp and coal dust. New sets of regulations were added concerning air compressors and workmen's inspectors.

The Code as adopted by the Conference will be submitted to the Governing Body of the International Labour Office for communication to Governments. It is not a binding text and does not require to be ratified by Governments. As the introduction states, "it is a code of model regulations designed to be of service to all who are working to reduce the heavy toll of accidents in the coal mines of the world", and it will be issued for the guidance of Governments and the coal-mining industry.

It was the understanding of the Conference that the Code would require to be revised from time to time in the light of technical advances, and that the work of revision might suitably be undertaken by the Office with the assistance of experts.

In addition to adopting the Code, the Conference unanimously passed four resolutions.

The first resolution, proposed by the entire Czechoslovak delegation, requests the Governing Body of the International Labour Organisation to instruct the Office to:

(1) prepare as speedily as possible a model code of safety regulations for underground work in all mines except coal mines:

(2) prepare as speedily as possible a model code of safety regulations for work in surface mines of all kinds; and

(3) convene a technical tripartite conference as early as possible to discuss such codes.

The second, submitted by the workers' group, requests the Governing Body to instruct the Office to:

(1) prepare as speedily as possible a model code of health regulations for all persons employed in and about coal mines;

(2) convene a technical tripartite conference at an early date to discuss such a code.

The third resolution, also proposed by the workers' group, requests the Governing Body to instruct the Office:

(1) to convene as speedily as possible a conference of men with practical experience in coal mining to advise upon —

(a) methods of coal mining which will result in the minimum degradation of coal and rock and the minimum formation of pathologically dangerous dust; and

(b) effective methods for the suppression of whatever dangerous dust is inevitably made in mining operations, so as to prevent such dust from becoming airborne.

(2) to prepare a model code of regulations for the guidance of governments and the industry, and

(3) to convene a technical tripartite conference to discuss such a code.

The last resolution, proposed by the entire French delegation, was worded as follows:

The Tripartite Technical Conference on Safety in Coal Mines

. . . . . .

Convinced of the fundamental importance of technical and scientifice research for the improvement of working conditions in the mines,

Pays tribute to the research work carried on over many years for the devclopment of safety in fuel mines,

Welcomes the collaboration achieved in this respect between the research stations of different countries, and

Expresses the hope that this activity will be continued and extended in all mining countries, that liaison between these countries will be strengthened, in particular by the regular publication of information on the work of each station, by the exchange of these publications between the various countries and their widespread distribution, and by means of periodical international conferences of research stations.

The Office will study these resolutions, and if the Governing Body agrees, will submit proposals concerning them as soon as practicable.

The Conference marks a new stage in the long and troubled history of coal mining. It represents the first international attempt to pool the knowledge and experience of the more advanced coal-producing countries in the formulation of safety standards for the coal mines of the whole world. All the delegates, representatives of Governments, employers and workers alike, were united in a single purpose — to make the best possible model code of safety regulations.

The president of the Conference doubtless expressed the general view when he said that while the Code would be most useful to undeveloped countries, there was something in it that would be useful to every coal-producing country.

[1] Vol. XXV, No. 1, p. 8.

BELGIUM

Mining Health Institute

Activities in 1948[1]

The Institute comprises a medical section, which undertakes medical examinations of miners and research into medical problems, in particular silicosis; and a technical section, which has studied the climate of deep mines and measures against dust. The Institute also functions as a centre of information for all matters relating to the health of miners.

In 1948 the work of the medical section consisted of research into the effects of silicosis on the heart and the circulatory system, radiological examinations by stratigraphic methods (tomography) and experiments on animals.

The technical section designed a dust counter, illustrated in the report, consisting essentially of a dry-type gas meter, a compressed-air ejector and a filtering unit.

Comparisons have been made between rotary and percussive methods of drilling in rock. Rotary drilling was found to produce less dust and to be faster in soft rock than percussive drilling, but nevertheless it is a dusty operation and requires the application of the usual protective measures — wet drilling, dust collection and/or the use of masks.

For drilling in coal, water infusion and drilling with atomised water seem to promise the best results.

In consequence of difficulties that had arisen in the maintenance of water meters in mining conditions, the Institute has designed a new apparatus for the routine measurement of the water used for infusion. This is described and illustrated as are also various types of improved hammer picks using atomised water.

An account of an investigation into the use of various types of dust mask underground describes their advantages and disadvantages and the miners' opinions of them. The conclusion is reached that masks with a filter pocket of the Willson and Brison types are best suited for work at the face.

The Institute's report also describes tests on various types of dust filter.

In connection with the climate of deep mines the Institute has investigated the effects of humidity, the original temperature of the rocks, the ventilation of preparatory workings and the graduation of measuring instruments, such as thermometers and barometers.

[1] R. Bidlot: "L'activité de l'Institut d'Hygiène des Mines au cours de l'année 1948", *Annales des Mines de Belgique*, 1 May 1949, p. 230.

FINLAND

Safety Days in Helsinki

A safety congress was held on 9 and 10 May at Helsinki under the auspices of the Finnish Ministry of Social Affairs and the Social Science Association on the occasion of the 60th anniversary of the promulgation of the first Finnish Labour Protection Act and the 40th anniversary of the foundation of the Social Science Association.

The congress brought together a large number of high-ranking Finnish personalities, members of the Accident Prevention Association, and labour inspectors, as well as representatives from Denmark, Iceland, Norway and Sweden. The International Labour Office was represented by Mr. E. Hellen, of the Industrial Safety Section.

A programme of lectures, cinematographic performances, and visits to exhibitions and industrial centres enabled the participants to form some idea of the vastness of the industrial safety movement in Finland.

FRANCE

National Safety Institute

The National Safety Institute *(Institut national de sécurité)* for the prevention of industrial accidents and occupational diseases was founded on 14 April 1947. The purpose of the Institute is to contribute, in every way possible in the technical field, to the improvement of industrial safety and health conditions and to the prevention of industrial accidents and occupational diseases. The Institute functions under the direction and supervision of the State Social Security Institution in conformity with the safety policy laid down by the Minister of Labour. It may receive grants paid out of the fund for the prevention of industrial accidents and occupational diseases administered by the State Social Security Institution.

The Safety Institute comprises only five active members. These are the national organisations most directly concerned with prevention work: the National Council of French Employers, the General Confederation of Labour, the General Confederation of Labour — Force Ouvrière, the General Confederation of Christian Workers, and the National Federation of Social Security Organisations. The Governing Body of the Institute comprises the representatives of these organisations together with two representatives of the Minister of Finance, one representative of the Minister of Labour and Social Security, and the Director of the National Social Security Institution. In accordance with a special provision in its constitution, the Institute is under State supervision.

The aim of the Institute is to use all suitable means of propaganda for the purpose of arousing "safety consciousness". It publishes safety posters which are distributed through the regional social security funds; it participates in various exhibitions, and safety demonstrations are made under its auspices during the National Safety Week organised by the *Œuvre pour la sécurité et l'organisation des secours*. The Institute is also planning educational and propaganda films dealing with industrial safety matters.

In view of the advantages of adapting safety education to the duties of those called upon to receive this education the Institute organised, in November 1948, a course of instruction for the safety inspectors of the Regional Social Security Funds. In addition, the engineers of the Institute give industrial safety lectures in the State vocational and arts and crafts schools. Lectures of this kind are also given to the instructors of accelerated vocational training centres attending the courses of instruction.

Furthermore, the Institute has undertaken technical studies on means of protection against industrial accidents and occupational disease. The Institute proposes to collect or compile documentary material respecting the prevention of industrial accidents and occupational diseases and to distribute this material by the means most likely to reach the organisations or persons interested.

In this connection, the Institute has published a number of technical pamphlets, the last two of which deal with safety and health in the welding industry [1] and benzol poisoning. [2]

It has also begun publishing a periodical entitled *Travail et Sécurité*, the first number of which appeared in April 1949.

French Association for Industrial Medicine

The new French Association for Industrial Medicine *(Association française "Médecine du Travail")* held its first meeting, under the chairmanship of Professor Mazel, on 26 March 1949 at Paris. Over 200 delegates from Paris and the provinces participated.

The aims of the association, as described by Dr. Morizot, its Vice-President, are:

(a) to unite all individuals and organisations interested in labour problems and the development of industrial medicine with a view to improving the workers' welfare;

(b) to study the advances made in industrial medicine;

(c) to study proper means of improving working conditions, of ensuring the protection of man at work with due regard to optimum production, and of increasing the efficiency of prevention techniques;

(d) to publicise by all possible means the work undertaken and the results achieved, with the object of educating or training all persons concerned.

The activities that the Association intends to undertake are:

(1) the creation and development of regional branches;

(2) the organisation of committee and other meetings;

(3) liaison with official or private French and foreign organisations dealing with the same problems;

(4) the organisation of conferences on problems dealt with by the Association.

National Safety Week, 1948

The *Industrial Safety Survey* has already mentioned the National Safety Week held at Paris in June 1948. [1] The papers read during that week have now been collected in a volume [2] of 278 pages and a complete list of their titles is given below.

The first series of 18 papers deals with protection against fire and aerial attack, one of the three subjects chosen by the organisers of the Safety Week:

General outline of civil defence, by Gen. Chassin.

The problem of the defence of populations, by Prof. Anthouard.

Aerial risks and civil defence, by Capt. Chanois.

The risks of crop destruction in case of war, by Mr. Vezin.

The role of the architect in the defence of cities, by Mr. Leclerc.

Underground sites, by Commander Plenier.

Recruitment and training of supervisers for civil defence, by Commander Mathieu.

Modern treatment for accidental asphyxiation, by Lieut.-Col. Genaud, M.D.

The protection of power plant against fire risks, by Mr. Perdijon.

Fires in oil-filled transformers, by Mr. Ducourneau.

Protection against fire in underground distribution systems, by Mr. Berquet.

Static electricity and fire, by Mr. Nissou.

The examination of private electrical installations, by Mr. Lange.

Chimneys (Laboratory tests, new materials), by Mr. Poulain.

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[1] *La Sécurité et l'Hygiène dans les industries de la soudure.* reviewed in *Industrial Safety Survey*, Vol. XXV, No. 2, p. 77.
[2] *Le Benzolisme, idem*, No. 1, p. 39.

[1] Vol. XXIV, No. 4, p. 129.
[2] *Semaine nationale de la sécurité, Travaux 1948.* Published by the Oeuvre pour la sécurité et l'organisation des secours, Grand Palais, Paris.

Chimney fires and their extinction, by Capt. WASSON.

The problem of fire in rural areas, by Commander COLLINET.

Ammonium nitrate — its dangers, by Mr. MEDARD.

Measures for preventing fire in building construction, by Mr. LECLERC.

Under the heading "Industrial Safety", a series of 31 papers deal with different aspects of the prevention of industrial accidents and occupational diseases.

Legislation and the prevention of industrial accidents, by Mr. LAROQUE.

Personal protection against dusts, by Mr. MARTIN.

Health and safety in the textile industry, by Mr. MALAGIE.

Evacuation of the personnel and the public in industrial and commercial undertakings, by Mr. ROISSE.

Health in welding work, by Mr. DANNA.

Possibilities of replacing benzene hydrocarbons by less noxious products, by Mr. LAFARGE.

The technical aspect of the prevention of occupational diseases, by Mr. VALLAUD.

Environmental heat, by Mr. BROIDA.

Silicosis in public works, by Prof. RAYMOND and Mr. SEROUL.

Contribution to the study of accident prevention in caisson work and diving, by Gen. FROMENT and Prof. RAYMOND.

Physical disturbances caused by the use of compressed air tools, by Dr. BERNARD.

The organisation of civil engineering works and the prevention of industrial accidents, by Mr. KUNHOLTZ.

Technical methods for the prevention of silicosis, by Mr. AVY.

Psychophysiological study of work at circular saws, by Dr. MORALI.

Electric fences in rural undertakings, by Prof. MOUREU and Mr. AMY.

Protection against fire at the Génissiat power plant, by Mr. OLIE.

The use of electric current in underground sites for waterfalls, by Mr. ARIES and Mr. JOSSIN.

The use of explosives in tunnel work, by Mr. CHARPENTIER.

The ventilation of tunnels where explosives are used, by Mr. FOURESTIER.

Safety of the personnel in the hydroelectrical and mechanical equipment of the Génissiat power plant, by Mr. ROBERT.

Safety in a group of hydroelectric power plants, by Mr. WYART.

Safety in the operation of a rural distribution system, by Mr. MIRABEL.

Principles and methods of work of the Certification Committee for safety devices for dangerous machinery, by Mr. VAYSSIÈRES.

Principles for the protection of grinding machines, by Mr. PALLAUD.

Protective principles for circular and band saws for work with wood and plastic materials, by Mr. JULLIAN.

The use of hoisting ropes, by Mr. THIOUX.

Safety rules for the construction and use of overhead travelling cranes, by Mr. JOUVION.

Inspection of material by ultrasonic methods, by Mr. VERWILST.

Safety by psychotechnical methods, by Mr. CONSOL.

First aid. Sketch of a plan of action, by Mr. GRZYBOWSKI.

The role of first aid — its scope — its limitations, by Mr. DULAC.

The last series of 10 papers deals with safety in transport. The titles are:

Rolling stock and the safety of passengers, by Mr. CHAPOULIE.

The safety of railcars, by Mr. CHAPOULIE.

International regulations on the safety of life at sea, by Mr. LE CAPON.

Amendments to the Road Code, by Mr. RUMPLER.

Activities of the Motor Aid Association, by Mr. BURIN DES ROSIERS.

Manufacture of reflecting devices required by the Road Code, by Mr. LE GRAIN.

Safety devices in the equipment of road vehicles, by Mr. HENNON.

Air accidents and their relationship to crew discipline, by Mr. BENZIMBRA.

The dangers of flying in the mountains, by Mr. VIAUT.

Insurance company automobile accident statistics, by Mr. DEPOID.

It is unfortunately impossible, due to lack of space, to analyse even briefly the various papers, many of which were presented by eminent specialists in matters relating to the prevention of accidents and occupational diseases.

GERMANY

GROUND-PRESSURE RESEARCH COMMITTEE OF THE GERMAN COAL-MINING ADMINISTRATION [1]

The German Coal-mining Administration has set up a Committee *(Arbeitsausschuss für Gebirgsdruckforschung)* to review the progress of research into ground pressure and to plan future research. The Committee has held two meetings, on 17 December 1948 and 4 February 1949. The matters discussed included various factors affecting pressures at longwall faces, types of props, and pressure-measuring techniques.

UNITED KINGDOM

CONFERENCE ON LABORATORY ACCIDENTS [2]

A Conference on the origins and prevention of laboratory accidents was held in London on 6 November 1948 under the auspices of the Royal Institute of Chemistry. The report of the Con-

[1] *Glückauf*, Nos. 25/26, 18 June 1949, p. 457.

[2] THE ROYAL INSTITUTE OF CHEMISTRY: *Report of a Conference on the Origins and Prevention of Laboratory Accidents, 6 November 1948*. Lectures, Monographs and Reports, 1949, No. 4.

ference published by the Institute contains the following papers:

The organisation of safety precaution in chemical laboratories, by J. IDRIS JONES.

Safety and good housekeeping in chemical laboratories, by L. J. BURRAGE.

Prevention of accidents arising from electrical work, by J. C. CORNWELL.

Safety arrangements in laboratories handling explosives and kindred materials, by O. C. ELLINGTON.

Supervision as the major factor in the prevention of laboratory accidents, by N. H. MASON.

Safety precautions to be observed in handling radioactive isotopes, by W. G. MARLEY.

Radiation monitors for use in laboratories handling radioactive isotopes, by D. TAYLOR.

Modern methods of first-aid practice in laboratory accidents, by H. DAVIS.

The report also includes contributions to the discussions and communications on the design of laboratories and apparatus in relation to the human factor, and electrical, fire, glass and various other hazards.

LAWS AND REGULATIONS, SAFETY CODES

ARGENTINA

DECREE NO. 6,891 CHANGING THE NAME OF THE DIRECTORATE-GENERAL OF INDUSTRIAL INSPECTION AND HEALTH TO THE DIRECTORATE-GENERAL OF INDUSTRIAL HEALTH AND SAFETY DATED 23 MARCH 1949 [1]

This Decree, in addition to changing the name of the Directorate, extends its functions with regard to the study, preparation and drafting of regulations dealing with industrial health and safety; the study of industrial accidents, occupational diseases and the readaptation and retraining of accident victims; technical study of industrial equipment in relation to the risks to which it exposes the workers, and to toxic and dangerous substances; courses of instruction, psychological studies, absenteeism and other work such as the compilation of bibliographies and training workers to acquire safe and healthy habits of work.

CUBA

DECREE NO. 378 LAYING DOWN PROTECTIVE MEASURES FOR RADIOLOGICAL, RADIO THERAPY AND RADIUM THERAPY SERVICES DATED 5 FEBRUARY 1949 [2]

The protective measures laid down by this Decree apply to all State services, services of autonomous organisations and private services for radiology, radio therapy and radium therapy.

With respect to radiology and fluoroscopy, the Decree provides that the protection of all equipment, sources of current and accessories shall comply with the requirements laid down in the National Electrical Code in all things that concern the risk of discharges of high-tension current, risk of contact, or proximity of persons. It also includes provisions respecting the protection against radiation of patients and of the personnel entrusted with the radiological and fluoroscopic examinations, and lays down that the maximum time during which personnel is exposed to radiation shall not exceed 120 minutes each day.

The provisions concerning radio therapy services deal with adequate ventilation of the rooms; the thickness of the lead boards, this thickness being determined in accordance with the voltage of the radio therapy apparatus; the protection of the patients, of the technical personnel and of the operators; and the periodical examinations to which the personnel shall be subject. The Decree also lays down that the personnel, whether technical or not, shall have some practical knowledge of the administering of artificial respiration.

With regard to radium therapy services, the Decree deals with methods of handling, transporting and storing radium; the examinations to which the personnel working in these services shall be subject every two months; and the protection of the patient.

It is also provided that all persons handling radium or employed in deep radio therapy operations as well as in fluoroscopic examinations shall be compelled to take three months' holidays per year as follows: one month after three months' work, or 45 days after 6 months', or 90 days after 9 months', the variation being established in accordance with the results of the periodical examinations.

FRANCE

ORDER RESPECTING REGULATIONS FOR ACETYLENE GENERATORS DATED 26 OCTOBER 1948 [1]

This Order regulates the construction, installation, use and maintenance of acetylene generators

[1] Information supplied by the I.L.O. correspondent in Argentina.

[2] *Gaceta Oficial*, No. 40, 17 Feb. 1949, p. 3,397.

[1] *Journal officiel*, 30 Oct. 1948, p. 10,454.

and deals with the approval and testing procedure for this equipment.

Decree No. 48-1895 and Orders concerning Special Hygiene Measures applicable in Undertakings where the Personnel is Exposed to Methyl Bromide Poisoning Dated 10 December 1948 [1]

The Decree of 10 December 1948 applies to all work in which personnel is normally exposed to methyl bromide poisoning, and in particular to: (1) the preparation of methyl bromide; (2) the preparation of chemical and pharmaceutical products with a methyl bromide base; (3) the filling of methyl bromide extinguishers; (4) the use of methyl bromide as a disinfectant or for the extermination of rats.

The provisions are of three kinds. They comprise protective measures of a technical nature, measures for personal protection, and measures for medical protection.

An Order of 10 December 1948 fixes the wording of the notice indicating the dangers of poisoning by methyl bromide.

A second Order of 10 December 1948 determines the guiding principles for the medical examinations required by the Decree of the same date.

In addition, these regulations are analysed in Ministerial Circular E.R. 9/49 of 23 March 1949 which was drawn up as a result of investigations and work undertaken by the Industrial Hygiene Committee.

Decree dated 11 December 1948 and Orders dated 12 December 1948 concerning Special Hygiene Measures applicable in Undertakings where the Personnel is Exposed to Lead Poisoning [2]

The Decree of 11 December 1948 applies to all work in which personnel is normally exposed to lead poisoning; in particular the preparation of lead compounds and the use of lead derivatives.

The provisions of this Decree are of two kinds. They comprise protective measures of a technical nature and measures for medical protection.

An Order of 12 December fixes the wording of the notice indicating the dangers of poisoning by methyl bromide.

A second Order of 12 December determines the guiding principles for the medical examinations required by the Decree of 11 December 1948.

[1] *Idem*, 15 Dec. 1948, p. 12,211.
[2] *Idem*, 16 Dec. 1948, p. 12,247.

Decree No. 48-2033 of 29 December 1948 [1] and Circular T.R. 8/49 of 14 March 1949 [2] respecting the Prohibition of the Use of Certain Solvents containing Benzene Hydrocarbons for Certain Work

The Decree deals principally with the use of benzene hydrocarbons as solvents for rubber, resin and fats. A number of provisions are reproduced below:

Sec. 1. It is prohibited to use as solvents:

(a) benzene, mixtures of benzene and its homologues and all mixtures of benzene hydrocarbons the distillation of which begins above 100°;

(b) petroleum spirits and complex solvents of which the fraction distilling below 100° contains benzene hydrocarbons the volume of which is more than 5 per cent. of the total volume of the solvent distilling below 200°.

Nevertheless this prohibition shall not apply in cases where solvents or solutions containing benzene hydrocarbons are used, evaporated or recovered in containers that are closed during normal operations.

Sec. 2. In addition, it shall be prohibited to use rubber solvents intended for the manufacture of waterproof garments, the manufacture or repair of footwear and the manufacture of feather ornaments or artificial flowers when these solvents are prepared with:

(a) solvents extracted from mixtures of crude benzene and its homologues more than 1 per cent. of which distils below 130° or more than 10 per cent. below 145°;

(b) petroleum spirits and complex solvents of which the fraction distilling between 100° and 145° contains benzene hydrocarbons the volume of which is more than 10 per cent. of the total volume of the solvent distilling below 200°.

. . . . . .

Sec. 4. The control of the distillation curve and the composition of the solvents mentioned in this Decree shall be carried out in accordance with the French standards that have been or will be determined in accordance with the Decree of 24 May 1941.

Since it is impossible to prohibit entirely the use of these solvents because of the many purposes to which they are put in industry, the Circular of 14 March 1949 examines the possibilities of replacing the solvents by less harmful products such as trichloroethylene and special petroleum spirits and analyses the conditions under which permanent or temporary exemptions may be granted for certain classes of industry in view of the shortage of special spirits, chlorinated solvents, toluols, xylols and solvent naphthas.

[1] *Idem*, 4 Jan. 1949, p. 225.
[2] *Idem*, 12 May 1949, p. 4,675.

GERMANY

Mutual Accident Insurance Association for Inland Water Transport. Accident Prevention Regulations. Effective 1 July 1948 [1]

The regulations, which are very detailed, are in 11 parts and are provided with a subject index.

The various parts are as follows: I. General provisions (duties of employers and workers, equipment and management of the vessel); II. Vessels and floating equipment; III. Winches and lifting appliances; IV. Loading and unloading operations; V. Special provisions for the lower Elbe; VI. Timber floating; VII. Dredges; VIII. Diving; IX. Tankers; X. First Aid; and XI. Transitional provisions, etc.

Appendices include principles for the construction and use of winches.

INDIA

Travancore

The Travancore Factories Act, 1124. Dated 7 March 1949 [2]

Chapter IV of this Act deals with safety and contains fairly detailed provisions respecting the fencing of machinery; work on or near machinery in motion; the employment of young persons on dangerous machines; striking gear and devices for cutting off power; casing of new machinery; hoists, lifts, cranes and other lifting machinery; precautions against dangerous fumes, explosive or flammable gas and dust, and against fire.

Self-acting machines, revolving machinery, floors, stairs and means of access, pits, sumps, openings in floors, etc., excessive weights, and eye protection are also dealt with. The employment of women and children near cotton openers is prohibited.

The Act also contains provisions respecting health (cleanliness, ventilation, disposal of waste, lighting, etc.), inspection, welfare, working hours, the employment of young persons, etc.

NETHERLANDS

Safety Decree concerning Electric Fences. Dated 2 November 1948 [3]

The Decree applies to electric fences erected to keep out horses, cattle, etc. It contains provisions concerning the position of electric fences with regard to heavy current lines, telecommunication lines and highly combustible substances; sources of current and earthing. The fences must be certified by an expert every year as to their conformity with the regulations.

Regulations for Buildings Hoists, 1948

The Netherlands Lift Institute *(Het Nederlandsche Instituut voor Lifttechniek)* has revised Part VI, Building Hoists, of its Safety Regulations for Lifts and Escalators. The new Part, completed in 1948, divides building hoists into three classes: I, hoists running in vertical guides, with the cage at least 30 cm distant from scaffolding and other places occupied by persons, and the cage not entered for loading and unloading unless it rests on the ground or the pivoting part is at least 30 cm above a loading floor; II, as for I, except that the gap between cage and scaffolding is bridged over for putting on or taking off trucks; and III, other types.

The regulations deal with shafts; lifting machinery and rope pulleys; lifting ropes; cage; counterweight; cage and counterweight guides; electrical installations; and maintenance, attendance and use.

Accompanying the regulations is an explanatory memorandum.

SWEDEN

Workers' Protection Act Dated 3 January 1949 [1]

The present Act replaces the Workers' Protection Act of 29 June 1912 as amended. It comprises 75 sections grouped in 10 chapters.

The first chapter defines the field of application of the Act. Chapter II contains general rules respecting the prevention of accidents and diseases. The principal provisions of this chapter are reproduced below.

. . . . . .

7. The employer shall be bound, with special reference to the provisions laid down herein or issued under the Act, and with due regard to the nature of the work, the conditions under which it is carried out, the age of the workers, their ability and aptitudes, to take all steps which can reasonably be considered necessary in order to protect the workers employed by him against occupational diseases and industrial accidents.

The workers shall be bound to use the safety devices provided, to comply scrupulously with the provisions laid down in the Act or issued under it, to exercise due caution and to co-operate in the prevention of diseases and accidents.

8. Workplaces shall be fitted out in accordance with any special requirements that may be laid down.

9. The workers shall have at their disposal, to the extent considered necessary in view of their sex, the nature and the duration of the work,

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[1] Binnenschiffahrts-Berufsgenossenschaft: *Unfallverhütungsvorschriften.* Kleinausgabe.

[2] Supplement to the *Travancore Gazette*, No. 31, 15 Mar. 1949.

[3] *Staatsblad*, 1948, No. I, 482.

[1] *Svensk Författningssamling*, No. 1, 1949.

either at the workplace or in the vicinity, drinking water, and water for washing, toilet rooms, and suitable premises where they can change, leave and if necessary dry their clothes, as well as a suitable place in which to eat their meals.

Places where the workers can rest or shelters offering adequate protection against cold and rain shall be provided for the workers when this may be considered necessary in view of the conditions under which the work is carried out.

10. Enclosed workplaces shall have sufficient air space, as a rule at least 10 m^3 for every worker employed in them. Adequate ventilation shall be provided in such places, and to such extent as is necessary, in all other workplaces.

Work shall be carried on in a sufficient and suitable light and at such suitable temperature and degree of humidity as can be reasonably required in view of the nature of the work and the place in which it is effected.

Suitable measures shall be taken, as far as possible, to prevent dusts, smoke, gases and steam from spreading in dangerous or disturbing quantities and to prevent workers from being injured by exposure to noises, vibrations or other similar inconvenience.

Order and cleanliness shall prevail in workplaces.

The work shall be so organised as to eliminate all unnecessary fatigue.

11. In order to prevent industrial accidents, prime movers, transmissions, working machines, and other similar mechanical equipment, boilers and other pressure vessels, as well as hoisting and transport equipment, shall be provided with the necessary protective devices and shall, in addition, be so designed and installed as to give a perfect guarantee of safety.

Such measures shall be taken as to eliminate, as far as possible, the risk of workers being injured in falling, by falling objects, collapse, splinters, splashes, sharp or hot objects, hot liquids, by crushing or blows, by flammable, explosive, corrosive, toxic or otherwise noxious substances, electricity, or as a result of exposure to cold, heat or a dazzling light.

12. When the necessary protection against diseases or accidents cannot be achieved or reasonably required by other means, the workers shall be provided with suitable personal protective equipment. The workers shall be bound to use this equipment in the performance of their work and to take good care of it.

13. For the administration of first aid in case of accidents or illness, such measures shall be taken as may be considered necessary in view of the size and situation of the workplace, the nature of the work, and the conditions in which it is carried on.

. . . . . .

Chapters III to V contain provisions respecting hours of work, and the employment of minors and women.

Chapter VI deals with collaboration between employers and workers. Parts of the text concerning safety are reproduced below:

39. Under the leadership of the employer, workers and employer shall co-operate in conducting suitable organised safety activities in order to ensure healthy and safe conditions of work in the undertaking.

40. In all undertakings where at least five workers are regularly employed, unless special circumstances justify an exemption, one or more safety delegates shall be appointed from among the workers to represent them in matters of industrial health and safety. Safety delegates shall also be appointed in undertakings with less than five workers if this is found to be necessary.

The safety delegates shall be elected by the workers or, at their request, by the local organisation by which they may be considered to be represented.

. . . . . .

41. In all undertakings where at least 50 workers are regularly employed there shall be a safety committee composed of representatives of the employer and the safety delegates, which shall promote health and safety in work. Safety committees shall also be created in undertakings where less than 50 workers are employed if this is found to be necessary.

Chapter VII deals with the duties of manufacturers, vendors, etc. The following is an extract:

45. Manufacturers and vendors of machinery, appliances, or other technical equipment, as well as persons hiring out such equipment for use shall see that such equipment when delivered for use or exhibited for sale or for advertising purposes within the realm is provided with the necessary protective devices and in other respects offers sufficient protection against disease and accidents and is accompanied by rules respecting the use and maintenance of the equipment.

When an independent contractor installs equipment referred to in the preceding paragraph he shall, during the installation, see that the prescribed safety devices are provided and that all other provisions respecting installation are complied with.

Chapters VIII to X deal with supervision of the enforcement of the Act, penalties and various other matters.

Royal Notification Regulating the Employment of Workers in Occupations involving the Use of Lead Paint Dated 6 May 1949 [1]

This Notification contains provisions respecting the employment of workers in occupations involving the use of lead paints and lays down compulsory preventive measures. It also includes provisions concerning the reporting of cases of lead poisoning by the employer and the doctors.

Royal Notification concerning Medical Examination and Re-examination with a View to Preventing Certain Occupational Diseases Dated 6 May 1949 [2]

This Notification deals with the prevention of benzol poisoning, lead poisoning and silicosis. It

[1] *Svensk Författningssamling*, No. 210, 1949, p. 417.
[2] *Idem*, No. 211, 1949, p. 419.

provides for pre-employment medical examinations, periodical medical examinations, and the keeping of a register or card index for the recording of the examinations and re-examinations.

ROYAL NOTIFICATION CONCERNING THE MEDICAL EXAMINATION AND RE-EXAMINATION OF YOUNG WORKERS DATED 6 MAY 1949 [1]

This Notification contains instructions respecting the medical examination of young workers.

UNITED KINGDOM

BRITISH STANDARD 487: 1949 FUSION WELDED STEEL AIR RECEIVERS [2]

The Standard deals with the quality and testing of the material and details of construction. Numerous welding specifications are illustrated by drawings.

UNITED STATES OF AMERICA

New York

RULES RELATING TO UNDERGROUND MINING OPERATIONS EFFECTIVE 1 MARCH 1949 [1]

The rules contain general provisions and provisions relating to sanitation, lighting, ventilation, first aid, maps and plans, telephones, exits, protection of openings, explosives, combustible liquids, electrical equipment, hoisting, signal systems, haulage and handling equipment, drilling and supports.

OFFICIAL REPORTS, ETC.

AUSTRALIA

South Australia

REPORT OF THE FACTORIES AND STEAM BOILERS DEPARTMENT FOR THE YEAR 1947 [3]

A total of 3,284 accidents occurred in South Australia during 1947, as compared with 2,246 in 1946.

This great increase did not represent a deterioration of safety supervision either by management or inspectors but was accounted for by better compliance with the Section of the Industrial Code respecting accident reporting and the inclusion for the first time of accidents occurring in districts proclaimed under the Country Factories Act and in factories and workshops conducted by the South Australian Government.

Of the total, 424 were machinery and 2,852 non-machinery accidents while eight were caused by lifts and scaffolding.

The greatest number of machinery accidents occurred in engineering (160) and carriage building (100). Non-machinery accidents were most frequent in carriage building (1,346); engineering (897); heat, light and power (186); and drugs and chemicals (174).

There were five fatal accidents during the year.

CANADA

FATAL INDUSTRIAL ACCIDENTS, 1948 [2]

The number of fatal industrial accidents decreased from 1,475 in 1947 to 1,350 in 1948.

Table I shows the distribution by main cause groups.

TABLE I

Cause	Number of fatal accidents
Prime movers	19
Working machines	35
Hoisting apparatus	20
Dangerous substances	157
Striking against or being struck by objects	38
Falling objects	214
Handling of objects	12
Tools	6
Moving trains, vehicles, etc.	397
Animals	21
Falls of persons	221
Other causes	210
Total	1,350

[1] *Idem*, No. 213, 1949, p. 423.
[2] Published by British Standards Institution, London. Price 3s.
[3] For 1946, see *Industrial Safety Survey*, Vol. XXIV, No. 2, p. 58.

[1] STATE OF NEW YORK, DEPARTMENT OF LABOR, Board of Standards and Appeals: *Industrial Code Rule No. 31.*
[2] *Labour Gazette*, Apr. 1949, p. 476.

Distribution by industry for 1947 and 1948 is given in table II.

TABLE II

Industry	Fatal accidents	
	1947	1948
Agriculture	117	94
Logging	192	162
Fishing and trapping	30	30
Mining, non-ferrous smelting and quarrying	190	190
Manufacturing	265	262
Construction	169	173
Electricity, gas and water production and supply	40	44
Transport and public utilities	289	244
Trade	57	42
Finance	8	3
Service	110	105
Unclassified	8	1
Total	1,475	1,350

DENMARK

Explosion of Sugar Dust [1]

A violent explosion, costing the life of two workers, occurred in a ball crusher in a brewery at Copenhagen.

At the time of the explosion the crusher contained a mixture of potassium bromate and dicalcium phosphate. The investigation undertaken showed that the machine had been used three weeks earlier to crush sugar and that it still contained a considerable amount of sugar when the explosion occurred.

Potassium bromate and dicalcium phosphate are not likely to form an explosive mixture. When, however, they are mixed with carbon or other organic substances, they are liable to explode. It is believed that this was an explosion of sugar dust ignited by a smaller explosion set off in the crushed mass.

FRANCE

Research Centre of the French Coal Board

Report for 1947 [2]

For many years research in the interests of safety in coal-mining was undertaken by the Montluçon experimental station of the Central Committee of French Coalowners *(Comité central des Houillères de France)*. With the nationalisation of the mines the station was taken over by the French Coal Board *(Charbonnages de France)*, which in 1947 set up a Research Centre *(Centre d'Etudes et de Recherches)*. The centre is under the direction of M. E. Audibert, assisted by a research committee *(Comité d'Etudes et de Recherches)*, consisting of six members of the Coal Board, the Vice-Chairman of the General Mines Council, the Director of Mines, one Chief Inspector of Mines and one representative of the National Centre for Scientific Research *(Centre National de la Recherche Scientifique)*.

Under the old régime, the Montluçon station carried on research work relating to matters such as the mechanism of the combustion of methane, permitted explosives, ground pressures and supports, ventilation and electrical equipment.

