INDUSTRIAL SAFETY SURVEY

MONTREAL JANUARY-MARCH 1946 VOL. XXII, No. 1

DEVELOPMENT OF INDUSTRIAL HYGIENE IN CANADA

By Kingsley KAY, M.A., Ph.D., Chief of the Industrial Hygiene Laboratory, Department of National Health and Welfare, Ottawa

Industrial hygiene as practised in Canada concerns the protection of the health of industrial workers. Although closely allied in theory with the general purposes of factory inspection, industrial hygiene has developed as a separate entity under Government departments of health, whereas factory inspection, which preceded organised industrial hygiene, has remained a responsibility of departments of labour.

The first Factory Act in Canada was passed in the Province of Ontario in 1884 following publication of the findings of a Royal Commission on Capital and Labour. The next year, 1885, a similar Act, the Industrial Establishments Act, was passed in the Province of Quebec. Between 1885 and 1917 Factory Acts became law in all provinces excepting Prince Edward Island, where the limited industrial activity has not made passage of factory legislation necessary. All these Acts make provision for the appointment of factory inspectors. The Acts all refer to cleanliness, heating, ventilation, dusts, gases and general factory sanitation. Except in the case of the Quebec Act none makes provision for appointment of medical inspectors and, indeed, except for the first appointees no medical inspectors have been maintained as part of the Quebec factory inspection staff. On the other hand, none of the provincial public health authorities had, up to 1917, established a medical factory inspection service. In general, therefore, it may be said that up to the end of the First World War protection of the health of Canadian industrial workers was assumed by factory inspectorates under departments of labour.

THE FIRST WORLD WAR

The formal inception of industrial hygiene as a service for protection of Canadian industrial workers took place following the First World War. Information regarding the health situation in Canadian industry of that period is meagre; nevertheless it cannot be concluded that fatigue, accidents and occupational disease were not problems, for the tremendous advances that have been made in the intervening years towards control and elimination of these health factors indicate that, before these advances were accomplished, ill health must have been present to an important degree. The experience of British health workers, about which ample data are available, indicates that the rapid wartime increase in production was accompanied by a corresponding increase in fatigue, accidents and occupational disease. It is well recognised that the tendency everywhere at that time was to force health supervision to the background, making production, at any cost, the important goal.

In Britain it was soon found that fatigue, accidents and occupational disease were having an adverse effect on the efficiency of the industrial war machine and as a result the Minister of Munitions, David LLOYD GEORGE, appointed, with the concurrence of the Home Secretary, the Health of Munitions Workers Committee to consider and advise on matters affecting the health of workers in British munitions factories. It was not long after this Committee had been active that a decided improvement in the health situation of the British war industries took place. The two direct results of the Committee's work were, first, an improved organisation of industrial effort as a result of the elimination of inefficiency due to fatigue from excessive hours of work and poor working conditions and, secondly, legislation based on scientific findings to control hazards in the manufacture of munitions. The Committee's findings received a wide application in industry, both in the United Kingdom and on the North American continent.

It is not possible to trace a direct and organised application of the many findings of the Health of Munitions Workers Committee to the Canadian industrial scene at that time. For one thing, records do not provide any picture of the incidence of industrial disease in the war industries of Canada. However, the Committee's findings appear to have influenced the federal Government of Canada to form, in 1919, a comparable Committee for Fatigue Study, and this was set up in Toronto under the chairmanship of Professor J. J. R. McLeod, then Professor of Physiology at the University of Toronto. Under the direction of Dr. J. G. Cunningham a survey of industrial hygiene conditions in the City of Toronto was undertaken at the Committee's behest. That same year instruction in industrial hygiene was instituted for graduates proceeding to the degree of Public Health in the Department of Hygiene of the University and for undergraduates in the Medical School.

1920 — First Government Division of Industrial Hygiene, Ontario

In 1920, for the first time in Canada, industrial hygiene was recognised by a provincial Government when a division for work in this field was set up under the Board of Health of the Province of Ontario. Dr. J. G. Cunningham was appointed as Director of the Division and has continued in charge during the subsequent years.

By means of the medical and laboratory service of the Division, the Provincial Health Ministry, to which the Board of Health was changed, offers technical assistance and consultative service to the Factory Inspectorate under the Provincial Labour Department, to the accident prevention associations set up under the Workmen's Compensation Act of the Province, to employers and to the medical profession. The Division, in effect, provides a medical inspection service through collaboration with the Provincial Factory Inspectorate, which can take action under the Factory Act where findings of the Division of Industrial Hygiene indicate a need.

In its role as collaborator with the Factory Inspectorate, the Division of Industrial Hygiene has frequently provided the basis for amendments to the Factory Act which were deemed necessary for control or elimination of hazards to health. Important amendments were recommended and made part of law, among these being regulations relating to the labelling of containers of toxic substances used in industry. Compulsory posting of printed bulletins indicating dangers and necessary precautions in handling toxic substances were included. Periodic physical examination of workers exposed to lead and benzol became a regulation under the Factory Act, with the proviso that reports of examinations be submitted to the Division of Industrial Hygiene.

In the matter of miners' health the Division has long been active and in 1928 the Mining Act of the Province was amended so as to require yearly physical examinations of miners employed underground in metal mines for more than 50 hours per month. Under the amendments a certificate is to be issued if health is found to be good and there is freedom from silicosis. Compulsory reporting of cases of occupational disease by physicians was another regulation made under the Factory Act in connection with industrial hygiene control in industry. However, in practice it has been found that this regulation has not worked well. The same experience has been reported in certain parts of the United States where similar regulation has been made.

Under the Public Health Act of the Province the Division of Industrial Hygiene assumes responsibility for sanitation of industrial camps in unorganised territory and is given power to require employers to provide medical and surgical care by contracting with a physician for provision of such service. The employer may be empowered by the Health Department to deduct from wages up to $1.00 per month per man as payment for medical service. During recent months the Division has taken charge of the development and operation of a modern health scheme for employees of the Ontario Provincial Government, and indications are that this demonstration will be followed by the institution of similar schemes in other Governments of the country.

The teaching of industrial hygiene, which was commenced in the University of Toronto in 1920, was followed in 1932 by the creation of a Section of Industrial Hygiene under the School of Hygiene. This Section has actively collaborated with Dr. Cunningham's Division towards the solution of a number of problems in toxicology. The arrangement is interesting in that

through the Government Division with its field contacts a steady flow of practical research projects can be supplied for study.

1936 — Second Division of Industrial Hygiene, Quebec

In the Province of Quebec, where factory legislation has provided authority from 1885 for the appointment of medical inspectors (called "Sanitary Physicians" under the Act), this authority as previously stated was acted upon at an early stage, but not continued. Thus, while factory inspection was carried out from 1888 onwards, no special emphasis, from an administrative point of view, was placed upon the prevention of industrial disease through the methods of industrial hygiene. By 1932 there were in this Province 16 inspectors administering the Factory Act, called the Industrial Establishments Act, under the administrative direction of the Provincial Minister of Labour. Inspection extended to general sanitary conditions and accident prevention in Quebec industry. Concurrently, authority was also granted to the Minister of Health, under the Quebec Public Health Act, to ensure protection of the health of wage earners of the Province, though by 1932 no specific administrative arrangements in this regard had been made.

In 1930 a Commission on Social Insurance was appointed by the Lieutenant-Governor of the Province and, among other matters into which the Commission was directed to enquire, were sanitary conditions of industrial establishments, the health of workers in these establishments, occupational disease, medical inspection of workers assigned to dangerous occupations, medical service in the factory and health education in industry. The Commission had, by 1932, recommended the drafting of regulations relating to health in industry, and further, recommended that these should be promulgated under authority of the Quebec Public Health Act, which already referred, in general terms, to the health of industrial workers. The Commission suggested that general sanitary conditions and safety should remain under the direct control of the Minister of Labour, but that medical and technical aspects of hygiene in industry should fall under the jurisdiction of the Minister of Health of the Province. Thus the Provincial Labour Ministry would take charge of routine inspection of the factories of the Province, while the Ministry of Health would act in an advisory capacity to the Labour Ministry's Factory Inspectorate, but would also be empowered to initiate, independently, investigations of health in industrial establishments. Special health regulations relating to miners, which had been incorporated in a Silicosis Act and the Quebec Mining Act in 1931, were rescinded in 1933 following the Commission's recommendations described above. These regulations (which were like those enacted in Ontario), although withdrawn from mining statutes, were maintained in actual practice under the new administrative arrangements recommended by the Commission.

Following the submission of the findings of the Commission, a Division of Industrial Hygiene was established in 1936 under administrative control of the Health Ministry. The Division continues to act in an advisory capacity to the Department of Labour, to the Department of Mines in relation to miners' health, and to the Quebec Workmen's Compensation Commission in the matter of the occupational diseases for which the Commission provides coverage. To the responsibilities placed on the Division in accordance with the recommendations of the Commission, sanitary inspection of lumber camps in the Province was added and 26 lay inspectors are employed for this purpose at the present time.

The Director appointed to head the Division was Dr. F. J. Tourangeau. He is now assisted by another physician, two industrial hygiene engineers and a chemist. The engineers and chemist cover the environmental aspects of the Division's activities and operate an industrial hygiene laboratory for air and biochemical analysis. Following a two-year period of organisation a preliminary health survey was conducted in 1938. This survey covered more than 3,000 industrial establishments. During 1939 a similar investigation was made into the health situation of miners and quarry workers. These surveys covered over 100,000 workers and provided a general picture of working conditions in the Province, as well as information relative to the incidence of hazards in various occupations. Upon this basis subsequent supervision of the health of Quebec workers by the Division has been developed and thereby data have been provided for promulgation of regulations such as compulsory reporting of occupational disease and maximum allowable concentrations of certain toxic substances in the workroom atmos-

phere. In order to ensure that premises from which occupational disease has been reported will be rendered safe and healthy, an arrangement with the Provincial Workmen's Compensation Commission provides the Division with information concerning cases of occupational disease coming to the Commission's attention.

Of interest in relation to enforcement of factory and health legislation and to the securing of co-operation from industry is the following extract from a paper presented by the Director of the Division before the Canadian Public Health Association on 14 June 1939:

> The Division will act more as an advisory board to industry than as a law-enforcing agency. It is, we believe, in that spirit that we should conceive the working relationship between a governmental industrial hygiene unit and industry and labour. Technical reports resulting from the study of the environment in industry should be discussed in detail with the plant engineer and the plant physician before definite recommendations are presented by the industrial hygienist to the plant officials. May we repeat here that plant officials have an indisputable right to require definite and precise data as to the existence and extent of a given hazard in their plant and that recommendations to industry must be justified and not based only on simple inspections and probabilities.
>
> In the past health officials have too frequently been looked upon by the public at large as a sort of sanitary police. Today this spirit has almost completely disappeared even in industry. Industrial hygiene has become an important branch of preventive medicine in which Governments, industry, the medical profession and the family are from an economic and social point of view all vitally interested.

1937 — Third Division of Industrial Hygiene, Manitoba

The Legislature of the Province of Manitoba passed the Factory Act of the Province in 1900—making Manitoba the third province of Canada to introduce such legislation — and under this Act a factory inspection service was instituted. The Act contains general provisions for sanitation in workplaces and stipulates that no person shall keep a factory so that the health of any person is likely to be permanently injured. Requirements are also included, as in other Canadian Factory Acts, for cleanliness of the factories of the Province, adequate heating and ventilation, and for a reasonable freedom from vapours, gases and fumes. While the Act contains provision for a factory inspector to take with him into any factory a qualified physician, provision was not made for medical inspection as a branch of the factory inspection service. In so far as accident prevention is concerned, an inspectorate is maintained under the Manitoba Workmen's Compensation Board.

Supervision of the health of industrial workers, although covered in general terms under the Factory Act of the Province, was also included in the Manitoba Public Health Act in the form of general power to inspect factories and make regulations regarding conditions of work. For instance, in 1931 regulations respecting silicosis among miners were issued, and in 1937 these were revised and extended to cover workmen employed in foundries as well as mines. These regulations require periodical medical examinations and the taking of chest X-rays. In addition, the Act gives special responsibility to the Minister of Public Health for the supervision of health conditions in lumber camps and industrial undertakings in unorganised areas of the Province. Under the Act employers may be required to retain the services of a physician and may be permitted to deduct not more than $1.00 per month from the wages of each employee for physician's services. Medical inspection under the Act was not formally organised; however, sanitary inspectors were employed in connection with matters of water supply and sewage disposal, and these inspectors were responsible for sanitary conditions of a similar kind in industry.

In 1936, as part of the public health programme of the Province, a Division of Industrial Hygiene was created in the Department of Public Health and Welfare. This Division was staffed with a part-time physician and the early programme consisted of an information service and educational activity. In 1942, however, an industrial hygiene laboratory was established in connection with the Division. This laboratory was housed and equipped by the Province and staffed by the federal Government with an industrial hygiene chemist trained at the Harvard School of Public Health in the analysis of air and environmental survey techniques. The laboratory made possible the routine evaluation of air conditions in Manitoba factories and measurement of toxic dusts and fumes in workroom atmospheres. Blood and urine examinations for toxic substances are now conducted. With the establishment of the industrial hygiene laboratory active collaboration with the Factory Inspectorate under the Department of Labour and with the Workmen's Compensation Board has grown, and as a recent outcome of this growth a joint committee has been formed for the purpose of co-ordinating the efforts of the

three groups in connection with the health and safety of the working population. The Division is now staffed with a full-time physician and one industrial hygiene chemist, and recent activity has been in the direction of implementing the silicosis regulations of the Public Health Act.