The new centre proposes to build new laboratories, set up pilot plant for various industrial processes and increase the research staff. However, the Committee's plans can only materialise slowly, and, in 1947, safety researches were mainly confined to firedamp and permitted explosives.

As regards permitted explosives, the researches have followed three directions:

(1) incorporation of an inhibitor in the explosive itself;

(2) concentration of the inhibitor in a sheath enclosing the explosive, combined with a reduction of the power of the explosive by the inclusion in it of a small quantity of the inhibitor;

(3) reduction of the density of the explosive so as to facilitate its decomposition in the shothole and reduce the risk of the projection of fumes into a fiery atmosphere before they are completely decomposed.

Very light explosives have been made in the laboratory and it now seems certain that complete safety against firedamp can be attained when firing from mortars, while maintaining a coefficient of practical utilisation of at least 50.

Delay-action detonators have been studied more especially as regards the risk of overlapping of different detonators in the same round and the sequence of explosions in the same round.

In connection with firedamp, work has continued on the oxidisation of methane. Investigations have been carried out into the slow combustion of methane in the presence of catalysts, metals and vitreous solids, into rapid combustion and into various other aspects of oxidisation, including the admixture of oxygen.

Some work has also been done on measurements of inflammable dusts and on ventilation equipment and systems.

The routine work of examining and testing electric and pneumatic equipment has continued

[1] Arbejds- og fabriktilsynet, Laboratoriet for Arbejdshygiejne: *Report No. 35/48a.*

[2] Centre d'Études et Recherches des Charbonnages de France: *Rapport sur l'activité du centre en 1947*, note technique No. 48/13, Dec. 1948.

and some methane indicators and CO detectors have been manufactured.

In addition to undertaking experimental work, the centre provides a documentary service, comprising the publication of studies, information bulletins and abstracts, the furnishing of ordinary or microfilm copies of documents and the making of translations.

The centre keeps in touch with the coal-mining industry by means of periodical visits to the coalfields and the formation of technical committees for all important researches, each committee including representatives of the principal coalfields and administrations concerned.

Lectures are regularly given to engineers from the different coalfields.

Another of the centre's duties is to examine applications for the approval of electrical equipment and to exercise surveillance over flameproof equipment in use.

NORWAY

Statistics of the State Social Insurance Administration for the Years 1943-1945 [1]

These statistics on industrial workers compiled by the State Social Insurance Administration contain information respecting industrial accidents, occupational disease, premiums and benefits.

Industry groups	Man-years worked	Number of accidents reported	Fatal accidents	Accidents per 1,000 man-years	Number of working days lost	
					Total	Per man-year
Extraction of minerals	79,951	9,341	110	116.8	2,554,597	32
Earth and stone	78,499	6,184	81	78.8	1,678,808	21
Metalworking, manufacture of machinery and transport equipment	377,987	25,783	103	68.2	3,226,833	9
Chemicals	88,410	5,169	40	58.5	989,733	11
Oils and fats	26,846	1,703	6	63.4	307,839	11
Electricity and gas	15,666	652	10	41.6	203,862	13
Woodworking	179,760	17,367	63	96.6	3,386,628	19
Wood pulp, cellulose and paper	157,267	8,693	56	55.3	1,491,792	9
Leather and rubber	34,225	967	6	28.3	165,173	5
Textiles	110,755	2,149	5	19.4	341,765	3
Clothing, shoes, cleaning	124,226	1,092	1	8.8	151,606	1
Food and trink	220,041	9,453	24	43.0	1,110,701	5
Printing and bookbinding	39,921	589	1	14.8	95,686	2
Building	458,982	31,272	367	68.1	7,900,847	17
Transport, warehousing, ice manufacturing	347,023	21,906	167	63.1	4,102,860	12
Agriculture, forestry	133,090	37,577	117	282.3	4,661,736	35
Other industries	454,106	28,929	303	63.7	6,381,520	14
Totals	2,926,755	208,826	1,460	71.4	38,751,986	13

The table above summarises the statistics of accidents that occurred in the various industry groups during the period 1936-1945.

[1] Rikstrygdeverket: *Industriarbeidertrygden — Ulykkestrygden for Industriarbeidere m.v.1943-1945* (Oslo, 1948).

SWEDEN

Annual Report of the Industrial Inspectorate, 1947 [1]

In its capacity as the supreme authority of the Labour Inspectorate, the State Insurance Institute examined a large number of plans for machinery and industrial equipment. It also published notes dealing with magnetos for motor bicycles and the testing of portable boilers for sawmills, as well as safety posters.

At the end of 1947, 21,784 undertakings employing 919,872 workers were registered with the State inspectors and 53,892 undertakings employing 198,714 workers with the sub-inspectors. These figures include 19,946 agricultural undertakings employing 67,842 workers. In addition, 73,472 undertakings were registered with communal inspection authorities. These authorities visited 65,888 undertakings employing 186,995 workers.

Inspectors and divisional inspectors presented 4,297 and sub-inspectors 6,946 inspection reports. Plans for the construction or alteration of workplaces and the modification of existing working methods submitted to the Labour Inspectorate numbered 4,116.

The Inspectorate recorded 14,103 undertakings with safety delegates, 523 with safety engineers and 767 with safety committees.

By the end of 1947, 14,654 boilers and 17,702 other pressure vessels were registered with the

[1] Riksförsäkringsanstalten: *Yrkesinspektionens verksamhet år 1947*; for 1946, see *Industrial Safety Survey*, Vol. XXV, No. 2, p. 62.

Labour Inspectorate. During the course of the year, 3,639 boiler inspections, 1,530 inspections to other pressure vessels and 23,143 inspections of elevators and hoisting equipment were made.

The total number of accidents reported in 1947 was 182,345, of which 371 were fatal. Cases of occupational disease numbered 1,224, three of which proved fatal.

There were 14,401 accidents, including 12 fatal, in the logging industry. The explosives inspector reported 697 industrial accidents (including four fatal), electrical inspectors 306 (39 fatal), railway inspectors 8,856 (26 fatal), and mine and quarry inspectors 3,900 (14 fatal).

The report contains descriptions of accidents, of safety devices, of working premises and of various installations for the welfare of the workers. Among the safety devices described are a belt-stretcher for tanning vats, a guard for the re-entrant angle of rolling mills, a guard for board drop hammers, two stopping devices for wire-drawing benches, a guard for hand shears used in cutting tobacco leaves, and a guard preventing the throw-back of the retaining ring of tyres for use when mounting these.

In the mining region of Kiirunavaara, transportation is effected by means of electric railways. The engines are sometimes used to push the wagons, a practice that hinders the view of the engine driver and that has in fact caused a number of accidents. To prevent further accidents, the engines have been provided with a periscope of extremely simple design.

The part of the report concerning hygiene contains descriptions of various types of exhaust ventilation systems.

Female inspectors made a number of observations in their report on the need for providing suitable seats in workplaces. They also drew attention to the injuries and nervous troubles caused by certain modern occupations (the work of telephonists, cashiers, stampers, etc.).

SWITZERLAND

Swiss Acetylene Association

Annual Report, 1948 [1]

During the year 1948, the Association organised 35 welding courses in which 505 persons participated.

The Laboratory of the Association examined and made calculations for a large number of devices for the prevention of flashback and laid down, on the basis of tests, guiding principles for the construction of hydraulic seals and reducing valves.

[1] *Journal de la Soudure*, No. 5, May 1949, p. 75.

In accordance with the provisions of the Federal Order of 10 April 1934 concerning calcium carbide and acetylene, the Acetylene Inspectorate gave 394 opinions on requests for authorisation to install new plant, made 103 inspections on delivery, and 1,228 inspections following accidents and issued 1,287 instructions to 523 undertakings.

The Inspectorate recorded, in 1948, 115 accidents involving two deaths and 100 injuries. In most cases, the accident was due to insufficient training of the worker, bad maintenance of the equipment, negligence or carelessness.

UNITED KINGDOM

Safety in Mines Research Board

Annual Report for 1947 [1]

Following upon the transfer of the Board to the Ministry of Fuel and Power, the Mining Equipment Testing Station at Sheffield, the Flameproof Testing Station at Buxton and the Dust Control Laboratory at Sheffield have been incorporated in the research stations. A mechanical engineering section has been established, but work in connection with strata control and support of workings has been taken over by the National Coal Board.

During 1947 the Safety in Mines Research Board was engaged on work in connection with coal dust explosions, electricity, mine gases, explosives and shotfiring, roof control and supports, diesel locomotives and dusts.

In connection with coal dust hazards, the Board is making a detailed examination of the dust conditions in several mines. Experiments have been undertaken to make continuous records of the rapidly changing speed of the air blast created by an explosion, to ascertain the effects of waterproofing limestone dusts and to ascertain the effects of humidity on mixtures of coal dust and stone dust, having regard to the difficulty of wetting coal dust. Other researches were concerned with the dispersion of dust deposits by explosion blasts, the mechanism of the dispersion of dusts by air blasts, the laying of floor dust on mine roadways, means of estimating the amount and nature of dust on the floor, roof and sides of roadways, deterioration of road dust mixtures from the safety standpoint and colorimetric methods of estimating dust mixtures.

The Board's electrical researches related to the intrinsic safety of circuits, flameproof equipment, apparatus for measuring pressure behind stoppings, lighting, locomotive accumulator casings, and shotfiring.

[1] Published by H.M. Stationery Office, London, price 2s. For 1946, see *Industrial Safety Survey*, Vol. XXIV, No. 1, p. 22.

Work has continued on the design of detectors for methane and carbon monoxide.

In connection with explosives and shotfiring, the Board investigated various properties of permitted explosives, the effect of the position of sheathing material, the pressures produced in the surrounding atmosphere by explosives, pressure distribution round a freely suspended cartridge, detonative properties of basic explosives, dispersion of sheathing material, and experimental gallery conditions.

Roof control investigations were directed to the interaction of mine workings, *e.g.*, the effects of extracting an isolated pillar, the effects of face workings on roadways), rock bursts (bumps) and conditions under a longwall retreating system. Various types of props were also investigated.

The Board continued its routine examinations of ropes and investigations of rope haulage gear and winding gear failures, tests of mining equipment and analysis of mine air and dust.

Educational work is being developed through the preparation of film strip slides, wall charts and cinema films.

Cause	Number of accidents	
	Fatal	Non-fatal
Electrical machinery	2	12
Transformers	—	1
Switchgear above 650 volts	2	35
Switchgear below 650 volts	—	98
Fusegear	—	48
Crane trolleys	7	22
Electric welding:		
(a) Shock and/or burns	—	24
(b) Eye injuries	—	149
Portable electric machines	2	39
Portable heaters and irons	—	7
Portable lamps	4	21
Fixed lamps	1	19
Plugs and adaptors	—	36
Cables and flexibles:		
(a) Portable apparatus	2	46
(b) Fixed installations	8	71
Electrical ignition of inflammable material	—	1
Testing		46
Other apparatus	2	29
Total	30	704

Electrical Accidents, 1947 [1]

The report is in three parts: I. Review of Accidents and Dangerous Occurrences; II. Electricity Supply; and III. Industrial Applications.

The statistics given in Part II show that electrical accidents reportable under the Factories Act numbered 734, of which 30 were fatal. However, the total number of fatal electrical accidents that occurred in 1947 was 130, the lowest figure recorded since the beginning of the war. Accidents occurring in the home and in industrial premises not subject to the Factories Act continued to be the most numerous.

The following table shows the distribution of industrial accidents by cause.

The first part of the report also contains statistics on artificial respiration and information on failures of electrical equipment having caused explosions and fires.

The second part deals with load shedding resulting from the shortage of power and accidents that might be attributed to it, and with a number of accidents resulting from the non-observance of the obligation to issue permits for work at electrical installations. In addition, the report draws attention to the necessity of providing protective barriers between isolators and the isolated equipment, to the dangers of electrocution presented by neutral connections of high pressure systems, on the need for providing low resistance connections to earth in medium-pressure systems, etc.

Part III deals with new developments in electronics, electrostatic deposition of paint, building operations on overhead lines, portable electric tools, earthing, earth-leakage protection, auxiliary generators, lamps used for film and television studios, metal ladders, and the use of electricity in foundries.

The rapidly increasing development of electronic apparatus for industrial purposes has presented new safety problems. Some electronic control equipment operates with extremely small "signal" power and precautions should be taken to prevent false operation due to leakage of stray power from undesired sources. It has long been a practice of the Factory Department to recommend that electrical apparatus should "fail to safety" wherever practicable, and electronic apparatus, by its complexity, affords perhaps greater scope than usual for this consideration. The report emphasises the danger of burns presented by high-frequency installations and discusses a number of risks peculiar to high-frequency conductors, risks requiring different protective measures from those necessary for standard power frequency.

In 1947, portable electric tools caused the same number of accidents as in the previous year. These tools, together with their plugs, sockets and flexible cables, were responsible for more accidents than any other class of electrical apparatus, except

[1] Ministry of Labour and National Service, Factory Department: *Electrical Accidents and their Causes, 1947*, Form 929, H.M. Stationery Office, 1949, price 9d. For 1946, see *Industrial Safety Survey*, Vol. XXIV, No. 1, p. 31.

switchgear. In previous reports, the use of low voltage and various forms of earth leakage protection were discussed as well as the advantages of regular tests of insulation and of the continuity of the earth conductor. Failure of an earthing conductor generally means the failure of the protective device. It is possible, however, to overcome this by the use of an additional conductor in the flexible cable, a small transformer and a contactor (or relay). The transformer provides a small low-voltage current along the additional conductor in the flexible cable, the current returning along the normal earth connection and through the holding coil of the contactor or relay, so that the supply is cut off if the circulating current ceases.

This form of protection has been in use for many years in mines and it is hoped that it will become general practice also in factories.

High pressure mercury-vapour lamps are replacing tungsten-filament and arc lamps more and more in film and television studios. These lamps present, however, three risks: ultra-violet radiation, shock from the high voltage starting pulse, and explosion of a bulb. Protection against ultra-violet radiation is obtained by suitable enclosure. There is a possibility, however, of the starting pulse, which ranges in peak value from 2 to 40 kV., breaking down the insulation to the lamp frame, thus placing the worker in danger. Experiments using up to 8 kV. show that solidly earthing the metalwork of the lamp fitting is not itself a solution of the problem, as with a long earth wire the impedance to a steep-fronted impulse wave may be considerable. Adequate protection up to 8 kV. can, however, be obtained by earthing combined with the connection of a 10 microfarad condenser between each supply lead and the earthed frame.

In conclusion the report describes typical accidents and dangerous occurrences in the industrial use of electricity.

Annexed to the report is a list of apparatus certified for use in certain dangerous atmospheres (petroleum vapour, hydrogen, acetone vapour, pentane and illuminating gas).

Annual Report of the Chief Inspector of Factories, 1947 [1]

Although climatic conditions seldom call for comment in a report of this kind, the Chief Inspector points out that the spell of severe cold at the beginning of 1947, combined with the fuel crisis, caused many undertakings to close down entirely while others were forced to reduce production. The enforced idleness was reflected in the reduction in the total number of accidents, although the exceptional spell of cold weather gave rise to a number of serious accidents. Unusual uses of industrial gases in attempts to provide adequate heating resulted in instances of carbon-monoxide poisoning. On the other hand, many firms utilised the enforced idleness of their workers from production to clean and tidy up works generally, and this led to a marked improvement in factory conditions.

The report gives detailed information on progress made in the mechanisation of handling systems and automatic systems of feeding and charging machines in various industries and discusses the development of joint consultation programmes and training schemes in industry.

Administration

Figures for administration, accidents, etc., are compared in this report with the corresponding figures for the year 1937 since that was the last complete year before the coming into force of the Factories Act on 1 July 1938. The years between 1938 and 1946 were either periods of war or transition and 1947 was therefore the first reasonably comparable year with 1937.

In 1947 the Factories Act applied to 197,836 factories with power (169,277 in 1937); 41,848 factories without power (71,106 in 1937); 2,874 docks, etc. (3,049 in 1937); 5,648 warehouses (5,260 in 1937); 10,235 building operations and 942 works of engineering construction. Inspectors' visits to factories with power numbered 211,016 (244,814 in 1937); to factories without power 17,811 (43,253 in 1937); and to other places under the Acts 8,999 (19,994 in 1937). There were, in addition, 58,328 other official visits and attendances (35,734 in 1937). Prosecutions totalled 914 (2,347 in 1937), the majority dealing with safety. Examining surgeons made 190,637 statutory medical examinations of young persons for employment (384,870 in 1937) and re-examined 2,669 persons under and 1,862 over 16 years of age. A further 290,842 examinations were made under various regulations (353,851 in 1937).

Accident Statistics and Accident Prevention

During 1947 there were 203,236 notifiable accidents at premises subject to the Factories Act, a decrease of 9.2 per cent. compared with 1946. Of these accidents, 839 proved fatal, an increase of 1.6 per cent. over 1946.

The distribution of accidents by causes, together with a comparison with 1946 is shown in table I.

[1] Cmd. 7621, H.M. Stationery Office, London, price 2s. 6d. For 1946, see *Industrial Safety Survey*, Vol. XXIV, No. 1, p. 27.

TABLE I

	1946	1947
Machinery moved by mechanical power:		
Prime movers	139	197
Shafting	116	132
Belts, ropes, etc.	874	803
Lifting machinery	4,364	4,260
Milling machines	534	432
Power presses	687	665
Circular saws	2,118	1,939
Planing machines	929	817
Verticle spindle moulding machines	321	345
Other woodworking machinery	898	765
Nip accidents	573	565
Other accidents	24,123	21,867
Transport:		
Railways	2,676	2,669
Other vehicles	3,393	3,533
Other Accidents:		
Electricity	769	734
Explosions	1,464	1,338
Fires	609	492
Gassing	242	244
Molten metal, etc.	9,261	8,353
Lifting machinery (non-power)	1,222	1,232
Other machinery (non-power)	2,851	2,625
Use of hand tools	21,705	19,846
Struck by falling body	22,403	18,885
Persons falling	27,849	26,046
Stepping on or striking against objects	16,619	14,073
Handling goods in manufacturing, etc., processes	64,876	58,869
Other accidents	12,144	11,510
Total all accidents	223,759	203,236
Additional Particulars [1]:		
Cleaning of machinery in motion:		
Men	515	503
Women and young persons	503	449
Eye injuries from particles, etc., thrown in process	6,389	5,605
Other eye injuries	4,196	3,829
Materials or articles while in motion in a machine	738	641
Immersion of any part of the body in scalding, etc., fluid	107	112
Sepsis	24,183	22,993
Other than electrical but associated with electricity	123	101

Table II shows the percentage distribution by main cause groups.

TABLE II

Cause	Percentage of total accidents	
	1937	1947
Power-driven machinery	19.7	16.7
Molten metal or other hot or corrosive substances	5.4	4.4
Use of hand tools	9.3	9.9
Struck by falling body	11.0	8.8
Persons falling	11.3	12.0
Stepping on or striking against objects	6.8	7.0
Handling goods	25.2	29.2
Other causes	11.3	12.0

[1] These additional particulars relate to certain accidents already included in the first part of the table.

Table III gives the fatal and non-fatal accidents in factories alone from 1937 to 1947.

TABLE III

Year	Fatal accidents		Non-fatal accidents	
	Numbers	Per cent. of 1937	Numbers	Per cent. of 1937
1937	716	100	176,013	100
1938	627	88	159,926	91
1939	724	101	169,829	96
1940	948	132	209,240	119
1941	1,095	153	249,084	142
1942	991	138	295,643	168
1943	913	127	293,389	167
1944	757	106	266,009	151
1945	651	91	225,810	128
1946	556	78	207,031	118
1947	516	72	185,231	105

Men suffered 77.5 per cent. of all accidents in factories in 1947, women, 12.5 per cent., boys under 18, 7.1 per cent. and girls under 18, 2.9 per cent.

Frequency rates were calculated, on the basis of total man-hours worked for 28 industries. The figures were drawn from 779 factories employing 820,525 workers. Industries with the lowest rates were printing, 0.52; tobacco and cigarette manufacturing, 0.90; radio and light electrical engineering, 1.07; aircraft and aero engines, 1.16; cotton, 1.31; pharmaceutical chemicals and cosmetics, 1.33; artificial silk, 1.33; and oil refining and extracting, 1.35. The highest rates were for food (except confectionery), 3.09; sawmills, general woodworking and cabinets, 3.10; electricity generation, 3.11; gas, 3.14; iron and steel extraction, conversion, rolling and tubes, 3.50; non-ferrous metal extraction, conversion, rolling and founding, 3.66; beet sugar, 3.68; and iron and steel founding, 3.75. The average rate for all industries was 2.27.

Non-Machinery Accidents

Non-machinery accidents accounted for 83.3 per cent. of all accidents in factories in 1947. In spite of the fact that accidents caused by "handling of goods" and "persons falling" were surveyed in some detail in the 1946 report, the percentages of accidents due to both of these causes rose slightly although the actual numbers fell. The two categories together accounted for 41.2 per cent. of all accidents. The Chief Inspector states that an effort must be made to educate all persons in factories in correct methods and to see that they are safety conscious.

The report also discusses accidents at docks and warehouses, in building operations and in engineering construction; and falls through fragile

roofing, of which approximately one in five had fatal consequences.

Accident Prevention Schemes

Progress was reported in the setting up of new safety organisations in factories, and safety officers were appointed in most parts of the country. Most of the committees were composed jointly of representatives of managements and workers. In one factory, the safety committee co-opted two juvenile members with the object of giving them an insight into the problems involved. The young persons serve for a year on the committee and are then replaced by two more. In this way it is hoped that safety consciousness and a sense of responsibility will be inculcated in the workers at the earliest opportunity in their careers.

There was also increased activity of area and local industrial accident prevention group associations and similar bodies. In some localities, safety exhibitions were held and appropriate films shown.

The Chief Inspector was gratified to report that the idea of "organising for safety" had spread, and that if the present tendency persisted, it might one day be the exception for a firm of any size not to have an active accident-prevention scheme in force.

Power Presses

Power presses still figured as one of the types of machine producing serious accidents. The Chief Inspector states that restricted output of manufacturers' guards owing to shortage of steel was one of the major causes of accidents, although in too many instances simple fixed guards were either not provided or inadequate.

A comparison of accidents caused by trapping between the tools and dies of power presses in 1945, 1946 and 1947 is shown in table IV.

TABLE IV

Type of guard	1945	1946	1947
Fixed	80	122	140
Automatic	95	120	123
Interlock	35	50	91
No guard	113	157	169
Total	323	449	523

The Chief Inspector strongly urges that guards be incorporated in the design of the press.

Experiments were carried out in the use of photo-electric control as a means of safeguarding hydraulic presses working on metal; the effectiveness of this arrangement in arresting and reversing the movement of the ram was impressive. The tests were being continued.

Printing Machinery

The number of accidents reported on machinery in the printing and allied trades (865), showed an increase of approximately 25 per cent. on the number in 1946. Letterpress printing machines, platen printing machines and wire-stitching machines were responsible for over 40 per cent. of the total. Although these machines are invariably fitted with guards intended to prevent the fingers being crushed between the descending head and the anvil, the guards were often found to be ineffective. Special attention was being given to these machines and it was hoped that accidents would be reduced considerably when conditions became more normal and facilities were available to makers to manufacture guards as and when required.

Cranes, Hoists, Lifting Tackle

The report contains information on accidents occurring with cranes, hoists and lifting tackle.

A total of 3,575 accidents, 59 of which proved fatal, occurred with cranes of various kinds. Of these, overhead travelling cranes accounted for 1,641 (14 fatal) and power operated travelling jib cranes for 1,247 (34 fatal). The principal causes of accidents of this type were crushing between the load and some other point (except sling) with 754 accidents; load or part of load falling from sling, 666; swinging load, sling or crane hook, 621; and crushing between load and sling, 401.

Although the total number of accidents involving cranes increased 40 per cent. since the Factories Act came into force in 1938, fatal accidents decreased from one in 42 to one in 58. The increase in the total was mainly due to the greater number of cranes in use, particularly those of the mobile type, accidents on power-operated travelling jib cranes having increased 90 per cent.

This part of the report deals also with accidents to young persons, accidents in the cotton industry, steam boilers and steam receivers and gasholders.

Fire and Explosions

The report briefly describes seven fires that occurred during 1947 in celluloid storage or processing rooms. It then goes on to discuss in detail the design of buildings where dust explosions are likely to occur.

Electrical Accidents

Electrical accidents reported to the Department under the Factories Act during 1947 numbered 734, of which 30 were fatal, compared with 769 accidents (33 fatal) in 1946. The total includes 149 cases of eye-flash from electric welding. Skilled electricians, jointers, etc., suffered 189 non-fatal and six fatal accidents, and

skilled fitters, erectors, etc., 36 non-fatal and three fatal accidents.

The apparatus most frequently involved in these accidents was electric welding equipment, 173 accidents (149 eye-flash and 24 shock and/or burns); cables and flexibles, 127 (portable apparatus 48, fixed installations, 79); switchgear below 650 volts, 98; fusegear, 48; and testing apparatus, 46.

Of the 30 fatalities, 18 occurred on alternating current systems below 250 volts, five on alternating current systems between 5,000 to 10,000 volts, and four on alternating current systems over 10,000 volts.

The report discusses the use of electricity in manufacturing processes, the manufacture of switches and socket-outlets, flame-proof electrical equipment, electronics, etc.

Gassing Accidents

There were 244 reported cases of gassing during the year, including 22 fatal. Of these, 131 involved carbon monoxide (19 fatal); 22 involved chlorine; 17 trichlorethylene (two fatal); and 14 sulphuretted hydrogen (seven fatal). The report contains brief descriptions of a large number of the gassing accidents.

Industrial Diseases

Numerous industrial diseases and dangerous substances are discussed in the report. There were 58 cases of lead poisoning (two fatal); 203 cases of epitheliomatous ulceration (16 fatal); and 296 cases of chrome ulceration. Pitch accounted for 98 cases (two fatal) of epitheliomatous ulceration; tar for 75 (three fatal); paraffin for one; and oil for 29 (15 fatal). Of the chrome ulceration cases, 59 occurred in chromium plating.

Reported cases of dermatitis in 1947 numbered 4,884 as compared with 6,166 in 1946.

The report also contains information respecting medical supervision and nursing services.

Health and Welfare

Underground workrooms, cleanliness, heating, lighting, colour, washing, cloakroom and canteen facilities are dealt with under this heading.

The Chief Inspector reports that colour in factories had undoubtedly come to stay. Progress in the adoption of colour schemes was maintained in spite of the difficulties of the times, and colour planning was being taken up with enthusiasm in the heavier industries, where dull and drab surroundings were the rule.

Definite progress was made in particular in the cotton and wool textile industries.

It was more clearly recognised that lighting and colour schemes are interdependent and should be planned together. For example, a colour scheme which is excellent in daylight may have its balance destroyed entirely by certain forms of artificial lighting; conversely, undesirable shadows creating dark areas around machines may be appreciably lightened by painting the walls and machines in lighter colours.

Safety, Health and Welfare Museum

The service rendered in the way of advice and information to industrial personnel and those with allied interests was rapidly returning to its pre-war level. Approximately 10,000 persons visited the Museum in 1947. Organised parties numbered 320.

A considerable proportion of the parties was made up of ex-servicemen who visited the Museum as part of their business training course. Apprentice groups formed another important section of visitors. An outstanding feature was the number of groups of apprentices from factories where works' training schools had been established.

Owing to the shortage of supplies it was not possible to acquire any new large exhibits of machinery. However, many models and photographs were received from co-operative firms and a considerable number of small exhibits covering a wide range of subjects was placed on exhibition. Serious consideration was also given during the year to the use of more effective and more modern methods in the different sections of the Museum.

The use of outside exhibitions for propaganda purposes increased and the Museum was very helpful in providing suitable exhibits for this purpose. Assistance of this kind was given to 17 such exhibitions in 1947; eight of these were open to the general public; the remainder were works exhibitions, training courses or special functions abroad.

UNITED STATES OF AMERICA

Injuries and Accident Causes in Fertiliser Manufacturing [1]

The Bulletin discusses accident frequency and severity rates, accident causes and safety precautions.

In 1940 the fertiliser industry had an accident frequency rate of 35.7 as compared with 15.7 for chemical industries generally and 19.9 for all manufacturing industries. The severity of injuries is also higher in the fertiliser industry than in the general body of manufacturing industries.

Fertiliser manufacturing is divided into three main processes — the manufacture of sulphuric or phosphoric acid, the manufacture of superphosphate, and mixing processes. Plants making superphosphate had a frequency rate of 40 and a severity rate of 0.7; for those engaged in dry

[1] United States Department of Labor, Bureau of Labor Statistics: *Bulletin No. 949*, Washington, 1949. 32 pp.

Type of safety programme	No. of establishments	No. of employees	Frequency rates				Severity		
			All disabling injuries	Death and permanent total disabilities	Permanent partial disabilities	Temporary total disabilities	Average number of days lost or charged per injury		Severity rate
							All disabling injuries	Temporary total disabilities	
With full-time safety engineer	14	2,306	17.4	0.2	0.8	16.4	168	17	2.9
With safety committee	12	2,127	17.3	0.2	0.9	16.2	182	15	3.1
Of supervisory employees	8	615	27.7	0.7	—	27.0	171	14	4.7
Of supervisory and non-supervisory employees	4	1,512	12.9	—	1.2	11.7	192	16	2.5
Without full-time safety engineer	472	21,907	36.0	0.3	1.0	34.7	92	16	3.3
With safety committee	157	11,545	38.0	0.3	1.0	36.7	94	16	3.6
Of supervisory employees	47	3,589	40.0	0.5	1.0	38.5	127	18	5.1
Of supervisory and non-supervisory employees	79	6,717	35.9	0.3	1.0	34.6	90	15	3.2
Without safety committee	310	10,251	33.5	0.2	1.0	32.3	91	17	3.0
Total[1]	521	27,460	35.7	0.3	0.9	34.5	99	15	3.5

[1] Totals include figures not shown separately because of insufficient data.

mixing the rates were 31.9 and 3.4; for combined superphosphate and dry mixing plants they were 37.4 and 4.5; and for plants engaged in all three processes they were 40.7 and 2.4. It is considered that the manufacture of superphosphate is the branch of the industry in which accident frequency is highest, although the severity of accidents in this branch is lower than in the others.

Of 521 establishments investigated, 226 employed fewer than 25 workers each; 67 employed up to 100 workers and 11 employed 250 or more. The accident rates for the different sizes of establishment were: less than 25 workers, frequency 33.9, severity 2.4; 25-49 workers, frequency 30.5, severity 3.9; 50-99, frequency 37.0, severity 3.7; 100-249, frequency 39.2, severity 2.0; 250 and over, frequency 32.7, severity 6.3.

Fourteen of the 521 plants had a safety engineer and 169 had a safety committee (12 had both). The following table compares the accident rates of establishments on the basis of their safety organisation.

Of 482 plants which reported upon their first-aid facilities, 259 indicated that they had established regular first-aid rooms. However, only 7 of these first-aid rooms were staffed with professional attendants. Of the 223 plants without first-aid rooms, 152 provided first-aid kits and 71 made no provision at all for first-aid treatment on the premises. Plants with first-aid rooms had an average frequency rate of 33.7 as compared with 34.4 for the others. The seven plants with professional attendants had a rate of 14.3.

Reports from 185 establishments indicate that in 23.2 per cent. of the accidents the head is injured, in 21.4 per cent. the trunk, in 26.2 per cent. the upper extremities, in 27.3 per cent. the lower extremities and in 1.8 per cent. the body generally. Eye injuries account for 16.9 per cent. of the total.

The percentage distribution of accidents according to the agency involved in 165 establishments was: machines 6.7, hoisting apparatus 1.8, conveyors 4.8, boilers and tanks 2.8, vehicles 20.4, electrical apparatus 1.2, hand tools 9.6, chemicals 7.0, working surfaces 13.0, containers 6.4, and miscellaneous 26.3. The principal types of accident were: "struck by" 37.2 per cent.; inhalation, absorption, ingestion 13.0; "striking against" 12.2; "caught in, on or between" 11.7; overexertion 10.6; falls 9.8.

The percentage distribution of accidents by unsafe working conditions (148 establishments) was: improperly guarded agencies 16.3; defective agencies 36.0; hazardous arrangements or procedures 36.0; lack of personal safety equipment 10.9; others 0.8. The commonest unsafe acts (160 establishments) were: using unsafe equipment or equipment unsafely 33.7 per cent.; taking unsafe positions or postures 33.3; operating or working at an unsafe speed 12.3; failure to use personal safety equipment 10.9.

The Bureau of Labour Statistics comments on these and other figures, which are presented in 16 tables, briefly describes numerous typical accidents and makes suggestions for preventing recurrences.

REVIEW OF PERIODICALS

Industry's Interest in Health and Safety Services. By H. W. SCHWARTZ. (*Industrial Medicine*, August, 1948, p. 287.)

This article discusses the cost of human disabilities to industry and to the general public and the value of health and safety programmes in industry.

The author underlines the fact that, in spite of close co-operation between medical and accident prevention services, each year, the American workman still loses an average of nine days, 18,000 workers are killed in the course of employment and 1,800,000 are injured at a direct cost of $ 740,000,000 for deaths and injuries and of at least another $10,000,000 for occupational diseases. The production time lost annually through illness is estimated at 300,000,000 days.

By the prevention and control of diseases and accidents, care and placement of physically disabled workers and plant sanitation, health services in industry account for a substantial reduction in losses due to occupational illness and injury, absenteeism, insurance cost, waste of raw and worked materials. These services thus bear a direct and beneficial weight on general production activities.

In the past, much attention has been devoted to the engineering aspects of accident and disease prevention, possibly at the expense of the most important production element, *i.e.*, the human factor. Examples are cited in the article which show the importance of pre-employment and periodical physical examinations. These examinations may well be applied not only to detect physical defects which hinder production but also to diagnose mental disturbances which are claimed to affect 75 per cent. of people who visit physicians, and which very probably affect a substantial percentage of industrial workers.

Industrial Accident Prevention. By H. Greenwood THOMAS. (*Australian Standards Quarterly*, October 1948, p. 4.)

Expresses the view that the basic methods of scientific accident prevention are investigation, standardisation and training, and explains how the Australian Standards Association is applying these methods. The Association is planning to compile codes for accident statistics, general principles of accident prevention and, for specific subjects such as eye protection, safety colours and various items of personal protective equipment. These codes will provide a basis for the framing of safety rules in individual undertakings.

Prevention of Accidents. (*British Medical Journal*, 4 December 1948, p. 993.)

The prevention of accidents was discussed at a meeting of the Section of Epidemiology and State Medicine at the Royal Society of Medicine held on 1 November 1948. The present article summarises the discussion, which was mainly concerned with accidents in the home and the medical treatment of the victims.

Time Loss due to Industrial Injuries in Illinois during 1947. (*Illinois Labor Bulletin*, December 1948, p. 14.)

In 1947, 156,187 industrial injuries resulted in an estimated time loss of 11,702,000 man-days, the estimate being based on the scale of standard time charges accepted by the American Standards Association. The total includes 45,069 compensation cases closed in 1947, which accounted for 10,363,000 man-days, and 109,331 non-compensable temporary disabilities, which accounted for 361,000 man-days. The largest items in the aggregate of 10,363,000 man-days were 7,108,000 in respect of 15,411 permanent partial disabilities and 2,076,000 in respect of 346 fatalities.

Lighting and Visual Efficiency : The Present Status of Research. By M. E. BITTERMAN. (*Illuminating Engineering*, September 1948, p. 906.)

A large part of this paper is devoted to an analytical and philosophical discussion of human efficiency, performance and fatigue. It deals in some detail with the most important theoretical concepts and experimental findings which bear on the problems of illumination standards. The conclusion drawn is that present-day lighting standards rest on unstable ground. Measures of performances actually in use leave much to be desired and measures of physiological cost are only in the earliest stages of development. There is a pressing need for fundamental research in this field.

A discussion of the paper by Matthew LUCKIESH, Director, Lighting Research Laboratory, General Electric Co., Cleveland, Ohio, is also included.

Unusual Uses for Vacuum Cleaning. (*Safety Engineering*, October 1948, p. 87.)

Several applications of vacuum cleaning equipment are suggested to improve safety, welfare and health conditions in industry. The article gives a list of industrial operations in which vacuum cleaning may be effectively used and shows by means of several convenient illustrations the method of application of vacuum cleaning systems in a few actual cases, such as in the food industry, garages, foundries, chemical industries and miscellaneous general plant and equipment cleaning.

The Right Finish, the Right Color. (*Safety Engineering*, Vol. 96, No. 6, December 1948, p. 18.)

The effectiveness of paint as a safety device and a psychological agent to reduce fatigue and cut down absenteeism, etc., is emphasised in this article. Colour codes used in industry are briefly described and it is pointed out that paint is an important factor in good housekeeping.

Paint, colour and lighting are closely interrelated in industry, and care should be taken to use all three to the best advantage. Paint chemists have evolved paints suitable for almost all kinds of industrial premises. These are enumerated in

the article. In conclusion, recommendations are made respecting the types of paint most suitable for various premises and machinery, methods of applying them, etc.

The Modern Automatic Sprinkler System. (*Occupational Hazards*, September 1948, p. 30.)

A brief outline is given of the various types of automatic sprinklers in use in the United States of America. There are approximately 250,000,000 of these devices at present in service in the country, and the records of the National Fire Protection Association show that in the last 47 years, 96 per cent. of the fires occurring in "sprinklered" properties were extinguished or held in check by the sprinklers.

La Prevenzione Infortuni Agricoli Nella Scuola. By Prof. Raffaele RESTA. (*Rivista degli Infortuni e delle Malattie Professionali*, May-August 1948, p. 504.)

This article reproduces the speech made by Professor Resta at the opening of the first course on accident prevention in agriculture held recently at the University of Bari. The course, for elementary school teachers, was held under the auspices of the National Industrial Accident Insurance Institute.

After touching on the social and economic aspects of the problem of accident prevention, Prof. Resta discussed the specific problems involved in preventing agricultural accidents in Italy.

Tradition and the belief in chance are deeply ingrained, and it is the task of educators to persuade agricultural labourers to take the measures necessary for their safety. The importance of the human factor in accidents is strongly emphasised and the psychological aspect of accident prevention discussed. In Italy 90 per cent. of agricultural accidents are due, not to machinery, but to farm tools such as ladders, ploughs, scythes, axes, etc., and this is attributed to the fact that the labourer has become so familiar with these tools that he no longer considers them dangerous and fails to take the necessary precautions when using them.

The farm worker must be taught that accidents caused by these implements are not necessarily an act of "fate" but are almost always due to carelessness or ignorance in handling.

Education and foresight are of the utmost importance.

Safe Methods in the Anthracite Field. By H. A. LEIDICH. (*Mining Congress Journal*, December 1948, p. 27.)

The author, who is the Safety Engineer of the Philadelphia and Reading Coal and Iron Co., describes the Company's safety organisation and activities.

He prefaces his description with the question how the best results can be obtained in safety work, and suggests that each supervisor should put his problems squarely to the men, encourage them to think and give them to understand that their ideas will receive due credit. Safety work is never so successful as when ideas emanate from the men themselves.

The Company's safety organisation comprises a general safety committee, of which the General Manager is chairman; divisional committees, with divisional superintendents as chairmen; departmental committees; sectional committees; and a Safety Inspection Department. The composition and activities of these bodies are described briefly.

The Safety Inspection Department, which consists of six inspectors and a safety engineer, makes daily inspections not only for the usual purposes, but also to give due credit for good safety work by supervisors.

The author also describes the procedure for investigating accidents, training in first aid and rescue and other special features of the Company's safety organisation. Emphasis is laid on the value of education and training for safety purposes.

Included in the article are the Company's shotfiring rules.

Safe Timber Recovery in Coal Mining. By George H. SAMBROOK. (*Mining Congress Journal*, October 1948, p. 23.)

The author traces the development of methods of removing mine timbering from the use of axes and sledge hammers by way of bar, chain and lever devices, locomotives and ropes, power-operated drums and ropes, to the use of the rope and sling method described, with illustrations, in the article.

The essential features of this method are as follows:

(1) Steel rope slings, approximately 4 ft. in diameter, are looped over those crossbars which, in the judgment of the section foreman, can be safely recovered. These slings are attached to the rib side of the crossbars.

(2) The slings are then threaded with the master rope, starting from the curve to the inbye timber to be recovered.

(3) Cribs (chocks) are then extracted by the use of a locomotive, and an auxiliary steel cable, beginning at the inbye end and removing the cribs singly.

(4) The master rope, which is already strung through the loops on the crossbars, is then attached to the locomotive and the crossbars are extracted in a single operation.

All the crossbars are in place while the cribs are being extracted, but the master cable and slings are on the crossbars before any of the roof supports are pulled. Thus, after the cribs are taken out, it is no longer necessary to go back into the fall area to hook on to the timbers, and the exposure time of the workmen in that area while recovering timbers is reduced to nil.

This system has reduced serious accidents by 70 per cent. in ten years, and has completely eliminated fatal accidents. Furthermore, the number of man-hours required to complete a roof fall has been reduced by 50 per cent.

Mining Gear Failures from a Metallurgical Aspect. By R. JEFFREY. (*The Colliery Guardian*, 20 January 1949, p. 69; 27 January 1949, p. 129.)

Metallurgical Aspects of Mining Gear Failures. By R. JEFFREY. (*The Iron and Coal Trades Review*, 21 January 1949, p. 123.)

The author discusses defects and failures of colliery haulage and winding gear, their causes and means of avoiding them.

The following table indicates the defects (D) in specimens of gear examined and the most probable causes of failure (F).

	Haulage						Winding					
	Wrought iron		Steel		1.5% mn. mild steel		Wrought iron		Steel		1.5% mn. mild steel	
	D	F	D	F	D	F	D	F	D	F	D	F
Poor material	85	68	23	16	3	1	26	9	—	—	—	—
Bad welds	67	56	18	17	—	—	25	21	3	3	—	—
Poor workmanship during fabrication	28	23	21	21	3	2	3	3	5	4	2	2
Faulty design	9	7	5	1	1	—	4	2	2	2	—	—
Defects due to colliery heat treatment	26	11	19	19	—	—	7	4	3	3	—	—
Defects due to service (surface hardening and wear)	38	23	6	4	—	—	2	—	1	1	—	—
Overloading	9	9	10	10	2	2	4	3	1	1	1	1
Fatigue	1	1	11	11	—	—	4	1	10	10	1	1
Satisfactory	32	32	21	21	5	5	8	8	2	2	7	7
Totals	295	230	134	120	14	10	83	51	27	26	11	11

These various causes are examined in detail.

As regards material for haulage and winding gear, the author recommends 1.5 per cent. manganese mild steel, which can be improved by quenching and tempering.

Heat treatment (annealing and normalising) is recommended for haulage gear, but it is usually not advisable to give it at the colliery, which is not likely to possess satisfactory equipment for the purpose.

The author's recommendations concerning materials, welding, heat treatment, and design are summarised in the form of conclusions.

Reducing Mine Haulage Accidents. (*Mining Congress Journal*, July 1948, p. 50.)

In this paper the Safety Committee of the American Mining Congress publishes reports by six companies showing how haulage accidents occur and what methods are being used to prevent them.

Among the points on which emphasis is laid are power failures, mechanical failures, haulage tracks, despatching systems, signalling, coupling and uncoupling vehicles, education and training.

Brief descriptions are given of a number of haulage accidents.

Transportation — Key to Successful Mechanization. (*Mechanization*, August 1948, p. 61.)

In a general review of modern American practice in mine transport, various haulage systems are analysed and sets of safety rules for their operation formulated. These rules relate to track haulage, shuttle car operation and conveyors.

La combustion des mélanges grisouteux. By E. AUDIBERT. (*Revue de l'Industrie Minérale*, No. 532, May 1948, p. 297.)

Mr. Audibert's paper is divided into five parts: (1) the mechanism of active combustion of firedamp; (2) the ignition of firedamp and the reactions that induce this ignition; (3) the effects of heating on firedamp; (4) the propagation of active combustion; and (5) the cessation of active combustion.

The author first gives reasons for accepting the chain-reaction theory of the combustion of methane and discusses the mechanism of such reactions. He then proceeds to discuss mechanisms that may provoke ignition of methane — raising the temperature of the methane, the generation of an electric spark, contact with a flame, introduction into the methane of a body that decomposes under the action of heat or radiation (*e.g.*, peroxides, certain nitrates and chlorates), fragmentation of molecules and the action of certain oxidisable metals. The effect of heating methane is discussed at length under the following heads: surface combustion, molecular oxidisation, ignition due to heating by contact with solids, and slow combustion on contact with solids. From the above the conclusion is drawn that there are two different mechanisms of combustion: one involving the action of atoms and radicals in chain reactions and the other involving the heating and compression of the layer of methane in the vicinity of a flame, which may lead to molecular oxidisation of the methane. Lastly the author discusses means of arresting chain reactions and thus terminating active combustion; these means include certain organic brominated compounds, solid surfaces such as the gauze of safety lamps, the flameproof gaps of electrical equipment and stone-dust barriers.

Poor College Safety Training Chided. (*Chemical and Engineering News*, 1 November 1948, p. 3261.)

This brief report, prepared by the staff of the American Chemical Society, outlines some of the important discussions which took place in the chemical section of the National Safety Congress held in Chicago, 18 to 22 October 1948. The need for developing safety consciousness in the student at the college laboratory is particularly stressed so that the men would already be prepared when they come into industry, to cope with the hazards of handling chemicals.

Attention was also given by the speakers to the important phase of tank car loading and unloading in chemical works and they all agreed that a safety dome platform is needed for carrying out this operation in a safe manner. Suggestions were also offered to the effect that tank cars should be standardised and that plants be equipped with a good unloading platform of the swinging or sliding type in order to develop more effective safe practices.

Violence Experienced in Ball's Reaction. By R. T. MIXER. (*Chemical and Engineering News*, No. 33, August 1948, p. 2434.)

In this article, the author describes a violent reaction that occurred when a naphthenic type of gas oil was treated with mercuric nitrate.

It is of special interest because in the analysis of sulphur compounds in petroleum fractions, mercuric nitrate has been used as the extraction agent (Ball's reaction), and in all previous work there has been no indication that such violent reaction could be expected.

The occurrence was as follows:

1. The batch consisted of 1,500 grammes of untreated gas oil which was stirred vigorously with

500 grammes of mercurous nitrate in a three litre flask for three hours. This was repeated twice and the stock washed with water and filtered.

2. The gas oil treated as above was stirred vigorously, at room temperature, with 500 grammes of finely crushed mercuric nitrate.

The reaction was going well and after one and a half hours of stirring the layer had formed one solid mass and was moving around with the stirrer in the flask. After 10 minutes there was a moderate evolution of white fumes and three seconds later the reaction became violent with generation of heat and copious evolution of white and reddish-brown fumes.

A similar reaction also occurred during analysis of cracked naphtha when the stock was added to the mercuric nitrate in a flask.

Sources of Ohio's Construction Injuries in 1947. (*Ohio Industrial Commission Monitor*, September 1948, p. 134.)

This article gives a cause analysis of injuries sustained by carpenters, bricklayers, plumbers, steam-fitters, painters, paper-hangers, and electricians, as a guide for establishing an accident prevention programme in the building trades.

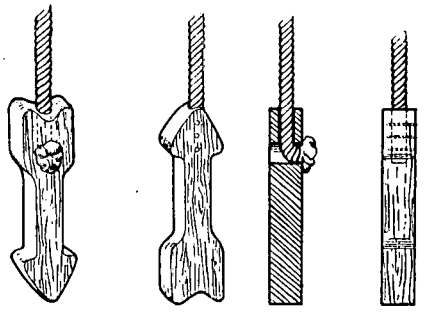
A total of 7,409 injury cases were reported, including 24 cases of permanent partial disability and 39 fatality cases. Also given in the analysis is a breakdown of the cases according to agency, type and nature of the accidents.

The Accident Potential of Steam Boiler Plant. By Sydney D. Scorer. (*The British Journal of Industrial Safety*, No. 8, Winter 1948, p. 115.)

Discusses the commonest causes of boiler accidents, including corrosion, overheating, low water, overpressure, defective supports, manhole joints, flue gases, residual pressure in boilers out of service, and blow-offs. Also mentions causes of accidents with economisers.

Arrows Identify Hoist Controls. (*The Machinist*, 2 October 1948, p. 760.)

Brief note on the use of wooden arrows to identify the rope controls of monorail electric hoists. These arrows are easy to make; the ropes



are inserted in holes drilled in the ends of the arrows and are either knotted or nailed in place (see fig.).

Some Fundamental Principles of Machine Guarding. By Henry A. Hepburn, Deputy Chief Inspector of Factories. (*The British Journal of Industrial Safety*, No. 6, 1948, p. 83, and No. 7, 1948, p. 99.)

The principles formulated and discussed in this article are based on the assumption that the ultimate objective in the safeguarding of dangerous parts of machinery is to ensure the absolute immunity from injury of every person employed at or near machinery of all kinds, that is, a zero frequency rate. Complete immunity from accidents, however, will never be achieved by safeguarding alone, since an accident on machinery is caused by the combination of two actions: that of the dangerous parts and that of the person injured. Hence the provision of guards must be supplemented by the training of all persons concerned in safe working practices and by the constant exercise of supervision to ensure that no hazardous working practice is adopted by a machine operative.

The author quotes Heinrich's estimate that of every 330 dangerous occurrences, 300 result in no injury, 29 in minor injuries and 1 in a major injury as evidence that immunity from accident over a number of years is no proof that an unguarded machine is not dangerous; and this leads him to his first principle of safeguarding.

"*The principle of inevitability.* An injury-producing accident will inevitably occur to a person employed on a machine having parts which experience has proved to be dangerous and which is normally used with the said parts not securely fenced."

The experience of over a hundred years has shown which parts and combinations of parts of machines are dangerous and of these it can be said that they have caused accidents in the past, are causing them today, and will cause them in the future. This suggests the second principle of safeguarding.

"*The principle of intrinsic danger.* Certain parts or combinations of parts are intrinsically dangerous in that they have caused accidents in the past, are causing them at the present time and will continue to cause them in the future."

The dangerous parts and combinations of parts can be divided into 25 groups as follows:

"1. revolving shafts, spindles, mandrels and bars (machine shafts; sensitive drilling machine spindles, chucks and drills, etc.; larger drilling machine spindles; boring bars; stock bars; traverse shafts on milling machines, etc.);

2. in-running nips between pairs of revolving parts (gear wheels; friction wheels; calender bowls; mangle rolls; metal manufacturing rolls; rubber washing, breaking and mixing rolls; etc.);

3. in-running nips of the belt and pulley type (belts and pulleys, plain, flanged or grooved; chain and sprocket gears; conveyor belts and pulleys; metal coiling, etc.);

4. projections on revolving bars (keyheads, set screws, cotter pins, coupling bolts, etc.);

5. discontinuous rotating parts (open arm pulleys, fan blades, spur gear wheels, etc.);

6. revolving beaters, spiked cylinders and drums (scutchers, rag-flock teasers, cotton openers, laundry washers, etc.);

7. revolving mixer arms in casings (dough mixers, rubber solution mixers, etc.);

8. revolving worms and spirals in casings (meat mincers, rubber extruders, spiral conveyors, etc.);

9. revolving high speed cages in casings, hydro-extractors, centrifuges, etc.;

10. abrasive wheels (manufactured wheels, natural sand stones and others);

11. revolving cutting tools (circular saws, milling cutters, circular shears, wood slicers, routers, chaff cutters, etc.);

12. reciprocating tools and dies (power presses, drop stamps, relief stamps, hydraulic and pneumatic presses, bending presses, hand presses, revolution presses and others);

13. reciprocating knives and saws (guillotines for metal, rubber and paper cutting; trimmers, corner cutters, perforators, etc.);

14. closing nips between platen motions (letterpress platen printing machines, paper and cardboard platen machine cutters, some power presses and similar adaptations);

15. projecting belt fasteners and fast running belts (bolt and nut fasteners; wire pin fasteners and the like; woodworking machinery belts; centrifugal belts; textile machinery side belting, etc.);

16. nips between connecting rods or links and rotating wheels, cranks or discs (side motions of certain flat bed printing machines, jacquard and other automatic looms, and various other machines);

17. pawl and notched wheel devices for intermittent feed motions (planer tool feed motions, power press dial feed tables, etc.);

18. nips between reciprocating and fixed parts, other than tools and dies (metal planer reversing stops; sliding tables and fixtures; cotton spinning mule carriages and back stops, pillars, etc.; shaping machine tables and fixtures; tool steady guide and steady arm on turret lathes, etc.);

19. nips between revolving control handles and fixed parts (traverse gear handles of lathes, milling machines and the like);

20. moving balance weights and dead weights (hydraulic accumulators, counter balance weights on large slotting machines, etc.);

21. nips between revolving wheels or cylinders in pans or on tables (sand mixers, edge runners, crushing and incorporating mills, dough brakes, mortar mills, leather currying machines, etc.);

22. cutting edges of endless band cutting machines (woodworking band saws, log-cutting band saws, metal-cutting and stone-cutting band saws, cloth-cutting band knives, etc.);

23. nips between gears and rack strips (inker roller drives on L.P.P. and lithographic machines, some planing machine drives, etc.);

24. revolving drums and cylinders — uncased (rumblers in the foundry, shaking barrels, barrel type dough mixers, varnish mixers, rag digesters, etc.);

25. nips between fixed parts and uni-directional moving parts (buckets or hoppers of conveyors against tipping bars, stops or parts of the framework)".

Mr. Hepburn doubts whether absolute safety can be achieved by position; the unpredictability of the human factor militates against it, and accordingly this factor cannot be fully relied on. His third principle is therefore "non-reliance".

"*The principle of non-reliance.* In the assessment of the degree of danger associated with any dangerous parts of machinery, no reliance should be placed upon the co-operation of any person employed in avoiding an accident".

Nevertheless safety education and training are essential aids to accident prevention because they reduce the frequency of dangerous occurrences and hence, by Heinrich's law, the frequency of accidents.

The intrinsic danger of the twenty-five groups of dangerous machinery having been proven by experience, that danger must be removed either at the design stage by safer construction or — before use — by secure fencing. It is in this connection that the machine designer can promote safety, probably to a greater degree than any other person, especially in regard to those parts which are not required to be altered when the machine is put in production. The fourth principle is therefore elimination.

"*The principle of elimination.* Dangerous parts of machinery inevitably produce accidents so that, if all accidents are to be prevented, the danger of the said parts must be eliminated either by construction or by secure fencing. This leads to the fifth principle, 'no-risk and non-use'."

"*The principle of no-risk and non-use.* The intrinsic danger of certain parts of machinery having been established, it is essential for the prevention of accidents that no person should be exposed to the risk of injury at a machine possessing such parts when the dangers have not been eliminated. If the machine is dangerous in any respect it must not be used until rendered safe either by reconstruction or by secure fencing."

The unreliability of the human factor and the need for safety education and training are reflected in the sixth principle.

"*The principle of training in safety precautions.* Since accidents will inevitably happen should unsafe acts be repeated by the personal factor, it is essential, in addition to eliminating the dangerous parts of machinery, that all persons should be properly and constantly trained in the knowledge and application of safe practices so as to reduce the repetition of unsafe acts".

Lastly, the efficiency of production depends, not only on the maintenance of machinery and plant, but also on the good health and absolute safety of the personnel. The seventh principle, therefore, concerns production, safety and efficiency.

"*The principle of production safety efficiency.* The over-all production efficiency of machinery depends upon the separate efficiencies of each factor involved. It is, therefore, essential, for obtaining the highest possible over-all efficiency, that not only should each machine be maintained at the maximum working efficiency but that all dangerous parts should be securely guarded and all operatives fully trained in safe practices so that the material and personal factor efficiency may be a maximum."

The author next considers the various methods of guarding which he enumerates as follows:

1. Guarding by the construction of the machine.
2. Guarding by the positioning of the dangerous parts so that they cannot be reached.
3. The use of a fixed guard.

4. The use of an automatic guard.
5. The use of an interlock guard.
6. The use of a trip guard.
7. The use of a positional safety guard.

Discussion of these types leads to the eighth, ninth, tenth and eleventh principles of guarding:

"*The principle of safeguarding for reverse motion.* The design and fitting of any type of guard must be such that the dangerous parts are securely safeguarded not only for motion in the normal running way but also for their reverse motion.

"*The principle of priority of use of a fixed guard.* A fixed guard must always be the first preference for the safeguarding of dangerous parts of machinery and if some redesigning or rearrangement of the machine parts would enable such a guard to be used then the necessary arrangements should be provided.

"*The principle of the best guard known.* The standard of any guard for any particular dangerous parts of machinery in a factory must be that of the best and most efficient guard known in the country as a whole and not merely that of the best guard in the district in which the factory is situated.

"*The principle of two-hand control.* Where the hands of the operative are necessarily placed between dangerous parts of a machine when the latter are at rest then, in addition to the requisite fitting of a suitable guard, the starting controls must be so designed as to require the operative to remove both hands from the danger area and use them to manipulate separate control devices, which must be independent in action but complementary in effect."

Mr. Hepburn concludes by formulating four essential requirements for carrying out a satisfactory safety programme.

The first is for managements, through their safety organisations, to possess a knowledge of those parts of machinery that produce accidents. The second is to know how best to safeguard those parts. The third is to ensure that all persons employed in the works are educated and trained in safe practices. The fourth is to revise continually the standards of guarding, in conformity with latest practice.

Safe Practice in the Use of Tubular Steel Scaffolding. By N. B. ELLIOTT. (*The British Journal of Industrial Safety*, No. 8, Winter 1948, p. 123.)

Discusses, with illustrations, the safe construction of putlog scaffolds (pole scaffolds) jib scaffolds (cantilever scaffolds) and independent scaffolds, and also matters common to all metal scaffolds — material and design, tubes and couplers. Mentions some precautions to be taken with aluminium scaffolding.

New Wire Fatigue Testing Method. By F. A. VOTTA, Jr. (*The Iron Age*, 12 August, 1948, p. 78.)

This article describes the construction and application of a new type of instrument developed to determine fatigue strength and endurance limit values of small diameter wires within accuracies of 2 per cent. Its simplicity of construction, its capability of taking wires from 0.005 in. to 0.03 in. diameter in one model and from 0.005 to 0.1 in. diameter in another model, its facility of operation, which requires no experience or special training on the part of the inspector, and its speed in performing the required fatigue tests (10 minutes for a 0.02 in. plow steel wire stressed to 125,000 p.s.i.), render the apparatus most useful to the manufacturer as a medium for the control of quality, and to the consumer as a basis for the acceptance of materials, thus influencing to an important degree testing methods for ensuring adequate engineering safety factors.

A picture and charts inserted in the article show the general appearance of the instrument and the results of tests which have been performed on small diameter plow steel and beryllium copper wires to determine the S-N values (number-of-cycles-to-failure v. stress). The method of testing, as shown by a diagram, consists in the looping of a sample length of wire through 180 degrees, one end being held in a chuck driven by a small synchronous motor and the other being held loosely in bushings in such a way that both ends are exactly parallel and that vibration of the wire under test is prevented.

The theory of the method involved resides in the existence of definite relationships between the length of the loop, the height of the arch formed by the loop and the minimum radius of curvature at the apex of the arch and the base of the loop, and also, between the bending stress at the point of minimum curvature (at the apex of the arch), and the length, height, base and minimum curvature. The formulae expressing these relationships and the derivation of these formulae are given in the text.

The instrument is also adaptable to the testing of wires submitted to various exposures, *i.e.*, corrosion, high or low temperature, or metal treatment such as electro-plating, and may prove of great use in quality testing by statistical methods.

Los Angeles Studies Lead and Silica Hazards in Pottery. (*Industrial Hygiene Newsletter*, August 1948, p. 16.)

During a seven-day study conducted by the Division of Industrial Hygiene of the Los Angeles City Department of Health in a large pottery employing 1,500 workers, interesting observations were made concerning an automatic sandblast machine and an automatic rotary glaze spray machine, both equipped with apparently efficacious exhaust ventilation.

Air samples taken at breathing level revealed the presence of excessive free silica dust in the area surrounding the sandblast machine and of dangerous quantities of lead glaze escaping from the hooded glaze spray machine. It was also found that the air from the exhausted spray of the glaze spray machine, which was recirculated through an open stack in the room after passing through a separator, contained excessive quantities of lead at air sampling points.

Recommendations were made to isolate completely the sandblast machine which caused disturbing noises and polluted the atmosphere, and to extend the stack of the spray machine to the outside of the building to prevent recirculation of the contaminated air. Emphasis was also placed on the necessity of close co-operation between the safety, medical and engineering departments to prevent health hazards in new installations or to control them in existing operations.

Fire and Explosions in Refrigeration Equipment. By A. S. HALL. (*Occupational Hazards*, May 1948, p. 42.)

The great majority of accidents involving industrial refrigerating equipment can be traced to mechanical breakdown from wear and tear or mishandling. Explosions are usually caused by the escape of ammonia, the most common refrigerant, as a result of breakdown of equipment, slow leaks, or excessive pressure and rupture.

The article briefly describes a number of fires and explosions caused by the escape of ammonia.

In small refrigerating units, the refrigerants used are not flammable, but the keeping of ether, alcohol or other volatile flammable liquids in refrigerator storage compartments, or in loosely covered containers, creates an explosion hazard.

Fires in small refrigerating plants are more frequent and are usually caused by electrical defects. To ensure safety, frequent cleaning of motor compartments, periodic mechanical and electrical maintenance, and proper use, particularly in the storage of flammable liquids, are recommended.

Butadiene-Crotonaldehyde Explosion. By Kenneth W. GREENLEE. (*Chemical and Engineering News*, 5 July 1948, p. 1985.)

This article describes an explosion which occurred in a laboratory at the Ohio State University when a 2.35 litre batch of crotonaldehyde and liquid butadiene were undergoing the Diels-Alder reaction in a 3.45 litre standard laboratory autoclave of the rocker type.

The pressure developed in the vessel, due mainly to the fact that the reactants had not been thoroughly mixed before or after the charge was made, was estimated to have reached 70,000 p.s.i. As a consequence of this pressure the vessel parted, releasing its contents with gas-type explosion causing severe material damage to the walls of the building.

For the prevention of similar accidents liable to occur during reactions of this type in the preparation of cyclic aldehydes, alcohols and hydrocarbons, the author gives the following list of precautions to be taken:

(1) mix the reactants before heating;
(2) connect the reaction vessel to a blow-out assembly with a disc yielding at some pressure within the working range of the vessel; the exhaust line must lead out of doors;
(3) never use excess diene; when in doubt, use an excess of the dienophile;
(4) allow at least 40 per cent. of the volume of the vessel for expansion;
(5) use peroxide-free reactants;
(6) add an inhibitor such as hydroquinone to the reaction mixture;
(7) remove air from the free space in the vessel by evacuation or by flushing with an inert gas before heating.

Liquid Fluorine - Cotton Explosion. By R. H. LAFFERTY, Jr., J. C. BARTON. and J. A. WESTBROOK. (*Chemical and Engineering News*, 8 November 1948, p. 3336.)

This article describes an explosion which occurred when cotton was immersed in liquid fluorine. A flanged nickel cylinder in which about 10 grams of fluorine had been condensed from a mixture of fluorine, hydrogen fluoride and air was placed in a stainless steel beaker containing liquid nitrogen as a refrigerant. The system was placed under a hood and shielded by heavy safety glass for the purpose of running resistance tests of neoprene, leather and cotton gloves to the liquid fluorine.

When immersed in the liquid, the neoprene caused a slight explosion and broke into flames while the leather charred. A violent explosion accompanied by brilliant white flame occurred when a finger of the cotton glove was put to the same test. As a result of the shock the safety glass of the hood and shield was badly fissured and the equipment was blown out of shape.

Pictures accompanying the article show the damage inflicted upon the installation and the equipment, and the article itself points to the verification of a conclusion reached earlier, namely, that fluorine, the use of which is becoming more common in industry, presents especially dangerous characteristics when brought into contact with organic materials.

Preventing Dust Explosions in Starch Factories. (*Occupational Hazards*, August 1948, p. 44.)

This article reproduces rules for the prevention of dust explosions in starch factories taken from National Fire Codes, Volume II, 1946. It suggests that the extracts of the Codes reproduced might serve as an aid in preventing explosions in any process which involves the accumulation of dust.

Dust Hazards in Industry. (*Chemical Trade Journal and Chemical Engineer*, 8 October 1948, p. 405.)

This article gives a summary of some of the technical papers presented at a conference on dust in industry organised by the Society of Chemical Industry at the University of Leeds, 28-30 September, 1948.

Methods of reducing contact with dust are dealt with, and examples given of hoods for the safe handling of dust in drums; means for charging powders into process vessels are also suggested, one of which is the feeding of lime into a lime slaker at a point below the level of the liquor.

In the process of manufacturing, dusty materials may be transferred into containers by means of equipment rendered completely dust-tight in a relatively safe way. Mention is made of a specially developed door, sealed by the alternate freezing and melting of the processed material and of the use of a vacuum-tight valve for discharging powders.

Research work made on protective skin creams for workers in explosives factories led to the conclusion that paraffin wax, Lanette wax and petroleum jelly form the most effective basic constituents of barrier creams. Studies made on the exposure to arsenical dusts revealed the absolute necessity for enclosing dusty operations, equipping workers with protective clothing and respirators, and providing exhaust ventilation at dust-producing points, adequate washing facilities and periodic medical examinations for the workers.

Attention is drawn in the article to the dangers created by air-borne dusts which may be ignited by electrostatic discharges. As the earthing of all conductors does not afford sufficient protection against explosions, the accumulation of dusts and charges should be prevented.

A final synopsis of an important contribution to the conference concerns manganese dioxide, the dust of which affects the whole of the respiratory tract and, for this reason, the disease it produces may well be termed "manganese pneumonitis".

Inspection of Radium Paint Rooms. By Joseph F. MELLOR, Jr. (*Industrial Hygiene Newsletter*, Vol. 8, No. 12, December 1948, p. 8.)

The relatively recent introduction of powerful lamps that are strong emitters of light in the near ultra-violet range (3,600 A), which when properly filtered prevent excessive visible light has made available a new tool for the industrial hygienist and those engaged in the application of radio-active luminous paint. The intensity of the near ultra-violet (black light) emitted by these lamps is very much stronger than that given off by the 250-watt purple X bulb.

The smock of a radium dial painter examined under this "black light" showed a good deal of contamination which had not been revealed under a 2½-watt argon glow lamp, and the author recommends that the "black light" lamp should be used in future for all inspections in radium paint rooms.

The article is illustrated and has a short bibliography.

Comparative Relationship of Medical, Nursing and Safety Personnel in Industry. By Robert T. COLLINS. (*Industrial Medicine*, August 1948, p. 295.)

The paper outlines the "health maintenance programme" followed by the General Motors organisation. The basic elements of the programme are (1) industrial hygiene service; (2) accident prevention; (3) industrial medical service; (4) opportunities for research; (5) a plant fellowship programme.

Under the scope of industrial hygiene service comes the responsibility for conducting studies of environmental conditions with reference to dust concentrations, disturbing noises and harmful mists, and more particularly the effects of new substances brought into operations. Industrial hygiene engineers are constantly available to visit, inspect and make recommendations for controlling sources of occupational diseases. Work is carried out in very close co-operation with the medical department, which in turn keeps in constant touch with the safety department in all matters concerning the prevention of injuries and illness-producing conditions.

As much of the time lost is chargeable to non-occupational illnesses, the medical department extends its services to the prevention of diseases of all types. Preventive as well as curative medicine is practised throughout the plants to attain the main goal: the promotion and preservation of good health. To this end also research work of all kinds is undertaken to ensure adequate comprehension of new problems created by changes in personnel, processes and substances.

Of great interest in the article is the outline of the corporation's "physicians in training" programme, by which outside physicians interested in industrial medicine may receive practical training at the corporation's New Departure Plant. The plan, believed to be the first of its kind in the United States, is under the supervision of the Institute of Occupational Medicine and Hygiene of the Yale University School of Medicine.

Optical Glass and Eye Protection. By Ernst WOLF, Ph.D. (*The Sight-Saving Review*, Vol. XVIII, No. 3, Fall 1948, p. 152.)

This brief article describes protective glasses used to prevent eye injuries from mechanical or chemical sources and from harmful radiations.

For protection against mechanical and chemical injuries, it is essential to give the lens the mechanical properties which will make it resistant to impact. For this reason lens with a high curvature are preferred since (1) the deflection of flying particles is higher; (2) specular reflection is avoided; (3) vision is more accurate and distortion and chromatic aberration are reduced; (4) curved lenses can be fitted closer to the eye, by which the protective properties are increased, and more eyelash clearance is available; and (5) curved lenses have less tendency to fog.

To increase resistance, protective lenses are also hardened.

For protection against harmful radiations the lens must have specific absorptive properties for injurious wave-bands of the spectrum.

When visible light (perceived in the spectral region between roughly 380 and 750 millicrons) of high brightness strikes the eye we may have the impression of glare. In adapting brightness-reducing glass to the human visibility curve, the extent of the spectrum beyond the visible spectral range is also reduced so that the amount of ultra-violet and infra-red striking the eye is almost negligible. For industrial purposes various types of glasses with total absorption in the infra-red are available.

Ultra-violet rays, especially from mercury vapour lamps, can damage the eye by the wave-band around 253 millimicrons. However, the use of brightness-reducing glasses which absorb wave-lengths below 370 millimicrons eliminates this risk.

What do your Accidents Cost? By Alan TURNBULL, Jr. (*Safety Review*, Vol. 5, No. 10, October 1948, p. 10.)

This article discusses the findings on accident costs made as a result of a special study of the accident experience in the shipyards of the Navy Department of the United States of America, conducted by Dr. Rollin H. SIMONDS, an actuary appointed by the National Safety Council.

For the purpose of this study, no-injury accidents causing a property damage of $20.00 or more or causing a loss of four or more man-hours were included in the total number of accident cases. The factors which contribute to make up the usual four to one ratio of indirect to direct costs were also reclassified to exclude from the study those costs which concern ordinary private industries and to which a Government enterprise is not normally exposed.

The article describes the method employed in making the calculations and gives a summary of the figures obtained for the accident experience of the naval shipyards. Some of the figures are as follows: average direct cost of a lost-time accident, $227.00; indirect cost, $53.00; average cost of a first-aid case, $10.00; average cost of a no-injury property-damage accident, $143.00. With regard to this last figure, however, it should be pointed out that no heavy property damage accident was reported during the period under study. These figures have been reduced to the following formula by which all other naval shore activities may compute their own accident costs —

$$\left[\left(\$280 \times \frac{\text{your sev. rate}}{\cdot 375}\right) + \$143\right] \times \text{Lost-time accidents} + (\$10 \times \text{No. of first-aid cases}) + \text{exceptional costs.}$$

Dig For Facts to Bury Accident Costs. By R. W. HABERSAT. (*Occupational Hazards*, October 1948, p. 28.)