1938 — Federal Division of Industrial Hygiene at Ottawa

The federal Government of Canada is not charged with specific responsibility in the matter of supervision of the health of industrial workers. Under the British North America Act this responsibility devolves on the respective provincial Governments. However, under the Department of Health Act of 1919 provision was made for co-operation between the federal Government and other health authorities with a view to co-ordination of efforts for improving public health and publication of information relating to public health, improved sanitation and the social and industrial conditions affecting the health of the people.

Through the authority granted under this legislation and under the inspiring leadership of Dr. J. J. Heagerty, Director of Public Health Services in the Department of Pensions and National Health, a broad programme of public health was evolving in 1938. As one aspect of the programme, a Division of Industrial Hygiene was created in that year under the direction of Dr. F. S. Parney, who had been actively associated with Civil Service health problems. The early function of the Division was to collect and publish information relating to industrial conditions affecting the health of workers, and to provide other special services towards co-ordination of industrial hygiene effort throughout the country. In order to assist the Division in developing its programme, authority was provided for the formation of a Technical Advisory Committee on Industrial Hygiene, which would meet from time to time and offer recommendations to the Department. The Committee membership includes representatives of provincial Governments, labour, industry, universities and the medical profession.

Before the war an industrial hygiene laboratory was installed at Ottawa. The purpose of the laboratory was not to conduct routine air analysis and environmental supervision in industry (since this was a provincial function) but rather to engage in the study of special problems arising in connection with the working environment of Canada's industry. In addition, it was intended that the laboratory should assist provincial and other interested authorities in the development of special air-testing techniques. The laboratory as established at that time was essentially for air-analysis problems with specific relation to gases and fumes. It was planned that at a later date facilities should be added for study of biochemical, toxicological, dust and other problems.

The relationship of the Federal Division of Industrial Hygiene under the National Health Department to the Federal Department of Labour is mainly through the Technical Advisory Committee on Industrial Hygiene, and a member of the Labour Department was appointed to the Committee, thus giving that Department a voice in the setting of the federal industrial hygiene policy. The federal Labour Department in its relation to the provincial departments of labour and workmen's compensation agencies is concerned with the broad aspects of factory inspection, working conditions and compensation, especially from the point of view of assisting in the development of uniform legislation throughout the country. However, as a result of the terms of the Department of Health Act of 1919, the lead in industrial hygiene within the federal Government was taken by the Department of National Health.

The Second World War

On the outbreak of war it was recognised that those agencies in Canada responsible for working conditions would have an important part to play in the maintenance of a high production level. Industry commenced a rapid expansion, and materials and processes potentially dangerous to health were introduced on a large scale. In one branch of manufacture alone, four large plants employing several thousand workers each were constructed for the production and handling of TNT and tetryl. Shipbuilding and manufacturing establishments increased in size and numbers not conceived of before the war. The number of employees in manufacture increased from 658,114 in 1939 to 1,241,068 by 1943. Thus for the first time many workers were exposed to the hazards of the war industries. The numbers of welders and spray painters soared, and women were introduced into these types of work, with their hazards from exposure

to nitrous fumes, metal fumes and solvent vapours.

Since the production of war supplies was conducted largely for the account of the federal Government it became apparent that that Government had a responsibility to ensure that manufacture would be conducted under safe and healthful conditions. In this way the federal Division of Industrial Hygiene became concerned with routine supervision of war contract premises. In peacetime, construction enterprises undertaken on behalf of the federal Government were subject to the federal Public Works Health Act, which required that working conditions on the job should be sanitary, and that medical services should be provided when the Department of National Health deemed these necessary. The required medical service was a responsibility of the contracting employer, and, as in the case of the Public Health Acts of Ontario and Manitoba already described, the contractor was empowered to deduct from wages an amount of $1.00 per month per employee, the money so collected being paid to the attending physician.

Contract Clause

In order that the problem of supervising health in war production might be considered nationally, it was discussed at meetings of the Dominion Council of Health, which advises the federal Department on national health matters, and at a meeting of the Technical Advisory Committee on Industrial Hygiene, the two meetings being held in October 1939. After further discussion with the federal Labour Department and the Department of Munitions and Supply, a clause was inserted in all Government contracts requiring health and sanitary conditions to be maintained to the satisfaction of the Minister of National Health. The clause provided the Department with power to require that working conditions should be healthful, that sanitary facilities and safe water supply should be adequate, that suitable medical services should be available and that health records should be kept wherever deemed advisable. Thus a uniform standard could be applied to the industries of all the provinces, and broad powers in the form of conditions of contract were available as a supplement to those already in the hands of the provincial Governments under the Health and Factory Acts.

Organised effort was not made in a national way to pool inspection resources of the country, a measure used in Germany. Collaboration between agencies was the method taken to assist in ensuring comprehensive supervision of war-contract premises under the contract clause, and arrangements were made whereby the Department of National Health was supplied with details of contracts let by the Munitions and Supply Department. This contract information was then disseminated by confidential reports to the respective provincial health departments which were free to pass on the information to the labour departments and compensation boards of their provinces.

A legislative measure comparable in scope to the contract clause was passed by the United States Federal Government in 1936 to ensure maintenance of good working conditions in factories engaged on contracts for that Government. The measure, called the Walsh-Healey Public Contracts Act, stated that compliance with safety, sanitary and factory inspection laws of the State in which the work, or part thereof, is performed shall be *prima facie* evidence of compliance with the subsection of the Act concerned with health and safety. Thus the Act did not interfere with authority of State health and labour departments. While the wording of the contract clause in Canada was not so specific in this respect, the practice was to require at least the minimum standard stipulated under the provincial law. Unlike the Walsh-Healey Act, which was administered by the federal Secretary of Labor, the Canadian contract clause was administered by the Health Ministry.

The contract clause provided powers, in effect, as comprehensive as those granted under the Factories Act, 1937, in Great Britain, and the 1940 Order issued by the Minister of Labour and National Service relating to medical supervision in factories. Under the British Factories Act, 1937, the Secretary of State was empowered to require reasonable arrangements for medical supervision in factories where there was reason to believe that injury to health might be caused by conditions of work or where juveniles were subject to risk. Under the 1940 Order the scope of the Factories Act of 1937 was extended so that employers could be required to engage a full-time or part-time doctor or nurse, or both, wherever the Factory Department of the Home Office considered such appointment necessary, the necessity to be determined by the number of workers employed in a given factory or by

special conditions appertaining to work, such as dangerous processes or isolated position.

Federal Order-in-Council P.C. 1550

The experience of the federal Division of Industrial Hygiene in administering the contract clause indicated, by 1942, that while in general co-operation of the contractor was obtained when unhealthful working conditions were found, instances were frequent where, to improve working conditions to a safe level, extensive alterations and additions to plant facilities were required. Other instances arose where large scale medical supervision of employees engaged in the manufacture and handling of toxic substances was indicated. In actual practice no contract cancellation was recommended where difficulty was encountered in bringing the health situation of contract premises up to standard. Such cancellation involved many considerations apart from the desirability of maintaining the manufacture of federal supplies under good conditions of working environment and sanitation and, as everywhere throughout the world, the need for war supplies was urgent.

It was considered desirable, therefore, to dissociate the health clause from contracts and to incorporate the requirement of the clause in a statute. This was done early in 1942 and the Minister of National Health was made responsible for administration of the statute — Order-in-Council P.C. 1550. The pertinent sections of the Order are reproduced below. While standards required by the Division of Industrial Hygiene were not changed, the responsibility for the condition of premises was assigned to a single federal ministry:

The Minister, or any officer of the Department authorised by him in writing may, at any time, enter, examine and inspect any war contract premises, and examine and inspect all equipment and appurtenances relating thereto and all employment or other records whatsoever relating to the business carried on or to be carried on within or about the premises, and the person or persons having the custody, possession or control of such premises, equipment and appurtenances or records shall permit the Minister, or officer so authorised as aforesaid, to enter such premises and to make such examination or inspection.

The Minister may by order in writing require the owner of any war contract premises or any person who, as a party to any contract with any of the Governments enumerated in paragraph (i) of subsection (*d*) of Section 1 hereof, is carrying on therein or thereon any work or producing any goods relating to such contract, or any person who may be so carrying on work or producing goods under a contract with any Government as aforesaid or all or any of such persons —

(*a*) to maintain a record of sickness and accidents according to the Standard Morbidity Code for Canada and to keep said records available for inspection by the Department at any time;

(*b*) to permit the display of posters authorised by the Minister and to permit the distribution of similarly authorised health and safety literature to and among the employees on the premises;

(*c*) to keep the said war contract premises at all times in a clean, sanitary condition and to provide lighting, heating, ventilation, water and toilet facilities satisfactory to the Minister;

(*d*) to provide medical, surgical, nursing and preventive services to the satisfaction of the Minister;

(*e*) to satisfy the nutritional or other standards specified by the Minister with respect to any foods which are or may be provided on the said war contract premises for the employees either by the owner of said premises or by any other person required by law or contract to provide said foods;

(*f*) to permit a regular physical examination or such examinations at any time of all persons whose duties include the preparation or serving of such foods as are referred to in paragraph (*e*) above, said examination to be carried out by a medical practitioner provided for under paragraph (*d*) above or by a medical officer of the Department.

It shall be the duty of the owner of any war contract premises to be constructed, extended or altered, to submit on request of the Department, plans and specifications thereof sufficient to show clearly all provisions for water supply, sewage system, ventilation system and such other information and particulars as may be required by the Department relating to health or safety conditions.

Every person who contravenes or fails to comply with any of these Regulations or any Order or direction made or given under any of these Regulations shall be guilty of an offence against that Regulation and shall be liable upon summary conviction to a penalty not exceeding five hundred dollars or to imprisonment for any term not exceeding three months or to both fine and imprisonment.

Where the person guilty of an offence against any of these Regulations is a company or corporation, every person who at the time of the commission of the offence was a director or officer of the company or corporation shall be guilty of the like offence unless he proves that the act or omission constituting the offence took place without his knowledge or consent, or that he exercised all due diligence to prevent the commission of such offence.

Other Federal Activity during the War

In addition to the administrative responsibilities assumed by the Division under the contract clause and Order-in-Council P.C. 1550, an information and educational campaign was undertaken. Pamphlets and posters on occupational hazards to health were prepared and distributed free to a number of about 500,000. This material was mailed to companies engaged

in processes involving the use of the various toxic substances with which the pamphlets and posters dealt. Special mailing lists were compiled and industries classified in these lists on the basis of hazards. Trade union organisations, technical schools and many other groups were supplied. This work is continuing and a monthly bulletin is now issued by the Division.

In 1941 the Division, in co-operation with the Dominion Bureau of Statistics and the federal Department of Labour, issued a pamphlet on "Health Services Provided by Canadian Employers". This pamphlet summarised the results of a statistical study carried out in 1938 and 1939 and provided a picture of the extent of health services in the factories of the country just before the war. Plans for a similar study to cover the post-war period are now in hand as well as an analysis of reports of sickness in war factories; these reports are submitted to the Department under Order-in-Council P.C. 1550. Recently work with the industrial section of the voluntary agency, the Health League of Canada, has been commenced and a questionnaire on requirements of industry for medical personnel sent out.

Upon the outbreak of war the Industrial Hygiene Laboratory at Ottawa began a survey of measures used during the First World War in the prevention of occupational disease arising from the handling of TNT and tetryl. It was apparent from this survey that a good method for determining the concentration of TNT in workroom air was not available. Research was commenced and a method devised which was applied in recording the concentration of TNT in the air of a federal arsenal, where at the same time the laboratory carried on routine Webster tests of TNT in urine of exposed workers. As the war progressed the laboratory conducted surveys of health hazards in the aircraft and shipbuilding industries with a view to determining the common hazards in these branches of manufacture. Research was undertaken on new methods for determining chlorinated hydrocarbons and methyl alcohol in air, and findings have been published in the literature. Consultative service in the form of environmental surveys has been extended on the request of employers and labour unions.

Nutrition in Industry

Nutrition can hardly be termed industrial hygiene, though it is recognised in some quarters as a branch of "industrial health". Under the Division of Nutrition of the Department of National Health an extensive educational programme and inspection service was carried on during the war under authority of the pertinent section of Order-in-Council P.C. 1550. That Order required federal contractors to "satisfy the nutritional and other standards specified by the Minister . . . ". Nutritional activities relating to war workers in the United States were the responsibility of the War Food Administration. This Administration carried out individual surveys on request and was not an inspecting agency. In a survey of 84 Canadian plants the Nutrition Division found that 72 per cent. of lunches selected by men in 1942 were fair or poor, whereas in 1943 and 1944 only 54 per cent. and 52 per cent. respectively were fair or poor.

Compensation for Occupational Diseases

Canadian ratification of the I.L.O. Convention (No. 42) concerning workmen's compensation for occupational diseases (revised 1934) has been a matter towards which the federal Division of Industrial Hygiene has been working actively, in co-operation with the federal Department of Labour. The importance of the scope of coverage recommended under the Convention became apparent at the beginning of the war when the manufacture and handling of benzene and its homologues, nitro and amido derivatives and other toxic substances were introduced into the industry of several Canadian provinces which did not recognise disease due to poisoning from such substances as compensable under the Acts. Several compensation boards were supplied with necessary technical and toxicological data, which were used as a basis for extending coverage in respect of diseases, to which the Convention refers.

1942 — British Columbia Division

By 1942, when the contract clause was incorporated in statute law, it become apparent that existing federal and provincial facilities were not developed, in all provinces, to the stage where the necessary environmental supervision of war contract premises was possible. As an example of the increase in manufacture, employment in shipbuilding rose from 3,491 workers in 1939 to 74,847 workers in 1943. For a com-

parable period employment in aircraft manufacture rose from 3,596 to 69,529. Only Ontario, Quebec and Manitoba had industrial hygiene divisions and only Ontario and Quebec had laboratories for environmental study in industry. To meet the need for further laboratory facilities the federal Division of Industrial Hygiene collaborated with the Manitoba Division as previously described. Concurrently, a branch of the federal Division was established in connection with the British Columbia Workmen's Compensation Board, which had long been active in safety work and was able to provide building space for a laboratory. In British Columbia the new Division commenced operation in the summer of 1942 and has operated under Order-in-Council P.C. 1550 since that time. Technical assistance and consultative service has also been extended to the Factory Inspectorate of the provincial Labour Department and to the Workmen's Compensation Board Inspectorate. Action is now being taken to establish a joint departmental committee which is intended to assist in co-ordination of Government agencies responsible for conditions of work.

1945 — Nova Scotia and Saskatchewan

Early in 1945 reconsideration of the assistance provided by the federal Government towards joint Dominion-provincial efforts to maintain good working conditions indicated that certain provinces had reached the stage of industrial development where, for adequate health supervision in war contract premises alone, industrial hygiene services would be helpful. As a result the Department of National Health, through the Division of Industrial Hygiene, offered the Provinces of Nova Scotia and Saskatchewan assistance in establishing their own industrial hygiene divisions, these to be equipped and staffed by the federal authority and housed by the provincial. Two such divisions are now operating under the provincial Departments of Health.

The Factory Acts of these two provinces stipulate, as they do in Manitoba and British Columbia, that no person shall keep a factory so that the health of any person is likely to be permanently injured. Furthermore, in common with all the other Factory Acts, these two contain general provisions as to sanitation. In addition, the factory inspectors may take qualified physicians into factories, and have authority to require that industrial establishments should be kept clean, adequately heated and ventilated and reasonably free from vapours, gases and fumes. In Nova Scotia, under the authority of the Workmen's Compensation Act, accident prevention is carried on as well as factory inspection. In neither province is medical inspection set up. The Public Health Acts of these provinces provide general power to the provincial health departments for inspection of workplaces and the promulgation of regulations. The Saskatchewan Act also provides for a Health Services Board with the function of advising employers and employees in urban communities regarding the establishment of employee health services. The Mines Regulation Act of Saskatchewan provides for examination of miners.

Under existing arrangements the services of the two Divisions are available to all departments of the respective provincial Governments, and thus factory inspectorates and workmen's compensation boards have available modern air-analysis laboratories and services of personnel trained for environmental study. Neither Division will pursue a policy of routine inspection. Special attention will be given to marine and mining industries in Nova Scotia and to mining and agricultural industries in Saskatchewan. In the latter province, where agriculture predominates, an attempt is being made to apply industrial hygiene in this new field.

The Post-War Period

At the commencement of war three provinces of Canada and the federal Government maintained divisions of industrial hygiene. These have been expanded since that time and three more provinces have added divisions. In spite of this growth it is difficult to assess statistically the contribution which industrial hygiene has made towards the health and safety of industrial workers, since health records are meagre throughout the country. Accident statistics are available, but the extent to which industrial hygiene supervision has contributed towards the prevention of accidents cannot be estimated. Occupational disease statistics are issued by the provincial compensation boards but these cover only compensable cases, which are few in number. The trend was towards an increase in cases as employment in industry grew during the war. In any event, the usefulness of such

figures is limited, since there is ample evidence to indicate that some disease of occupational origin is not diagnosed in relation to the individual's occupational exposure. It is also to be expected that even in the absence of increased employment, under war conditions, the effect of industrial hygiene educational programmes tends to assist and increase identification of disease of industrial origin. As a result of substantially increasing industrial hygiene services in Canada during the war, medical departments were attached to many factories which, without direction, might have used less effective methods for protecting employee health. Air analyses which were conducted in a large number of manufacturing establishments disclosed many work situations where danger of poisoning existed. Over 900 such determinations were made last year by federal industrial hygiene chemists covering a working population of over 500,000. So much for prevention of occupational disease and accidents — the safety phase of industrial hygiene.

The amount of non-occupational disease which was prevented among industrial workers through industrial hygiene services is also impossible to evaluate accurately without health records. Some evidence has come to hand from individual factories indicating that after the development of a factory medical service lost time due to sickness decreased. Experience abroad would tend to confirm these findings, though bases of data do not permit safe comparison. Two surveys of industrial medical services in Canada do permit some comparison relative to the numbers of physicians and nurses employed in industry. The first survey "Health Services Provided by Canadian Employers" has already been mentioned. The second was carried out by the Canadian Medical Procurement and Assignment Board in 1939. While definitions and statistical populations were not comparable it can be gleaned that in 1939, 50 per cent. of all firms surveyed with more than 500 employees, had a formal arrangement for the services of a physician. In 1943, 58 per cent. of such firms surveyed had the services of a physician on a fee basis. Furthermore, the report of the 1943 survey states that since the 1939 survey manufacturing plants with more than 500 employees which employ nurses have increased by 50 per cent. Nevertheless, the survey report states "in spite of the increase in the number of factories with health supervision since the war began, the number of factories not covered is still very large". For this situation several important reasons can be recognised. The employers of Canada have not become convinced, generally, that the factory medical service pays its way. This is confirmed in the 1943 survey findings by the fact that surveyed employers having no health services "had very little interest in making new arrangements". In general, only limited educational work has as yet been done in this country to encourage industry to provide medical services in the factory. In this effort the Health League of Canada is now taking an active part and indications are that governmental activities to the same end will be intensified. As a practical reason for such educational work there exists everywhere a great need for statistical data on incidence of sickness among industrial workers.

Scope of Industrial Hygiene

During the past twenty-five years industrial hygiene as a branch of applied science and clinical method has been largely concerned with environment and toxicology. A perusal of the literature of the subject reveals the boundaries of interest of groups active in this field. In the early days of industrial development the attention of physicians was drawn to the many diseases associated with work in the factory and the mine. The medical phase of the subject became well developed before chemists, physicists and engineers began to develop air-analysis techniques and ventilation design — the environmental phase. In recent years dramatic progress has been made in the methods of environmental evaluation and control, to such an extent that the manufacture and handling of substances known to be toxic can be carried on with little damage to health. More and more, especially in the United States, where research facilities are highly developed, a study of toxicity of substances new to industry is undertaken before widespread damage to health of industrial workers can result. With toxicity known, environmental or anti-dermatitis control can be instituted.

Recently, as control of occupational disease has been widely effected in modern industrial countries, the scope of industrial hygiene has shown signs of broadening to include general health of the working population — preventive medicine among the working population. This

approach is frequently referred to as "industrial health" or "industrial medicine" and is a logical outcome of the factory medical service where diagnosis, treatment and prevention become possible with the presence of the physician in the factory. For the employer sustaining a medical service in his factory the scope of the service is a matter of local concern. For the Government agency committed to a policy of encouraging preventive medicine in industry along modern public-health lines the measure of authority granted under the British Factory Act of 1937 or the Canadian Order-in-Council P.C. 1550 seems a necessary accompaniment to a vigorous educational programme towards the end of better health for the working population.

Aside from powers similar to those referred to above, the problems of ensuring environmental and medical control for workers exposed to health hazards of occupational origin will continue to be large as long as new substances are introduced into use. Further extension of technical and medical inspection services, provided with power of regulation based on scientific knowledge, would appear to be indicated in Canada. The recent action towards joint departmental committees in Manitoba and British Columbia to consider industrial hygiene problems made common to more than one agency by overlapping legislation is an important advance in the solution of this complicated administrative anomaly that has arisen over the years.

MANUEL BARRERA VERGARA

The International Labour Office has the sad duty of announcing the untimely death of Sr. Manuel Barrera Vergara, member of the Correspondence Committee on Accident Prevention.

Sr. Barrera was born in Santiago de Chile in 1903. He was educated at the Escuela de Artes y Oficios, the most important State Institute for industrial and professional education, and graduated with the highest honours in 1924. In 1937, Sr. Barrera entered the services of the General Directorate of Labour, where as an industrial safety engineer, he greatly distinguished himself in the services in charge of the supervision of safety conditions in the industries governed by the Labour Code and the regulations issued under this Code. This difficult and strenuous work, entailing the supervision of some 4,600 industrial establishments throughout the country, was carried on by Sr. Barrera with unfailing enthusiasm and devotion.

In 1945, Sr. Barrera was appointed member of the Correspondence Committee on Accident Prevention attached to the International Labour Office and attended, for the first time, the 11th Session of the Committee in November-December last year. Sr. Barrera rapidly won the high esteem of his colleagues in the Committee; his great courtesy, his profound technical knowledge and his ability to grasp quickly the essential points in difficult technical discussions enabled him to make a valuable contribution to the Committee's work.

His untimely death is a great loss; in Sr. Barrera, Chile has lost a prominent citizen and the International Labour Organisation a good friend and a valued collaborator. He will be long remembered by all those who had the good fortune to work with him, even for a short time.

15.2

THE FRENCH RESEARCH COMMITTEE "PREVENTION AND SAFETY"

By Julien CAEN, Paris

In April 1939 Mr. Raoul DAUTRY, recently Minister of Reconstruction and Town Planning, founded the French Research Committee "Prevention and Safety" (*Comité Français d'Etudes "Prévention et Sécurité"*), a non-profit making association comprising the leading personalities in industry, the various branches of accident prevention, insurance, the supervisory staffs, and among the workers. The objects were to co-ordinate all the activities undertaken in France in the interests of safety in all domains, to establish a documentary centre, to review the technique of prevention, to develop this technique by means of efficient researches, to gain acceptance for the methods found to be best, to train technical safety officials and, lastly, to engage in very extensive safety propaganda that should be both general and practical.

The war interrupted the work of the Committee whose members were dispersed, but it was revived early in 1942 under the chairmanship of Mr. August DETOEUF, chairman of the organisation committee of the electrical engineering industries, and in spite of the difficulties arising out of the enemy occupation, it succeeded in organising itself and in proceeding with the execution of its programme.

ORGANISATION

The Committee is administered by a Governing Body of 19 members, including a high official of the Ministry of Labour, 4 representatives of the principal employers' associations and 4 representatives of the principal workers' organisations. This arrangement ensures the collaboration in accident prevention work of those who are its most immediate beneficiaries, without whose assistance no success could be expected. The tripartite representation in the Governing Body has brought about confident collaboration between employers and wage earners. It will certainly produce the happiest results.

A permanent staff composed of a director, a delegate-general and a secretary-general gives effect to the instructions of the chairman and to the decisions of the Governing Body. It is assisted by technical services for accidents, fire and medico-social questions, which are directed respectively by:

Mr. Pierre BOUYEURE, Chief Engineer of the Normandy Industrial Accident Prevention Association;

Colonel BUFFET, former chief of the technical service of the City of Paris Fire Brigade;

Dr. THEIL, technical adviser to the French Foundation for the Study of Human Problems.

Further, since the liberation, the writer, former director of the French Manufacturers' Association, has been in charge of the Document Service.

ACTIVITIES

Research and Documentation

The technical services for research and documentation are essentially research organisations, and as a general rule document the reporters of the research committees (which are set up as and when required), and for this purpose have recourse to persons who possess a recognised competence in the matters in question, persons such as technical safety experts, users and manufacturers. These committees are set up within the framework of sections that are attached to the Committee and correspond to the different branches of accident prevention:

Prevention of industrial accidents;
Occupational diseases;
Hygiene and protection of human life;
Fire prevention;
Prevention of traffic accidents;

Teaching of accident prevention in schools;
Prevention of accidents at sea and on inland waterways;
Prevention in agriculture;
Prevention at home.

The schemes for researches are submitted to the competent committee, whose opinions and suggestions make it possible to take into account the practical requirements of all those interested in the subject in question. French and foreign literature is also consulted.

These researches are published in the form of pamphlets, notices or placards; they are also utilised in safety folders, posters and calendars. Together with the pamphlets, which are very carefully prepared, the notices are generally designed to furnish information and advice on specific subjects, and their essential purpose is to facilitate the work of safety committees in undertakings.

Education

In collaboration with the Foundation for Safety and the Organisation of First Aid (*Oeuvre pour la sécurité et l'organisation des secours*), the Committee publishes a journal entitled *Sécurité et prévention du feu.* In addition to miscellaneous information, each number contains a review of legislation, a bibliography and signed papers by leading French industrial safety experts.

The Committee also organises annual courses for the purpose of training safety engineers, foremen and other safety officials for undertakings, and also familiarising delegates to safety committees with their duties and imbuing workers and apprentices with the safety spirit. Further, the Committee has begun the publication of manuals for apprentices in collaboration with the various occupational organisations, such as those for the metal industries and mines.

Safety in Undertakings

The Committee endeavours to stimulate and facilitate the practical organisation of safety in undertakings by placing itself at the disposal of manufacturers so as to help them through the medium of existing safety associations, such as the Association of French Manufacturers, the Normandy Association, the Association of Manufacturers of Northern France, the Association of Owners of Steam Appliances and the *Bureau Véritas.* The manufacturers take out a "safety subscription" which covers an inspection of their undertakings followed by a detailed basic report comprising a precise and complete study of all the installations and all the advice required for the perfection of safety arrangements; the subscription also covers the attendance, when requested by the head of the undertaking, of a specialist engineer at the quarterly meetings of the safety committee.

Publications

In spite of the difficulties inherent in enemy occupation the Committee considered it its duty to be in a position to take effective action at the moment of liberation and to prepare the ground for this action.