The author presents a four-step programme designed to detect accident proneness in workers due to defective eyesight and to remedy this condition by appropriate training and rehabilitation methods. Among other basic points in the programme is the establishment of visual safety standards for the performance of the various jobs in a plant. The same type of programme may also be applied to investigate other personal factors which contribute heavily to industrial accidents.

Keeping the Accident-Prone Worker Safe. By Bernard T. PARKER. (*Mill and Factory*, December 1948, p. 123.)

The accident prevention research department of a large optical company in the United States carried out a number of tests in an attempt to determine the differences existing between accident-prone employees and others.

A testing instrument was used which measures the keeness of vision and postural characteristics of the eyes at various distances as well as colour and depth perception, and it was conclusively proved that there was a marked relationship between visual deficiency and the recurrence of accidents.

A "visual" safety standard was established for the plant. All employees are now examined every two years and those below the standard are referred to an ophthalmologist for attention. In the four-year period after the adoption of this practice, there was an average reduction of 23 per cent. in lost-time accident frequency. Since the safety programme of the undertaking was not fundamentally changed in any other way during this period, the proof that vision was very closely related to accident-proneness was considered conclusive.

Psicotecnica ed infortuni sul Lavoro. By Dr. G. DRAGOTTI. (*Rassegna Medica di Infortunistica e Patologia del Lavoro*, Vol. I, No. 1; July-August 1948, p. 113.)

The human factor in accidents is the theme of this article.

The author briefly discusses work carried out in various countries with a view to determining the accident proneness of workers. He found that for this purpose reaction and intelligence tests were not as satisfactory in practice as in theory, since the psychological factor leading to an accident might be, and frequently was, momentary, and did not constitute part of the personality of the individual.

Tests carried out by the author in the psychotechnical laboratory of the Italian State Railways led him to conclude that at present there is no satisfactory means of determining that a person's physiological constitution will make him accident-prone.

Choosing a Safety Director. By Paul W. GRAFF. (*Coal Age*, July 1948, p. 98.)

In the author's view, the best way of reducing the toll of accidents in a coal mine is to carry out a carefully planned and integrated safety programme. Such a programme implies the employment of a safety director or engineer on a full-time basis. The author explains why production officials cannot at the same time be safety directors, and discusses the qualifications and experience that a good safety director should possess. For various reasons which are discussed at length, the author considers that the safety director should have a thorough knowledge of production problems; otherwise he will be seriously handicapped in his work and the safety department may be treated with contempt. Safety, however, is so important that mine managements should form safety departments staffed by production-trained officials and headed by a director enjoying a status on a par with that of the general superintendent or the production manager. The director would have a very wide field of activity, and although he should not have executive authority, he would have great responsibilities.

Illness Absenteeism in Manufacturing Plants, 1947. By Frank S. MCELROY and Alexander MOROS. (*Monthly Labor Review*, September 1948, Vol. 67, No. 3, p. 235.)

Discusses the various causes of absenteeism in manufacturing industries, absence rates, annual time lost, etc.

Only 1.9 per cent. of all absences were attributed to work injuries, but these absences were responsible for 5.8 per cent. of the total lost time.

RECENT BOOKS

Prevençao de Acidentes do Trabalho. By Dr. Decio PARREIRAS. Ministry of Labour, Industry and Commerce, Rio de Janeiro, May 1948. 16 pp.

This is a paper given at the Argentine Congress of Industrial Medicine in 1948. The author gives a brief analysis of accident statistics in various South American countries, discusses mechanical and human causes of accidents, describes methods of calculating frequency and severity rates, and makes a number of recommendations respecting prevention of accidents and the development of safety consciousness.

Aspetti della Prevenzione. By Giorgio MASTINO DEL RIO, Member of Parliament. Published by the Ente Nazionale di Propaganda per la Prevenzione degli Infortuni, Rome 1949. 75 pp.

Discusses in some detail the functions of accident insurance associations and their relationship to accident prevention associations.

The conclusion reached is that accident prevention activities should be centred in a national autonomous organisation, which would be independent of insurance associations.

The Law and Practice Relating to Safety in Factories. International Labour Office, Geneva, 1949, 1,701 pp. Price $8.50; £2 2s. 6d.

In this substantial volume the International Labour Office presents a study of industrial safety activities in 14 countries, representing the five continents, together with some account of international safety activities. The countries selected are: Canada, Chile, Czechoslovakia, France, Germany, Great Britain, India, Mexico, Netherlands, New Zealand, South Africa, Sweden, the United States and the U.S.S.R.

The volume comprises a general introduction to the subject of industrial safety, a survey of national and international agencies, both official and unofficial, and a detailed analysis of factory safety regulations. Factory and labour inspection systems are not treated exhaustively, since they have been dealt with in a separate volume, *The Organisation of Labour Inspection in Industrial and Commercial Undertakings*, published by the Office in 1939.

The introduction touches on the human and economic costs of industrial accidents, the development of safety legislation and safety movements in the different parts of the world, and the principal causes of accidents.

Part I, entitled *National and International Organisation* describes the work of bodies such as national safety associations, standards institutions, insurance institutions, safety museums, general trade associations, associations for particular industries, trade unions and scientific institutions; it also gives some account of the scientific, educational and propaganda activities of labour inspectorates, and the accident prevention activities of Workmen's Compensation Boards and other Government agencies.

The chapter on international organisation deals with the International Labour Organisation, the Inter-American Safety Council, and various other bodies and conferences that have concerned themselves either with industrial safety generally or with particular aspects of it, such as fire precautions, safety films and safety in welding operations.

There are three appendices to Part I — a note on the standardisation of industrial accident statistics, a list of national and regional industrial safety associations, institutions and museums, and a list of safety magazines published in various countries.

Part II, on legislation, which accounts for 1,450 of the 1,700 pages in the volume, is divided into 43 chapters, most of which are sub-divided into numerous sections. The contents of the 43 chapters are briefly as follows:

I. General (scope of factory legislation, registration of factories and approval of plans, general duties of employers and employees, general powers of inspectors, etc.).
II. Factory premises (space requirements, floors, fencing and guarding of dangerous equipment and places, lighting, ventilation, temperature, cleanliness, etc.).
III. Elevators.
IV. General fire precautions (including fire resisting construction of buildings, exits, alarm and extinguishing appliances, fire drills, combustible waste, etc.).
V. Machinery: general rules (instruction and training of workers, employment of women and young persons, passageways, guarding and fencing, sale and hire of unguarded machinery, starting and stopping devices, examination, maintenance, repair, etc.).
VI. Prime movers.
VII. Transmissions.
VIII. Metal-working machines.
IX. Wood-working machines.
X. Food and drink industry machines.
XI. Paper-working and printing machines.
XII. Textile and laundry machines.
XIII. Other machines (leather, paper, rubber, oil cake, etc.).
XIV. Electrical installations.
XV. Steam boilers.
XVI. Pressure vessels.
XVII. Cylinders and other containers for compressed, liquefied and dissolved gases.
XVIII. Compressors.
XIX. Refrigerating plant.
XX. Metal-producing equipment (blast furnaces, steel furnaces, forges and rolling mills).
XXI. Foundries.
XXII. Hoisting appliances: general rules (cranes, winches, jacks, ropes, chains, tackle, etc.).
XXIII. Track-mounted cranes.
XXIV. Plant railways (including cableways).
XXV. Other factory equipment (hand tools, ladders, conveyors).
XXVI. Handling materials (storage and stacking; loading, unloading and transport; lifting and moving heavy loads by hand).
XXVII. Dangerous and noxious substances: general rules (includes work in confined spaces).

XXVIII. Explosive and flammable substances.
XXIX. Storage of flammable liquids.
XXX. Flour mills and malt houses.
XXXI. Other undertakings with organic dust explosion risks (cork mills, coal dusting plants).
XXXII. Processing of flammable aluminium and magnesium alloys (melting, casting, machining, storage, transport, etc.).
XXXIII. Celluloid (including film waste).
XXXIV. Manufacture and use of acetylene (includes oxy-acetylene welding and cutting).
XXXV. Spray painting.
XXXVI. Hot and corrosive substances.
XXXVII. Radio-active substances; X-rays.
XXXVIII. Personal protective equipment.
XXXIX. Employment of women and young persons.
XL. First aid.
XLI. Reporting and investigation of accidents, etc.
XLII. Selection, medical examination and instruction of workers; safety officials and committees.
XLIII. Miscellaneous (alcoholic drinks, factory registers, etc.).

The laws, regulations, etc., quoted or referred to in Part II are listed at the end of the volume, and there is also a short bibliography of industrial safety literature. Reference to Part II is facilitated by a detailed subject index that takes up nearly 40 pages.

It will be seen that the volume provides a wealth of information on factory safety legislation and safety activities in many of the most industrialised countries, and it should be of considerable value to Governments, safety associations and other bodies and persons who are called upon to play a leading part in the promotion of safety in factories.

Ventilation and Heating, Lighting and Seeing. Conditions for Industrial Health and Efficiency, Pamphlet No. 1. Issued by the Industrial Health Research Board of the Medical Research Council. Published by H.M. Stationery Office, London, 1943, reprinted 1949. 20 pp. Price 6d.

A clearly written and well illustrated pamphlet setting out the principles of ventilation, temperature control, and lighting in factories, and indicating their bearing on safety and health. Short bibliographies are provided.

Safety in the Mining Industry. U.S. Bureau of Mines, I.C. 7485, Washington, April 1949. 157 pp.

In this substantial publication, the United States Bureau of Mines undertakes a comprehensive review of the accident records of the various branches of the mining industry. Well over half of it is accounted for by coal mining, and most of the rest is devoted to metal mining and quarrying. Non-metal mining and the petroleum industry receive only brief treatment.

An introduction compares accident risks in the American mining industry with those in other American industries and in the mining industries of other countries, and touches on the progress of accident prevention in mining in the last 40 years.

The section on coal mining discusses the general trend of accident rates in the industry, and the principal causes of accidents. It then deals separately and in more detail with *(a)* bituminous coal and lignite, and *(b)* anthracite, and covers both underground mining and strip mining.

The accident records of other classes of mine are reviewed in a similar manner. First the principal accident causes are considered generally and then mines for copper, iron, lead and zinc, gold and silver and non-metallic substances are dealt with in turn.

The section on quarries deals with cement rock, limestone, granite, marble, sandstone, slate and trap rock.

A few figures are given for the production and refining branches of the petroleum industry, and these are followed by a note on the health of miners and graphs showing the trend of fatal accidents in the different branches of the mining industry.

The study closes with a brief summary of the changes that have taken place in the mining industry in recent years as regards technique, employment and safety, and indicates some directions in which further advances are needed in accident-prevention work.

Safety Course for Bituminous Coal Miners. U.S. Bureau of Mines, Washington, 1948. xii + 253 pp. Price 75 cents.

In this handbook are gathered together the seven sections of the safety course previously published separately as miners' circulars. The sections deal respectively with falls of roof and coal, haulage, explosions and fires, electricity, explosives, prevention of accidents in mechanised mines and prevention of miscellaneous accidents. A very large number of risks and precautions are dealt with in the handbook and it should prove extremely useful for educational and training purposes.

Hazards of Black Blasting Powder in Underground Coal Mining. U.S. Bureau of Mines, I.C. 7492, Washington, March 1949. 29 pp.

Gives information on the use of black blasting powder in the United States, compares its properties with those of other explosives, describes accidents in its use, and provides a set of safety rules for storage, transport and shotfiring.

Tests on the Ignition of Natural Gas-Air Mixtures by Permissible Explosives in the Experimental Coal Mine. U.S. Bureau of Mines, Technical Paper 716, Washington, 1949. 38 pp. Price 15 cents.

The tests described in this paper were made to determine whether the charge limit for permissible explosives in coal mines could be increased from 1.5 to 3 pounds per shot hole. The tests were made with blown-out shots (blow out along the axis of the hole), blown-through shots (blow out perpendicular to the axis), crevice shots (blow out through a fissure in the shot hole) and suspended charges. The text is illustrated with photographs and graphs.

The various conclusions reached are set out in a summary.

Grubenbrand-Versuche. By H. SCHULTZE-RHONHOF and K. KLINGER. Berichte der Versuchsgrubengesellschaft, Heft 9. Verlag Glückauf G.m.b.H. Essen-Kettwig, 1948. 191 pp.

The authors describe the various research and experimental work relating to mine fires undertaken over a period of years in the German experimental

mine at Gelsenkirchen. The volume is in six parts: I, experiments on the origin of mine fires; II, investigations into the possibilities of reducing the risk of mine fires; III, investigations into the course of mine fires; IV, experiments for testing fire-fighting methods; V, experiments for testing and developing measures for the protection of men employed in sealing off fires; and VI, measuring instruments for detecting and observing fires.

Each of these parts is divided into a number of sections. Part I, for example, deals with the ignitability of coal dust at low temperatures, causes of conveyor fires, fires in staple pits, coal dust as a cause of machinery fires and fires after explosions, welding and flame-cutting risks and shotfiring as a factor in fire risks. Part II is mostly concerned with different kinds of supports and Part IV with extinguishers and stoppings.

There are 154 illustrations, a bibliography of 140 items and an index. The authors have made a valuable contribution to the literature of mine fires.

Unfälle beim chemischen Arbeiten. By Dr. Ernst RÜST and Dr. Alfred EBERT. Second edition. Rascher Verlag, Zürich, 1948. vii + 408 pp.

A general introduction to the subject of accidents in chemical work is followed by sections on mechanical injuries; burns, corrosions and fires; poisons and poisoning; explosions and explosive substances. Numerous accidents are described in the text. The volume contains a bibliography, a list of sources and a subject index.

Safety Measures in Chemical Laboratories. Department of Scientific and Industrial Research. Published by H.M. Stationery Office, London, 1949. 22 pp. Price 6d.

An introduction giving general advice for the prevention of laboratory accidents is followed by a set of rules for general operations such as handling glass, corrosive liquids, and flammable substances. Next come short sections on fire risks and burns, electric hazards and shock, and dermatitis. The concluding section consists of a table of poisons, their symptoms and first-aid treatment. This is a useful pamphlet for chemical laboratories.

Raumexplosionen durch elektrische Anlagen. By Helmut FREYTAG. Verlag Chemie G.m.b.H. Wernheim/Bergstr., Berlin, 1949. 204 pp. Price DM 7.

In this volume the author considers explosions and ignitions of gases, vapours and dusts due to electrical equipment.

He first considers criteria for determining the degree of risks of combustible substances generally (ignition temperature, explosive range, etc.) and the risks of electrical equipment.

He then turns to means of avoiding explosions by suitable arrangement of the installations and processes and by the use of protected electrical equipment.

In connection with protected electrical equipment the author first considers general precautions against ignition and explosion and then deals successively with combustible gases, combustible liquids and dusts.

The section on gases deals with handling without chemical or physical reactions; electrical cleaning of gases; compression, liquefaction, decompression; production of gases by various methods; physical and chemical reactions between combustible gases and *(a)* other gases and vapours, *(b)* liquids, and *(c)* solids; and oxidisation and combustion of gases for industrial purposes. The section on liquids also discusses handling and reactions of various types.

The volume includes seven illustrations, numerous tables and an index. A very useful guide to the use of electrical equipment in flammable surroundings.

The Film in Industrial Safety Training. By Paul IGNATIUS. Division of Research, Graduate School of Business Administration, Harvard University, Soldiers Field, Boston, Mass. March 1949. 119 pp.

This study deals in detail with the advantages and limitations of films as a means of training in industrial safety.

The author has done a good deal of research on the various aspects of this comparatively new and little-used training technique. The work with the problem of industrial accident prevention, the problem of industrial safety training, the usefulness of films as a safety training device, problems of utilising films in industrial safety training, the various appeals found in industrial safety films and the production of industrial safety films.

In the "conclusion" which forms the seventh part of the study the author states that researches indicated that films can serve a useful purpose in safety training. Because of their emotional impact on individuals they have brought about desired responses from employees where other training methods have failed. It is considered that in order to have the greatest effect safety films should make use of the technique of audience participation. It is also felt that the element of fear should be avoided in safety films and replaced by an appeal to the humour, logic, or desire for proficiency of the worker. Finally it is recommended that better film catalogues be made available and that more regional industrial film libraries be formed.

Examples of industrial safety training programmes are given in Appendix A and some catalogues listing industrial safety films in Appendix B.

NEW POSTERS



Look where you're going!

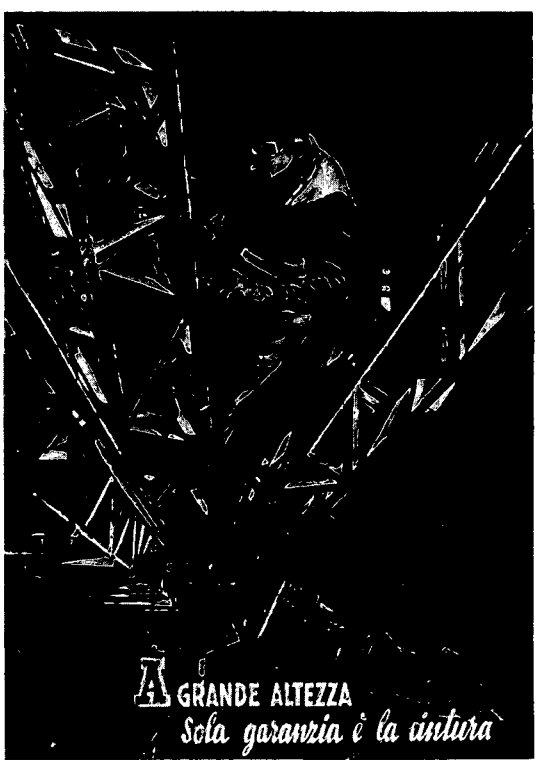


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At great heights the only guarantee is a belt.

(National Association for the Prevention of Accidents, Rome)

INTERNATIONAL LABOUR OFFICE

INDUSTRIAL SAFETY SURVEY



(Industrial Health Division, Department of National Health and Welfare, Ottawa)

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CONTENTS

Page

Fire and Explosion. By J. H. F. SMITH 121

Safety Institutions, Associations and Museums

INTERNATIONAL: Miners' International Federation 130
AUSTRALIA: National Safety Council of Australia: Reports for 1948-1949 130
COSTA RICA: State Insurance Institute: Accident Prevention Campaign 131
FRANCE: New Periodical: *Travail et Sécurité* 131
Two-Day Congress on Industrial Safety, Strasbourg 131
ITALY: Industrial Safety Congress of the Italian Centre for Safety Experts 131
LUXEMBOURG: Accident Insurance Association: Report for 1948 131
POLAND: Second Trade Union Congress: Resolution concerning Safety and Health 132
SWEDEN: Industrial Accidents in Engineering Undertakings in 1948 132
UNITED KINGDOM: Fire Protection Association 132
UNITED STATES OF AMERICA: United States Bureau of Mines: Report of Research and Technological Work on Explosives, Explosions and Flames, Fiscal Years 1947 and 1948 132
Wartime Activities of the Health and Safety Division, U.S. Bureau of Mines 133
The President's Conference on Industrial Safety 134

Laws and Regulations, Safety Codes

AUSTRALIA: Standard Rules for the Storage and Use of Explosives. Dated February 1949 . . 137
Recommendations respecting the Risk of Ignitions in Oxygen Breathing Apparatus 137
(Western Australia): Mines Regulation Act Regulations. Dated 10 March 1949 138
BELGIUM: Order regulating the Use of Explosives in Undertakings other than Mines and Underground Quarries. Dated 31 March 1949 138
BULGARIA: Safety Regulations concerning Work at Grinding and Sharpening Machines. Dated June 1949 138
Safety Regulations concerning Work at Woodworking Machines. Dated 3 June 1949 . . . 138
Safety Regulations concerning Transmission Gear. Dated 3 June 1949 139
Safety Regulations concerning Portable Wood Ladders. Dated 3 June 1949 139
Regulations concerning Electric and Oxy-acetylene Welding Equipment. Dated 3 June 1949 139
CANADA: Canadian Standards Association Code of Practice for Window Cleaning. Z. 91-1949 . . . 139
Canadian Electrical Code, Part V: Use of Electricity in Coal Mines 139
(Alberta): Safety Regulations governing Oil and Gas Well Drilling Plants, etc. Dated 4 May 1949 139
(Nova Scotia): Act to amend the Metalliferous Mines and Quarries Regulation Act, 1937 . 139
Steam Boiler and Pressure Vessel Inspection Act. Dated 14 April 1949 140
JAPAN: Mine Safety Law, No. 70. Dated 16 May 1949 140
NETHERLANDS: Decree concerning Surface Installations of Mines. Dated 21 June 1949 . . . 140
Decree concerning Steam Appliances. Dated 17 September 1949 140
NORWAY: Provisional Act concerning Conditions of Employment in Agriculture. Dated 3 December 1948 141
SWEDEN: Notification concerning the Application of the Workers' Protection Act. Dated 6 May 1949 141
Notification Prohibiting the Employment of Young Persons in Certain Dangerous Work. Dated 6 May 1949 141
SWITZERLAND: Federal Order concerning Suspended Scaffolds. Dated 27 May 1949 142
UNITED STATES OF AMERICA: Medical X-Ray Protection up to Two Million Volts 143

Official Reports, etc.

BELGIUM: Annual Report of the Administration for the Technical Protection of Labour, 1946 and 1947 143
FRANCE: Causes and Origins of Fires in France during the First Half of 1948 144
GERMANY: Food and Tourist Industries Mutual Accident Insurance Association. Report for 1948 145
SWEDEN: Industrial Accidents, 1939-1943 146
Industrial Accidents in 1945 146
UNITED KINGDOM: Electricity in Mines in 1947 148
Electricity in Mines in 1948 149
UNITED STATES OF AMERICA: Motor Carrier Fire Accidents, 1948 150

Review of Periodicals 151

Recent Books 157

New Posters 160

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INDUSTRIAL SAFETY SURVEY

VOL. XXV OCTOBER-DECEMBER 1949 No. 4

FIRE AND EXPLOSION

By J. H. F. SMITH, M.Sc., F.R.I.C., A.M.I.Chem.E.,
H.M. Inspector of Factories, Engineering and Chemical Branch, London

According to the Annual Report of the Chief Inspector of Factories, 1,338 persons were injured by explosions in factories in the United Kingdom in the year 1947, and 24 of these persons died from their injuries. In addition 492 persons were injured in fires and 13 of them died.

The Chemical Section of the Factory Department has for some years been making a study of this kind of accident, and has adopted certain basic principles to guide it in its work on the prevention of accidents due to fire and explosion. These principles are simple ones, but they have proved their value, and it is hoped therefore that the following account of them and of some of their applications may be of interest.

First of all a clear distinction is made between the prevention of injury to persons and the prevention of damage to property. In the majority of factories the risk of personal injury from fire is almost negligible if there are adequate exits from the workrooms and from the buildings. Factory legislation, enforced jointly by the Factory Department and the local authorities, has ensured a fairly high standard as regards means of escape in case of fire, and accidents due to lack of proper means are fortunately rare in British factories.

The Factory Department is therefore specially interested nowadays in the prevention of explosions, and of those types of fire which spread so rapidly that workpeople may be involved before they can reach the exits, however well-placed and adequate the exits may be.

Explosions can occur, of course, which are not in any way associated with fire. Vessels containing compressed gases and vapours may give rise to explosions simply because they are reservoirs of energy and not because the gases or vapours contained in them are flammable or chemically unstable. Examples are steam receivers, air receivers, and the cylinders used for the conveyance of gases such as nitrogen and carbon dioxide. All the examples quoted are associated with fairly comprehensive safety legislation and serious accidents due to these "energy reservoirs" are relatively few.

Certain other types of accident that can be classified as explosions are not themselves due to burning, but are often followed by fire. Molten metal for example may be thrown with explosive violence about a workroom as it is being poured into a mould, as it is being stirred, or as flux is being added to it. The cause may be the unsuspected presence of moisture in the mould or the accidental introduction into the molten metal of water, either alone or with flux which has absorbed moisture from the air. The addition of scrap metal, containing foreign matter such as rosin or bitumen, to molten metal in furnaces has caused explosions. Sometimes supersaturation of molten metal with dissolved gases has been suspected, the theory being that gases always present in small amounts in metals have accumulated in the melt and been evolved suddenly, perhaps as a result of some movement of the molten metal, just as gas will be given off from a glass of soda-water when one shakes the glass. Water that has been accidentally allowed to enter the baths of molten cyanide or molten nitrate used in the heat treatment of metals has resulted in explosive dispersal of these molten salts and consequent injury, sometimes fatal, to persons in the vicinity. Explosions sometimes occur while cyanide for heat-treatment work is being melted and also as the molten cyanide cools down and solidifies after use; in each case there is at some stage a hard crust of the solid cyanide over the liquid, and it is believed that pressure generated in liquid and gases held below this hard crust is the explanation of this kind of accident.

All the above-mentioned types of explosion are due to physical rather than to chemical causes, *e.g.*, heat has caused sudden generation of steam from moisture or generation of gases formerly dissolved in a liquid or expansion of a liquid, or cooling has caused contraction of a crust. The pressures built up are generally relieved by the sudden discharge of molten metal or molten salts from the containing vessel. Fire involving buildings or plant may follow, but the chief danger is of serious burns to workpeople from the hot material or from ignition of their clothing. Methods of prevention such as elimination of moisture and foreign material, use of special forms of heating, etc., are well known, but even so additional precautions, such as the provision of

deflecting shields or enclosures on plant and the wearing of protective clothing, are often necessary.

An increasing amount of attention is being paid to the prevention of explosions due to the "chemical" energy liberated by sudden burning or by chemical decomposition, and to the prevention of fires which burn so fast that they are akin to explosions. The molten nitrate mentioned above can give rise to "chemical" explosions. A few years ago a bath containing sodium nitrate which was used for the heat treatment of aluminium alloys exploded. The bath was blown to pieces and the workroom was badly damaged. One piece of the bath which weighed 112 lb. was thrown 200 yards away by the force of the explosion. It is thought that a quantity of aluminium alloy had been left in the nitrate, that serious overheating occurred, and that an explosive reaction between the nitrate and the metal followed. Similarly chlorates, peroxides and other oxidising agents have caused explosions and rapid fires when in contact with easily oxidisable materials. The obvious precaution is to prevent such contact, but where this precaution is impracticable special precautions to avoid ignition, and to restrict the spread and effects of a fire or explosion, have to be devised to suit the particular case.

Powerful chemicals such as those named above are fortunately not to be found in every factory, and the oxidising agent of which account has to be taken, when precautions against industrial fires and explosions are considered, is generally the oxygen of the air. Most explosions and rapid fires in factories are caused by the burning in air of quite ordinary industrial materials, starch, coal, sugar, sulphur, petrol, fuel oil, paints and varnishes, coal gas, etc., materials which are not in themselves explosive and are not generally regarded as particularly dangerous. How then do these ordinary materials become dangerous? One way in which to answer this question is to consider how a rapid fire or explosion could be produced from a common material such as the paraffin wax of an ordinary wax candle. A candle, like the materials mentioned above, is combustible, but a lighted candle burns quietly and the fact that a match or other source of ignition has been applied to it is of no great importance. An increase in the air supply will, up to a limit, make the candle burn more fiercely but beyond this limit the air will extinguish the candle flame. Too little air will also cause the candle flame to be extinguished, so that there are obviously limits of flammability outside the range of which combustion will not take place. If the paraffin wax of the candle is melted in a tray and the liquid wax is ignited, it will burn more rapidly than before, but it is still not particularly dangerous, unless there is leakage or spillage of the burning wax outside the confines of the tray. To obtain the extremely rapid combustion required for an explosion a much bigger surface would have to be exposed to the air, *i.e.*, there would have to be much more intimate mixing with air. This could be achieved by converting the wax to a fine powder and suspending it in the air in the form of a dust cloud, by forming a spray of the liquid in the air, or by heating the wax until it passed into air in the form of vapour. (In the last two instances the air itself would have to be heated, otherwise the cold air would condense the vapour and solidify the spray—but this need not affect the general argument.) As with the burning of the candle, the air would have to be present in the dust cloud, in the spray and in the vapour respectively, within a definite range of concentration for flame propagation to occur when a light was applied.

This example of the paraffin wax of the candle illustrates the fact that the rapidity of a fire and the likelihood of an explosion depend, in most instances, on the intimacy with which the combustible substance may become mixed with air, and whether the resulting mixture has a composition which lies between certain limits of concentration known as "limits of flammability". Whether or not a light is applied does not determine the likelihood of a dangerous occurrence; it is the presence or absence of an explosive mixture which is important. Thus the light may be applied to the candle and nothing dangerous happens; the same light may be applied to an intimate mixture of the material of the candle and air and an explosion results.

Most explosions and rapid fires in factories are due to flammable gases, vapours, sprays, liquids and dust, and it follows from what has been said above that the fundamental precaution is to avoid intimate mixture of these materials with air, or, if this is not practicable, to keep the mixtures with air outside the "limits of flammability".

Precautions in the Workroom

For many years great care has been taken, by provision of ventilation systems and by other means, to ensure that the atmosphere in factory workrooms is not contaminated by gases, vapours, sprays or dust to such an extent that injury to health may occur. A result, mainly fortuitous, of this work to promote health has been the avoidance to a large extent of flammable, as distinct from toxic, concentrations of impurities in workroom atmospheres. The gas carbon monoxide, for example, must be present in the air to the extent of about 12.5 per cent. by volume before it becomes explosive; to breathe air containing one thousandth part of this concentration of carbon monoxide is regarded by many authorities as harmful to health. About

1.4 per cent. by volume of the vapour from benzene is the smallest percentage which will give an explosive mixture with air, whereas one hundredth part of such a concentration might be toxic. Similarly the precautions needed to prevent workpeople from breathing harmful concentrations of paint-spray are far greater than are necessary to make the spray harmless from the point of view of fire and explosion.

These health precautions are, however, apt to leave loopholes. Little objection may be taken on the grounds of health to the fact that a man, in the course of his work, splashes and spills, say, white spirit over his clothes and over the floor of the workroom, but in doing so he is preparing the intimate mixture with air which may cause his death from fire. Similarly flammable dust such as starch may be allowed to accumulate on beams, ledges, plant casings, etc., in workrooms, because it is not specifically harmful to health, but this same dust, when stirred into a cloud and ignited, may blast the whole of a factory. Lastly inhalation of fumes can be avoided if a workman wears breathing apparatus, but he is still not safe if the atmosphere around him contains a flammable concentration of the fumes.

Most explosions and rapid fires are nevertheless due, not to normal conditions in the workrooms themselves, but to the conditions inside plant situated in the workrooms, or to the inadvertent release of flammable substances from inside such plant into workrooms. The latter can occur in various ways, and it is useful to consider this part of the subject before passing on to consideration of the conditions that can lead to explosions inside plant.

All too common is the practice of fitting to plant that contains flammable gas or vapour safety valves which, if they are called upon to operate, will discharge this gas or vapour into the air of the workroom. This practice has probably arisen from the practice followed with safety valves on steam boilers and air receivers. Release of flammable gas or vapour, possibly in large quantities, into a workroom is, however, obviously dangerous and consequently safety valves on stills, solvent extraction vessels, chemical reaction vessels, and other plant in which pressure due to flammable gas or vapour may arise, should be connected to suitable absorption systems or to safe places outside workrooms. Generally speaking, the vent pipes on plant which is normally at atmospheric pressure should be treated similarly, and should not terminate inside workrooms, if flammable gas or vapour is to be vented.

Perhaps even more serious is a risk which is associated with many kinds of plant in which flammable liquid is boiled and a water-cooled condenser is used to condense the vapours given off back to liquid. If, as has happened, an operator forgets to turn on the water supply to the condenser, or if for some reason the water supply is interrupted, uncondensed vapour may issue from the condenser outlet instead of liquid and fill part or the whole of a workroom with a flammable atmosphere. The speed with which this can occur can be appreciated when one considers that failure to condense one pint of a liquid such as acetone, benzene, alcohol or petrol could fill a space of three or four hundred cubic feet with a flammable concentration of vapour. Precautions are (1) to have condensers which are not self emptying so far as the water is concerned, (2) to have liquid seals, in the form of U-tubes vented to the outside atmosphere, between the condensers and the delivery points for the condensate, and (3) to interlock the water supply and the means used to heat the liquid, so that heat cannot be supplied until water is running through the condensers and if the flow of water ceases the heating is automatically stopped.

Sudden escapes of ammonia gas into the atmosphere of workrooms in sufficient quantity to form flammable mixtures with the air occur occasionally. Usually the ammonia comes from an ammonia refrigerating plant, and in most of the cases reported ammonia compressors have been started with the inlet valve open and the outlet valve closed. Big pressures have been built up and the compressors have burst. A precaution now widely adopted is to connect the high pressure side of a compressor with the low pressure side by means of a pipe in which there is a safety valve or a bursting disc. If the pressure on the delivery or high pressure side rises unduly, because of a closed outlet valve or for any other reason, the pressure is transmitted to the low pressure side through the safety valve or bursting disc: this means that no more ammonia is drawn in by the compressor from the refrigerator and the pressure ceases to rise.

Slow leakages of ammonia are of course easily detected because of the irritant nature of the gas, and indeed slow leakages of most industrial gases and vapours usually show their presence in the air of workrooms by their smell or other effects on workpeople before flammable concentrations are reached. An exception is propane, a gas used in metal-cutting and metal-spraying. Propane is a heavy gas which is not easily detected in low concentrations by smell. Odorants are added to increase the smell, but even so a number of serious fires and explosions have occurred as a result of undetected leakages of propane, and a search is being made for odorants which will make early detection of leakages more certain.

The so-called "re-cycling device" fitted to ammonia compressors can also be used to prevent the escape into workrooms of flammable liquid. A pump, particularly if it is of the reciprocating

type, may build up sufficient pressure to burst a pipeline if it is started when a valve in the pipeline is closed, and a dangerously large escape of liquid may occur before the pump can be stopped and the flow of liquid arrested. The remedy, as with ammonia compressors, is to connect the outlet to the inlet of the pump through a safety valve.

Leakage of flammable liquid into a workroom is doubly dangerous if the liquid is a volatile one, because there is the added risk of a vapour explosion. Even if the liquid is not very volatile, (*i.e.*, if it has a "flash-point" well above the temperature of the workroom), there is the danger that, by flowing in an uncontrolled fashion across floors, down staircases, through openings in floors, etc., it will spread out and offer a big surface in contact with the air. If ignition should then occur, burning may be rapid and flame may spread with great speed throughout a factory. A precaution which is gradually growing in favour is the provision of trays, sills, mounding, catch-pits, retaining walls, etc., to catch any flammable liquid that might escape by leakage or spillage from process vessels. The idea is to localise possible danger as far as practicable, and it is merely a logical application to process plant of a precaution which has for many years been a standard one with petroleum storage tanks (figs. 1 and 2).

Leakages may occur as a result of bad design of plant, development of faults in welds, subjection of plants to abnormal pressures, *e.g.*, owing to blockage of outlets or vent lines, or the leakages may be due simply to accidental overfilling of a vessel from a pipeline. To prevent serious leakages it is a good rule to have as little liquid above ground-floor level as possible, and to provide suitable overflow pipes leading to a storage tank at the lowest level in the system. A point which is sometimes overlooked is that if a closed vessel provided with a tall vent pipe is overfilled, and the liquid runs up the vent pipe and overflows, the vessel may be subject to hydraulic pressure far in excess of the pressure for which it was designed. This is because, in addition to the pressure due to the quantity of liquid it was meant to hold, it has to withstand the pressure due to the head of liquid in the vent pipe and also the not inconsiderable pressure of the frictional force built up as the liquid flows up the pipe.