It has concentrated on researches and the publication of its documentary material. In the course of the past 15 months it has published in addition to *Prévention et sécurité du feu,* already mentioned, 15 pamphlets including a safety calendar, two placards and 36 notices.

Regional Sections

Accident prevention propaganda has also been developed by the creation, under the name of Regional Sections, of co-ordination and propaganda centres; these already exist at Besançon, Nancy, Lyons and Bordeaux, and others will very shortly be established at Toulouse, St. Etienne and Marseilles. The Committee also has close ties with Rouen and Lille, headquarters of the Normandy Association and the Association of Manufacturers of Northern France respectively.

Safety Subscriptions

Notwithstanding the unfavourable circumstances of the times the Committee has secured the safety subscriptions of an appreciable number of undertakings and occupational organisations, and, by means of its propaganda, has extensively supported the work of the safety associations. The total number of workers reached in these various ways is about a million.

Rehabilitation

Lastly, the Committee has established a rehabilitation centre with the object of restoring to victims of accidents the attainable maximum of their physical capacity.

Future Plans

The Committee contemplates the speedy creation of two organisations for traffic safety — a station for the technical examination of motor vehicles and a station for the psycho-physiological examination of road transport drivers.

*
* *

Formerly, France lacked a central accident prevention organisation capable of creating a movement similar to those that have been so effective in Great Britain and the United States. The French Research Committee "Prevention and Safety" has been founded to meet this deficiency; it is to be hoped that the return of better social and economic conditions will enable it to accomplish speedily the task it has courageously assumed.

SAFETY INSTITUTIONS, ASSOCIATIONS AND MUSEUMS

INTERNATIONAL

International Labour Office: Coal Mines Committee

The Coal Mines Committee is one of the Industrial Committees set up by the Governing Body of the International Labour Office to deal with conditions of employment in certain industries.

Among the matters discussed by the Committee at its first meeting held in London in December 1945 were the principles to be embodied in a mine workers, charter. As regards safety and health the Committee adopted the following principle:

4. Work under conditions conducive to the safety, health and comfort of the workers and an adequate scheme for accident prevention and workmen's compensation.

The Committee also adopted the following resolution:

The Coal CMines ommittee requests the International Labour Office to continue and complete its report on Safety Provisions in Coal Mines[1] and to make a thorough enquiry into health conditions in coal mines and the health of coal-mine workers; and

Requests the Governing Body of the International Labour Office to convene a session of the Coal Mines Committee which would act in the capacity of a Technical Preparatory Conference, charged with formulating a draft Recommendation on the whole problem and a draft Model Code on Safety, taking as a basis for its discussions the Report prepared by the International Labour Office, for the Preparatory Technical Conference which was to have been held in Geneva in 1939, as completed and brought up to date.

[1] Safety Provisions for Underground Work in Coal Mines. Report to the Preparatory Technical Conference, Geneva, Oct. 1939. Vol. I: National Legislation; Vol. II: Draft Recommendations. Geneva, 1939.

International Labour Office: Inland Transport Committee

The Inland Transport Committee, another of the Industrial Committees attached to the International Labour Office, also held its first meeting at London in December 1945. The Committee adopted two resolutions bearing on safety.

The first, dealing with the social problems of the industry, recommended that the International Labour Office should undertake a study of safety precautions.

The second, on the automatic coupling of railway vehicles, reads as follows:

The Committee recommends the continental European authorities competent to deal with these matters to take steps to secure agreement among the interested parties with a view to providing that in future all new equipment should be so constructed as to make possible the substitution of automatic coupling for screw coupling at any given time. The International Labour Office is recommended to resume its studies of automatic coupling and to prepare a draft international agreement thereon for consideration by the next session of the Committee.

AUSTRALIA

The National Safety Council of Australia

Report for 1944-1945

The report gives information on the Council's activities in relation to industrial safety, child safety and safety on the roads, in the air, at home, etc.

The Industrial Safety Committee records a year of expanding activity. During the year, 56,750 posters and 1,237,800 pay slips were issued to members.

The British system of uniform accident statistics has been sponsored as desirable for use in Australia with a view to facilitating comparisons. In spite of the extra work entailed and shortage of staff, many plants compiled figures on this system.

Over 130,000 copies of the booklet "We Don't Want to Lose You" have already been distributed, and a further edition has been made available. "Danger — Out of Order" tags found a ready market in all sections of industry as a means of indicating that machinery was under repair or being oiled and should not be set in motion. The journal *Safety News* has continued to prove its worth.

The Shipbuilding Subcommittee completed its adaptation of the book *Ships and Slips* issued by the British Royal Society for the Prevention of Accidents. The first edition of 10,000 copies was easily disposed of among shipbuilding and dock workers, and further orders continued to be received. It proposes to issue further propaganda material on shipbuilding hazards. Another new departure was the issue of specially selected posters for the coal mining industry. The Committee hopes to increase its activities in this field. With the growth of shop or plant safety committees there has developed a demand for badges for members of these committees.

The Industrial Committee has continued to act as a clearing house for information, and has given much technical advice on various subjects. The attention of the competent authorities was drawn to the dangers of face masks made of nitro-cellulose, and to the defects of certain hand-operated chain blocks.

Use was made of instructional films, including sound film strips, which have been found useful in foremanship and other workshop training. The Council has offered its collaboration to the National Film Board, which will shortly begin to function.

The Standards Association of Australia has been asked to draw up a standard code for general signs and signals in industry, and more particularly as regards colours.

Membership of the Industrial Safety Educational Service has steadily increased and has been extended to New Zealand.

The Traffic Committee has continued to distribute road safety literature and to give awards, medals, certificates, etc., to participants in safe driving competitions.

The Committee is interested in the movement towards the standardisation of traffic regulations and road signs throughout the Commonwealth.

Special attention has been paid to the safety of children. With the co-operation of the Victorian Education Department, a special drive was made to form more Junior Safety Councils in schools, and the response, particularly from country areas, was most satisfactory. These Councils are furnished with certificates and supplies of literature. Many more schools are also making use of the flags "N.S.C. Children Crossing", which are placed in position when children are going to and from school as a warning to road users. A safety song and kerb drill posters have also been issued for use in schools. Thirty-two display cases containing dummy detonators, gelignite and other explosive cartridges have been supplied to the Council by Imperial Chemical Industries of Australia and New Zealand for use in schools as a means of teaching children to recognise such dangerous objects.

Assistance from safety organisations in Canada, Great Britain, and the United States is gratefully acknowledged.

Since the foundation of the Council in 1927, interest in safety has regularly grown, at first slowly but later more rapidly.

In conclusion, the Council expresses the view that —

> the answer to the challenge of accidents is bound up in engineering, education, and enforcement, with the emphasis very much on education. There is need for a plan of organised safety education on an adequate scale. It would pay dividends in precious lives, prevent permanent disablement and suffering, and relieve the monetary cost of accidents, which now levies such an unnecessary burden in all directions, a cost so high and far-reaching as to be difficult of assessment.

BRAZIL

Education Campaign Sponsored by the Department of Labour, Industry and Commerce, 1944[1]

The Brazilian Department of Labour, Industry and Commerce, through its Division of Industrial Safety and Hygiene has launched a campaign of education in order to make not only the employers and the workers but the population at large understand the importance of industrial hygiene, in all its aspects, to the health and economy of a country.

The campaign was carried out by means of pamphlets and conferences. The pamphlets

[1] Information communicated to the I.L.O.

were easy to handle, well presented and well printed, thus facilitating reading; their contents are brief and easy to understand, so that they are within everyone's comprehension.

Among the pamphlets received by this Office are some dealing with occupational diseases of the eyes, aniline poisoning, work prohibited to women, etc. They do, in fact, cover all the various aspects of industrial hygiene problems.

We hope that this campaign will have met with the success it deserves.

CANADA

Ontario

Industrial Accident Prevention Associations

1945 Annual Convention

The Report of the Convention has now been issued as a volume of 115 pages. It contains the full text of the reports and papers presented to the Convention. A brief account of the Convention has already appeared in the *Industrial Safety Survey*.[1]

SWEDEN

The Labour Protection Association in 1944[2]

During the year 5,909 persons signed the visitors' book in the Association's exhibition in Stockholm, but the actual number of visitors was considerably larger. The number of lectures given on industrial safety and hygiene rose to 133 (98 in 1943) and they were attended by 2,411 persons (2,200 in 1943). Several interesting items were added to the exhibits.

New exhibits illustrating the causes and prevention of accidents with elevators and other lifting equipment, and woodworking machines, including circular saws, were prepared for the Association's travelling exhibitions.

The collection of lantern slides was again increased and much use was made of it in lectures. There was a lively demand for the Association's posters and literature, and also for the protective equipment sold under its auspices. A new edition of the safety handbook (*Arbetsplatsens Skyddsfrågor*) issued by the Association brought the total number of copies printed to 30,000. The issue of new posters and the revision of old ones has continued.

The circulation of the Association's journal *Arbetarskyddet* has increased to 17,700 copies. The Association also distributed 20,500 copies of the Industrial Inspectorate's descriptions of noteworthy accidents and dangerous occurrences.

At the end of 1944 the Association had 180 permanent and 403 annually subscribing members.

UNION OF SOUTH AFRICA

The National Safety Council of South Africa

Recently the provincial safety associations in the Union combined to form the National Safety Council of South Africa with headquarters at Johannesburg (47 Provident Buildings, 108 Fox Street).

The Council is incorporated under the Companies Act and its objects will be to "promote the safety of the people of South Africa generally on a national basis by acting as a national body comprised of representatives from the provinces of South Africa". For this purpose it will deal with all national safety questions, co-ordinate and develop local safety organisations, carry on propaganda, watch over safety legislation, and generally do all in its power to further the safety movement. The Council will be managed by an Executive Committee.

The Council publishes a monthly magazine, *Safety First*, and proposes to issue other propaganda material such as pamphlets, posters and calendars. It is also hoped to show safety films and give safety talks to employees. Particular attention will be given to improving conditions in existing factories, the planning of new factories and the provision of sanitary and first-aid facilities.

In addition to industrial safety, the Council's field of activity includes off-the-job safety in general and highway safety in particular. It is hoped to develop general safety educational courses in schools and colleges and to combat accidents in the home.

The Council finds that there is tremendous scope for accident-prevention enterprise and sees in this enterprise one of the fundamentals for the reconstruction of a new, peaceful and more prosperous world.

The International Labour Office has learned with much pleasure of the foundation of the Council and wishes it every success in its great task.

---

[1] Vol XXI, No. 4, pp 130-131.

[2] *Arbetarskyddet*, No. 5, 1945, p. 132; for 1943 see *Industrial Safety Survey*, Vol. XXI, No. 2, p. 57.

LAWS AND REGULATIONS, SAFETY CODES

AUSTRALIA

New South Wales

REGULATIONS GOVERNING THE USE OF DANGEROUS SUBSTANCES FOR THE PURPOSE OF FUMIGATION. DATED 18 APRIL 1945[1]

The regulations apply to the fumigation of buildings and ships. No fumigation may be undertaken without a licence from the Board of Health. The precautions to be taken are specified in detail.

REGULATIONS APPLICABLE TO DREDGES. DATED 26 JUNE 1945

A Proclamation groups all the provisions of the Mines Inspection Act and of rules under the Act relating to dredges. These provisions relate to engine drivers, powers of inspectors, reporting and investigation of accidents, boilers, explosives, machinery, first aid, electrical apparatus and supervision.

REGULATIONS CONCERNING SAFETY AND HEALTH OF EMPLOYEES IN FOUNDRIES. DATED 27 JUNE 1945[2]

Since the issue of detailed safety regulations for foundries is a comparatively rare event, we give below the technical provisions of the regulations recently issued in New South Wales.

Storage of Equipment

4. All equipment shall, when not in use, be kept stored in a safe and orderly manner in such a position as to cause no interference with the safety or free movement of employees, or the free movement of materials or equipment. With respect to such storage the following provisions shall have effect:

(i) Moulding boxes, box weights, binders, floor boards and ladles shall be removed from any working area and stacked or stored rigidly in a convenient position.

(ii) Moulders' heavy tools, feeding irons and skimming irons shall be stored in racks above floor level.

(iii) Pouring bushes, core irons, clamps, wedges and gaggers shall be stored in suitable receptacles or racks above floor level.

Moulding Floor

5. The moulding floor shall be maintained at a uniform level throughout.

6. Clearly defined main gangways not less than three feet six inches wide shall be provided for the use of employees engaged in foundry operations.

7. Where the surface of the floor consists of sand or other loose material, kerbs or borders shall be laid down on either side of the main gangways flush with the floor so as to permit of the surfaces of such main gangways being readily and constantly maintained at a uniform level.

8. Where molten metal is carried by hand to and from various points within the foundry, passageways or pouring aisles not less than two feet six inches wide shall be provided in addition to the main gangways so as to enable persons engaged in the carriage of the molten metal to proceed to and from those points in safety.

9. All main gangways and passageways or pouring aisles shall be constantly maintained at a uniform level and be kept clear of materials, stock or any articles of matter which may be likely to obstruct, hinder, impede or prevent the safe use of such main gangways, passageways or pouring aisles.

Moulding Operations

10. Moulding operations shall not be carried on within ten feet of any part of a cupola furnace while such furnace is in use.

Dressing of Castings

11. No castings shall be cleaned and/or dressed otherwise than in an area set aside solely for such purpose.

12. Where castings are cleaned and/or dressed within a radius of forty feet from employees engaged in work other than cleaning or dressing castings an effective screen shall be provided so as to prevent injury arising to such employees from the cleaning and/or dressing operations.