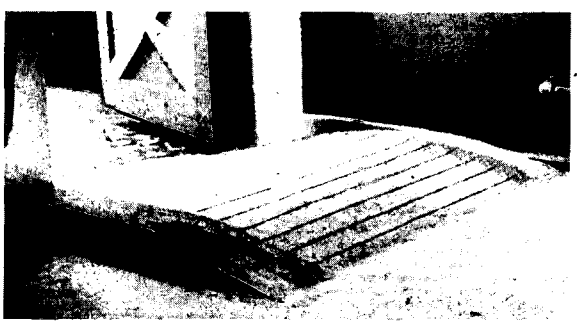


FIG. 1. Mounding at a doorway. If it is impracticable to mound each tank or plant unit separately, the escape of flammable liquid can be limited to one room or portion of a room by mounds or sills.

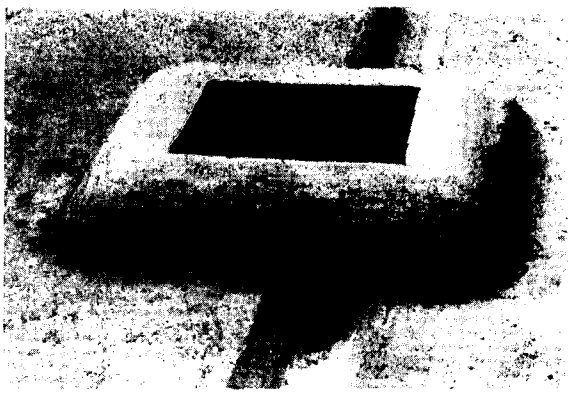


FIG. 2. Mounding around a drain to prevent flow into the drainage system should an escape of flammable liquid occur. Note removable plug for use when washing floor with water from a hose.

On many plants the glass tubes connected at top and bottom to the sides of vessels containing flammable liquids are an ever-present source of danger. These glass tubes are probably the simplest and most reliable instruments available for indicating liquid level but they are apt to break and to release the contents of the vessels. Several serious fires and explosions have started in this way and adoption of safer types of level indicator is advisable. Sometimes this particular problem is solved by fitting spring-loaded or weighted cocks at the top and bottom ends of the glass level indicators. These cocks are automatically kept closed by the springs or weights except while an operator holds them open manually to take a reading (fig. 3).

A tragic example of fire and explosion due to an escape of flammable liquid from a process vessel occurred at Hull in December 1948, when 12 people were killed and 29 injured (fig. 4). A large quantity of flammable liquid was involved in this instance, but quite small leakages or spillages may be serious. A boy was killed a year or two ago when he slipped and upset a vessel he was carrying which contained a mixture of hot paraffin wax and white spirit. The mixture was ignited by the pilot flame of a gas heater that had been used in the manufacturing process and the boy was burned to death. Other fatal accidents have been caused by the breakage of glass bottles containing ether. Various "non-spill" safety containers for small quantities of flammable liquids have been devised and their use is strongly recommended.

Flammable dust may leak into workrooms from plant for grinding, sieving, mixing, polishing, etc., if these plants are not properly enclosed or if the enclosures are not maintained in a dust-tight condition. Quite often dust escapes into workrooms at feed openings to machines and at delivery openings where bagging or packing of a dusty material is done. Provision of exhaust ventilation on "fume-cupboard" lines around such openings is often necessary. The dust that escapes does not usually remain in the air very long but settles on any and every surface in the workroom. It is not, of course, particularly dangerous in this condition. The danger, a very serious one, is that some shock, often a comparatively minor explosion *inside* the plant, may stir up the dust in the workroom into a cloud which can cause a major explosion (fig. 5). This major explosion may in turn stir up dust in passages and in other workrooms into clouds which ignite and cause flame and blast to pass through the whole of a large factory. The precaution here, an easy one in theory but often a difficult one to carry out in practice, is to prevent these dangerous accumulations of dust in workrooms by the constant use of vacuum cleaners, etc.

An interesting feature of some dust explosions, found also with other types of explosion and fire, is that they occur in factories where conditions have remained substantially the same for many years. A few years ago, for example, an explosion which killed 18 people occurred in a starch factory and on investigation it was found that almost the only change that had taken place before the explosion in nearly 100 years was the substitution of electric light for open gas flames. It is evident that the fact that a process has been in operation for a long period without trouble is no guarantee that the process is a safe one. Some slight omission on the part of a workman, or some quite minor deviation from the normal method of operation, may be sufficient to change a process which seems at first sight to be safe into one which may kill or injure many people.



FIG. 4. Results of fire and explosion that followed a leakage of flammable liquid from a process vessel.

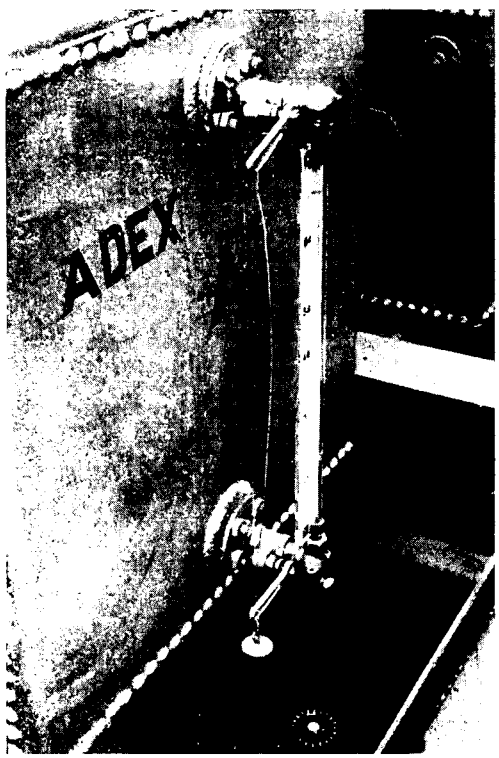


FIG. 3. Self-closing cocks fitted to a level gauge.

PRECAUTIONS INSIDE THE PLANT

The control of conditions *inside* the plant so as to avoid, at any stage of a process, the formation of flammable mixtures with air is often more difficult than the corresponding problem of control of conditions in the general space of the workroom. Even so, a great deal has been



FIG. 5. Results of a dust explosion.

achieved in this direction and many examples can now be found of processes that have been made safe by the adoption of this fundamental precaution.

One obvious method is the substitution of non-flammable for flammable materials. A good example of this is found in plants for the cleaning and degreasing of metals, where aqueous solutions containing wetting agents and various chemicals have been substituted for dangerous liquids such as petrol. The non-flammable solvent trichlorethylene is also widely used for such work. Dry-cleaning of garments, a process in which petrol was formerly used in large quantities, is now done with trichlorethylene or with white spirit, a solvent which, while it does not remove the danger of fire and explosion completely, reduces it considerably.

In many processes the likelihood that a source of ignition will be present or will appear is so great that the need for precautions to prevent the formation of a flammable mixture should be self-apparent. A common instance is that of work involving the application of heat, *e.g.*, from an oxy-acetylene burner, during repair of tanks and other containers which have held flammable materials. Many explosions, some with fatal results, have occurred during such work because the flammable materials have not been removed or rendered harmless. It has been found that the danger in such work is not confined to drums and vessels which have contained volatile liquids such as petrol; fatal accidents have been caused by the application of oxy-acetylene burners to drums which had contained diesel oil, linseed oil and a solid organic ester respectively. Apparently the heat of the burner had in each case caused sufficient evolution of fume from the residue in the drum to form a flammable mixture with the air in the drum (figs. 6 and 7).

Steam and chemicals such as boiling caustic soda solution are commonly used to remove the flammable materials from containers that are to undergo repairs.

Perhaps the most versatile method for preventing fire and explosion inside plant is based on the control of admission of air to the plant and the substitution in appropriate cases of inert material in place of air.

A few special processes are carried on under partial vacuum. Examples are vacuum distillation, vacuum drying and vacuum sublimation. In such processes the amount of air present is often too small to form a flammable mixture with the material being processed. Even if a flammable mixture is formed, the danger may not be great if the flammable mixture occurs only when the plant is under partial vacuum. (If ignition should occur in these circumstances the pressure produced by an explosion is unlikely to be more than about eight times the low pressure that existed in the plant prior to the explosion, and consequently the plant in many instances may be sufficiently strong to contain the explosion without bursting.)

The vacuum plants mentioned provide examples of the control of air in such a manner that there is too little air for explosions to occur. Much more general is the control of air so that safety is achieved by dilution of flammable material with so great an excess of air that the concentration of the flammable material in the air in the plant never reaches the "lower explosive limit". This dilution method is used in exhaust ventilation systems for gases, *e.g.*, for hydrogen liberated at "pickling" baths and in electrolytic processes, and in exhaust ventilation ducts carrying flammable dust. Ovens in which materials containing flammable solvents are dried are ventilated so as to keep the concentration of solvent vapours in the ovens below the lower explosive limit. Similarly spreading machines, for spreading and drying rubber solutions on cloth and for making cellulose acetate and cellulose nitrate films, are ventilated at a rate sufficient to render non-explosive the concentrations of solvent vapours both in the machines and in the ducting, etc., connected to them. The dilution method gener-

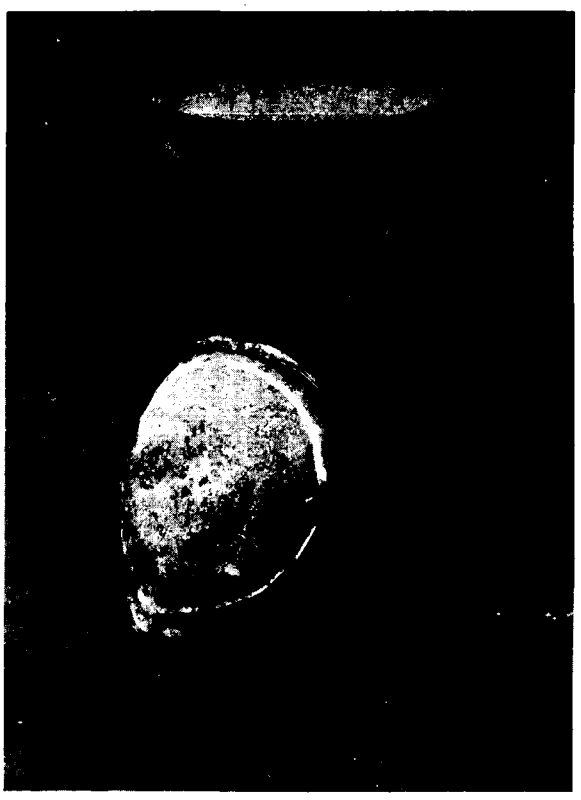


FIG. 6. Drum in which an explosion occurred when heat was applied by means of an oxy-acetylene burner. The drum had contained a solid organic ester.

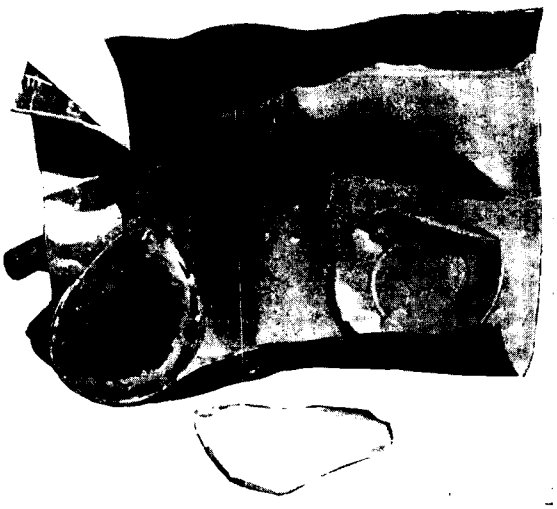


FIG. 7. Petrol tank which exploded while undergoing repairs.

ally involves mechanical ventilation, and danger sometimes arises through failure of a plant attendant to set the ventilation system in operation or through some mechanical breakdown of the ventilation system. For this reason it is quite common to use interlocking devices which ensure automatically that a machine is stopped, or the heating system of an oven is turned off, if the quantity of air necessary to ensure safety from explosion is not passing through the system. In some instances stand-by fans driven by some source of power independent of the normal are provided as an additional precaution.

Dilution with air is an effective precaution against fire and explosion with gases, vapours and sprays, but there are limitations in its application to liquids and solids. Fast currents of air passing over the surface of a volatile liquid may cause unwanted and uneconomic loss of liquid by evaporation. If the liquid is accidentally ignited the currents of air are likely to increase the rate of burning and it is unlikely that sufficient air will blow over the surface of the liquid to extinguish the flames; similarly ventilation may, and probably will, increase the rate of burning of most solids. Devices controlled by fusible links are therefore often incorporated in plant so that if a fire occurs the ventilation is stopped and in some cases these devices also bring fire-fighting devices such as carbon dioxide cylinders into operation. Dilution with air necessarily fails as a means of preventing explosions in dust-collecting plant such as cyclones and bag-filters because it is the function of such plant to accept air containing comparatively small amounts of dust and to deliver clean air and concentrated dust separately. During the concentration the dust, if it is flammable, necessarily passes through the explosive range of mixtures with air.

Because of these limitations the method of dilution with air is frequently replaced by methods based on exclusion of air. For example, a firm engaged in the manufacture of sulphuric acid had a number of explosions of sulphur dust. These explosions occurred inside the casing of a bucket elevator used to convey sulphur to the burners of the sulphuric acid plant. Various precautions were taken, *e.g.*, to eliminate sources of ignition such as hot bearings, stones, etc., from the elevator, but this did not prevent further explosions. Dust clouds were, of course, being formed in the elevator casing and it was finally decided that the fundamental precaution ought to be taken, the elimination of the dust clouds. Sulphur was therefore delivered to a pit outside the factory: the pit was heated by steam pipes which melted the sulphur and this liquid sulphur was then pumped through a pipeline into the factory. No further explosions occurred.

Air under pressure, in contact with flammable liquid, may produce very dangerous conditions, particularly if the liquid is at a temperature at which it gives off sufficient vapour to form a flammable mixture with the compressed air. A number of explosions have occurred under such conditions in plant known as vacuum and pressure varnish impregnators. These impregnators are used in several industries but they are probably most used in the electrical industry. The process of impregnation is as follows. Work, often electrical coils, is placed in the impregnation vessel which is then sealed by means of a heavy lid fitted with bolts or clamps. A vacuum pump is started and creates a vacuum in the vessel; this is to remove air and moisture from the vessel and from the interstices of the coils, etc. Varnish is then sucked in until the work is covered and the vessel is perhaps half full. To drive the varnish into the work, *i.e.*, to "impregnate" it, pressure is then applied to the surface of the varnish. In the past this driving force has been provided by the admission of compressed air at pressures up to 100 pounds per square inch. Often the plants are complicated by heaters, driers, humidity detectors, etc., all of which can be potential sources of ignition, and the varnish itself usually contains drying oils and resins which can give rise to spontaneous ignition. Add to this the fact that an initial pressure of 100 pounds per square inch may lead to a final explosion pressure of 700 or 800 pounds per square inch or even more and it can be seen that there are possibilities of disastrous accidents (figs. 8, 9 and 10). The most practicable precaution has been found to be the use of the inert gas nitrogen instead of compressed air and most firms, particularly those using the bigger and more complicated plants, have now taken this precaution.



FIG. 8. General view of the results of an explosion in a vacuum and pressure varnish impregnation plant.

Air is a mixture of approximately 21 per cent. oxygen and 78 per cent. and 1 per cent. respectively of the inert gases nitrogen and argon. The active principle of air, so far as fires and explosions are concerned, is oxygen, and safety can generally be achieved by elimination of the oxygen or by the addition of so much nitrogen or other inert substance that the proportion of oxygen in the mixture is not enough to support combustion. (Nitrogen is reactive only in certain special cases, *e.g.*, with magnesium.) Nitrogen atmospheres inside plant are used in many chemical processes to avoid risks of explosion, and carbon dioxide, either pure or in the form of flue gas, is likewise widely used. The inert material does not necessarily have to be a gas. Inert dust is sometimes mixed with flammable dust to reduce the risk of explosion, water may be used instead of an inert gas to fill an air-vapour space in a vessel and water sprays are sometimes used in fume-extraction plant in such a manner as to bring them under this general heading.

It may be mentioned in passing that, since oxygen is the active principle for most fires and explosions, an increased risk of fire and explosion is to be expected when pure oxygen or highly oxygenated atmospheres come into contact with flammable materials. This is confirmed by experience, for numerous accidents have occurred as the result of the misuse of oxygen. One type of accident in particular is worthy of note, since it can happen in almost any industry. A man has to go inside a plant or into a confined space to do some work such as oxy-acetylene welding or cutting. His work may produce fumes and in the absence of proper ventilation plant he or his mate may decide to blow oxygen into the confined space to "sweeten the atmosphere". Almost inevitably if this is done the workman will emerge with his clothing blazing furiously and his chance of survival is poor.

CONCLUSION

To sum up, from what has been said so far it will be apparent that the first precaution to be considered is always "how to avoid the formation of the bomb". In other words we should consider, as in the examples quoted above, every possible step that can be taken to prevent the formation of the flammable mixture. This is all too often completely overlooked by safety officers, works managers and others interested in the prevention of fire and explosion, and we find in

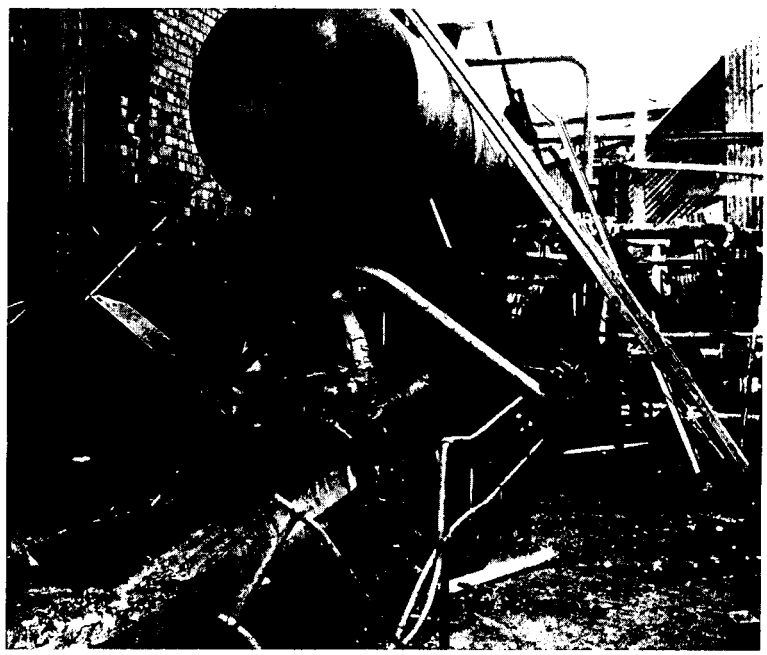


FIG. 9. Close view of the varnish impregnator.



FIG. 10. Wreckage of the heavy steel lid blown from the varnish impregnator by the force of the explosion.

practice that the more obvious but much less reliable precaution—avoidance of sources of ignition—is in many cases the only one which receives attention. The absurdity of precautions based solely on the avoidance of sources of ignition can perhaps best be illustrated by reference to explosions that occur in ovens and furnaces heated by gas or oil. Here the remedy is obviously to make quite sure that the gas or oil is *ignited* as soon as it reaches the oven or furnace burners and thus to prevent dangerous accumulations of unburnt fuel in the combustion chambers.

Devices are available which stop the supply of fuel automatically if there is no flame at the burners and the use of these automatic safety devices on industrial ovens and furnaces is increasing.

No inference is intended that avoidance of sources of ignition is not an important precaution against accidents due to fire and explosion. It is often, of course, very important, but as an auxiliary precaution; where there is risk of rapid fire or explosion it should not be the only precaution.

Naked lights, hot surfaces, frictional heat, static electricity, electrical apparatus, spontaneous ignition of drying oils, pyrophoric chemicals such as finely divided metals, ferrous sulphide, etc., have all received much attention in the literature on fire and explosion, but none of these sources of ignition need make a workman fear danger from fire or explosion if fundamental precautions have been taken.

Sometimes formation of the dangerous mixture cannot be prevented; it may be an essential part of a process, or precautions to avoid the formation may be so elaborate, cumbersome or expensive as to be impracticable. Sometimes a substance which is chemically unstable and which can give rise to explosion without any admixture of air has to be used in a process. In such circumstances, having eliminated foreseeable sources of ignition, it is generally wise to assume that unforeseen sources of ignition may appear at some time, *i.e.*, that an explosion will sooner or later occur, and that precautions are necessary to ensure that no one will be injured when the explosion does occur. This, the second fundamental principle, is, of course, a big subject in itself and only a brief account can be given of it.

Subdivision of plant into small units either by complete physical separation or by the introduction of "flame arrestors" between interconnected portions of plant is generally advisable to prevent the spread of explosions and rapid fires. In special instances plant units can be made so strong that they can contain the force of an explosion without bursting. Often, how-

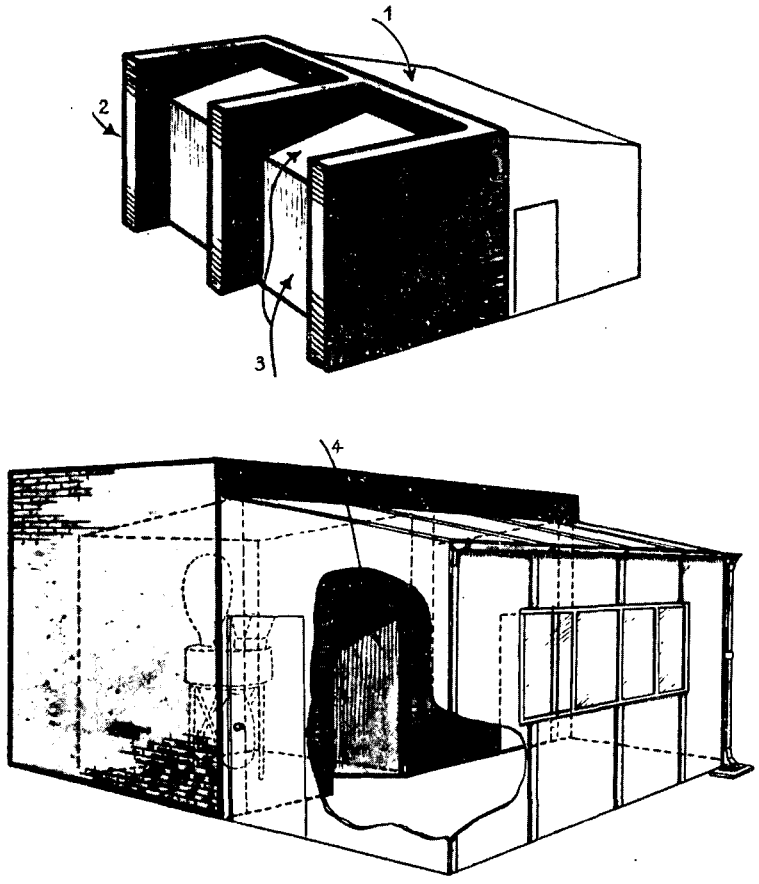


FIG. 11. An example of precautions to limit the spread and effects of explosions.

ever, provision of explosion reliefs designed to vent an explosion inside a plant enclosure to a safe place outside the workroom is necessary. Finally if a plant cannot be made safe in this way it is put in some place where it can explode without doing harm, and automatic devices are employed to ensure that men cannot enter these places while the plant is running (fig. 11).

This figure shows a suggested lay-out of grinding cubicles for diazo-compounds. The general working space (1) can be of light workroom construction ; the doors should open outwards. The front and side walls of the cubicles (2) should be blast-proof, consisting, for example, of 14″ brick work. The roof and the back wall (3) should be of light construction so as to burst easily on explosion. Materials such as plaster board or even varnished paper are suitable, as are also light panels on batten framework held by weak spring-clips. The cubicle should have an explosion-proof door (4) hinged inside the cubicle, to open inwards, and supported on three sides against explosion by the blast-wall. The door should be interlocked with the driving mechanism, so that the machine inside the cubicle cannot be at work unless the door is shut. The floors of the building should be of non-sparking material, and the surfaces of the walls should be such that they can easily be cleaned of deposits of dust.

SAFETY INSTITUTIONS, ASSOCIATIONS AND MUSEUMS

INTERNATIONAL

Miners' International Federation

The Conference of the Miners' International Federation held at Amsterdam in October 1949 passed the following resolution concerning the activities of the International Labour Organisation relating to health, safety and other working conditions in mines:

The Conference of the Miners' International Federation pledges its energetic support to the International Labour Organisation and urges its national affiliated unions (1) to give the widest possible publicity to decisions of the I.L.O. Coal Mines Committee and to the activities of the I.L.O. in the field of safety and health in coal mines, and also working conditions in mines other than coal mines and (2) to work through their respective Governments for the full application of these decisions in mining countries.

AUSTRALIA

National Safety Council of Australia

Report for 1948-1949 [1]

In its Twenty-second Annual Report, the National Safety Council of Australia records that the year 1948-1949 was one of the busiest in its existence.

The large increase in the number of new industrial enterprises and the expansion of Australian industry in general resulted in an increased activity of the Industrial Committee of the Council. An increasing number of requests were made to the Committee for assistance in safety problems.

During the year, 67,000 safety posters of a general nature and 1,220,000 payslip inserts were distributed to factories and workshops, and an investigation was undertaken to determine the possibility of issuing posters dealing with hazards in metalliferous mining.

Publication of the Council's journal *Safety News* was continued and many booklets, leaflets and other literature were made available to industry.

The Council took an active part in the introduction and arrangement of the syllabus of a course of lectures on industrial accident prevention given at the Melbourne Technical College. It was also represented on the many new committees of the Australian Standards Association.

During the year the Safety Research Group of New South Wales became affiliated to the Council. This group is composed of safety officers from various industries who agreed to act as a subcommittee of the Industrial Committee to carry out research work, contribute articles to the *Safety News* and represent the Council on the Standards Association of Australia's committees in New South Wales.

The report also contains information on road safety, child safety and on the activities of the Council's committees on home safety, propaganda and air safety.

[1] For 1947-1948, see *Industrial Safety Survey*, Vol. XXV, No. 1, p. 10.

COSTA RICA

State Insurance Institute

Accident Prevention Campaign [1]

The Costa Rican State Insurance Institute recently organised a special accident prevention campaign, with the help of competent persons and technical advice from a safety engineer. The immediate aim of the campaign was to reduce the number of accidents, which exceed 12,000 each year, by means of modern methods adapted to the needs of the country.

FRANCE

New Periodical: "Travail et Sécurité"

The first number, January-April 1949, of the periodical *Travail et Sécurité* published by the French National Safety Institute [2] contains approximately 20 articles on various subjects, written by well-known personalities, who have for a long time been active in the fight against accidents.

The titles of the articles are as follows:

Half a century of accident prevention in France.

The evolution of regulations dealing with the health and safety of workers, by P. Lafarge.

The progress of safety and health in mining undertakings, by F. Leprince-Ringuet.

Industrial hygiene services in the chemical industries.

An occupational disease conquered: phosphorous poisoning among match makers.

Principles approved by the French National Mercantile Marine for the improvement of industrial safety and hygiene conditions.

The prevention of accidents in the building and civil engineering industries, by P. Caloni.

The protection of workers against fire. By André Breton.

The French Manufacturers' Association for the Prevention of Industrial Accidents, by J. Troyon.

The Association of Manufacturers of Northern France, by F. Dujardin.

The Normandy Industrial Accident Prevention Association, by P. Bouyeure.

The Federation of French Associations of Owners of Steam Appliances.

The prevention of industrial accidents and occupational diseases in the metal industries, by J. Pluyette.

Health and safety in the chemical industries, by Ch. Bourdon.

The prevention of industrial accidents in the French National Railway Company, by M. Beauvois.

Organisation and activities of the Safety Service of the French National Electricity Board, by A. Genthial.

Safety organisation in the French National Gas Board.

Social Security and the prevention of occupational risks, by Etienne Gout.

The International Labour Office wishes this new periodical every success.

Two-Day Congress at Strasbourg on Industrial Safety [1]

The Union of Metallurgical and Mining Industries, in collaboration with the Employers' Federation of the Lower Rhine, organised at Strasbourg on 27 and 28 May 1949 a two-day congress on industrial safety.

The congress comprised lectures, visits to factories and the showing of foreign safety films.

The papers read emphasised the importance of the employers' role and responsibilities in the field of industrial accident prevention.

ITALY

Industrial Safety Congress of the Italian Centre for Safety Experts

A National Congress of the Italian Centre for Safety Experts *(Centro Italiano Addetti alla Sicurezza)* organised by the National Association for Accident Prevention Propaganda *(E.N.P.I.)* was held at Florence from 16 to 18 October 1949.

The following questions were discussed:

Recommendations respecting the better functioning of safety committees.
Personal equipment.
Construction of "safe" machines.
Earthing of electrical installations.
Building industry machinery.
Protection against radiation—collection of dusts.
Safety in transport.
Elimination of gas and vapours.

LUXEMBOURG

Accident Insurance Association

Report for 1948 [2]

In 1948, 8,360 undertakings were affiliated to the Accident Insurance Association.

During the year, the Association recorded 13,690 accidents, of which 773 occurred on the way to or from work. Fatal accidents numbered 29 (of which 10 occurred on the way to or from work). In addition, 6 cases of occupational disease were reported.

From 1947 to 1948, the total number of accidents increased by 11 per cent. approximately, while the number of man-years worked increased 19 per cent. during the same period.

[1] Information submitted by the I.L.O. correspondent in Costa Rica.
[2] See *Industrial Safety Survey*, Vol. XXV, No. 3, p. 91.

[1] *L'Usine nouvelle*, No. 24, 16 June 1949, p. 23.
[2] For 1947, see *Industrial Safety Survey*, Vol. XXV, No. 1, p. 12.

The Association continued its activities in the field of accident prevention. The Committee charged with the compilation of new provisions on the prevention of accidents drew up, with the collaboration of the Labour and Mining Inspectorate and industry, a "Final Draft of New Regulations for the Prevention of Accidents".

POLAND

Second Trade Union Congress [1]

Resolution concerning Safety and Health

The Second Polish Trade Union Congress (Warsaw, June 1949) devoted special attention to questions of industrial safety and health.

The Secretary of the Central Council of Trade Unions, Mr. Kofman, stated that the new industrial undertakings to be set up under the six-year plan would be constructed in accordance with all pertinent provisions respecting the protection of industrial work.

The Vice-President of the State Committee on Economic Planning, Mr. Szyr, declared that the Government supported the trade unions in their efforts to improve industrial safety and health.

The Congress adopted a resolution requesting trade unions and Government administrations to devote particular attention to the elimination of causes of occupational diseases and industrial accidents. The resolution also emphasised the importance of setting up research institutes for the study of industrial safety and health matters, the training of a sufficient number of specialists, and the development of labour inspection techniques. Other points in the resolution dealt with the problems of protective clothing, intensifying propaganda measures for the prevention of accidents and occupational diseases (posters, radio, press, films), "social inspection of labour", and the conclusion of additional collective agreements determining precisely the management's responsibilities with respect to matters of industrial safety and health.

SWEDEN

Industrial Accidents in Engineering Undertakings in 1948 [2]

The statistics compiled for the year 1948 by the Swedish Engineering Trades Association cover 286 undertakings employing 97,745 full-time workers (man-years).

In 1948 the accident frequency rate was 16.0 per 100 man-years as compared with 16.9 in 1947. Of the 15,616 accidents reported, 20.1 per cent. were attributed to machine tools, 19.0 per cent. to moving or falling objects, 13.6 per cent. to slipping and stumbling and 12.2 per cent. to sharp objects, etc.

The statistics also revealed that the frequency rates of small undertakings are considerably higher than those of large undertakings.

[1] *Biuletyn informacyjny Centralnej Rady Zwiazkow Zawodowych*, No. 29, 4 Aug. 1949.

[2] *Verkstäderna*, No. 8, p. 187; for 1947, see *Industrial Safety Survey*, Vol. XXV, No. 1, p. 12.

UNITED KINGDOM

Fire Protection Association [1]

With the aim of campaigning actively against fire, the Fire Protection Association was formed in December 1946 by members of the Fire Officers' Committee.

The objects of the Association are to advance the science of fire protection, to disseminate advice on fire protection and allied subjects, to investigate the causes and spread of fire, to publish codes of practice relating to fire protection, to collate and analyse fire statistics, to propagate knowledge in connection with fire protection and to co-operate with Government departments and other bodies interested in fire protection.

Close liaison is maintained by the Association with the joint fire research organisation of the Department of Scientific and Industrial Research and Fire Officers' Committee, and with the Fire Service Department of the Home Office.

So far the Association has issued the following publications:

Technical Booklets.

Fire Resistance of Dwelling Houses (1947).
Prevention of Fire in Coal Stacks (1949).
Fire Prevention Notes for Industrial Premises (1948).
Fire Prevention Notes for Storage Buildings (1948).

Journal Reprints.

Studies of the Growth of Fire (1949).
The Cooling Effects of Water and Carbon Dioxide (1949).

Quarterly Publication.

Since 1948 the Association has published a quarterly journal of about 32 pages with several illustrations.

The Fire Protection Association provides a free service for industry as a whole whether in public or private ownership and whether or not insured.

UNITED STATES OF AMERICA

United States Bureau of Mines

Report of Research and Technological Work on Explosives, Explosions and Flames, Fiscal Years 1947 and 1948 [2]

The subjects dealt with in the report are explosives research, testing of explosives, flame and

[1] 84, Queen Street, London, E.C.4.

[2] R.I.4502, July 1949.

combustion research, flammability of gases and vapours, and work in the experimental coal mine, laboratories and testing galleries.

The researches on explosives were concerned with the effect of sheaths on the gaseous products from permissible explosives, the explosion hazards of perchloric acid and mixtures of perchloric acid and organic materials, hazards of ammonium nitrate, powder-powered tools, and blasting units.

As regards the flammability of gases and vapours the Bureau of Mines studied the ignition temperatures of numerous compounds in air and in oxygen, the extinction of flames of isobutane, propane and butane by other gases, the effect of hydrocarbons and other gases on the explosibility of gasoline, the flammability of mixtures of gasoline vapour and air at low pressures, and reactions between calcium carbide and mixtures of acetylene and water vapour.

In the experimental mine, research was continued on the prevention of coal dust explosions in mine rooms and the charge limits of permissible explosives.

Laboratory studies related to the explosibility of organic and metallic dusts, and testing galleries were used to study the release of pressures produced by dust explosions.

The report is illustrated by 71 photographs, diagrams and graphs.

Wartime Activities of the Health and Safety Division of the United States Bureau of Mines [1]

When the United States entered the war in 1941, the Health and Safety Division of the Bureau of Mines consisted of the Health and Safety Branches together with eight field headquarters in the different mining regions of the country. At that time the Safety Branch consisted of some 35 mining engineers and 35 safety instructors, together with clerks and others, making a total of about 90 persons; the Health Branch had a personnel of 17, including chemists and physicists.

During the war period these two branches were supplemented by three others—the Coal Mine Inspection Branch, the Explosives Control Branch, and the Mineral Production Security Branch. The functions of the last two were mainly to prevent damage by enemy or subversive action.