Permanent Pit or Deep Moulding

13. Where pits or deep moulds are in permanent use, such pits or deep moulds shall be securely fenced by means of a wall of adequate construction raised to a height of not less than two feet above the surface of the surrounding floor, or by means of railings or chains and stanchions raised in either case to a height of not less than two feet nine inches above the surface of the surrounding floor.

14. Where pits or deep moulds are in permanent use, the internal walls of such pits or deep moulds shall be adequately reinforced with brick, concrete or other material suitable for the purpose.

[1] *Government Gazette of New South Wales*, No. 39, 20 Apr. 1945, p. 700.
[2] *New South Wales Industrial Gazette*, 31 July 1945, p. 1.

Ladles

15. (i) All ladles of a holding capacity of not less than fifteen hundredweight shall be fitted with a safety worm gear or an equivalent safety device to regulate their position.

(ii) All ladles of a holding capacity of less than fifteen hundredweight but not less than ten hundredweight brought into use for the first time by an occupier after the date of commencement of these Regulations shall be fitted with a safety worm gear or equivalent safety device to regulate their position.

(iii) All other ladles carried otherwise than by hand shall be fitted with safety clips.

16. No ladle whose weight including contents exceeds sixty pounds shall be lifted or moved otherwise than by mechanical means or by more than one male person.

17. No person shall be required or permitted to lift or move by hand a greater weight than sixty pounds where a single-handled ladle is used or eighty-four pounds where a double-handled ladle is used.

18. All parts of ladles shall be regularly inspected and maintained in good order and condition.

19. All single-handled ladles shall be fitted with a suitable shield or guard to protect the persons carrying such ladles from heat radiation.

Protective Equipment

20. Where electrical or oxy-welding plants are in use suitable screens of a type sufficient for the purpose of protecting employees from flash shall be provided.

21. Suitable gaiters or spats shall be provided for the use of all employees who are engaged in any process in which the handling of molten metal is involved or who are otherwise exposed to injury from the spilling or splashing of molten metal.

Lighting

22. (i) All windows shall be cleaned at regular intervals and maintained in such a condition as to permit the free access of natural light.

(ii) All skylights shall be fitted with wired glass or protected by means of wire netting fitted under the underside.

Regulations for Securing the Safety and Health of Persons Employed in Factories in Which Luminous Radioactive Substances are Used. Gazetted 1 June 1945[1]

The fundamental provisions of the regulations resemble those of the British regulations of 1 April 1942, which were summarised in the *Industrial Safety Survey* of April-June 1942 (p. 58). They deal with the structure of workrooms, the arrangement of work benches, ventilation, the disposal of waste, washing facilities, dark room, protective clothing, storage and handling of luminous substances, medical examinations, health registers, training of workers, etc.

[1] *New South Wales Industrial Gazette*, 30 June 1945, p. 676.

Queensland

Rules relating to Sewers. Dated 18 August 1945[1]

The safety provisions of these rules relate to ventilation; protection of shafts, excavations, etc.; precautions against accumulations of water or gas; ladders; internal combustion engines; raising and lowering of persons and materials; use of explosives; prevention of dust; reporting of dangerous occurrences and accidents; and first aid.

Victoria

Uniform Building Regulations. Dated 26 June 1945[2]

These voluminous regulations comprising 42 chapters and occupying over 150 large pages of print constitute a complete building safety code. Although they are applicable to all kinds of building, there are numerous provisions specially concerned with the building of factories. These provisions relate, *inter alia*, to room height, lighting, live and dead loads, walls, floors, chimneys, means of egress, sanitation, and dangerous businesses.

Lifts Regulations 1945. Dated 26 June 1945[3]

There are nine parts to these regulations as follows: I. General, II. Electric Lifts, III. Hydraulic Lifts, IV. Goods Lifts not Driven Directly by Electricity or Hydraulic Power, V. Service Lifts, VI. Escalators, VII. Power Lifts of the Hoist Type, VIII. Hand-Power Goods Lifts, and IX. Hand-Power Goods Lifts of the Hoist Type. In all there are 193 regulations.

Part I contains 13 divisions concerned with: scope of the regulations; general requirements; machine rooms and overhead equipment; overruns for cars and counterweights; buffers and stops; pits; lift enclosures and lift wells; clearances in wells and enclosures; cars and car gates; ropes, rope attachments and fittings; safety gear; machines; and counterweights.

[1] *Queensland Government Gazette*, 18 Aug. 1945, p. 253.
[2] *Victoria Government Gazette*, No. 87, 28 June 1945, p. 1650.
[3] *Idem*, No. 88, 28 June 1945 p. 1804.

BELGIUM

Order Issuing General Regulations concerning Personal Equipment for Health Protection. Dated 18 October 1945[1]

The Order is in three parts dealing respectively with protection against harmful agencies, seats for workers and general requirements.

Part I is concerned with protective clothing, disinfectants and protective ointments, insulating, dermatological preparations and neutralising substances, breathing apparatus, goggles and face screens, and instruction of personnel.

The regulations are of a general character; they indicate the protective equipment required for various kinds of work and leave precise specifications to the competent Ministry or to the Labour Inspectorate.

Order Issuing General Regulations for the Medical Control of Workers in Industrial and Commercial Undertakings, Public Services and Public Utilities. Dated 18 October 1945[2]

The purpose of this Order is to codify and generalise regulations governing medical examinations of workers. It establishes a system of medical control consisting of —

(1) pre-employment medical examinations;
(2) periodical medical examinations for workers under the age of 21; and
(3) medical examinations for the detection of occupational diseases among workers exposed to these diseases.

Part I of the Order lays down detailed rules concerning the various categories of medical examination; Part II deals with the organisation of the system of control; and Part III contains administrative provisions.

The following are subject to a pre-employment examination:

(1) All persons under the age of 21;
(2) All persons, irrespective of age, who seek an occupation covered by the regulations concerning occupational diseases;
(3) All persons, irrespective of age, who in one and the same undertaking are transferred from an occupation not exposed to occupational diseases to one so exposed.

Whenever the persons mentioned under (1) and (2) change their employer, they must, as a general rule, be re-examined.

The scope of each of the various examinations is defined in detail.

The periodical examination must be given annually, and at intervals not exceeding 13 months, until the worker reaches the age of 21.

The periodicity of the examinations for the detection of occupational diseases is determined separately for each occupation by means of tabulations of industries and occupations. The main groups in these tabulations are lead and its compounds, mercury and its compounds, arsenic and its compounds, cadmium and its compounds, fluorine and its compounds, manganese and its compounds, white phosphorus, dermatoses due to chromium compounds, dermatoses due to exotic woods, epitheliomatous affections, carbon bisulphide, aromatic and fatty hydrocarbons, pneumoconioses, radium and radioactive substances, X-rays, and ultra-violet rays.

Every worker covered by the Order must be given a medical control card for each examination, and the results of the examination are to be recorded on the card. In addition, every worker is to be given a medical record book (*carnet sanitaire*), as a rule, at the time of his pre-employment examination. This book must be produced at each medical examination required under the Order, and it must be kept up to date by the examiner.

Employers must take account of the indications furnished to them by the examiners in assigning workers to occupations.

[1] *Moniteur belge*, 14 Nov. 1945, p. 7665
[2] *Idem* 15 Nov. 1945, p. 7683.

CANADA

British Columbia

Regulations re Female Factory Employees. Dated 11 May 1945[1]

The text of these regulations is as follows:

1. If the Inspector so directs in writing, seats with back rests shall be provided by the employer.
2. If the Inspector so directs in writing, women's dressing-rooms with individual lockers shall be provided by the employer.
3. Women shall not be required by the employer to lift more than 35 pounds in the course of their regular work.
4. Women shall be prohibited by the employer from doing any type of overhead lifting or stacking.

[1] *British Columbia Gazette*, 17 May 1945, p. 847.

5. (1) When the duties of any female employed in a factory require her to operate or to be in close proximity to power-driven machinery, the moving parts of which constitutes a hazard, she shall, while performing such duties, wear a cap or other equally effective protective covering over her hair.

(2) Any female employee so employed and found not to be wearing protective covering over her hair, as required by subsection (1), shall, when directed by the Inspector, wear, and continue to wear when so employed, protective covering of a type approved by the Inspector, as being in conformity with subsection (1).

6. (1) When the duties of any female employed in a factory require her to operate or be in close proximity to power-driven machinery which constitutes a hazard, she shall, while performing such duties, wear a coverall or slacks or other equally close-fitting garments.

(2) Any female so employed and found not to be wearing garments of the type required by subsection (1) shall, when directed by the Inspector, wear, and continue to wear when so employed, garments approved by the Inspector as being in conformity with the requirements of subsection (1).

7. If the Inspector so directs in writing, jewellery, and shoes with open toes and high heels shall not be worn during working hours.

Ontario

REGULATIONS PURSUANT TO THE PROVISIONS OF THE FACTORY, SHOP AND OFFICE BUILDING ACT. DATED 13 JUNE 1945[1]

The regulations are in four parts: Control of dust in factories; Use of benzol and lead; Inspection of pressure vessels; and Exterior fire escapes. The first three parts re-enact existing regulations; Part IV is new.

The regulations concerning fire escapes are concerned with the approval of drawings by the Chief Inspector of Factories, means of access, protection against fire, design of stairs, means of access to ground level, material and construction specifications for escapes, maintenance, signs and illumination.

Yukon

ORDINANCE GOVERNING THE STORAGE, TRANSPORTATION AND DISTRIBUTION OF INFLAMMABLE PETROLEUM PRODUCTS IN THE YUKON TERRITORY. ASSENTED TO 30 APRIL 1945[2]

The Ordinance is divided into four parts dealing respectively with transportation and handling on public highways and construction and operation of vehicles; construction and erection of handling and storage plants; service stations and containers; storage in containers.

[1] *Ontario Gazette*, 11 Aug. 1945, p. 1510.
[2] *Ordinances of the Yukon Territory*, 1945, p. 34.

UNITED STATES OF AMERICA

Panama Canal Zone

PANAMA RAILROAD COMPANY SAFETY RULES. EFFECTIVE 1 MAY 1945

The Company's rule book contains general rules, rules for transportation employees, rules for employees on maintenance of way and structures, rules for receiving and forwarding agency employees and fire prevention rules.

The transportation employees rules deal with getting on and off vehicles, riding on vehicles, warning signals, coupling and uncoupling, hand brakes, switches, operating and conditioning locomotives, walking or standing on tracks or platforms, miscellaneous train and engine service work and handling of freight, etc.

The rules for maintenance staff comprise general rules and rules for the operation of track cars, care and use of hand tools, handling and placing material, roadway machinery and equipment, care, handling and use of explosives and work near electric power lines.

The rules for receiving and forwarding agency employees include provisions for stevedoring and hoisting appliances.

URUGUAY

DECREE PROHIBITING THE EMPLOYMENT OF PERSONS WHOSE INFIRMITIES PREDISPOSE THEM TO ACCIDENTS. DATED 14 SEPTEMBER 1945[1]

This Decree amends Section 11 of the accident prevent regulations of 22 January 1936, by adding a subsection 13 which prohibits the employment in any occupation of workers who are clearly not in a normal physical or mental condition.

DECREE RESPECTING DOUGH BRAKES. DATED 14 SEPTEMBER 1945[2]

The Decree amends Section 19 of the accident prevention regulations of 22 January 1936. It fixes the position of the rolls in the machine, requires the lower roll to be fenced, and provides for the installation of a handwheel for separating the rolls, of hand and foot brakes, and of protection for gearing, belts and pulleys.

[1] *Diario oficial*, No. 11684, 22 Sept. 1945, p. 450-A.
[2] *Ibid.*

DECREE CONCERNING DEMOLITION. DATED 14 SEPTEMBER 1945[1]

The Decree amends Section 70 of the accident prevention regulations of 22 January 1936. Before undertaking any excavation or demolition bordering on the public highway, permission must be obtained from the Directorate of Municipal Works. Neighbouring walls must be adequately shored, and precautions must be taken to prevent heavy falls of material from damaging adjacent buildings. Specified precautions must also be taken when lowering demolition material on to the public highway. As a general rule, buildings must be demolished storey by storey, beginning at the top. When necessary for the safety of the workers, platforms and scaffolds must be used. If other means of protection are not practicable, safety belts must be worn.

OFFICIAL REPORTS, ETC.

CHILE

MINING ACCIDENTS, 1942 AND 1943[2]

Information is given concerning accidents in the mining of copper, nitre and coal.

Table I relates to copper mining, which employed 3,990 salaried employees and 20,117 "workers" in 1942, and 4,170 salaried employees and 20,186 workers in 1943. Of the workers 7,104 were employed in the mines themselves in 1942 and 6,901 in 1943; 12,416 were employed in metallurgical works in 1942, and 12,683 in 1943; and 597 were employed in transport in 1942 and 602 in 1943. The production of copper in 1942 was 477,734 metric tons and in 1943, 489,306 metric tons.

TABLE I. COPPER

Cause	Accidents in 1942			Accidents in 1943		
	Fatal	Serious	Slight	Fatal	Serious	Slight
Shafts and staples..	1	1	278	—	4	358
Winning.....	—	22	295	—	67	508
Falls of ground....	1	19	933	3	17	1,080
Explosives.....	—	6	29	1	1	26
Electricity.....	1	2	22	1	1	32
Transport and handling of wagons	—	185	1,007	1	162	1,068
Falls in shafts.....	5	11	111	1	3	9
Machinery and vehicles.....	8	170	677	10	223	940
Miscellaneous.....	8	349	3,085	9	232	2,948
Total.....	24	765	6,437	26	710	6,969

Table II relates to nitre mining, which employed 2,392 salaried employees and 19,289 workers in 1942 and 2,194 salaried employees and 17,902 workers in 1943. In 1942, 6,724 workers were employed in extraction, 1,603 in transport and 3,828 in preparation; in 1943 the corresponding figures were 5,515, 1,770 and 3,659.