The activities of the Safety Branch included training in first aid and mine rescue, safety instruction for personnel in the mining and petroleum industries, demonstrations of coal mine hazards, scientific research and specific investigations.

During 1941 and 1942 over 170,000 persons in the mineral industries and about 6,000 in other industries were trained in first aid, and about 5,500 persons were trained in mine rescue work. It is known that between 1941 and 1944 at least 150 lives were saved as a direct result of the application of first aid, and it is estimated that the total number of lives saved by first aid is about 200 a year. The interest in first-aid training shown in the early years of the war diminished as the risk of enemy action on American soil decreased. Attendance at training classes was also adversely affected by the shortage of manpower, longer working hours, and other factors, and the number of trainees fell to a little over 15,000 in 1945. However, in that year about 3,000 people were trained in mine rescue work.

During the war more than 300 men were rescued after mine fires and explosions. The number saved as a direct result of Bureau of Mines training is not definitely known, but it is thought to be fairly large.

During the war the Safety Branch continued to give instruction courses in accident prevention to the personnel of coal and metal mines, petroleum refineries, quarries, and metallurgical plants.

Demonstrations of coal dust hazards were given to numerous audiences composed of persons connected with the mineral industries. In addition, a number of sound motion pictures were used to teach safety to some 16,000 persons a year. Addresses on safety topics were given by members of the Safety Branch at 617 meetings during the war. In all, about 213,000 persons are estimated to have attended the meetings and the demonstrations.

About 300 special investigations were made during the war into matters such as explosions, asphyxiations, fires, contaminations of air and water, and ventilation in mines and war plants.

The Safety Branch also co-operated with various Government agencies in the study of various problems such as the prevention of fires and explosions in ordnance and munition plants, die-casting plants, oil-storage tanks and kapok stores, the toxicity of substitutes for freon in Aerosol bombs, explosive properties of aluminium powder, and the use of wetting agents.

The Electrical-Mechanical Section of the Safety Branch studied the installation of explosion-proof electrical equipment in aircraft carriers and other vessels carrying highly volatile aviation gasolene, the adaptation of American mining machinery for use abroad, the suitability of plastic materials as a substitute for glass in globes for explosion-proof portable lamps, and other matters.

[1] *Activities of the Health and Safety Division, Bureau of Mines, U.S. Department of the Interior, during the War Years 1941-45*, U.S. Bureau of Mines, I.C.7487, Jan. 1949.

Probably the most interesting and important problem studied by the Health Branch was that of the hazards from carbon monoxide on tank landing vessels; it was necessary to design a system of ventilation for the ship's hold such that harmful concentrations of carbon monoxide would not accumulate during the prolonged warming-up of the engines of tanks and other vehicles immediately prior to landing. Other matters investigated by the Health Branch included the loading of packaged gasolene at the New York port of embarkation, the application of tetrachloride types of fire extinguishers to burning magnesium chips, the toxic gases produced by thermal decomposition of the insulation of electric cables as a result of current overloads, and the study of toxic gases produced by burning or thermal decomposition of moulded and laminated thermosetting plastic materials.

The Respirator Laboratory undertook much work in connection with the testing and approval of respiratory protective devices. At the outbreak of war the Bureau of Mines had laid down conditions for the testing and approval of all types of respiratory protective devices except chemical cartridge respirators. With the increased use of spray-painting, especially with lead-base paints in the construction of ships, the Bureau was called upon to lay down conditions for the testing and approval of chemical cartridge respirators fitted with mechanical filters, so as to be capable of removing both the organic vapours and the lead particles from the air breathed in by the workers.

The Coal Mine Inspection Branch created a Federal Inspection Service and inspected coal mines all over the country. When it was established in 1941, the Branch employed 107 inspectors and 10 engineers; the number of inspectors was brought up to 157 by July 1945, and this number made it possible to inspect all coal mines employing 25 or more men, and also a few of the smaller mines.

The newly appointed inspectors were given special training at the Central Experiment Station of the Bureau of Mines in Pittsburgh. The training included intensive instruction in the fundamentals of mine safety. To guide the inspectors in making their recommendations and also to co-ordinate their activities, a set of inspection standards comprising some 600 provisions was prepared by the Bureau of Mines.

The Coal Mines Inspection Act does not provide for the enforcement of recommendations made by inspectors, and, accordingly, appreciable results can only be achieved by close co-operation between the Federal inspectors on the one hand and management, labour and the State mine inspection agencies on the other. Although the publicity given to inspection reports usually helps to secure compliance with recommendations, the most effective results have been obtained by close personal contacts in the industry, and by convincing all concerned of the advantages of compliance.

Between 1 December 1941 and 1 October 1945, some 3,100 of the 14,000 coal mines in the United States were inspected once; these mines accounted for nearly 90 per cent. of the total output of coal, and employed about 97 per cent. of the personnel of the coal mining industry. A large number of mines were re-inspected, sometimes on several occasions.

It is estimated that during the war at least 250,000 recommendations made by Federal inspectors were put into effect by the mining companies. It is noteworthy that the fatality rates for the years 1943, 1944 and 1945 were the lowest in the history of the coal mining industry, and that these years constituted the first period in which fatality rates had fallen regularly for three consecutive years. If the fatality rates for 1916, 1917 and 1918 had been maintained in 1942, 1943 and 1944, it is estimated that the total loss of life would have been 7,730 instead of 4,228. In 1944, when the record amount of 683,200,000 tons was mined, the fatality rate fell below 2 per million tons of coal produced for the first time in American coal mining history.

The President's Conference on Industrial Safety [1]

The President's Industrial Safety Conference was held in Washington from 23 to 25 March 1949 to consider the reports of the seven main committees organised at a preliminary meeting convened in September 1948. [2]

The proceedings have been published in an impressive bulletin containing 362 pages, which is briefly reviewed below.

In his opening address, President Truman stressed the need for greater concerted action on the part of accident prevention workers, and set the goal for the nation's co-operative effort in terms of a 50 per cent. reduction in the national accident toll by the end of 1952.

Mr. Maurice J. Tobin, Secretary of Labor, as General Chairman of the Conference, urged that the nation's tremendous experiences in the industrial field be put to useful application in the solution of the industrial accident problem. After explaining the way in which a nation-wide programme had been arrived at, he pledged the nation's official institutions to an intensive co-operative effort with the country's employers', workers', public and private organisations for accident prevention.

[1] U.S. Department of Labor, Bureau of Labor Standards: *Proceedings of the President's Conference on Industrial Safety*, Bulletin No. 112, Washington, D.C., 1949.

[2] See *Industrial Safety Survey*, Vol. XXV, No. 1, p. 13.

The Hon. John O. PASTORE, Governor of Rhode Island, and representative of the Governors of the States of the Union, also addressed the Conference. He laid stress upon the necessity to promote safety by a sound educational system in preference to enforcement methods, and suggested that the programme outlined by the General Conference should be applied by all concerned on a State-wide as well as on a national basis.

The Conference set up seven main committees, the work of which was systematised by a Co-ordinating Committee.

Report of the Committee on Accident Records, Analysis and Use. During the year 1948 an estimated 1,960,000 industrial casualties were reported, amongst which there were 16,500 deaths, 1,800 permanent total disabilities, and 83,700 permanent partial disabilities. The total loss of time chargeable to these injuries amounts to 219 million man-days, the equivalent to the loss of one full year of 730,000 workers. It is expected, however, that the frequency rate for injuries during 1948 will show a substantial reduction over those of 1947 for most industries when the final figures are arrived at.

The main aim of this committee was to review the entire field of industrial injury and accident statistics and formulate a number of recommendations designed to improve the quality and usefulness of the statistics now being produced, and to undertake the additional types of statistics which are needed. Amongst other deficiencies in existing statistics, it was found that there is a need for greater detail in accident and injury records of small establishments, and that with respect to the cost of injuries and their social consequences, statistical information is severely deficient.

The report includes several recommendations, of which the following are of special importance:

1. All industrial establishments should conform to the standard method of compiling industrial injury rates as approved by the American Standards Association.

2. Analysis of accident and severity rates among small establishments should be strengthened.

Report of the Committee on Engineering. Six subcommittees devoted their time to the study of the following subjects: safety and efficiency; the techniques involved in the engineering approach to the control of accident hazards; the safe design and lay-out of plant, structure and processes; the safe design and safeguarding of machinery, tools and equipment; integrating safety within industrial organisation; adequacy of existing safety engineering standards.

In the development of these subjects the committee arrived at a large number of interesting recommendations which may be summarised as follows:

1. Greater consideration should be given to safety in the design of machinery and lay-out of plant, structures and processes.

2. Detailed studies should be made to demonstrate clearly the relationship between safety and efficiency.

3. Preventive maintenance programmes should be instituted to eliminate accidents due to defective machines or guards.

4. The management of all plants should be educated to realise the fact that effective accident prevention programmes are good business.

5. An analysis of existing State statutes and codes should be prepared by the U.S. Department of Labor in co-operation with the State labour departments to determine the adequacy of safety standards.

6. The principles of national standardisation of safety codes should be encouraged among State regulatory bodies and through expanded education in industry.

7. Present developments in engineering safety standards should be reviewed in relation to needs, and a programme should be formulated for further extension of the work in this field.

There are two appendices to this report, one of which outlines the principles involved in safety engineering, together with the methods of application of these principles to the elimination of specific hazards, and the other gives a list of valuable safety standards prepared by the various national organisations, such as the American Standards Association, the National Fire Protection Association, the American Petroleum Institute, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the Association of American Railroads, the Interstate Commerce Commission and the Manufacturing Chemists' Association.

Report of the Committee on Laws and Regulations. The function of this committee was to review and appraise existing State occupational safety laws to determine their adequacy and the extent to which they are used, to suggest certain principles and practices which can be followed to develop or amplify the State safety laws and regulations, and to consider the organisation and adequate financing of State safety agencies. The committee also drafted, for inclusion in basic legislation, suggested wording covering certain key provisions in connection with the delegation of authority to draft rules and regulations having the force of law. The principal legislative provisions are incorporated in the text.

The main recommendations of the committee are as follows:

1. The President of the United States should suggest to the Governor of each State that the Governor appoint qualified personnel to review existing State statutes dealing with the prevention

of industrial accidents and occupational diseases, in the light of the recommendations adopted by the Conference, to the end that existing State laws and regulations, or proposed legislation, be maintained in a manner to meet changing conditions, methods, techniques and equipment.

2. The Secretary of Labor should prepare and make available an index and analysis of all State laws, rules and regulations pertaining to safety and occupational disease control.

3. Safety codes, rules and regulations, covering all industrial operations and having the force and effect of law, should be promulgated, altered and amended by the regulatory State authority which is charged with the administration of the State's accident prevention programme rather than by enactments of State legislature.

4. Where regulatory bodies are granted rule-making authority, certain basic principles and procedures should be enacted into the statutes of each State in order to make certain that such authority will be fairly and effectively administered. (These principles are set out in considerable detail in the report of the Committee.)

5. In the formulation of safety regulations and codes, the following basic principles should be followed:

(a) Regulations should be designed to provide the groups concerned with sound technical information for voluntary use in the prevention of accidents, as well as an instrument for compelling compliance with minimum safety requirements. The regulatory Government agency should be a service organisation as well as an enforcement agency.

(b) Regulations should be developed with the assistance of technical societies, public service groups and insurance, trade and labour organisations.

(c) Regulatory bodies of the various States should strive for uniformity.

6. Federal, State and municipal authorities should take steps to consolidate, in so far as practicable, all activities in the field of industrial safety and health.

7. The following principles should be observed in any programme for the elimination of duplication in the field of prevention of industrial accidents and occupational diseases:

(a) The primary political subdivision in governmental operations in the field of accident prevention should be the State.

(b) Partial regulatory or enforcement authority should not be granted to municipalities.

(c) The Federal Government should confine itself to statistical and fact-finding activities, studies of administrative procedures and all types of technical assistance to State agencies.

8. The principle of national standardisation of safety codes sould be encouraged among State regulatory bodies, and through education in industry.

9. All technical personnel dealing with industrial safety and hygiene should be placed in the classified service of the State and the qualifications of such personnel should be established by the Civil Service Commission of the State.

10. The agency having jurisdiction over industrial safety should institute and conduct adequate training programmes for personnel engaged in accident-prevention work.

11. States should make provisions for more adequate financing of State labour department safety programmes.

Report of the Committee on Education. Several subcommittees were set up to study the needs and methods of adequately integrating and implementing industrial safety education and training in all pertinent areas and levels of education. The report points out that education should be given to the individual worker before and after he enters industry. Several recommendations are included in the report with respect to the organisation and supervision of safety education in elementary, secondary, vocational and technical schools, the institution of training courses for teachers in colleges and universities and for employers and workers in large or small industrial undertakings. The report offers many valuable suggestions to the various States for a complete educational programme.

Report of the Committee on Labor-Management Co-operation for Safety. Representatives from the most powerful and influential labour and management groups in the United States served on this committee. The report sets forth the terms in which labour-management co-operation for safety may be achieved and lays down the fundamental principles which should be used as a guide for establishing the obligations of individuals and groups in accident prevention.

Report of the Committee on Programmes and Services. This report deals with: (1) the appraisal and outlining of desirable, organised safety programmes for Government agencies, for all types of industrial enterprises and for other public and private organisations; (2) the need for methods of co-operation and co-ordination of all these agencies at national, State and local levels; (3) the development of an approach to the solution to the accident problems of small undertakings.

It sets forth the fundamental requirements for a comprehensive safety programme, and defines the responsibilities of labour and management in carrying out the programme. Considerable attention is given to the selection, training and supervision of workers and a basic programme is offered as an example of an induction training programme for new workers.

Report of the Committee on Research. The task of the committee was: (1) to appraise the present knowledge of the environmental and personal causes of industrial accidents and their control from the standpoint of adequacy and usefulness for industrial accident prevention; (2) to determine

areas in which a deficiency of knowledge is apparent; and (3) to recommend, plan and conduct investigations pertinent to these and other subjects within the purview and plan of the Conference.

It was fully realised that additional knowledge of the human factors and personal causes of accidents and their control is needed to reduce injury rates in industry.

The committee's report suggests a certain number of recommendations designed to help management and labour to benefit from the knowledge already acquired in this domain and to find paths through which this knowledge may be expanded by further study and experience. As to mechanical and physical causes of accidents, it is recommended, *inter alia*, that means be ensured to ascertain greater consideration of safety in the design, purchase and installation of plant and equipment. Consideration is also given to the subjects of job analysis; source and application of anthropometric data (with tables) in relation to designs of equipment; standardisation of equipment, tools and working methods; and other environmental conditions, *e.g.*, noise, vibration, ventilation, as factors in accident causation. Of particular interest is the discussion in the report of the problems involved in developing tests of accident proneness and in determining factors which influence the efficiency of industrial workers.

Report of the Co-ordinating Committee. This report summarises the major principles and recommendations of the seven technical committees of the Conference. For the control of hazards, reference is made to the reports of the committees on engineering and research for more detailed information, and emphasis is laid on the close relationship between safety and efficiency in any industrial undertaking, on education and training for elimination of personal or human factors, on the assignment of responsibility, and on effective engineering controls and the formulation of an organised safety programme as means of furthering accident prevention.

Appendices to the report show the organisation of the Conference, the names of the participants in the Conference committees, and the names of the delegates from the various States, Hawaii and Canada.

LAWS AND REGULATIONS, SAFETY CODES

AUSTRALIA

Australian Standard Rules for the Storage and Use of Explosives Dated February 1949 [1]

The eleven sections into which the Code of Rules is divided deal with scope and definitions, general requirements, storage, conveyance on and about the site of operations, preparation for use, charging holes, firing, misfires, equipment and maintenance, special applications to submarine work and to caissons and compressed-air tunnels, and disposal of surplus and defective explosives.

Standards Association of Australia: Recommendations respecting the Risk of Ignitions in Oxygen Breathing Apparatus [2]

A committee of investigation set up by the Standards Association of Australia to examine the design of regulator valves used in rescue apparatus and the fabrication and material of the valve seatings has made the following recommendations with a view to eliminating, or reducing to a negligible amount, the risk of ignitions in oxygen breathing apparatus:

Seat Material

No new material was found giving better performance than those at present in use in Australia. The most important of these are the so-called "blonde rod" (essentially a casein material) and ebonite (hard rubber material).

It was considered that the risk of seat ignition can be so reduced by other means that the question of the seat material becomes relatively unimportant provided that the material can be given and will retain a smooth surface.

Special Main Valve

It was considered that the most effective means of preventing seat ignition is by eliminating or reducing sudden increases of pressure and the consequent production of localised high tempe-

[1] Standards Association of Australia: *SAA Explosives Code*, CA 23-1949.
[2] *Australian Standards Quarterly*, Apr. 1949, p. 11.

ratures in the vicinity of the seating material. A needle type valve (developed by officers of Commonwealth Industrial Gases, and investigated by the committee) offers a positive solution to this problem and it was recommended that such a valve should be fitted to existing safety sets as soon as opportunity occurred.

Other Fitments

Until it is possible to fit a needle type valve, the cylinder valve should always be opened as slowly as possible. The use of a rod or heat dissipator, approved by the manufacturers, in the high-pressure tube of the oxygen regulator valve was suggested.

Where existing regulator valves are already fitted with a dissipator rod, or other similar approved device, this need not be removed when the needle type valve is fitted.

Maintenance

The seat of the oxygen regulator valve should be replaced whenever it shows signs of wear or loses its polish. The safety sets should be maintained in efficient condition and given a complete overhaul every month.

Ignition at Points other than Regulators

The committee was of the opinion that, where a needle type valve is fitted and maintenance is properly carried out, the risk of ignition at points other than regulators will be negligible.

Western Australia

MINES REGULATION ACT REGULATIONS
DATED 10 MARCH 1949 [1]

There are 14 parts to these regulations, as follows:

I. Preliminary.
II. Inspection.
III. Management and supervision.
IV. Explosives.
V. Safety and protection.
VI. Ladders and travelling ways.
VII. Winding and signals.
VIII. Ventilation.
IX. Sanitation and hygiene.
X. Underground locomotives, including shuttle cars.
XI. Electricity in mines.
XII. Plans and surveys.
XIII. Miscellaneous.
XIV. Occupational diseases.

[1] *Government Gazette of Western Australia*, No. 20, 4 Apr. 1949, p. 731.

Part II deals with the qualifications, appointment and duties of inspectors, including workmen's inspectors; Part III with the examination, certification and responsibilities of managers; and Part IV with explosives magazines, handling of explosives and shotfiring.

Numerous matters are regulated in Part V, including men working alone, lighting, rises, fencing of dangerous places, winzes, precautions against water, safety helmets and belts, and first aid.

Among the matters dealt with in the winding regulations in Part VII are the medical examination of winding drivers, cage safety gear, signalling systems, hoists, winding engines, ropes, and winding operations.

Part VIII, ventilation, includes regulations for the prevention of dust, and provides for the appointment of dust and ventilation officers.

BELGIUM

ORDER OF THE REGENT REGULATING THE USE OF EXPLOSIVES IN UNDERTAKINGS OTHER THAN MINES AND UNDERGROUND QUARRIES
DATED 31 MARCH 1949 [1]

This Order deals with the loading, priming, tamping, firing and signalling of shots and policing of the area; certain special types of shotfiring such as firing in a confined space or under water; incomplete explosions and misfires; liquid air or liquid oxygen explosives and the use of detonating fuses; supervision of the use of explosives; the reporting of accidents and incidents.

BULGARIA

SAFETY REGULATIONS CONCERNING WORK AT GRINDING AND SHARPENING MACHINES
DATED 3 JUNE 1949 [2]

The provisions of these Regulations deal with the maximum permissible peripheral speeds of grinding wheels; the obligations of manufacturers; the marking, testing and mounting of grinding wheels; protective hoods; the collection of dusts in dry grinding; the support of the piece being worked; the testing of wheels before they are put into service; etc.

SAFETY REGULATIONS CONCERNING WORK AT WOODWORKING MACHINES
DATED 3 JUNE 1949 [2]

These Regulations, in 49 sections, contain safety measures to be observed in woodworking operations. They include a group of general

[1] *Moniteur belge*, 17 June 1949, p. 5576.
[2] *Drjaven Vestnik*, No. 136, 16 June 1949, p. 20.

provisions and special provisions dealing with circular saws, band saws, planing machines, wood-milling machines, and horizontal drilling machines.

Safety Regulations concerning Transmission Gear Dated 3 June 1949 [1]

These Regulations contain numerous provisions dealing with the protection of transmission gear, *i.e.*, shafts, pulleys, belts, metal belts, chains, etc. Special detailed provisions are also included dealing with the construction, installation, protection, starting and stopping, and maintenance of belt drives.

Safety Regulations concerning Portable Wood Ladders Dated 3 June 1949 [2]

A comprehensive collection of provisions dealing with the construction and use of portable wood ladders.

Regulations concerning Electric and Oxy-acetylene Welding Equipment Dated 3 June 1949 [3]

Title I of these Regulations deals with oxy-acetylene welding. It contains provisions respecting the classification of the equipment, its construction and accessories, and also includes a number of rules on protection against fire and explosions.

Electric welding is dealt with in Title II. This contains provisions respecting requests for the certification of electric welding machines, personal protection equipment, and the earthing of electrical installations and conductors. The maximum pressure of the welding circuit is fixed at 30, 70 or 80 volts according to the respective cases.

Title III contains general provisions.

CANADA

Canadian Standards Association Code of Practice for Window Cleaning Z.91-1949

The Code consists of seven sections of which the first lays down general rules and the others deal respectively with responsibilities, safety equipment (swinging scaffolds, boatswains' chairs, ladders, safety belts, etc.), installation of anchors, strength of materials, special conditions (extra-wide windows, casement windows), and inspection of equipment.

[1] *Drjaven Vestnik*, No. 136, 16 June 1949, p. 22.
[2] *Ibid.*, p. 23.
[3] *Ibid.*, p. 19.

Canadian Electrical Code, Part V: Use of Electricity in Coal Mines [1]

The provisions of Part V of the Canadian Electrical Code have been drawn up by the Canadian Standards Association in collaboration with provincial departments of mines, the Canadian Institute of Mining and Metallurgy and other authorities.

Part V is in three sections: 1, Definitions; 2, General Rules; and 3, Electric Hoists and Transportation. The general rules include provisions on supervision, inspection and repair, construction of electrical systems, control and protective devices, storage batteries, guarding or isolating live parts, transformers, grounding. conductors, flexible or trailing cables, lighting systems, telephone and signal systems, operation of apparatus, lightning protection, fire protection and wiring plans.

Alberta

Safety Regulations governing the Drilling, Cleaning, Repairing, Operation and Maintenance of Oil and Gas Well Drilling Plants, Rigs and Equipment O.C.544-49. Dated 4 May 1949 [2]

The principal matters dealt with in these regulations are derricks, safety belts and lines, drilling rigs, electric wiring and equipment, and storage of oil and gas.

In connection with derricks, there are provisions concerning cellars, derrick-room exits, crown platforms and railings, outside platforms for drilling rigs, inside platforms, ginpoles, crown sheaves, finger boards, ladders, auxiliary means of escape, pipe hooks and loose material.

Other matters dealt with in the regulations include static electricity, fire extinguishers, gas masks, the use of natural gas, and head protection.

Nova Scotia

Act to Amend the Metalliferous Mines and Quarries Regulation Act, 1937 Dated 14 April 1949 [3]

The amended sections of this Act deal with the reporting to the Deputy Minister of Labour of all accidents causing fatal or serious injury and the appointment and duties of "special examiners" to investigate fatal accidents.

It is also provided that workmen may appoint a committee to examine the scene of any accident resulting in the death of or injury to any person.

Certain dangerous occurrences, such as inrush

[1] C.S.A. C22.5, No. 2-1949, Canadian Standards Association, Ottawa, July 1949.
[2] *Alberta Gazette*, 14 May 1949, p. 559.
[3] *Statutes of Nova Scotia*, 13 Geo. VI, p. 230.

of water from old workings, outbreak of fire underground, premature or unexpected explosion or ignition of explosives, flammable gas in the mine workings, etc., must be reported whether loss of life or personal injury is caused by them or not.

The Steam Boiler and Pressure Vessel Inspection Act. Dated 14 April 1949 [1]

The Act contains definitions of various types of steam boilers and pressure vessels, and provides that regulations may be made under the Act on a number of matters, including the following:

(1) the construction of steam boilers and pressure vessels;

(2) the inspection of steam boilers and pressure vessels during their construction, reconstruction and repair;

(3) the powers and duties of the chief inspector; and

(4) reports of inspectors.

JAPAN

Mine Safety Law, No. 70 Dated 16 May 1949 [2]

The four chapters into which the law is divided are entitled General Provisions, Maintenance of Safety, Supervisory Organs and Penal Provisions.

The chapter on maintenance of safety deals with the general duties of employers and workers, the certification of machinery, explosives and other mining equipment, approval of buildings, equipment and operational plans by the inspectorate, mine safety rules, technical personnel, mine safety committees, supervision by the mining authorities and mine plans.

Every mine-owner must draw up safety rules for the mine, in consultation with the mine safety committee, and these rules must be approved by the inspectorate.

Every mine must have a safety supervisor with a number of assistants, all duly certified, and their appointment must be notified to the inspectorate.

The mine safety committee consists of the safety supervisor (chairman), and members selected by the mine-owner, half of them on the recommendation of the majority of the workers in the mine.

Chapter III, concerning supervisory organs, provides for the establishment of a Mine Safety Bureau, a Mine Safety and Inspection Division, a Coal Mine Safety and Inspection Division, a Mine Safety Examination Board, a Central Mine Safety Committee, a Mine Inspectors Training Institute and a Safety Techniques Training Facilities Agency, all in the Ministry of Commerce and Industry.

A local mine safety committee is attached to the Mine Safety and Inspection Division, and a local coal mine safety committee to the Coal Mine Safety and Inspection Division. The Central Committee must be consulted as to the provisions of Ministerial Ordinances issued under the law, and the local committees must be consulted as to mine safety rules and other matters. The committees are also empowered to consider any matter of safety submitted to them by the Minister of Commerce and Industry or the Chief of the Safety and Inspection Division. The committees are composed of technicians and representatives of employers and workers.

The Mine Safety Examination Board conducts examinations of technical personnel and considers matters concerning their qualifications.

The staff of the Mine Safety Bureau is fixed at 17 mine inspectors, 16 technical officials and 5 secretarial assistants. The two Inspection Divisions are provided with 166 inspectors, 32 technical officials and 19 secretarial assistants.

NETHERLANDS

Decree concerning Surface Installations of Mines. Dated 21 June 1949 [1]

This Decree adds to the Mines Regulations a Chapter XIV A entitled "Installations that can cause danger, damage or nuisance". Such installations may not be erected, extended, altered or re-employed after being closed down for four years or after an accident without the authorisation of the Minister. The procedure for obtaining authorisation is set out in the Decree.

Decree concerning Steam Appliances Dated 17 September 1949 [2]

The Decree consists of 70 sections grouped in nine chapters as follows: I. General provisions; II. Authorisation of the use of steam appliances; III. General provisions concerning the construction, installation and equipment of steam appliances; IV. Steam-appliance accessories for which an authorisation is required; V. Steam-appliance accessories for which no authorisation is required; VI. Rules for the operation of steam appliances; VII. Supervision of steam appliances subject to

[1] *Statutes of Nova Scotia*, 13 Geo. VI, p. 48.
[2] *Official Gazette*, English Edition, Extra No. 42, 16 May 1949, p. 15.

[1] Decree to Supplement the Mines Regulations, 1939, under Section 9 (1) *(c)* of the Mines Act, 1903. *Staatsblad*, 1949, No. J.266.
[2] Decree issuing general administrative regulations under Section 15 (2) of the Steam Act (Steam Decree 1949), *idem*, 1949, No. J.431.

authorisation; VIII. Exemptions; and IX. Transitional and final provisions.

Chapter I deals, *inter alia*, with the organisation of the Steam Appliance Inspectorate.

Chapter II specifies the appliances subject to authorisation, the general requirements that they must satisfy and the authorisation procedure.

Chapter IV deals with safety valves, pressure gauges, thermometers, water gauges and gauge glasses, low-water alarms, fusible plugs, feed appliances, blow-offs, economisers, superheaters, steam receivers and other pressure vessels.

NORWAY

Provisional Act concerning Conditions of Employment in Agriculture Dated 3 December 1948

Chapter II of the Act deals with protection against occupational risks and Chapter III with inspection. The requirements of Chapter II are essentially as follows:

Employers must see that the working equipment is maintained in such a condition and the work is arranged and carried out in such a way that the workers are protected against danger to life and health to the fullest extent that circumstances permit. They must also see that the workers have their attention drawn to the risks inherent in their work and are instructed in the means of avoiding risks. The requirements concerning working equipment also apply to accommodation furnished by the employer.

Workers must work carefully and in all respects do all in their power to prevent accidents and injuries to health.

Both employers and workers must see that order and decency prevail at workplaces.

Fatal accidents and accidents likely to result in at least one week's incapacity for work must be reported forthwith by the employer to the labour inspectorate. Accidents due to the use of mechanical power must be reported if they result in at least three days' incapacity for work.

Young persons under 18 years of age may not be employed on work such as machine minding or other work that may call for special precautions. The labour inspectorate is to issue more detailed rules on the subject.

Chapter III includes a provision entrusting the labour inspectorate with supervision over the enforcement of the Act.

SWEDEN

Royal Notification concerning the Application of the Workers' Protection Act of 3 January 1949. Dated 6 May 1949 [1]

This Notification containing 76 sections deals particularly with occupational health and industrial safety.

Under these rules, the employer must inform the workers of the risks inherent in the work that they carry out. He must also see to it that the persons entrusted with the direction of work have a sufficient knowledge of safety matters. It is prohibited to employ workers at particularly heavy work unless they have previously been declared fit for this work by a doctor.

Under the heading "Examination of Plans for Working Premises" it is laid down that the construction of working premises in rock or underground must be authorised by the Labour Protection Board.

The Notification also contains various provisions dealing with industrial health and the prevention of occupational diseases. These relate, in particular, to ventilation, lighting, temperature and humidity. Workers exposed for long periods to high humidity, water, cold, heat or intense light must be specially protected. As far as possible, suitable protection is also to be provided against noise and vibration. A number of measures are included dealing with the personal comfort of the workers and the provision of personal protective equipment.

Numerous provisions supplementing the general provisions of the Workers' Protection Act are grouped under the heading "Methods of Protection against Accidents". The amendments made to the earlier legislation deal with the transport of material, loading and unloading operations, tools, protection against falls of persons and objects, collapse, poisoning, working clothes, etc. This heading also contains provisions respecting first aid.

The part dealing with the work of young persons contains provisions concerning their work books, their registration by the employer and their medical examination.

General provisions concerning works' safety organisation are contained in the Workers' Protection Act. These are supplemented by the present Notification, which includes measures concerning the qualifications of safety delegates, their rights and responsibilities and methods of appointment. Other provisions deal with the role of safety committees.

The Notification also contains provisions concerning inspection and a number of special provisions.

Royal Notification Prohibiting the Employment of Young Persons in Certain Dangerous Work Dated 6 May 1949 [1]

This Notification replaces that of 26 September 1930. The occupations prohibited to young

[1] *Svensk Författningssamling*, No. 208, 1949, p. 397; for the Workers' Protection Act, see *Industrial Safety Survey*, Vol. XXV, No. 3, p. 96.

[1] *Svensk Författningssamling*, No. 209, 1949, p. 413.

persons under the age of 18 are the following: extraction or handling of substances containing quartz; sandblasting; minding and maintenance of acetylene installations; drilling, chipping, riveting, etc.; employment as banksmen or winding enginemen in mines and quarries; and shunting, coupling and uncoupling of mechanically-hauled wagons.

The occupations in which young persons may be employed under certain specified conditions are the following: work with flax, hemp, jute, horsehair and bristles; the handling of rags; pickling and tempering of metal objects; etching; tinning, galvanising, chroming, metallisation and spray painting; electric and gas welding and cutting; handling of lead or lead compounds and toxic substances of the first category; work involving the giving off of noxious dusts, smoke, gases and vapours; minding certain prime movers; the starting of transmission and putting belts, ropes and chains into place while the transmission is in motion; employment as boiler attendant or attendant for other pressure vessels; minding and maintenance of high-tension electrical installations and work near such installations; employment as operators of various types of mechanically-driven hoisting appliances; employment as locomotive driver, truck driver, etc.; lubrication of certain dangerous machinery and equipment; and finally the manufacture of various explosive or flammable substances.

SWITZERLAND

Federal Order concerning Measures to be Taken to Prevent Accidents in Building Work when Suspended Scaffolds with Movable Platforms are used for Rough Casting, Painting, etc. Dated 27 May 1949 [1]

The principal provisions of this Order, which came into force on 1 June 1949, are reproduced below:

Sec. 1. Suspended scaffolds with movable platforms shall only be permitted for work such as chipping, rough casting and painting. They shall be prohibited for more important masonry work (replacing ashlar, making new openings etc.).

Sec. 2. If the movable platform is constructed of wood, it shall comprise two ledgers of adequate cross-section, a tightly planked floor and strong putlogs. The wood shall be barked. All the parts shall be strongly fixed together and shall have the following dimensions:

(a) ledgers (horizontal poles): minimum diameter: 0.10 m; square timber of equal strength is permitted;

(b) putlogs: maximum spacing: 1.00 m; minimum projection beyond the ledgers: 0.15 m;

(c) floors: minimum thickness: 27 mm;

(d) platforms: minimum width: 0.60 m; maximum span between deck irons: 4 m; maximum number of spans: 2; length beyond the deck irons: minimum, 0.50 m; maximum 1.20 m;

(e) guard rails: height above the floor: building side, 0.70 m; external side, 1.00 m; if planks are used, these shall have a minimum thickness of 24 mm, minimum width of 12 cm;

(f) toeboards: minimum thickness: 24 mm; minimum height: 15 cm.

Sec. 3. The platforms shall be provided with guard rails and toeboards on all sides.

Sec. 4. Only metal deck irons of strong construction may be used. They shall be closed, pass under the bottom and around the sides of the platform and be provided with rigid supports for the installation of guard rails. They shall be so constructed as to permit the hoisting appliance (winch) to be perfectly attached and to ensure good transverse stability of the platform.

Sec. 5. Decisions respecting the suspension of a scaffold shall only be taken by technically qualified persons capable of judging the strength of the suspension device chosen.

Special suspension devices shall be constructed in accordance with precise instructions issued by the contractor or his deputy.

Sec. 6. The outriggers shall be of barked round timber and of such dimensions as will ensure safe suspension of the scaffold. Beams of rectangular timber or of iron, of equal strength, are permitted. When round timber is used, it shall have the following dimensions:

Length of overhang in metres	Minimum diameter in centimetres
0.10	10
0.25	12
0.50	14
0.75	16
1.00	18
1.50	20
2.00	24

In order to prevent the platform from being pulled on the slant, the space between the outriggers shall be equal to that between the deck irons.

The outriggers shall be supported only by sufficiently strong parts of the construction.

To avoid tilting, the outriggers shall be fastened to sufficiently strong parts of the construction.

They shall be properly fastened by means of bolts, ropes, cords or other similar fastening devices; nails or dogs may be used if they do not have to support the load but are merely fastenings.

Counterweights shall only be permitted when the outrigger cannot be fastened to suitable parts of the construction. They shall have a safety factor of at least 4 against overturning. Counterweights shall be checked each day before work is begun on the scaffold.

Material serving as counterweights shall not merely be laid on the outrigger but be suitably secured to prevent displacement or tilting.