TABLE II. NITRE

Cause	Accidents in 1942			Accidents in 1943		
	Fatal	Serious	Slight	Fatal	Serious	Slight
Explosives.....	9	22	56	1	19	61
Winning.....	3	39	990	3	25	608
Burns.....	—	5	126	1	4	82
Electricity.....	1	1	25	—	3	26
Others.....	6	44	1,138	13	51	1,357
Total.....	19	111	2,335	18	102	2,134

Table III relates to coal mining, which employed 932 salaried employees and 16,079 workers in 1942; and 1,012 salaried employees and 16,871 workers in 1943. In 1942, 10,485 workers were employed underground and 5,594 at the surface; the corresponding figures for 1943 were 11,262 and 5,609. The output of coal was 2,150,799 tons in 1942 and 2,265,128 tons in 1943.

[1] *Ibid.* p. 449-A.
[2] DIRECCION GENERAL DE ESTADISTICA: *Mineria Años 1942 y 1943.*

TABLE III. COAL

Cause	Accidents in 1942			Accidents in 1943		
	Fatal	Serious	Slight	Fatal	Serious	Slight
Underground:						
Shafts and staples	—	—	119	3	—	360
Falls of ground	14	59	1,465	6	29	1,225
Firedamp and asphyxiation	14	12	14	1	—	—
Inrush of water	—	—	—	—	—	—
Explosives	1	1	5	1	3	13
Transport and handling of wagons	17	17	1,109	13	26	984
Electricity	3	—	16	1	—	3
Miscellaneous	3	55	1,329	2	37	1,472
Total underground	52	144	4,057	27	95	4,057
Surface	1	18	565	3	4	682
Total	53	162	4,622	30	99	4,739

GREAT BRITAIN

Electricity in Mines during the Year 1944[1]

The horsepower of motors in use for all purposes at mines under the Coal Mines Act on 30 June 1944, was 2,503,428, an increase of 1.38 per cent. on the total for 1943. Surface horsepower amounted to 1,159,392 and underground horsepower to 1,344,036.

Particulars of fatal and non-fatal accidents due directly or indirectly to the use of electricity at these mines are given in table I.

Table II shows the numbers of persons killed and injured in these accidents, and gives information on their occupation.

The inspector's report is once again mainly concerned with trailing cables, which accounted for 17 shock or burn accidents in 1944. All these accidents were due to unscreened cables. The most frequent cause was "previous injury exposing conductor" with 6 accidents. Damage by shotfiring and damage by panshifting caused 3 accidents each. During the 10 years 1935-1944, screened cables caused 12 shock or burn accidents and unscreened cables 117. The principal accident causes over the 10-year period were damage by shotfiring (36), previous injury exposing conductor (30), short circuit in use (18), and damage by panshifting (16).

[1] *Mining Electrical and Mechanical Engineer*, Vol. XXVI, No. 299, Aug. 1945, p. 38; for 1943, see *Industrial Safety Survey*, Vol. XXI, No. 1, p. 22.

TABLE I

	Fatal		Non-fatal	
	1944	Total 1935-1944	1944	Total 1935-1944
Nature of accident:				
Electric shock and/or arc burns	3	54	52	429
Ignition of firedamp or coal dust	4	23	5	33
Fire arising from electrical defects	0	4	8	95
Other causes	0	3	7	37
Total	7	84	72	594
Contributory cause:				
Design or unsuitability of apparatus	1	11	1	37
Installation or maintenance	3	20	25	181
Misuse, negligence, ignorance	3	34	46	355
Organisation or lack of equipment	0	9	0	0
Unforeseeable	0	10	0	21
Total	7	84	72	594
Apparatus involved:				
Switchgear and fuses	3	20	36	269
Flexible cables and plugs	2	37	28	220
Overhead lines, bare or insulated	0	6	0	18
Unarmoured cables and wiring in conduit	0	0	0	
Lighting accessories	0	0	2	19
Motors and transformers	1	4	1	18
Coalcutting machines	0	5	0	1
Armoured cables and accessories	0	10	5	48
Signalling bells	0	0	0	1
Miscellaneous and unknown	1	2	0	0
Total	7	84	72	594

TABLE II

	Killed		Injured	
	1944	Total 1935-1944	1944	Total 1935-1944
Electric shock and/or arc burns:				
Surface workmen	1	7	3	51
Electricians	1	18	27	189
Coalcutter machinemen	0	15	7	104
Machinery attendants	0	4	0	23
Other underground men	1	17	16	111
Total	3	61	53	478
Ignition of firedamp or coal dust	5	190	11	135
Fire	0	19	0	19
Other causes	0	6	7	25
Total, all causes	8	276	71	657

Although screened cables combined with earth-leakage protection have long been recog-

nised as affording the maximum of protection against shock, a census of trailing cables taken throughout the country in June 1943 showed that of 13,324 trailing cables in use, 4,121 or 31 per cent. were unscreened.

The inspector draws attention to the new problem created by the introduction of caterpillar-mounted power loading machines, with which the trailing cable is particularly liable to be damaged. He also stresses the need for adequate inspection and maintenance of electrical equipment, and not only in the interests of safety but also in the interests of economy.

Brief descriptions are given of all fatal accidents and of selected non-fatal accidents.

Report of the Technical Advisory Committee on Coal Mining[1]

In September 1944, a Committee was appointed "to examine the present technique of coal production from coal face to wagon, and to advise what technical changes are necessary in order to bring the industry to a state of full technical efficiency".

The Committee has produced an extremely interesting and valuable report consisting of 25 chapters and four Appendices. It is divided into two parts.

Part I (Chapters I-VI) is historical and includes a comparison between the coal industry of Britain on the one hand, and the industries of the United States, the Ruhr, Poland and the Netherlands on the other.

Part II (Chapters VII-XXIV) is a detailed analysis of British coal-mining practice, in which each chapter concludes with recommendations for the future. The chapter headings are as follows:

VII. Systems of Mining Coal.
VIII. Methods of Winning Coal.
IX. Special Requirements for Power-Loading.
X. The Support of Workings Underground.
XI. Underground Transport.
XII. Transport of Men Underground.
XIII. The Making of Roadways.
XIV. Mine Ventilation.
XV. Underground Lighting.
XVI. The Supply and Use of Power Underground.
XVII. Shaft-Winding and Associated Problems.
XVIII. Surface Lay-Out and Equipment.
XIX. Maintenance of Machinery and Provision of Workshops.
XX. Training and Education.
XXI. The Problems of Labour Relations.
XXII. The National Coal Resources.
XXIII. Planning for Production.

The conclusions and recommendations scattered over the various chapters are collected together in Chapter XXIV. Those having a direct bearing on safety and health are reproduced below:

C. Methods of Winning Coal (Chapter VIII)

(i) The hand pick and shovel will, exceptionally, be retained where coal is very easily won, but Britain's proportion of 20 per cent. hand-got coal could doubtless be reduced with advantage.

(ii) There is scope for some extension in the use of the pneumatic pick where hand getting is now practised and coalcutters cannot be used, or as a possible alternative to cutting, drilling and shotfiring in highly mechanised Room and Pillar workings. These picks, however, cannot be used except incidentally as an adjunct to mechanical loading and for this reason we do not consider their use will come to rank as one of the principal methods of coal getting.

(iii) The coalcutter will provide the basis for many of the mechanised getting and loading operations of the future, but hand filling of coal which has been previously cut will give place to more advanced methods of loading. Some standardisation is desirable, and the replacement of obsolete machines should be hastened.

(iv) There is scope for the application of Room and Pillar types of mechanical loading machines already available, and while the results with Longwall designs have been disappointing, some success has been achieved and further trials should be made.

(v) Mechanical loaders, and machines which simultaneously cut and load the coal, represent a revolutionary development in mining technique of the greatest importance to the future of mining. They offer the possibility, where they can be applied, of a big advance towards the ideal of a great reduction in the amount of hand shovelling, and towards the development of machines which will cut and load the coal with the same facility as has attended the use of the coalcutter. The work which is being done on their application and development must be vigorously pressed forward and co-ordinated, and every effort made, including, if necessary, the provision of financial assistance, to develop a machine which can operate in thin seams, and on gradients.

D. Special Requirements for Power-Loading (Chapter IX)

(i) Power-loading demands that extra attention should be paid to a number of special factors; for example, drilling and shotfiring. In particular the importance of good preparation of coal for power-loading requires, we think, the attention of a specially trained official.

[1] Ministry of Fuel and Power: *Coal Mining, Report of the Technical Advisory Committee.* Cmd. 6610, Published by H.M. Stationery Office, London, 1945. 150 pp.

(ii) Special types of support are often required with power-loaders; in addition solid stowing by machines or mechanically stowed strip packs should often be regarded as a corollary to their installation.

(iii) It is of vital importance that a conveyor should be designed which can follow a loader within the width of the buttock.

E. The Support of Workings Underground (Chapter X)

(i) The extended use of steel supports on the face would considerably improve general working conditions.

(ii) The width and arrangement of packs should be reviewed in the light of the knowledge now available, and re-examined periodically.

(iii) The whole question of mechanised stowing needs investigation on a large scale, and co-ordinated research, with financial assistance from the industry, on the systems and appliances.

(iv) A large proportion of the work involved in roadway maintenance could be eliminated by greater regard to support and packing, with special attention to double-packing.

(v) Co-ordinated research on the practical problems of roof control should continue to receive special attention, and the knowledge already available should be more widely applied.

(vi) Better technical supervision and improved training of the under-officials and workmen are most important. The provision of special staff to undertake the work of devising and applying measures of roof control should be more widespread throughout the industry.

F. Underground Transport (Chapter XI)

(i) Traditional British haulage practices are wasteful of manpower and call for revolutionary changes.

(ii) The scraper chain conveyor should be more widely used on Longwall faces.

(iii) Subsidiary rope haulages from the face to the main haulage system should be replaced by conveyor installations on the widest possible scale.

(iv) The establishment of well equipped, high-capacity, central loading stations, situated in settled ground, will be essential to any big extension in the use of conveyors.

(v) In new or remodelled mines, and wherever possible in other mines, locomotive haulage or conveyor transport should be introduced as the main system of haulage. With locomotives the largest size of mine car possible in the circumstances should be installed.

(vi) The adoption of locomotive haulage will require fundamental changes in the layout of the majority of British mines, and a great deal of work will be required on the construction of new roads, often through the strata, before this form of haulage can be installed.

(vii) Efficient provision for the transport of supplies, machinery, and stone, is a most important matter in the general planning of an underground haulage system, and its organisation down to the last detail, will be amply repaid in smooth working, and in economy of time and labour.

(viii) Diesel and storage battery locomotives should be allowed in both intake and return airways under appropriate General Regulations, so long as the firedamp content of the air does not exceed the amount at which the law requires the electric current to be switched off.

(ix) The general regulations covering the use of electricity should be amended to enable trolley locomotives to be installed, and a model code of Special Regulations should be issued at an early date to govern their use.

G. Transport of Men Underground (Chapter XII)

(i) Man-riding facilities have been far too rarely installed in the past, and should be greatly extended.

(ii) The simplest and most economical system of man-haulage is in mine cars drawn by locomotives along the coal-haulage roads.

(iii) Where man-riding is done on separate roads, special carriages should be provided.

H. The Making of Roadways (Chapter XIII)

(i) The extensive programme in view of construction of level underground roadways and drifts from the surface, demands the application of the best tunnelling practices known; such work should be under the special supervision of an official in charge of all stone work.

(ii) The mechanisation of these operations requires the use of an improved drilling technique, suitable machines for the loading of stone, and satisfactory methods for its transport.

(iii) Water application and ample ventilation are necessary to deal with dust suppression and dispersal of fumes.

(iv) Attention should be directed towards forming main roadways in solid coal or in the strata above or below the seam.

I. Mine Ventilation (Chapter XIV)

(i) We are of the opinion that the reduction of the withdrawal standard to a firedamp content of 2 per cent. and the standard for cutting off electricity to 1 per cent. as recommended by the Royal Commission on Safety in Coal Mines, 1938, would tend to impede production without increasing safety.

(ii) We consider that the standard of ventilation required for the use of diesel locomotives should be the same as that governing the use of electricity under Section 60 of the Coal Mines Act, 1911. We also consider that the prohibition of coal haulage in return airways contained in Section 42 (4) of the Act calls for amendment.

(iii) Ventilation planning calls for specialised knowledge. There should be an official supervising the maintenance of the ventilation system.

(iv) Efficiency in the production of ventilation is capable of improvement in regard to fan installations; the wider use of axial-flow type fans is recommended.

(v) The first essential of a satisfactory ventilation system is the provision of roadways of adequate size, with surfaces as smooth as possible, clear of unnecessary obstacles, and without sharp bends.

(vi) Ascensional ventilation should be adopted as standard practice wherever practicable.

J. Underground Lighting (Chapter XV)

(i) The standard of underground lighting is too low and reacts adversely on production, safety and health. We consider that a standard of lighting of the order of 0.4 foot-candles in the general working area should be aimed at.

(ii) As a source of illumination we regard the flame safety lamp as obsolete.

(iii) The required standard of lighting at the face is unlikely to be provided by hand or cap lamps alone. A system of general lighting by power-fed lights supplemented, preferably, by cap lamps is necessary for this purpose.

(iv) If electricity is permitted on the face there is a *prima facie* case for permitting mains lighting also, subject to appropriate safeguards which should be covered by General Regulations, and not by Special Regulations in each case.

(v) A higher standard of lighting should be provided outbye on roadways.

K. The Supply and Use of Power Underground (Chapter XVI)

(i) From the standpoint of efficiency in distribution and use, electricity is undoubtedly superior to compressed air, and for the intensive Room and Pillar system of mining, and for serving the higher-powered machines in Longwall mining, it will be essential.

(ii) Permission to use electricity should depend primarily upon the general standard of ventilation. The aim must be to make the mines safe for electricity rather than to instal machinery which can be safely worked in badly ventilated mines.

(iii) From the point of view of economy and efficiency the adoption of a standard working voltage would be an advantage.

(iv) The provision of light-weight switchgear of simplified design, for use at the coalface, is a matter of urgent necessity.

(v) The Draft Electricity Regulations are unreasonably restrictive in relation to recent developments and should be carefully reviewed and amended before they are established.

L. Shaft Winding and Associated Problems (Chapter XVII)

(i) Winding represents the final stage of underground haulage and improvements recommended in the earlier stages will require a review of winding arrangements.

(ii) There are many old steam winding engines in use which should be replaced by modern types.

(iii) The possibilities of the Koepe system of winding should be investigated, especially for deep mines, and for reconstructed mines where the continental system of layout is adopted.

(iv) Skip-winding should be much more widely practised.

(v) All shaft-bottom and shaft-top arrangements should be reviewed to make use of automatic appliances for marshalling and controlling the tubs and thereby reduce the manpower required.

N. Maintenance of Machinery and Provision of Workshops (Chapter XIX)

(i) The arrangements for the systematic inspection and maintenance of all machinery and plant should be given the increased attention which their importance demands.

(ii) Records, based on the reports of the maintenance staff, should be kept relating to each major piece of machinery, so that a complete history of its working life may be available.

(iii) Each large mine or group of mines should employ a qualified mechanical and/or electrical engineer, who should have technical responsibility for the organisation and supervision of the maintenance of all machinery and workshops at the mine.

(iv) Mines should be provided with workshops, both on the surface and underground, which should be properly equipped and staffed for the work they are called upon to perform. Central workshops should generally be provided at the larger groups of mines.

O. Training and Education (Chapter XX)

(i) Preliminary training of new entrants should be as broad-based as possible, covering the elements of the technique of mining and some knowledge of mining machinery and its uses, as well as safety methods.

(ii) The establishment of special training faces for general underground training should be pressed on, and the practical difficulties must be overcome.

(iii) Specialised training could also be provided on training faces, and the issue of certificates of proficiency to machine operators might be considered.

(iv) There should be an apprenticeship system for the training of electricians, mechanics and other tradesmen.

(v) A limited number of additional centres for advanced training of engineering apprentices might be established in conjunction with an organised system of apprenticeship.

(vi) Operators of new machines should be trained both on the surface and underground on the machines themselves, and the practical difficulties of arranging underground training must be overcome.

(vii) For the training of officials provision should be made —

(*a*) to enable suitable mineworkers to work their way up, and to acquire the personal as well as the technical qualifications necessary for an official;

(*b*) to attract into mining engineering, as a profession, young men of ability drawn from all classes of society, and from all parts of the country.

(viii) To encourage the recruitment of men of the highest mining engineering qualifications an ideal arrangement would be a national scheme, organised and paid for by the industry, to enable wide and varied experience to be gained.

(ix) The amalgamation of the mining departments of certain universities would enable better equipment to be provided, and would help to create conditions more favourable to good work.

Report of the Committee on Safety in the Use of Power Presses[1]

A Committee representing the Factory Inspectorate, the Royal Society for the Prevention of Accidents, and press makers and users was appointed in February 1940 to consider the safety problems of ordinary power presses. The Committee appointed three subcommittees on

[1] Issued by the Ministry of Labour and National Service and published by H.M. Stationery Office, 1945.

press design, tool design and guard design respectively.

The Committee completed its report in November 1944. It is a searching study of the problem of effectively guarding power presses and the recommendations made are numerous and detailed.

Extracts from the statistics relating to punch and die accidents on mechanical power presses in 1943 are given in the tables below.

TABLE I. SUMMARY TOTALS

Type of guarding in use	No. of accidents
Tools fenced with:	
(*a*) Static fixed guards	148
(*b*) Automatic guards	137
(*c*) Interlocking guards	34
	319
Tools not fenced at time of accidents:	
(*a*) During production run	179
(*b*) During tool-setting and allied operations	54
	233
Total	552

TABLE II. TOOLS GUARDED BY STATIC FIXED GUARDS

Nature of access to danger area:	
Over the guard	3
Under the guard	42
Through the guard feed opening	44
Through side of guard	32
Access at back of guard	6
Access by reason of dislodgment of guard	22
Type of operation:	
Strip feeds	73
Second operations (*i.e.*, individual piece parts)	75

TABLE III. TOOLS GUARDED BY AUTOMATIC GUARDS

Type of guard	No. of accidents	No. of accidents related to dimensional characteristics of presses					
		Stroke		Clearance		Crankshaft speed	
		5″ and greater	Less than 5″	3″ and greater	Less than 3½″	Less than 50 r. p. m.	50 r. p. m. and over
Sweep across	22	—	22	—	22	2	20
Pull out	91	11	80	11	80	16	75
Push away	7	4	3	4	3	4	3
Downwards and outwards	8	6	2	5	3	7	1
Rising screen	5	5	—	5	—	5	—
Other	4	—	4	—	4	—	4
	137	26	111	25	112	34	103

TABLE IV. UNGUARDED TOOLS

During production run:	
Reason for absence of guard:	
No guard available	122
Tools thought to be safe by design	14
Neglect to fit or use guard provided	41
Other reasons connected with lack of fencing:	
Awaiting a special guard	15
No guard at back of tools	3
Operator to blame	12
During operations associated with tool setting:	
Class of person:	
Age 18 and over	49
Age under 18 years	5
Setter operators	2
Class of operation:	
Fitting and proving	4
Setting	21
Trying out and clearing faults	29
No. of cases in which precautions such as application of a clutch safety catch would have prevented the accident	11
No. of cases in which guard could have been used	27

The Committee finds that the great majority of accidents with punches and dies occur during a normal stroke of the press through the operator's hands being inadvertently within the trapping area. Seeing that a press may make up to one and one half million strokes a year, it can scarcely be considered carelessness if by chance a finger remains once, during that number of strokes, in the danger area.

Secondly, accidents take place during a stroke commonly known as the follow-on or repeat stroke, which can occur on many presses merely by a continued depression of the pedal or lever. Thirdly, accidents may occur during a stroke termed the uncovenanted stroke, induced by a fault in the mechanism of the press. Strokes of this kind can and do occur when the press is normally at rest.

The commonest faults leading to uncovenanted and repeat strokes are:

(*a*) Failure of the extractor to return to the effective extracting position;

(*b*) Gravity fall of the ram due to brake fracture or maladjustment.

Methods of prevention of accidents between punches and dies may be divided into three well defined classes:

(*a*) Complete prevention of access by a worker to the danger area, for example, by the use of a fixed guard;

(*b*) Mechanical removal of a worker from the danger area by a device associated with the movement of the press. Examples of this class are the automatic guard and the pull-away tethering device;

(*c*) Systems intended to ensure that the hands of persons working at a press are so engaged that they cannot be within the trapping area when the punch comes into dangerous proximity with the die. Two hand lever devices and multiple press-button controls fall within this category.

The report discusses these three classes at length, and while finding that there is some scope for automatic guards, expresses its decided preference for fixed guards. These are divided into two classes called static fixed guards and interlocked fixed guards.

The Committee has separated its recommendations applicable to new presses from those applicable to existing presses; for new presses it has formulated detailed specifications.

In addition to questions of design, the Committee has given close attention to questions of inspection and maintenance, and the selection and training of press operators and the supervision of press operations. The Committee also advocates the creation of a joint committee under the control of the Chief Inspector of Factories to deal with all problems associated with all types of power presses, including heavy presses. In particular the Committee would have the duty of examining designs for presses and safety devices.

The following are the specifications formulated for the safe construction of new power presses:

A. Presses with Positive Clutches

The expression "extractor" (also known as latch) means that device which controls by direct contact the movement of the clutch key or other intermittent positive driving unit.

1. (i) The extractor or latch shall be fitted with a positive interlocking device which fulfils the following conditions:

(*a*) The interlocking device shall be capable of locking the extractor in the position which it takes up when holding the clutch out of engagement;

(*b*) When the extractor is in any position other than that specified in (*a*) it shall not be possible to move the interlocking device;

(*c*) The interlocking device shall be designed so that in its free condition, that is, when it is not constrained by attachment of a guard or by locking it in position so that the extractor is free to move, it takes up the position in which it locks the extractor as described in (*a*) through the action of a spring incorporated in the device or by gravity.

(ii) In a case where the interlocking device can be applied directly to the parts of the clutch which transmit the drive, the device shall be so applied, instead of to the extractor, and this clause shall then read as follows:

The clutch shall be fitted with a positive interlocking device which fulfils the following conditions:

(*a*) When the interlocking device is in the clutch locking position the driving and driven members shall be positively prevented from making a driving contact;

(*b*) When the driving and driven members are in driving contact it shall not be possible to move the interlocking device, unless the object of this clause is achieved by other means.

2. The extractor, and if necessary, the part of the clutch which engages with the extractor, shall be designed so as to prevent the return of the extractor to the position of disengagement, before the crankshaft has commenced to revolve.

3. (*a*) Effective means, in addition to and independent of the normal cyclical working of the friction brake on the press, shall be provided to prevent involuntary descent of the ram, and/or any other slide either by over-run or fall-back of the crank-shaft or by gravity fall of the ram where this is not directly connected to the crankshaft (as in the sliding block clutch machine).

For the prevention of over-run such means shall be positive in action. For the prevention of fall-back such means may be by spring loaded or other types of device.

This requirement shall be deemed to be met if slide balancing is procured so that the out of balance "pressure" at the top of the stroke is greater by an adequate percentage than that of the suspended parts of the press, consideration being given to the weight of the punches to be used.

The expression "over-run" means a movement of the crankshaft with the clutch disengaged beyond the position at which the crankshaft normally comes to rest.

(*b*) The clutch shall be so arranged that when the key is disengaged the driving part thereof shall not be in rubbing contact with the flywheel or flywheel bush.

4. Each press shall be fitted with an effective single stroke attachment but this requirement shall not prevent the provision of arrangements for continuous stroking.

5. Each press shall be fitted with a guard or guards for the punch and die having a feed opening capable of being closed by a movable shutter, the shutter being arranged so that in its fully closed position it overlaps the fixed framework of the feed opening by an amount not less than 10 per cent. of the shutter movement, the guard to be a permanent part of the press equipment. The shutter shall be connected positively to the interlocking device described in paragraph 1 in such a way that for all positions of the shutter other than when it is closed and preventing access to the tool and die of the press *the extractor shall be locked in the position of the clutch disengagement.* The design should allow the guard to be moved out of position for tool setting and when enclosed tools or tools equipped with fixed guards are to be used, and should provide that the guard is

so constructed that it remains attached to the press structure by means of its fixings during operations for tool setting or whenever it is not in use as a guard, and that the moving of the guard from its effective position so controls the extractor that the press cannot be set in motion until an adjustment has been made. If the design of the press permits working from more than one side arrangements shall be provided for the fitting of a guard giving the same standard of protection on each side as is specified in this clause.

If the work to be performed in the press is such that the feed opening of the guard can be permanently restricted so as to prevent access of the fingers to the trapping area, the guard need not incorporate a movable shutter but shall comply with this clause in all other respects. An automatic feed press is an example of the application of this clause. Where in pursuance of clause 1, the interlocking device is applied directly to the clutch, the words "the clutch shall be locked in the position of disengagement" shall be substituted for the words "the extractor shall be locked in the position of clutch disengagement".

6. (*a*) Effective independent means shall be provided which will ensure that when the clutch is in engagement whether by intention or otherwise, it shall not be possible to open the shutter of the guard.

(*b*) The arrangements shall be such that it shall not be possible to develop pressure on the extractor through the locking device, or through the shutter connected to the locking device so as to prevent the movement of the extractor to the position specified in clause (i) (*a*).

7. Fixed side and, where necessary, back guards shall be provided which in conjunction with the guard(s) specified in paragraph 5, shall prevent access to the trapping area except through the feed opening; these guards should be mounted in such a way as to permit of being kept attached to the press when the interlocked fixed guard is not in use.

8. On variable stroke presses, stroke variation shall not affect the performance of the guard and associated interlocking arrangements.

9. Arrangements shall be made for the effective lubrication of the flywheel bearing, in order to prevent seizure of the flywheel upon the journal.

B. Non-Positive Clutch Presses except Friction Screw Presses

1. With the exceptions mentioned in the following paragraph every press shall be fitted with an interlocked fixed guard which shall have the following standard of performance:

(*a*) When there is access to the parts where trapping can occur, the press clutch shall be prevented from making an engagement.

(*b*) When the press ram is in motion, no access of the fingers to the parts where trapping can occur shall be possible.