Sec. 7. A clamp or special attachment shall permit the rope, cord or chain to be fastened to the outriggers so that any additional bending stress will not impair the safety of the suspension.

The suspension point of the rope, cord or chain shall be chosen so that the distance between the

[1] *Recueil des lois fédérales*, No. 23, 2 June 1949, p. 500.

platform and the face of the building does not exceed 30 cm.

A suitable device shall effectively prevent any displacement of the fastening on the outrigger.

If work is carried out above the fastening devices, these shall be adequately protected against any damage that might be caused by the fall of material.

Sec. 8. The ropes, cords or chains used for suspension shall have a safety factor of at least 8 based on the maximum load that they may have to support.

They shall be of such length that at the lowest position of the platform, there are two turns of rope on the drums or a free end at least 2 metres in length.

The end to be attached to the platform shall be provided with a ring, safety hook or loop.

The ropes, cords and chains shall be carefully kept in repair and inspected each time they are used. Hemp or cotton ropes shall be given special attention.

Sec. 9. All parts of the hoisting appliance shall be made of suitable strong material, shall be of good construction, and free from all defects. They shall be kept in good repair and inspected each time before they are used.

The maximum working load shall be clearly and durably indicated on each appliance.

Sec. 10. The Swiss State Accident Insurance Institute may at any time require that hoisting appliances be inspected or tested by the laboratory for the testing of materials of the Zurich Federal Polytechnic or that of the Polytechnic of the University of Lausanne.

Sections 11 to 14 contain various provisions respecting the enforcement of the Order.

UNITED STATES OF AMERICA

Medical X-Ray Protection up to Two Million Volts [1]

The handbook issued by the National Bureau of Standards with this title is in the form of a code of regulations. It consists of three main parts.

Part I, General, deals with the planning and inspection of new installations, working conditions of the personnel, and structural details of protective barriers.

Part II, Rules for specific applications, deals with fluoroscopic, radiographic, dental, diagnostic, fluorographic and therapeutic equipment.

Part III concerns electric protection and includes provisions on high-voltage circuits, grounding, warnings and instructions, first aid, fire extinguishing, inspection and maintenance.

An appendix contains radiation attenuation curves, and data on protective lead thicknesses, protective distances, and primary protective-barrier requirements.

OFFICIAL REPORTS, ETC.

BELGIUM

Annual Report of the Administration for the Technical Protection of Labour, 1946 and 1947

The Administration for the Technical Protection of Labour has published a report for the years 1946 and 1947 which contains a wealth of interesting information.[1]

The first part dealing with technical inspection reads, in part, as follows:

The Administration for the Technical Protection of Labour, known under this title since its reorganisation in accordance with the Order of 18 July 1947, consists of three services: the Technical Inspection Service, the Medical Inspection Service and the Chemical and Laboratory Inspection Service.

The function of the Technical Inspection Service is to supervise the enforcement of laws and regulations concerning undertakings classified as dangerous, unhealthy or obnoxious, and the health and safety of workers employed in industrial and commercial undertakings and in public or public utility services or undertakings.

The technical personnel consists of: engineer-inspectors and assistant inspectors. The engineers inspect all undertakings other than mines, surface mines, underground quarries and undertakings where ores are processed. Their inspection activities cover glass factories, glazing works, the chemical industry, tanneries, sugar factories, woodworking shops, metalworking shops, electrical generating and distributing stations, coke ovens, ceramic factories, the food and drink industry, the textile industry, etc., commercial undertakings and public or public utility services or undertakings, from the largest plants to the smallest workshops. These undertakings combined employ the majority of professional and manual workers in the country.

In non-mining areas, the engineers are also charged with the inspection of steam plant.

The functions of the engineers are fundamentally of a technical character. At the time that factories or equipment considered dangerous, unhealthy or obnoxious are created or installed, the role of the engineer is to advise the employer and to advise and make recommendations to the authorities empowered to grant the authorisation to operate.

[1] Information of a similar nature on other countries has been published by the International Labour Office in *The Law and Practice Relating to Safety in Factories*, Montreal, 1949.

[1] U.S. Department of Commerce, National Bureau of Standards: *Handbook 41*, Washington, D.C., 1949.

In the great majority of cases, the decisions to grant or refuse the authorisation are in accordance with the advice received from engineers. The engineers supervise the enforcement of clauses in authorisation orders dealing in particular with public safety, hygiene and comfort, the safety of workers and the hygiene of workplaces. In addition, they supervise the enforcement of numerous technical safety and health provisions forming part of the General Regulations for the Protection of Labour. They assist in the work of certain joint and technical committees such as technical committees for vocational qualifications, the Permanent Advisory Committee on Steam Plant, the Belgian Electro-technical Committee, the Belgian National Committee on Lighting, the Committee for the Co-ordination of Regulations, the Research Committee on Work in Ports, the National Committee for the Organisation of Congresses on Safety, Hygiene and the Embellishment of Workplaces, the Supreme Council on Safety and Health, etc.

The engineers also participate in the work of the Belgian Standardisation Institute. In this connection they have contributed the results of their experience to the compilation of codes and standards of good practice in the following fields: welded constructions, pressure plant, the use of the oxy-acetylene flame, hoisting equipment, and oil heating.

The assistant engineers are placed under the orders of the engineers. They are employed mainly in the inspection of work in ports, in the building industry, the metal industry and the inspection of electrical installations and hoisting equipment. Their functions are:

(1) to suggest measures to be taken to improve the hygiene of workplaces and the safety of the workers;

(2) to draw the engineers' attention to any infractions of Acts or Orders that they may have noticed.

If necessary, the assistant engineer may impose emergency measures and must immediately inform the engineer.

The report then reviews the provisions respecting working rules for undertakings classified as dangerous, unhealthy or obnoxious, and gives detailed information respecting industrial hygiene and the safety and health of workers.

During the period under review a special study was made on work in the loading and unloading of ships. The report makes the following observations:

Apart from the accidents that may be attributed to "repairs and maintenance of ships", the accidents that occur in ports are caused mainly by the handling of goods requiring the use of many different hoisting appliances. The causes of accidents, although very varied, can be grouped into four categories:

(1) a defect in one of the constituent parts of a hoisting appliance;

(2) excessive power of hoisting engines on board ship;

(3) too much haste in the carrying out of a specific task;

(4) inexperience of young workers employed after the war.

With respect to the second category, the following observations are made:

Causes attributed to excessive power of hoisting engines on board must not be underestimated. Modern ships of even small tonnage, whether they are of the Hamburg or Anglo-American type, usually have on board very powerful electric winches enabling the hoisting to be very rapid and therefore involving sudden movements of the load. This gives rise to risk of collision, displacement of the load and consequently the falling of parts of the load or even the entire load. Often, the breaking of a rope is due to this same cause and to the fact that the load collides with an object or is caught on some protruding part of the ship. The possibility of rapid handling gives rise to the possibility of a large output per man-hour and results in excessive haste on the part of the worker to carry out his job, haste that was increased by the lack of shipping in 1946-47, which resulted in the reduction to a strict minimum of the time in port and of the period of loading and unloading.

In order to increase output, bonuses were granted to dockers, to the workers operating winches and cranes, etc., and two and even four teams of workers were put to work in the same hold. As hoisting and lowering operations had to be carried on at a tempo in keeping with the number of persons occupied, it can easily be seen that there was little possibility for the workers at the bottom of the hold to protect themselves (which theoretically was compulsory) against possible falls of goods.

The number of accidents caused by this particular way of working was by far the greatest.

Annexed to the first part of the report are descriptions of numerous typical accidents and a summary of a certain number of studies on matters within the competence of the technical inspection service, *i.e.*, screw-cutting machines; flanging presses; abrasive wheels, rubber mixers, reheaters and calenders; explosion of empty drums having contained flammable substances; electrical installations; abolition of minium paint in railway workshops; and spray painting.

The second part of the report deals with medical inspection, the third part with chemical and laboratory inspection and the fourth part with works organisations for safety, health and the embellishment of workplaces. This last part contains information both on legislation in force on the subject and on practical application in a number of cases.

FRANCE

Causes and Origins of Fires in France during the First Half of 1948

These statistics cover a total of 6,742 fires that occurred throughout France and caused damages amounting to over 6,000 million francs.

It was possible to determine the origin of the fire in 4,862 cases.

The most frequent thermal causes were: chimneys or flues (627); ignited hot substances (374); braziers or open fires not otherwise classified (368); unextinguished matches (322); unextinguished cigarettes (309); internal combustion engines (223); heating stoves (206). Sources definitely involving industrial undertakings were: blow pipes and soldering lamps (119); industrial furnaces or fires (103); kilns and drying ovens (37); gas generators for automobiles (49). Steam locomotives were the source of 161 fires.

Fires of electrical origin numbered 1,056. Of these 426 broke out in copper conduits.

Fires of mechanical origin were more rare: 13 caused by heating through defective lubrication; 42 by sparks caused by friction or impact; 36 by explosion due to overpressure; and 22 other.

Finally there were 105 fires of chemical or biological origin (slow oxidation, fermentation, etc.).

Most fires occurred in undertakings that were not guarded outside working hours and which had no special fire-prevention services.

GERMANY

Food and Tourist Industries Mutual Accident Insurance Association

Report for 1948 [1]

The report covers the American, British and French Zones as regards the Accident Insurance Associations for the food and tourist industries, breweries and malthouses, and the American and French Zones as regards the Associations for milling, sugar, dairies, spirits, starch and tobacco. At the end of the year the Associations for milling, dairies, spirits, starch, breweries, malthouses and tobacco amalgamated with the Association for the food and tourist industries.

The currency reform introduced on 20 June 1948 had a profound effect on safety work. Whereas in 1947 there was a marked shortage of machines and skilled workers, after the reform undertakings were able to acquire quantities of German marks and to improve working conditions considerably. After a time some equipment was again in short supply, but in general industry found itself on a firmer footing.

Table I shows the distribution of the accidents occurring in 1947 and 1948, by severity, among the various food, drink and tobacco industries, and affords a comparison with 1937.

[1] Berufsgenossenschaft Nahrungsmittel und Fremdenverkehr: *Jahresbericht, 1948*, Mannheim, 1949.

TABLE I

Industry	Year	Undertakings	Insured persons	Industrial accidents		
				Reported	Compensated	Fatal [1]
Milling	1948	6,399	19,469	1,243	122	15
	1947	6,574	14,443	1,051	87	9
				Per 1,000 insured persons		
	1948			63.84	6.26	0.78
	1947			72.80	6.02	0.623
	1937			86.08	4.83	0.57
Sugar	1948	12	2,882	469	13	2
	1947	12	3,290	276	16	—
				Per 1,000 insured persons		
	1948			162.73	4.51	0.69
	1947			83.89	4.86	—
	1937			57.20	3.22	0.31
Dairies, Spirits, Starch	1948	3,102	24,465	1,259	58	7
	1947	3,036	24,173	1,188	55	10
				Per 1,000 insured persons		
	1948			51.46	2.36	0.29
	1947			49.00	2.28	0.414
	1937			77.00	2.00	0.20
Tobacco	1948	1,150	17,320	372	20	2
	1947	1,041	15,288	267	10	1
				Per 1,000 insured persons		
	1948			21.47	1.15	0.12
	1947			17.46	0.654	0.065
	1937			24.00	0.37	0.015

[1] Fatal accidents are included in the figures appearing in the preceding columm.

The distribution of the accidents over the principal causes is shown in table II. Other causes, such as pressure vessels, explosive substances, gas cylinders and animals, were responsible for relatively small numbers of accidents.

TABLE II

Cause	Milling	Sugar	Dairies, spirits and starch	Tobacco	Breweries and malthouses
Prime movers . . .	7	5	5	3	12
Transmissions . . .	66 (5)	9	11	4	23 (2)
Working machines—					
(a) General machines . . .	109 (1)	30	66	34	139 (1)
(b) Food, drink and tobacco machines . . .	77	20	36	53	166 (1)
Hoisting machines and equipment . .	74	22	24	19	68
Transport (including traffic)	295 (2)	115	294 (6)	53	963 (6)
Flammable, hot and corrosive substances	26	32	117 (2)	13	128
Collapse, etc.. . . .	105	35	77	20	389 (1)
Falls of persons . .	211 (1)	92	285 (1)	56 (1)	604 (4)
Hand tools	48	20	61	28	136
Way to and from work.	73 (1)	45 (1)	88 (1)	59	214 (2)

In all the industries taken together, machinery accounted for 15.8 per cent. of the compensated accidents, and falls of persons 30 per cent. Of 205 falls of persons, 40 were on stairs, 48 from structures, 29 with or from ladders, 29 on the level ground, 17 through openings, and 42 were of other descriptions.

The report gives descriptions of some noteworthy accidents and cases of industrial diseases, and illustrates them with numerous photographs of guards and other safety devices that might have prevented the accidents.

The report also discusses, with illustrations, some particular problems of accident prevention such as the provision of good flooring, the safe construction of ladders and steps, machine operation, Perkins tubes and the equipment of road vehicles. It then touches on the need for close collaboration between the insurance associations, employers, workers and manufacturers of machines and other equipment in the prevention of accidents, and explains the role of propaganda and education in this connection.

SWEDEN

Industrial Accidents, 1939-1943 [1]

These recapitulative statistics dealing with the period 1939-1943 contain much more detailed information than that contained in the annual reports of the State Insurance Institute.

Table I shows the distribution by sex of accidents that occurred from 1939 to 1943.

TABLE I

Year	Number of accidents		
	Men	Women	Total
1939	174,583	21,702	196,285
1940	162,344	21,518	183,862
1941	168,197	21,227	189,424
1942	193,427	24,663	218,090
1943	214,534	27,263	241,797
Total . .	913,085	116,373	1,029,458

Table II reproduces accident figures for industries in which the largest number of accidents were recorded during the period under review (large undertakings, except State undertakings).

TABLE II

Industries	Man-years	Accidents				No. of days lost per accident
		Fatal	Permanent disability	Total	Per 100 man-years	
Metal producing . .	160,129	83	466	35,642	22.26	54
Metal working	802,388	132	1,496	197,956	24.67	26
Agriculture, forestry, stockbreeding	643,155	208	1,548	111,562	17.35	52
Woodworking .	248,157	63	1,201	48,656	19.61	64
Paper and printing . . .	306,616	83	570	29,764	9.71	73
Food, drink, tobacco . . .	303,897	47	389	40,275	13.25	38
Building . . .	429,420	310	1,553	84,909	19.77	74
Commerce, warehousing, offices. . . .	1,273,867	92	621	55,742	4.38	43

Industrial Accidents in 1945 [1]

In 1945 the total number of full-time workers subject to compulsory insurance was 2,091,984 made up as follows: large undertakings 1,432,263 (men 1,008,560, women 423,703); small undertakings 403,171 (men 198,121, women 205,050); State undertakings 256,550 (men 188,122, women 68,428). Table III shows the number of accidents to workers of both sexes.

In large undertakings, absence from work caused by accidents was as follows: less than one week's absence in 37.5 per cent. of the cases; from one to two weeks' absence in 26.7 per cent.; from two to three weeks in 13.7 per cent.; from three to four weeks in 7.6 per cent.; from four to five weeks in 4.4 per cent. and more than five weeks in 10.1 per cent. In these undertakings, industrial accidents caused a loss of 6,155 days per man-year or approximately 8,816,000 working days.

TABLE III

	Number of accidents						
	Fatal		Resulting in permanent disability		Total		Total
	Men	Women	Men	Women	Men	Women	
Large undertakings	335	18	1,847	204	166,887	20,567	187,454
Small undertakings	108	5	715	164	30,273	5,649	35,922
State undertakings	72	—	241	34	23,914	1,961	25,875
Total.	515	23	2,803	402	221,074	28,177	249,251

[1] Riksförsäkringsanstalten: *Olycksfall i arbete åren 1939-1943*, Stockholm, 1948.

[1] Riksförsäkringsanstalten: *Olycksfall i arbete år 1945* (Stockholm, 1949); for 1944, see *Industrial Safety Survey*, Vol. XXIV, No. 1, p. 21.

Table IV shows the distribution of accidents by sex and age group together with the percentage of accidents resulting in permanent disability.

TABLE IV

Age group (years)	Number of accidents		Permanent disability (per cent.)	
	Men	Women	Men	Women
Less than 15	1,063	208	0.9	1.0
15 — 19 . .	19,847	4,408	0.5	0.3
20 — 24 . .	26,607	4,685	0.6	0.4
25 — 29 . .	30,620	3,223	0.8	0.6
30 — 34 . .	27,169	2,735	0.9	0.9
35 — 39 . .	23,588	2,598	1.1	1.1
40 — 44 . .	18,916	2,379	1.5	1.6
45 — 49 . .	14,966	1,735	1.7	2.0
50 — 54 . .	11,423	1,677	2.1	3.6
55 — 59 . .	8,876	1,234	2.7	4.6
60 — 64 . .	6,613	625	3.8	5.1
65 — 69 . .	3,696	302	4.5	7.0
70 and over .	1,566	115	5.9	18.3
Age unknown	2,210	292	—	—
Totals and averages	197,160	26,216	1.3	1.4

Figures for the industries with the largest numbers of accidents in large undertakings only are given in table V.

Table VI gives information on the principal causes of accidents in large undertakings (excluding State undertakings).

TABLE VI

Cause	Accidents	Accidents per 100 man-years	Days lost per man-year	Days lost per accident
Working machines	26,114	1.823	0.950	52
Hand tools, etc. .	28,705	2.004	0.389	19
Animal-drawn road vehicles . .	13,799	0.963	0.514	53
Flammable and hot substances, light and heat .	5,627	0.393	0.189	48
Slipping and falling of persons .	19,998	1.396	0.708	51
Falls of objects .	8,963	0.626	0.312	50
Handling of loads	36,342	2.537	0.674	27
Malice of third parties and other causes	22,484	1.570	0.346	22

TABLE V

Industry	Man-years	Accidents			Accidents per 100 man-years	Days lost per man-year
		Fatal	Permanent disability	Total		
Metalworking and engineering:					25.8	6.48
Men	138,938	23	220	37,298	26.8	
Women	10,056	1	10	1,189	11.8	
Earth and stone:					19.1	9.29
Men	39,696	15	103	8,063	20.3	
Women	4,340	—	—	368	8.5	
Agriculture, forestry, stock-breeding:					20.5	9.18
Men	114,608	37	274	25,649	22.4	
Women	14,070	1	11	679	4.8	
Woodworking:					21.6	10.85
Men	58,516	14	240	12,840	21.9	
Women	1,801	—	—	175	9.7	
Paper and printing:					11.5	6.41
Men	56,453	13	117	7,181	12.7	
Women	15,064	—	8	1,059	7.0	
Food, drink, tobacco:					15.6	5.59
Men	44,088	11	53	7,968	18.1	
Women	23,392	3	18	2,533	10.8	
Construction:					24.3	13.82
Men	94,789	47	333	23,132	24.4	
Women	1,061	—	3	150	14.1	
Commerce, warehousing, offices:					4.7	1.68
Men	183,315	11	95	10,423	5.7	
Women	127,788	4	37	4,322	3.4	
Communications and transport (except shipping):					17.5	12.21
Men	33,346	31	55	5,929	17.8	
Women	1,396	—	3	137	9.8	

During the year, 27 fatal accidents and 763 disabling injuries were attributed to working machines. Circular saws accounted for seven fatal and 304 disabling injuries; drilling machines, drop hammers, hydro-extractors, mixers and kneaders for two fatal accidents each and agricultural machinery for four fatal and 42 disabling injuries.

The operations at working machines causing accidents were the following: adjusting the machine or the work, three fatal and 31 disabling injuries; starting or stopping or working at the machine in motion, 14 fatal and 554 disabling; greasing, cleaning or inspecting the machine at rest, three fatal and 22 disabling; greasing or cleaning the machine in motion, four fatal and 106 disabling; breakage of machine parts, three fatal and 14 disabling; breaking of the work, 24 disabling; other causes, 22 disabling injuries.

In large undertakings (excluding State undertakings) 2,676 cases of occupational disease were recorded among men. Of these, 974 involved carbon monoxide, 68 carbon disulpide, 45 the halogen derivatives of the aliphatic series of hydrocarbons, 39 substances containing lead, 23 stone dust, etc. In these undertakings there were 460 cases of occupational disease among women, of which 200 occurred in the hotel industry, domestic service and health institutions.

UNITED KINGDOM

Electricity in Mines in 1947 [1]

Five accidents of electrical origin and causing the death of several miners occurred underground during the year. Three of them resulted in three deaths by electrocution and the other two were attributed to ignition of firedamp and caused the death of one and nine miners respectively.

Table I contains a classification of all accidents and dangerous occurrences due directly or indirectly to the use of electricity at all mines under the Coal Mines Act.

Table II contains a classification of the persons killed or injured.

The report of the Chief Electrical Inspector of Mines describes the fatal accidents. The description of one of these which occurred on 7 May 1947 is as follows:

The explosion started at the top end of a 150-yard longwall face, near the driving gear of a shaker conveyor. In this driving gear the motor was connected to the pans by two rocker arms secured to the rocker shaft by large nuts. Each rocker arm was normally protected by a sheet steel guard or cover but one of these, on the goaf side, had been missing for some days. After the explosion, the five-core collectively-screened trailing cable supplying the conveyor motor was found to be resting upon the unprotected rocker-arm nut and there was clear evidence that the oscillation of the nut had worn through the cable until it reached a live conductor. A test carried out on the surface after the explosion showed that an undamaged part of the same cable was worn through to a conductor when the conveyor was run continuously for 1¾ hours. Of the three overload trips in the gate-end switch, one was ineffective because the coil former was distorted and jammed the trip plunger, and the trip plunger of the second was missing altogether. There was therefore no automatic protection in this switch for the phase which actually made contact with the nut. The next switch in the circuit outbye had its overload trips set at about 330 ampères. The only earth-leakage

TABLE I

	Fatal		Non-fatal	
	1947	Totals 1938-1947	1947	Totals 1938-1947
Nature of accident				
Electric shock and/or arc burns	3	49	47	438
Ignition of firedamp or coal dust	2	20	1	30
Fire arising from electrical defects	0	3	10	95
Other causes	0	3	1	29
Totals	5	75	59	592
Contributory causes				
Design or unsuitability of apparatus	0	7	1	20
Installation or maintenance	2	21	20	207
Misuse, negligence or ignorance	3	39	38	355
Organisation or lack of equipment	0	4	0	1
Unforeseeable	0	4	0	9
Totals	5	75	59	592
Apparatus involved				
Switchgear and fuses	0	20	31	262
Flexible cables and plugs	4	35	13	194
Overhead lines, unarmoured cables and conduit wiring	0	3	2	21
Lighting accessories	0	0	1	19
Motors and transformers	0	3	4	28
Coal-cutting machines	0	4	0	4
Armoured cables and accessories	1	7	8	62
Signalling bells and telephones	0	0	0	2
Miscellaneous or unknown	0	3	0	0
Totals	5	75	59	592

[1] *The Mining, Electrical and Mechanical Engineer*, Feb. 1949, p. 255; for 1946 see *Industrial Safety Survey*, Vol. XXIII, No. 3, p. 109.

TABLE II

	Killed		Injured	
	1947	Totals 1938-1947	1947	Totals 1938-1947
Electric shock and/or arc burns				
Surface workmen . .	0	8	9	45
Electricians	0	18	21	206
Coal-cutter machinemen	2	15	7	87
Machinery attendants	0	4	5	24
Other underground workers.	1	9	10	119
Totals . .	3	54	52	481
Ignition of firedamp or coal dust.	10	58	23	100
Fire	0	10	0	17
Other causes.	0	6	0	18
Totals, all causes . .	13	128	75	616

protection was at an oil circuit-breaker at the pit bottom and evidence was given at the enquiry that this switch tripped on earth leakage at the time of the explosion. This trip was later found to operate at 36 amperes earth leakage.

The three fatal cases of electrocution were also attributed to trailing cables. Cables were therefore responsible for four accidents causing the death of 12 persons, five cases of electrocution without fatal results, and three fires.

British regulations provide that "trailing cables shall not be dragged along by the machine when working". It is rare for an inspector to find this provision actually being contravened but it is nevertheless admitted that the practice is widespread. Prevention may be difficult, but the danger involved if the cable comes under tension for which it is not designed should be constantly impressed upon all machine operators. Several accidents involving shock or the ignition of firedamp have resulted from the cable ends being pulled out of the machine plug.

The explosion described above emphasises the fact that a screened cable does not offer certain guarantee against the ignition of firedamp.

The Chief Inspector discusses the training of colliery electricians, which should be given by qualified instructors.

The human factor is responsible for the majority of accidents. In 1947, for example, 19 electricians were involved in non-fatal accidents. In almost every case the accident was due to the fact that the worker had handled or touched live apparatus, either deliberately or through negligence or forgetfulness. In only three cases was the apparatus made live through agencies outside the injured man's control.

In commenting on these accidents, of which a brief description is given, the Chief Inspector states that they are due to a lack of safety consciousness which could be overcome by proper training.

The report also includes information on the distribution of electric power underground.

Electricity in Mines in 1948 [1]

The Chief Electrical Inspector of Mines discusses the fatal and non-fatal accidents due to electricity in mines under the Coal Mines Act during the year, and reviews the accident experience of the past twenty years.

The total horse power of electric motors in use for all purposes on 30 June 1948 was 2,848,486, an increase of 7.1 per cent. over the corresponding figure for 1947, and the total number of motors in use was 81,544, an increase of 5.4 per cent. Underground there were 46,963 motors with 1,581,646 horse power, and on the surface 34,581 motors with 1,266,840 horse power. The underground distribution was: haulage, 10,474 motors, 551,523 h.p.; pumping, 9,709 motors, 481,670 h.p.; air-compressing, 848 motors, 35,878 h.p.; coal cutting, 6,004 motors, 250,613 h.p.; conveying and loading, 11,004 motors, 203,327 h.p.; other portable machines, 5,203 motors, 24,592 h.p.; auxiliary ventilation, 2,042 motors, 20,454 h.p.; and miscellaneous, 1,679 motors, 13,589 h.p.

Particulars of the accidents occurring in the period 1939-1948 are given in table I.

The persons killed or injured in the accidents due to electric shock and /or arc burns are classified in table II.

Descriptions are given of the fatal accidents and of selected non-fatal accidents and dangerous occurrences.

The Chief Inspector again deplores the frequency of accidents due to trailing cables, 20 in all, of which two were fatal. In ten years, of 109 shock accidents due to trailing cables, 100 were due to unscreened cables.

During the period 1929-1948 electrical horse power increased by 62½ per cent., fatal accidents decreased approximately 45 per cent. and non-fatal accidents increased 28 per cent. Shock and burns accounted for 118 fatal and 895 non-fatal accidents in this period (120 persons killed and 1,003 injured); fires, for 6 fatal and 150 non-fatal (19 killed, 23 injured); ignitions of firedamp and coal dust, for 39 fatal and 49 non-fatal (275 killed, 208 injured); and other causes for 4 fatal and 51 non-fatal (7 killed, 39 injured).

[1] By G. M. Harvey, H.M. Chief Electrical Inspector of Mines, *The Mining, Electrical and Mechanical Engineer*, Sept. 1949, p. 83.

TABLE I

	Fatal		Non-fatal	
	1948	Totals 1939-1948	1948	Totals 1939-1948
Nature of accident				
Electric shock and/or arc burns	2	48	53	447
Ignition of firedamp or coal dust	1	19	1	27
Fire arising from electrical defects	0	3	6	91
Other causes	0	3	1	24
Totals	3	73	61	589
Contributory causes				
Design or unsuitability of apparatus	0	7	6	20
Installation or maintenance	1	20	13	202
Misuse, negligence or ignorance	2	38	38	357
Organisation or lack of equipment	0	4	2	3
Unforeseeable	0	4	2	7
Totals	3	73	61	589
Apparatus involved				
Switchgear and fuses	0	20	29	253
Flexible cables and plugs	2	33	18	192
Overhead lines, unarmoured cables and conduit wiring	0	3	2	23
Lighting accessories	0	0	0	18
Motors and transformers	1	4	1	28
Coal-cutting machines	0	4	0	4
Armoured cables and accessories	0	6	10	68
Signalling bells and telephones	0	0	0	2
Miscellaneous or unknown	0	3	1	1
Totals	3	73	61	589

TABLE II

Categories	Killed		Injured	
	1948	Totals 1939-1948	1948	Totals 1939-1948
Surface workmen	0	8	4	41
Electricians	0	17	31	216
Coal-cutter machinemen	0	15	5	77
Machinery attendants	0	4	2	26
Other underground workers	2	4	16	123
Totals	2	48	58	483

As far as could be ascertained, the principal contributory causes of these accidents were: misuse, negligence, ignorance, 59 fatal, 670 non-fatal; installation or maintenance, 41 fatal, 336 non-fatal; and design or unsuitability, 27 fatal, 80 non-fatal.

The apparatus most frequently involved was: switchgear and fuses, 37 fatal accidents, 517 non-fatal; flexible cables and plugs, 75 fatal, 405 non-fatal; unarmoured cables (including overhead lines) and conduit wiring, 10 fatal, 75 non-fatal; and armoured cables and accessories, 19 fatal, 68 non-fatal.

The number of electricians injured rose from 11 in 1929, when the total horse power installed was 1,754,000 (123,800 for coal-face machines), to 31 in 1948, when the horse power was 2,848,000 (478,500 for coal-face machines). This increase from 11 to 31 cannot be completely explained; the suggestion is offered that electricians are not as careful as they were 20 years ago, but it is also pointed out that the speed at which they usually have to undertake repair work in order not to disturb the cycle of mining operations is not conducive to safety.

The Chief Inspector concludes that, having regard to all the circumstances, the use of electricity in mines is becoming safer every year, but that it is still not as safe as it should be. One of the means to this end is to improve standards of installation and maintenance, and this can only be done by effective training. Mr. HARVEY also briefly touches on various matters in connection with earth-leakage protection, flame-proof enclosures, intrinsically safe circuits, trailing cables and oil-immersed switchgear.

UNITED STATES OF AMERICA

MOTOR CARRIER FIRE ACCIDENTS, 1948 [1]

During 1948, 569 cases of fire accidents were reported to the Interstate Commerce Commission by motor carriers engaged in interstate or foreign commerce. These accidents caused the death of 177 persons, injuries to 521 and property damage amounting to $5,112,531. This is a substantial increase in rate over the year 1947 for fatalities, injuries and property damage. Analysis of these accidents shows that 78 per cent. of all vehicles involved were less than 5 years old, which fact seems to indicate that the age of the vehicles was not a factor in fires caused by mechanical defects.

Collisions caused more than 50 per cent. of the fire accidents and were more frequent than those of previous years. On the other hand, a decrease in the number of "fire only" accidents (accidents

[1] INTERSTATE COMMERCE COMMISSION, Bureau of Motor Carriers, Section of Safety, Washington, D.C., 1949.

which were not caused by a collision or by other accidents but which were due to defective wiring, over-heated tyres or fires in the cargo) tends to indicate better maintenance of vehicles and improved fire-fighting technique.

Of the 569 fire accidents, 370, or about 65 per cent., were caused by collisions or as the result of vehicles turning over or being ditched; 128, approximately 22 per cent., by mechanical defects, of which 32 concerned over-heated tyres and 28 defective wiring; 29, or 5.1 per cent., by non-mechanical causes, such as arson, cigarettes, matches, etc. In 7.4 per cent. of the accidents the causes were unknown or were not reported.

The report closes with a number of recommendations for the prevention of motor carrier accidents in general and of fire accidents in particular.

REVIEW OF PERIODICALS

Occupational Mortality Study Coming. (*The Iron Age*, 10 February 1949, p. 94.)

Briefly mentions the plans made by the National Office of Vital Statistics of the U.S. Public Health Service to prepare for 1950 an occupational mortality study on a nation-wide basis and gives as the main purpose of the project the collection of valuable data to be used in the field of industrial hygiene. It is also mentioned in this brief note that the National Office of Vital Statistics invites any interested party to make suggestions regarding the type of information most useful to the industrial hygienist which should be contained in these statistics.

Give Industry a Safe Flooring. (*Safety Engineering*, April 1949, p. 25.)

Discusses the merits of various types of flooring material from the point of view of safety.

Hot asphalt mastics present a number of drawbacks. Apart from the fact that heating equipment is expensive and cumbersome and that the fire hazard cannot be eliminated, the asphalt itself may be damaged by overheating. Hot asphalt mastics also retain the tendency to flow and soften under heat, which often results in ruts, etc.

Asphalt emulsions and the principles involved in laying flooring with cold asphalt mastic are described and it is concluded that as far as safety is concerned this type of flooring is ideal.

Cold-laid asphalt mastic can be laid in thick or thin section, may be used over old or new bases, and will be ready for light traffic in as little as 48 hours. Its load-carrying capacity is as great, as the base and heavy traffic will not rut the surface. Under steel tires it absorbs shock and does not crack, spall or ravel. Joints are not required, so that structural impact loads caused by uneven joints are not a problem.

De Veiligheidsdienst van de Staatsmijnen. By P. F. DE ZEE. (*De Veiligheid*, February 1949, p. 18.)

The author discusses accident risks in coal mines and some of the measures taken in the Netherlands State mines to overcome them. Coal mining is an occupation in which safety largely depends on the men themselves, and it is therefore important to develop the miner's character so that he will work well without supervision and be his own safety supervisor.

The training of miners is extraordinarily difficult. If they are taught various methods of working, the question always arises which particular method is the right one for the place in which they are actually working. In the past, little attention was paid to training, but on the whole the miners are proficient. One of the good things to the credit of the Netherlands mines is that before many others they saw the necessity of good vocational training. This training is directed not so much towards the achievement of technical skill as towards the formation of character. In this training the safety service plays a prominent part. It tries to make the miners safety-minded while they are still young.

The State mines comprise four coal mines and three chemical works, together with railways and port installations. All these undertakings are under the direction of a works engineer, who, like the Chief of the Safety Service, is directly responsible to the management.

The Chief of the Safety Service, who is equal in rank to the works engineer, is present at all discussions between the management and the engineers, and is acquainted with all current problems and plans. This arrangement makes it possible to consider the requirements of safety in all operations that are contemplated. Although the Safety Service has no executive power, it can always make its views heard. As a rule, there is no need for it to insist, since its views are practically always accepted. If this should not be the case, however, the Service can appeal to the management. This is more than a legal right, because the entire management is safety-minded.

The State mines employ 14,500 workers and 675 officials underground, and 8,550 workers with 2,150 officials on the surface. In addition, there are 3,750 workers and 625 officials in the chemical works, making a total of 27,000 workers and 3,450 officials. For the maintenance of safety underground, a senior supervisor is appointed in each mine to make daily inspections and give instructions. There are also two senior supervisors in general service who visit all the mines. They are specially concerned with the supervision of shotfiring and with the efficiency of rescue brigades and the use of filter masks and breathing apparatus. There is also a supervisor specially concerned with measures against dust and the prevention of silicosis. Over these officials is a works inspector. The Safety Service underground also includes a mining engineer, who

exercises day-to-day supervision and is especially concerned with ventilation and scientific research.

For the daily inspection and supervision of the surface works there are three senior supervisors and a safety inspector. Recently, a chief chemical engineer and a senior supervisor were appointed to deal with chemical problems. Finally, there are two safety officials in the technical departments who take charge of propaganda. There are no workers' committees, for they have not been found satisfactory.

The Safety Service has its own administration, comprising one chief and four technical administrative officials, a draughtsman, a photographer and clerical staff.

The technicians spend their time in those parts of the undertaking for which they are responsible. In the first place, they investigate accidents. All accidents are recorded in the first-aid room, and if disablement lasts for three days or more, a form is filled up by the sectional supervisor and used by the safety supervisor for making his enquiries and recommendations. In addition to investigating accidents, the safety supervisors exercise regular supervision over the enforcement of regulations and instructions, study working methods, follow new developments, and concern themselves with all other matters bearing on safety.

Particular attention is paid to personal protective equipment. It may be mentioned that the ordinary safety boots have not been found fully satisfactory, and a new type has been designed to afford better protection. They are not very attractive in appearance, and it is doubtful whether the surface workers will like them, but there should be no difficulty with the underground workers. In order to persuade the workers to use the protective equipment provided, propaganda of all kinds is carried on, and the supervisory staff also exercises all its influence. The Safety Service does not itself inflict any punishment or blame, for that might lower its prestige, moreover it could scarcely function as a judicial body. Every week discussions are held with inspecting officials, when results are discussed and plans made. These meetings provide much material that can be used for the purposes of regulations, instructions, communications, posters and other propaganda. The minutes of the meetings have also proved useful, for it has been found that proposals meet with less opposition if they are first made known through the minutes of the meetings.

The accident reports furnished by the first-aid station are used to compile various kinds of statistics. These statistics are used to compare the various parts of an undertaking, similar parts of different undertakings, and the experience of the same part of an undertaking at different times. Accidents are also classified by type and by cause. Statistics are a useful means of convincing managers and others where the fault lies.

Safety data are incorporated in instructions written in popular style and illustrated by photographs for each separate occupation. Formerly, a set of rules was worked out for each occupation, but these did not prove attractive and now they are only used for courses of instruction. As a rule, the instructions are first issued in a provisional form, and after all criticisms have been taken into account, are issued for general use.

Further, leaflets in which all kinds of noteworthy matters are discussed are distributed periodically, talks are given now and again over the radio, and articles are published in the technical press.

Since the war the miners have been given sandwiches as they go underground, and the wrapping-paper has been printed with safety messages and pictures. It has been found that after the miner has finished his sandwiches he usually looks at what is printed on the wrapping-paper.

The Safety Service is also concerned with the prevention of disasters such as explosions of firedamp and coal dust, carbon monoxide poisoning, mine fires, and inrushes of water, and also, of course, with the commonest causes of accidents, such as falls of coal and ground and the haulage installations.

Particular attention is paid to ventilation. Under the regulations, three cubic metres of air per minute per man must be supplied underground, but the actual quantity supplied is as much as 15 cubic metres. This ventilation is not so much for breathing purposes as for diluting firedamp, and in the deeper mines for lowering the temperature. In the Hendrik mine, the air supply amounts to 20,000 cubic metres a minute, and it removes over 100 cubic metres a minute of firedamp from the mine. In each of the State mines there is a special ventilation service.

After 13 men lost their lives in a fire at the Hendrik mine caused by the slipping of a conveyor belt, the Safety Service has issued special rules for the elimination of fire risks on conveyors. Special watchmen have been appointed, fire-extinguishing equipment installed, and the personnel given regular instruction. Further, the ventilation has been arranged in parallel currents free from mutual disturbance, so that a fire in one air current cannot spread to another. Not more than 100 men are employed in one current.

The Safety Service also looks after the health of the workers, both below ground and on the surface. Special attention has been devoted to the dust problem, and this has been attacked by wet drilling, water sprays, mechanical loading, and the use of time detonators in shotfiring. In addition, water infusion is applied at the coal face.

Conveyor Belt Vulcanising. (*The Colliery Guardian*, 5 May 1949, p. 579.)

Describes with illustrations a flameproof unit for vulcanising conveyor belts underground.

Deep Shaft Winding Problems. By H. HITCHEN. (*The South African Mining and Engineering Journal*, 22 January 1949, p. 619, and 29 January 1949, p. 647.)

As regards ropes, the author first mentions laboratory tests with special reference to fatigue stresses and then discusses stresses occurring in winding operations and causes of rope failures.

He goes on to consider various factors affecting the safety and efficiency of bi-cylindroconical drums, twin-parallel drums and the Koepe winder.

The article concludes with a discussion of problems affecting rigid and rope guides.

Kohlenstaubbekämpfung mit dem Stosstränkverfahren in halbsteiler und steiler Lagerung auf dem Steinkohlenbergwerk "Consolidation". By Bergrat Dr.-Ing. Hubertus ROLSHOVEN and Inspector Alexander HEITMANN. (*Glückauf*, 12 March 1949, p. 179.)

The article describes trials made with water infusion in inclined seams at a Ruhr mine. Particulars are given of the infusion equipment, the

quantity and pressure of water, the method of applying it, and the results achieved. The trials showed that the dust content of the air can be reduced from 450-650 mg/m³ to 150-200. Such a reduction in inclined fat coal seams means a considerable improvement in working conditions and safety.

Steam Infusion as a Means of Dust Suppression. By K. Z. GEORGE. (*The Colliery Guardian*, 14 April 1949, p. 469.)

The author describes laboratory tests with steam jets at the Sheffield University Mining Department and trials undertaken underground at a coal face.

The steam was generated in an electrode-boiler in which the water was in an insulated tank, and was infused into the coal by infusion tubes connected to the boiler through high pressure hose pipes. The infusion holes were 4 feet deep and varied in number from 60 to 85 on a 95-yard length of face.

The first experiments were unsuccessful, but better results were achieved after the equipment had been improved. Tabulations show that steam infusion is much superior to water infusion as a means of suppressing dust. For instance, a dust concentration of 1.6860 gm per 1,000 cubic feet of air during machine-cutting was reduced to 1.0987 by water infusion and to 0.5054 by steam infusion supplemented by a small infusion of water.

The author is convinced of the superior efficiency of steam as compared with water for dust suppression. For steam infusion only a small quantity of water is required—not more than 1.5 gallons per ton of coal.

Drainage of Firedamp from Coal Seams. By J. Ivon GRAHAM. (*The Colliery Guardian*, 31 March 1949, p. 403, and *The Iron and Coal Trades Review*, 1 April 1949, p. 683.)

The author quotes some British and German examples of the use of boreholes for draining off methane from the coal, and suggests various schemes for this purpose. The first entails the driving of advanced headings in an advancing longwall system, the second contemplates boring in the seam at the face or from the return airway, also in advancing longwall, the third is for retreating longwall, and the others involve boring from adjacent strata, an adjacent seam or a cross-measure drift.

The author then goes on to discuss the quantity and pressure of methane in different types of coal, and in conclusion refers to the economic possibilities of drainage of methane.

Erfahrungen über die Grubenwetteruntersuchung. By Dr. Paul MICHAELIS. (*Glückauf*, 9 April 1949, p. 251.)

Discusses methods of taking and preserving air samples and various types of analytical apparatus and methods of analysis. Refers in particular to colorimetric methods for the determination of carbon monoxide, to oxidisation and the use of incandescent platinum spirals for methane, and to the determination of carbon dioxide from the combustion of methane.

Earth-Leakage Protection. (*The Mining, Electrical and Mechanical Engineer*, March 1949, p. 319.)

The author advocates a system described as an unearthed district transformer neutral with multi-point limited earthing, which is a compromise between earthed and free neutrals. He discusses the core balance system of earth-leakage protection with special reference to difficulties in clearing faults, and comes to the conclusion that the earthed neutral has several shortcomings and is in fact a potential danger rather than a protection.

Remote Control and Sequence Control of Electrically Driven Conveyors. By E. E. GROVER. (*The Colliery Guardian*, 19 May 1949, p. 673.)

Discusses various methods of remote control and sequence control, including automatic sequence control, from the technical and safety standpoints.

Safety Practice in Chemical Works. By A. WEBSTER. (*Chemical Trade Journal and Chemical Engineer*, 1 April 1949, p. 359.)

The author discusses works safety organisation and precautionary measures with particular reference to paint works. He advocates the establishment of a works safety committee and the appointment of one person in a plant whose duties shall be to deal with all matters pertaining to accidents and accident prevention.

Special attention should be given to certain conditions and operations which present the greatest risks. The storage of solvents, for example, which entails a major fire risk, could be made much safer if greater use of carbon dioxide were made where possible to fill the free space in tanks, or of water to seal the surface of solvents which are heavier than water and immiscible with it. Among other subjects, the author refers to the difficulty of removing an unconscious worker from a tank through a standard size manhole in emergency cases. He suggests that manholes be made larger than required by law and that a small tripod equipped with a pulley plug be installed over the manhole whilst a worker is in a tank. This simple mechanical device would be of great assistance in emergency cases.

Glass — Handle with Care! By Carl MINIDEO. (*Occupational Hazards*, March 1949, p. 21.)

Tests made by a plate-glass manufacturing company in the United States showed that ordinary protective gloves did not provide sufficient protection for a long enough period in cutting operations.

To overcome this difficulty the use of a natural rubber work glove with a strong fabric lining and rough finish was recommended. This glove proved to outlast several pairs of other types of glove and and offered more complete protection to the hands and wrists. The rough finish prevented the glass from slipping from the grasp of the workers.

Sleeve guards suitable for use in plate-glass factories are also briefly described.

Are Cranemen Expendable? By R. D. DARRAH. (*Safety Engineering*, April 1949, p. 70.)

It is pointed out that cranemen in the metal-working industry are exposed not only to dangerous temperatures but also to noxious gases, dusts and vapours. A table giving the maximum allowable concentrations of a number of these gases and dusts is included and various methods of air-conditioning crane cabs are described.

Gas, Flames and Sparks. By J. I. BANASH. (*Safety Engineering*, August 1948, p. 7.)

The author reminds the users of oxy-acetylene welding equipment of the general hazards involved in handling it and of the special risks of fire and explosion created by the nature of the gases employed. Particular attention is given to the pressure at which the gases are used at the torch, as the more the oxygen pressure rises, the farther dangerous sparks are projected from the point of operation. For all practical purposes the maximum pressure limits should not exceed 15 and 200 lb./sq.in. respectively for acetylene and oxygen cylinders. Photographs and drawings which accompany the article illustrate points in fire prevention, ventilation of workrooms and the exhaustion of fumes from containers during and after welding.

Beschermingsglazen voor lasarbeid. By G. A. W. RUTGERS. (*De Veiligheid*, August-September 1948, p. 114.)

The main theme of this article is the protection of arc welders' eyes against radiation. Discrepancies between American, British and German specifications for goggles, etc., led the Netherlands Illumination Foundation to investigate on its own account the requirements that protective glasses should satisfy. The author refers to experiments conducted to ascertain the maximum amounts of ultra-violet and infra-red radiation that the human eye can safely be subjected to and then compares these amounts with the amounts of radiation emitted during electric and gas welding. This comparison yields the maximum permissible penetration factor for protective glasses, as indicated in table I.

TABLE I

MAXIMUM TRANSMISSION FACTOR, EXPRESSED AS A PERCENTAGE (WAVELENGTHS IN MICRONS)

Class	Ultra-violet		Infra-red		
	0.313	0.365	0.8	1.0	2.0
A. Gas welding and cutting	0.1	1.0	1.0	1.0	3.0
B. Electric welding to 75A, heavy gas welding . .	0.03	0.3	0.3	0.3	0.9
C. Electric welding from 75A to 200A . .	0.03	0.3	0.3	0.3	0.9
D. Electric welding above 200A . . .	0.01	0.1	0.1	0.1	0.3

As regards visible radiation, it will not suffice to fix a maximum permissible transmission factor; the glass must not be too dark and therefore a minimum factor must be fixed too.

Table II shows, for the same four classes, the aggregate transmission factor for visible radiation from an incandescent lamp with a colour temperature of 2,800° C.

TABLE II

Class	Maximum	Recommended	Minimum
A	0.8	0.4	0.2
B	0.2	0.1	0.04
C	0.04	0.02	0.01
D	0.01	0.005	0.002

Table III compares American, British, German and Netherlands standards for the four classes in question, expressed in terms of transmission factors.

TABLE III

TRANSMISSION FACTOR, EXPRESSED AS A PERCENTAGE, FOR ULTRA-VIOLET RADIATION WITH A WAVELENGTH OF ABOUT 0.35 MICRONS

Class	U.S.A. 0.365 m.	Great Britain 0.32 - 0.35 m.	Germany 0.35 m.	Netherlands 0.365 m.
A	0.1	0.1	12.6	1.0
B	0.1	0.01	1.6	0.3
C	0.1	0.001	1.6	0.3
D	0.05	0.001	0.004	0.1

Table IV provides a similar comparison in respect of the total transmission factor, expressed as a percentage, for visible radiation from an incandescent lamp with a colour temperature of 2,800° C.

TABLE IV

Class	U.S.A.	Great Britain	Germany	Netherlands
A	0.45 -1.18	0.1 -1.0	0.06 -0.3	0.2 -0.8
B	0.06 -0.16	0.01 -0.1	0.06 -0.3	0.04 -0.2
C	0.009-0.023	0.001-0.01	0.001-0.06	0.01 -0.04
D	0.001-0.003	0.001-0.01	0.001-0.06	0.002-0.01

Table V compares the standards of the same four countries for infra-red radiation.

TABLE V

PENETRATION FACTOR, EXPRESSED AS A PERCENTAGE FOR INFRA-RED RADIATION WITH A WAVELENGTH OF ABOUT 1 MICRON

Class	U.S.A. (total)	Great Britain (total)	Germany 0.95 m.	Netherlands 1 m.
A	1.5	0.1	0.13	1.0
B	1.0	0.03	0.0048	0.3
C	0.6	0.003	0.0048	0.3
D	0.5	0.003	0.00017	0.1

Kettingen en Staaldraadstroppen. By J. H. DE WEERD. (*De Veiligheid*, March 1949, p. 33.)

The author first discusses materials for making chains, methods of manufacture and defects to be avoided. He then considers defects that may arise in use (brittleness, deformation, etc.), and remedial measures such as annealing. He gives

a set of rules for the maintenance of chains. He next turns to various types of wire-rope slings and the safety requirements applicable to their construction and use.

There's No Need to Hang by a Thread. (*Safety Engineering*, October 1948, p. 24.)

Two separate articles appear under this title. The first one, by Stephen A. REED, deals with fibre ropes and gives the characteristics of natural and synthetic fibres which are used in their manufacture and a brief account of the manufacturing process that the fibres undergo to be turned into ropes of sufficient tensile strength and of proper resistance to abrasion. Some noteworthy suggestions are made with respect to the preservation of ropes, and the author particularly reminds the users that, in a tackle, the weakest point is usually the block itself and not the rope. Among other items covered are the factor of safety, care in handling, detection of defects or results of wear, and maintenance of the ropes.

In the second article, by Douglas H. DYER, the author discusses two main factors which affect the life of wire ropes. These factors are the selection of the wire rope and its maintenance after it has been placed into service. He underlines the important points which should be considered when selecting a rope, such as the kinds of stresses to which it will be submitted, and suggests the right type of rope construction for various conditions of service as well as the suitable type and arrangement of tackle to be used in order to avoid undue fatigue and abrasion.

The article also deals briefly with the maintenance of wire ropes under various atmospheric conditions and it suggests, *inter alia*, that wartime rope construction substitutes be replaced by ropes of standard construction now that these have become available.

Brand- en Ontploffingsgevaar geboden door Ammoniumnitraat. By Is. DEHING. (*Doe Het Veilig*, March-April 1949, p. 28.)

The article explores the risk of explosion and fire with ammonium nitrate, and briefly describes some noteworthy disasters for which it has been responsible. It sets out the following precautions to be taken in the storage and handling of ammonium nitrate—

(1) It is absolutely necessary that the prohibition of breaking up ammonium nitrate or mixtures of it, even with inert substances, by explosives should be generally known and respected.

(2) If ammonium nitrate or mixtures of it are stored in bulk, high piles should be avoided, so that if the nitrate agglomerates it can more easily be broken up with pickaxes.

(3) Care should be taken to prevent combustible substances such as straw, metal powders, sawdust, lubricating oil and other flammable liquids from being mixed with ammonium nitrate in bulk. In this connection, account must be taken of the fact that some piping may become leaky as a result of an accident or fire; arrangements should be made to prevent any flammable liquid from flowing near the nitrate as a result of defects in piping.

(4) It is advisable to store ammonium nitrate packed so that it cannot agglomerate; then no-one will be tempted to commit the imprudence of breaking it up with explosives.

(5) For packing, use may be made of iron drums, wooden drums lined with paper, and water-proofed paper bags. The use of jute should be avoided.

(6) Used combustible packing must be removed from places where ammonium nitrate is stored. It is better to burn it.

(7) In the construction of store-places and silos, and also in the machinery that is used in them, no combustible materials should be employed. Above all, the use of wood should be avoided because it is easily impregnated with ammonium nitrate and is then highly flammable.

(8) Pure ammonium nitrate and mixtures of it with non-oxidisable substances offer no risk of fire. If, however, they are packed in wooden drums or paper bags, combustion of the packing is intensified by the nitrate. However, extinguishing is possible, although much water is required for this, and accordingly it is desirable to connect the store-place with water piping under pressure. Other extinguishing appliances, for example, those using carbon dioxide or foam are unsuitable. Steam should not be used.

(9) In the store-places, between the piles themselves, between the piles and the walls, and between the piles and the ceiling, free spaces should be left so that if a fire breaks out, the gases and the heat generated can freely disperse and the seat of the fire can be attacked by jets of water.

(10) In the storage or stowage of ammonium nitrate or mixtures of it, care should be taken that steam pipes or electric cables do not come into contact with the nitrate.

(11) Open fires must be avoided in places where there is ammonium nitrate, and also in the loading and unloading of it. Smoking or going about with a light or a flame or using fire for heating purposes or welding appliances and cutting flame must be strictly prohibited, and the prohibition must be carefully observed.

(12) Ammonium nitrate that is mixed with organic substances or metal powders must be handled more cautiously. For such mixtures it is always necessary to consult an expert who will decide whether they are to be considered as explosives.

(13) In the case of a fire in rooms or ships' holds containing ammonium nitrate, large quantities of water should be applied, if possible from behind cover, because the sudden generation of steam may project incandescent objects.

(14) The fire brigade or the personnel who may have to fight the fire must be equipped with oxygen or fresh air masks.

(15) Supervision over store-places and over ships and other vehicles laden with ammonium nitrate is necessary to prevent any malicious act.

(16) It is advisable to inscribe the exact quantity of ammonium nitrate on drums and bags containing it.

(17) On ships ammonium nitrate should, as far as possible, be stowed away from organic, acid, oxidisable, highly flammable or explosive substances, and never under or over holds containing these substances. It is advisable not to carry any of these substances with ammonium nitrate in the same ship. Before loading, the holds should be thoroughly cleaned.

Facts You Should Know About Toxic Solvents. By Ronald E. BALES. (*Occupational Hazards*, January 1949, p. 14.)

The aim of this article is to provide industrial nurses with essential information concerning the composition and use of industrial solvents and their toxic effects on workers.

Together with a table of the maximum allowable concentrations of the most commonly used solvents, it also gives the most generally accepted methods of protection against their toxic effects and a summary of the symptoms by which intoxication by benzene, carbon disulphide, carbon tetrachloride, chloroform, methyl alcohol, toluene or trichlorethylene may be readily recognised.

Cyclone Dust Collectors. By A. J. TER LINDEN. (*Engineering*, 18 February 1949, p. 165.)

This article, taken from a paper read at a meeting of the Institution of Mechanical Engineers in London, describes a series of investigations conducted at the laboratory of the Technical High School at Delft on cyclone dust collectors. Particular consideration in this abstract is given to the flow of gas in a cyclone, and the most efficient shape and the most suitable type of cyclone collectors for general industrial use.

The factors which affect the general efficiency of a cyclone collector have been ascertained by means of experimental tests and calculations, the results of which are shown in illustrations and graphs. These, together with the text, explain the properties of a cyclone and show how the efficiency and pressure loss of a cyclone dust collector in its construction stage may be estimated to serve practical needs in many cases. Amongst the factors analysed are the rate of settling of the dust particles, the size and shape of the inlet ducts, the path followed by the dust particles and the size of the exhaust pipe.

A brief review is also given of the advantages and disadvantages of replacing a large cyclone by a series of small units for high efficiency in collecting very fine dust.

Disposal of Fluorescent Lamp Tubes. (*Industrial Accident Prevention Bulletin*, Vol. XVII, No. 168, January 1949, p. 3.)

This article deals with the disposal of burnt-out fluorescent lamp tubes with a view to the elimination of the beryllium dust hazard. It is recommended that tubes be broken under water to avoid exposure to even a minute quantity of the hazardous dust. This may be done by the use of a drum filled with water and equipped with a fine wire mesh basket in which the tubes are broken. The basket catches the particles of the contaminated glass and dust is not liberated into the atmosphere. Another recommended method, where large quantities of tubes must be disposed of, consists in the use of a specially constructed cabinet, the door of which when closing breaks the tubes as they are placed in it. The broken glass falls into a basket immersed in water in the bottom of the cabinet. In all methods, it is important to remove the broken glass for burial in such a way as to eliminate the danger of cuts or punctures. Goggles and gloves should be worn during the disposal operation.

The article also refers to first-aid treatment for wounds inflicted by broken tubes as they are usually of a very treacherous nature; complications may set in even after a long period of time. Doctors should also be advised of the nature of the glass from which the injuries are sustained, as fluorescent tube glass presents greater hazards than ordinary glass, due to its contamination by beryllium compounds.

In conclusion, it is advised that all fluorescent tubes should be handled and disposed of with extreme care in spite of the fact that some manufacturers no longer make use of beryllium compounds in their tubes. The precautions recommended should be taken unless it is absolutely certain that the tubes do not contain any harmful substance.

How to Dispose of Fluorescent Tubes Safely. (*Engineering News Record*, 14 April 1949, p. 64.)

This is a summary of an article which appeared in a recent issue of the *Monthly Bulletin* published by the Indiana State Board of Health. Its author, Doctor Louis W. SPOLYAR, outlines the health hazards involved in disposing of fluorescent lamp tubes containing beryllium compounds and mercury, and recommends several dry and wet methods by which the tubes may be disposed of safely and efficiently.

Mechanical-Filter and Chemical-Cartridge Respirators. By Allen D. BRANDT, D.Sc. (*Safety Engineering*, February 1949, p. 16.)

Various types of mechanical-filter respirators for protection against dusts, fumes and mists and chemical-cartridge respirators for protection against organic vapours and gases are described in some detail.

It is pointed out that mechanical-filter respirators are not substitutes for other methods of controlling dust, fume and mist, and the jobs for which they can adequately be used are listed. Chemical-cartridge respirators are most useful for work involving intermittent or unexpected exposure to dangerous concentrations of gaseous contaminants.

Combination respirators, or respirators with both dust and gas filters are briefly mentioned.

The method used by the U.S. Bureau of Mines for testing certain types of respirator is outlined and the article concludes with a number of recommendations respecting the selection, use and maintenance of respirators.

RECENT BOOKS

Lavoro Sociale e Prevenzione degli Infortuni. By Giorgio MASTINO DEL RIO. Published by Dr. A. Giuffre, Milan, 1949. 10 pp.

A pamphlet reproducing a lecture given in April 1949 at the Institute of Psychology of the University of Rome on social work and the prevention of accidents.

After defining social work, briefly outlining its history and discussing the tasks of social workers, the author goes on to discuss accident prevention. He briefly traces the origins of the safety movement in Italy, mentioning in particular the work of the National Association for the Prevention of Accidents (*E.N.P.I.*). The various causes of accidents, including physiological and psychological causes, are dealt with. Accident prevention has three aspects: a technical aspect, a physical one and an educational one. The author briefly reviews what has been done in Italy in each of these fields and makes recommendations for the safeguarding of workers.

In conclusion he states that accidents must be prevented not only in industry but also in agriculture and commerce, in the roads and in the home. Accident prevention is therefore a social problem and in fact constitutes one of the most important aspects of social work.

U.S. Navy Manual of Safety Equipment. Navexos P-422. Office of Industrial Relations, Safety Branch, Navy Department, Washington, D.C. No date. 169 pp., 138 figs.

The manual furnishes information on the design, construction, maintenance and use of articles of safety equipment commonly used in the Navy. These articles include oxygen-deficiency indicators, detectors for carbon monoxide, hydrogen sulphide and flammable gases, self-contained oxygen breathing apparatus, various types of respirator, air samplers, dust counters, geiger counters, light meters, air-velocity meters, goggles, face shields, hard hats, welders' helmets, protective clothing, safety boots, safety belts, safety cans for flammable liquids, carboys and carboy tilters, shin guards, portable electric lamps, ladder shoes and siphons.

The manual is profusely illustrated and provided with an index.

Fire Protection and Accident Prevention Year Book, 1950. Edited by Geoffrey G. D. PRATT. Published by *Fire Protection and Accident Prevention Review*, Benn Brothers Ltd., London, 1949. 364 pp. Price 10s. 6d.

The first six sections of the year-book are directories of public fire services of the United Kingdom, British Commonwealth and other countries, private fire brigades of the United Kingdom, Government departments, associations, etc. Section VII reviews British legislation bearing on fire protection, and Section VIII deals briefly with the safety provisions of the Factories Acts. Section IX is on civil defence, and Section X is devoted to fire engineering and technology.

Section VII is in six parts. Those of most interest from the industrial safety standpoint are Part II, which deals with fire protection in factories and dangerous trades, and Part IV, concerning fire legislation and dangerous substances. Part II summarises the provisions of the Factories Act, 1937, and various regulations issued under this and earlier Acts dealing with celluloid, cinematograph film, cellulose solutions, aircraft engine testing, magnesium, etc. Part IV deals with the storage and carriage of petroleum, calcium carbide and carbon bisulphide.

Section X consists for the most part of numerous tables, some of which relate to combustible gases, vapours and dusts.

Grisoumètre M.S.A. Centre d'Etudes et Recherches des Charbonnages de France. Note technique No. 49-13. Paris, September 1949. 14 pp.

Illustrated description of the construction and performance of three methane detectors constructed by the Mines Safety Appliances Company of Pittsburgh, Pa.

Le Grisoumètre Léon Cerchar. Centre d'Etudes et Recherches des Charbonnages de France. Note technique No. 49-14. Paris, September 1949. 17 pp.

Describes with illustrations a new methane detector designed by the research station of Charbonnages de France at Montluçon. It is relatively easy to carry, use and maintain, is of robust construction and accurate to within ± 10 per cent.

Accident Experience, Iron-Ore Mines, Lake Superior District, 1940-47. U.S. Bureau of Mines, I.C. 7510. Washington, D.C., June 1949. 16 pp.

Gives information on the mining methods, safety organisation and accident rates of the Lake Superior iron mines.

In the years 1940-1947 the mines shipped 619,000,000 tons of ore, worked 328,000,000 man-hours and lost 1,557,565 days on account of injuries. There were 192 fatal, 171 permanent partial and 5,964 temporary injuries, giving a frequency rate of 19.27 and a severity rate of 4.74.

The rates for various operations and methods were as follows: general shops, frequency 5.78, severity 1.44; open cuts, frequency 11.73, severity 3.68; concentrators (1946 and 1947 only), frequency 12.32, severity 4.16; top slicing, frequency 26.56, severity 5.20; stoping, frequency 23.21, severity 5.98; sub-level caving, frequency 29.18, severity 6.79.

The average number of days lost per injury was 249.8 for general shops, 313.8 for open cuts, 337.3 for concentrators, 195.7 for top slicing, 257.6 for stoping and 232.8 for sub-level caving.

Information on the causes and severity of accidents during the years 1944-1947 is given in the accompanying table.

Causes	Number of injuries	Days lost	Average days lost
Inrushes, mud and water	9	18,607	2,067.4
Explosives	20	28,377	1,418.9
Railroad cars and locomotives	22	16,768	762.2
Electricity (shocks and burns)	11	6,174	561.3
Falls and slides of ground (ore and rock)	504	228,920	454.2
Cages, skips and buckets	18	7,967	442.6
Persons falling (shafts, raises, banks, scaffolds, etc.)	150	49,392	329.3
Haulage (conveyor, truck, locomotive, etc.)	319	95,132	298.2
Machinery (moving)	135	38,037	281.8
Falling material (shafts, raises, etc.)	183	44,275	241.9
Loading equipment (shovels, scrapers, etc.)	101	24,180	239.4
Drilling equipment	152	26,694	175.6
Flying objects	139	16,116	115.9
Persons falling (slipping and stumbling)	212	12,495	58.9
Not classified	552	28,908	52.4
Falling material (other than ground)	120	5,529	46.1
Handling material	603	24,743	41.0
Hand tools	188	6,448	34.3
Runs of ore and rock (chutes and bins)	62	1,482	23.9
Mine fires	5	39	7.8
Suffocation (natural gases)	1	7	7.0
All causes	3,506	680,290	194.0

Safeguarding Underground Workmen from Noxious Gases Resulting from Blasting in Strip Mines. U.S. Bureau of Mines, I.C. 7503, Washington, D.C., May 1949, 8 pp.

Describes cases in which gases from blasting operations in strip mines have penetrated into adjacent underground workings and sets out some precautions taken by a mining company to prevent accidents from this cause.

The "Carbon-Oxygen Complex" as a Possible Initiator of Explosions and Formation of Carbon Monoxide in Compressed-Air Systems. U.S. Bureau of Mines, R.I. 4465, Washington, D.C., June 1949. 22 pp.

Discusses theories concerning causes of explosions and formation of carbon monoxide in compressed-air systems and describes experiments in which carbon deposits from such systems were heated in air, oxygen and nitrogen. The experiments point to the importance of selecting suitable lubricants and controlling the temperature of air compressors. The paper is illustrated with numerous diagrams and graphs and provides a bibliography.

Electrical Code. The Institute of Petroleum, 26, Portland Place, London, W.1., 1946. 77 pp. Price 5s.

These electrical regulations compiled for the use of the petroleum industry are in three parts. The first part contains definitions of the terms used, the second deals with flammable and explosive atmospheres and the risk of fire arising from the use of electrical equipment, static electricity, protection against lightning, and flexible cables for use in dangerous areas.

The third part contains safety rules grouped in four chapters as follows: general, protection against static electricity, protection against lightning, oilfields.

It is intended to revise the Code periodically in the light of experience and future development.

Prescriptions et recommandations pour installations électriques en Belgique. By H. K. DE MEERENDRE and M. PYPEN. Editions Erasme. Brussels, 1948. 297 pp. Price 78 fr.

This volume gives a very instructive picture of Belgian legislation on electricity. It contains commentaries on legislative texts, examples and graphs, and deals with installations at low and medium voltage and installations on the premises of electric distribution centres.

Safe Openings for Some Point of Operation Guards. Technical Guide for Accident Prevention No. 2. Published by the National Association of Mutual Casualty Companies, Chicago, Ill., January 1949. 16 pp.

Discusses the dimensions of necessary openings in point of operation guards and the placing of these guards at such distances from the danger zones as to reduce risk of injury to a minimum.

The booklet is profusely illustrated.

Spreaders for Variety and Universal Saws. Technical Guide for Accident Prevention No. 1. Published by the National Association of Mutual Casualty Companies, Chicago, Ill., January 1948. 16 pp.

An illustrated pamphlet giving detailed information on the design, construction and installation of spreaders (riving knives) on variety and universal woodworking saws.

Explosive Properties of Hydrazine. U.S. Bureau of Mines, R.I. 4460, Washington, D.C., May 1949. 18 pp.

Gives information on the properties of hydrazine and discusses experiments undertaken to determine its sensitivity to friction and impact, detonability, ignition temperature, limits of flammability, etc.

Flammability of Methyl Alcohol Vapor-Air Mixtures at Low Pressures. U.S. Bureau of Mines, R.I. 4473, Washington, D.C., May 1949, 5 pp.

Discusses experiments undertaken to determine flammability limits of mixtures of methyl alcohol and air. The experiments have a bearing on the operation of internal-combustion engines at high altitudes and on other combustion processes at reduced pressures.

Dust in Industry. Published by the Society of Chemical Industry, London. 175 pp.

This book contains 23 papers which were presented during sessions of the conference held by the Society of Chemical Industry at Leeds from 28 to 30 September 1948, together with the discussions which followed the reading of each paper.

The sessions were devoted to the study of the following subjects:

(1) physical characteristics and estimation of dust;

(2) practical aspects of the dust problem;

(3) fire and explosive hazards (coal dust explosions in mines and dust explosions in industry);

(4) health hazards.

In addition to the useful information and valuable data which the book contains, it has been enriched by a great number of photomicrographs of dust samples taken under various conditions, photographs and reproductions of designs of plants, equipment, apparatus, charts and tables used for the determination and removal of dust and of the hazards created by dust in industry.

Industrial Hygiene and Toxicology, Volume II. Edited by Frank A. PATTY. Interscience Publishers, Inc., New York, 1949. ix + 504 pp. Price $15.00.

Volume I of this publication was reviewed in the *Industrial Safety Survey*, Vol. XXV, No. 2, p. 79.

This second volume deals with the various toxic substances encountered in industry, *i.e.*, the halogens, alkaline materials, various metalloids and metals, aliphatic, aromatic and cyclic hydrocarbons, halogenated hydrocarbons, alcohols, organic acids, esters, ketones, ethers, glycols and glycol ethers, nitro, diazo and amino compounds, phenol and phenolic compounds. Under each substance is mentioned: (1) uses and industrial exposures, (2) determination (in principle), (3) physiological response in animal and man, (4) maximum allowable concentration, (5) (in some cases) flammability and warning properties.

In the space allotted in the volume, it is not possible to give an extensive description of each substance dealt with. Industrial lead poisoning, however, is described in an excellent chapter of 30 pages, by Robert A. KEHOE, mercury in 10 pages and beryllium in 5 pages. As legislative and statistical tables are omitted, it has been possible to include all factors of toxicological importance.

An extensive bibliography is also included.

These two volumes constitute an excellent and up-to-date textbook on industrial medicine.

Small Portable Coal-Dust Explosion Gallery. U.S. Bureau of Mines, R.I. 7520, Washington, D.C., June 1949, 3 pp.

Describes a portable gallery designed to demonstrate the explosibility of coal dust. The gallery is used in the Bureau's educational campaign for the prevention of coal-dust explosions.

Cours de médecine du travail. Edited by H. DESOILLE, Professor at the Faculty of Medicine, Paris, 1949. 668 pp.

This important work reproduces a number of courses of lectures given at the Institute of Industrial Hygiene and Medicine of the Faculty of Medicine, Paris. It is in two parts entitled "Prevention" and "Pathology", each containing a considerable number of chapters written by specialists.

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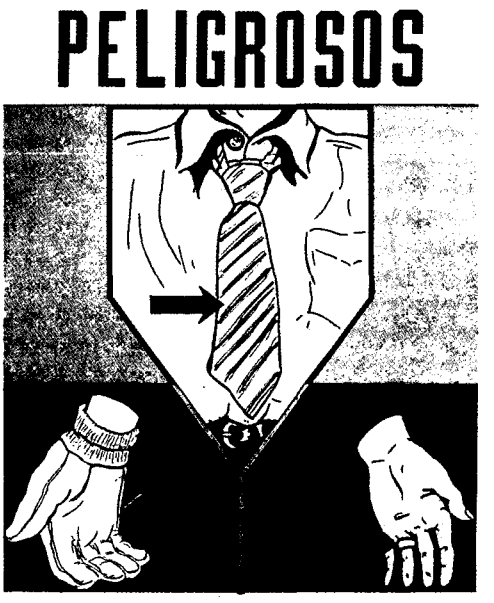
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