The design for such a guard should, in each case, be submitted to H. M. Chief Inspector of Factories for reference to the Joint Standing Committee referred to in our Recommendations unless that Committee has issued a specification dealing with the construction of a guard of this type when a guard complying with that specification should be fitted. The objects to be attained by the requirements of the specification dealing with positive clutch presses are equally applicable to the case of non-positive clutch machines and any interlocked fixed guard designed and fitted for the latter type of press should provide the standard of safety provided by that specification. Further, fixed side, and where necessary, back guards shall be provided, which in conjunction with the interlocked fixed guard shall prevent access to the trapping area, except through the feed opening; these guards should be mounted in such a way as to permit of being kept attached to the press when the interlocked fixed guard is not in use.

2. The following alternative safeguards may be fitted (instead of the interlocked fixed guard referred to in the foregoing paragraph) to the classes of presses mentioned:

(i) On presses to which the Report of the Committee on Safety in the Use of Heavy Presses[1] refers a safety device complying with the recommendations in that document shall be fitted but such a device should not be fitted to presses with a stroke of less than 15 inches and which are designed to run at an equivalent speed of greater than 30 strokes per minute, or in the case of double and multiple acting presses to presses which are designed to run at an equivalent speed of greater than 15 strokes per minute. In the case of multiple acting presses, the expression "stroke" means the stroke of that member which has the least movement.

(ii) Presses with a stroke of 10 inches and less than 15 inches, should be fitted with a guard which in construction and function shall comply with the recommendations of the Heavy Press Committee's Report, subject to the following modifications:

The device should be of a type incorporating an outward and upward moving member, and should be designed so that the member attains a safe position before the space between the punch and die is less than one fifth of the stroke. A safe position is deemed to be within the following range of relative distances:

Distance in inches horizontally from nearest trapping point...	36	33	28	24	18
Distance in inches vertically above standing place of worker.....	48	54	58	60	63

The movement of the guard should be such that it is not possible for any person to be trapped between the moving guard and any fixed or moving part of the press, whether associated with the "tools" or not. This type of guard should not be fitted to presses which are designed to run at an equivalent speed of greater than 30 strokes per minute, or in the case of double or multiple acting presses to presses designed to run at a greater speed than 15 strokes per minute.

C. Friction Screw Presses

An interlocked fixed guard complying with the following standards shall be fitted.

The guard (or guards) shall have a feed opening capable of being closed by a movable shutter such guard forming part of the press equipment. The shutter shall be connected positively to interlocking devices which shall operate in the following ways:

A device shall be provided so that when the shutter is open permitting access to the trapping parts in the event

[1] See *Industrial Safety Survey*, Vol. XVI, No. 6, p. 109.

of any descent of the ram, the operating gear shall be moved so as to effect reversal of the motion of the ram.

It shall not be possible to operate the press to obtain a stroke until the shutter is fully closed and prevents access to the trapping parts and when the press ram is descending it shall not be possible to open the shutter. Further, fixed side and, where necessary, back guards shall be provided which in conjunction with the interlocked fixed guard shall prevent access to the trapping area except through the feed opening; these guards should be mounted in such a way as to permit of being kept attached to the press when the interlocked fixed guard is not in use.

D. Belt and Pulley Drive Presses not Fitted with a Clutch, and Other Power Presses not Dealt with Specifically

Every press shall be fitted with an interlocked fixed guard of a type which shall provide the same standard of performance and safety as that specified for presses dealt with in parts A, B and C of this specification, whichever is the most appropriate to the case.

Appended to the report are photographs and drawings of static and interlocked fixed guards.

Report of the Joint Standing Committee on the Safety of Heavy Power Presses: Bending Brakes[1]

The Joint Standing Committee was appointed in March 1940 as the outcome of the report of a committee on the fencing of heavy power presses.[2]

In the present report the Committee discusses:

(1) The use of static and interlocking fixed guards.

(2) The use of the interlocked distance bar, which should be in a position of effective safety before the ram can descend.

(3) The use of an interlocked rise and fall screen (interlocked fixed guard), which should be in such a position as effectively to prevent the fingers from reaching into any part of the trapping area before the clutch can be operated to permit of the descent of the beam, and consequently be fixed in such safe position before the tools can be in dangerous proximity.

(4) The use of the automatic guard, which embodies the principle of the mechanical removal of the operative to a safe distance from the danger area before trapping can occur.

The Committee recommendations may be summarised as follows:

(*a*) Each machine should be fitted with:

(i) A positive clutch withdrawal device so as to provide for effective single stroking.

(ii) Effective devices to prevent gravity fall of the ram by fall-back due to brake defects.

(iii) The interlocked fixed guard in conjunction with the positive clutch withdrawal device.

(*b*) (i) A system of examination and upkeep of bending brakes should be devised in each factory.

(ii) The development of devices to prevent overrun, that is, movement of the crankshaft past top dead centre after disengagement of the clutch occasioned by brake defects, should be studied.

(*c*) Consideration should be given to the making of regulations under the Factories Act, 1937, to give legal force to our recommendations.

Appended to the report are a specification for a guard and general description of a guard illustrated by photographs and drawings.

The specification reads as follows:

Interlocked Fixed Guard: A rise and fall screen extending the full width of the beam should be mechanically interlocked with the positive clutch withdrawal mechanism so that unless the screen is in a safe position preventing all access of the fingers to the trapping area, the clutch cannot be operated to permit descent of the beam. It should not be possible to move the screen from the safe position until after the tool is in contact with the component on the die. Preferably the screen should be dropped by gravity and the device should be so arranged that after the tool is in contact with the component on the die, the screen is lifted mechanically to permit of component manipulation.

In conjunction with this safety device there should be provided a static fixed guard or if necessary an interlocked fixed guard as specified above to prevent access to the trapping area from the back of the machine.

Accidents to Dock Workers in 1944

According to information communicated by the British Government there were 9,864 reported accidents, including 102 fatal, at docks, wharves and quays in Great Britain in 1944. The principal causes were: handling goods or articles in manufacturing or carrying processes (2,566), struck by falling body (1,837), lifting machinery (1,689), persons falling (1,442), stepping on or striking against objects (581), railways (locomotives and rolling stock) (544), use of hand tools (378), and other vehicles, excluding hand trucks, bogies, etc. (301).

[1] Published by H.M. Stationery Office, London.
[2] See *Industrial Safety Survey*, Vol. XVI, No. 6, p. 109.

Annual Report of the Safety in Mines Research Board, 1944[1]

During 1944 special attention was paid to improvements in the safeguards against explosions of coal dust and of firedamp, improvements in methods of strata control, the safety aspects of haulage material and the examination of broken and defective haulage gear. Increased assistance has been given in connection with the training of new entrants to the coalmining industry.

Coal-Dust Explosions

The question as to which is the best incombustible dust to use as a preventive of coal-dust explosions in a mine is one on which it is as easy to have opinions as it is difficult to obtain actual proof. Some progress has, however, been made by means of new tests of the "overall" efficacies of two limestone dusts of different characters. These tests are designed to include both the dispersability of the incombustible dust when it is subject to a blast of air such as that which precedes the flame of an explosion, and its intrinsic extinctive power after it has been raised as a cloud along with the coal dust.

The two dusts were a "free-flowing" limestone dust and a slightly sticky limestone dust, which contained a much larger proportion of ultra-fine particles than the "free-flowing" dust. When the limestone dusts were well mixed with the coal dust, there was little or no difference in their efficacies. When they were very imperfectly mixed, as by being thrown by hand separately but as far as possible regularly, there was again very little difference between the two limestones. When the dusts were laid in separate zones, in an attempt to bring out by exaggeration any difference that might be due to patchiness in practice, there was some evidence of an appreciable superiority of the sticky dust.

Exposed layers of coal dust, covering any other dust that may be present, provide the most dangerous condition experimentally, and one which occurs in practice. It has yet to be determined which dust is to be preferred under these conditions.

In the light of these new experiments, the present position of knowledge as regards the relative efficacies of common stone dusts may be summarised as follows. When the incombustible dust and the coal dust are well mixed and therefore (as has been proved) rise together into the air when subject to the blast of an explosion, gypsum is the most efficacious of the common dusts, limestone is second, and shale follows close behind; always assuming that dusts of similar fineness are compared. When the dusts are not well mixed, gypsum and limestone tend to cake more readily than shale in moist atmospheres. If they are found to cake in any particular district of a pit, shale is to be preferred. In damp places a waterproofed limestone is best. Finally, if the experience with the two limestones can be generalised, a dust which does not contain enough ultrafines to make it sticky should be preferred. Incidentally, it may be mentioned that, with certain types of automatic stone-dusting machines, a "free-flowing" dust gives a more regular delivery and with less trouble than the sticky dust.

Firedamp Explosions

Tests of a wide range of coal measures rocks have shown that their ability to ignite firedamp when struck or rubbed with steel, while varying enormously with the nature of the rock, depends very greatly on the speed of impact. A correlation of the danger, in this respect, with the petrological nature of the rock is being made, in order to learn whether the present view is true that the danger is due to the hardness of the rock alone. The matter will be the subject of a detailed report when this has been done.

Tests made at the request of other Government departments on the danger of friction sparks in flammable atmospheres other than those which contain firedamp may be mentioned, although, it is to be hoped, they are not likely to be of direct interest underground. Mixtures of hydrogen with air and of carbon disulphide with air were immediately ignited by impact between a revolving steel wheel and each of the following: chips of limestone, granite, slag, gravel and basalt, mounted in cement; and concrete paving. Petrol vapour was ignited by the gravel chips, not by any of the others. Petrol vapour was also ignited by impact between a mild steel plate and a hard steel wheel. In these last experiments, ignition was obtained much more easily if sulphide of iron was present on the steel plates.

Electrical Researches

The problems concerning the safety of electrical apparatus which have received most

[1] For 1943, see *Industrial Safety Survey*, Vol XXI, No. 1, p. 23.

attention during the year relate to flame-proof casings for high-power equipment and the intrinsic safety of low-power circuits such as are used in signalling and shotfiring apparatus.

Two details concerned with flame-proof casings have been cleared up. First, the "safe gap" between a case and its cover has been shown to be unaltered when the casing and its contents are heated, as occurs during use. Secondly, the "safe gap" is the same between flanges of synthetic resin as between steel flanges, so long as the resin flanges have not become charred by the repeated passage of flame.

The examination of the conditions necessary for intrinsic safety in low-power circuits has been carried a stage further by establishing the quantitative relationship between the effects of safety devices (condensers and resistances) on the minimum igniting currents in circuits of a wide range of inductance, at voltages of 25 and 60. It has been shown that, when the current in a circuit exceeds 1.0 amp., condensers and resistances are practically useless as safety devices, for the increase in the minimum igniting current resulting from the use of a condenser or a resistance is negligibly small

It follows that apparatus such as bells and relays must have high impedance and low current consumption for safety. Such bells and relays have the additional advantage that more of them can be used in parallel, fed from an approved source of power.

A safety multi-shot magneto exploder has been designed and constructed.

Mining Explosives and Shotfiring

A statistical review of the number of ignitions of firedamp in mines by permitted explosives during 1916-1943 has been published. It supports the view that the risk of ignition attending shotfiring by permitted explosives during that time had decreased and at the end was lower than it had ever been.

Experimental work on the ignition of firedamp by shotfiring in narrow galleries representing breaks in the strata has shown that long breaks (18 ft.) are much more dangerous than short breaks (3 ft.). The value of sheathing as a precaution against ignition of firedamp in breaks has again been demonstrated, and the use of a plug of clay introduced first into the shothole has been confirmed as a contribution to the same objective.

Coal-Mine Fires

The Board has investigated spontaneous heating and inflammation of leaking air hoses, and means for indicating at the pit-head the occurrence of explosions behind the stopping of a fire underground.

Supports

During the year the Board continued its investigations of home-grown timber, which has been found generally suitable for use as props, subject to certain conditions. Tests have also been carried out on steel props and arches.

Roof Control

Research on roof control at coal faces has been carried on in collaboration with numerous collieries. Reference is made to the value of "double packing". The use of built-up steel chocks has effected much improvement in several seams. These chocks have proved to be very efficient "breaking off" supports along the edges of wastes and have eliminated the shotfiring previously practised to obtain stone for building packs.

Haulage

Many failures in haulage gear were caused by faulty welding. Defects in forge welds were again traced to overheating and incomplete adhesion. A number of electrically-welded mild steel lashing chain links which had failed under abnormally low loads during tensile tests were found to be welded over only about one half of the cross-sectional area. This accounted for the premature failures, but in addition it was found that brittleness caused by a "Widmanstatten" structure produced during welding had not been eliminated by the inadequate heat treatment applied. Unsatisfactory material was once more responsible for many failures. Most of it was so-called wrought iron and the main defects were the incorporation of scrap iron and steel and the presence of excessive phosphorus.

The use of 1.5 per cent. manganese mild steel for cage shackles and pins appeared to be completely satisfactory.

Mild steel gear failed largely because of inadequate means for controlling temperature during heat treatment and during heating for forging; but frequently also because of use of the wrong type of mild steel, *e.g.*, free cutting steel.

The following table shows the causes of failures of haulage gear examined during the year.

Cause of failure	Wrought iron	Mild steel	1.5 per cent. manganese mild steel
	per cent.	per cent.	
Quality of material	24	12	Only one failure was recorded; it was due to bad quality of material
Blacksmith's welds	45	12	
Electrical resistance welds	—	4	
Faulty heat treatment	7	24	
Fabrication (forging, etc.)	4	19	
Embrittlement by surface hardening	10	—	
Bad design — leading to fatigue	5	19	
Overloads	5	10	

Owing to the poor quality of much of the wrought iron gear, a statistical analysis of its composition and properties has been made. This confirmed the opinion that the quality of wrought iron is primarily determined by its phosphorus content, and showed that not more than 0.16 per cent. of phosphorus should be present in any iron used for such gear.

Wire Ropes

The report describes examinations of man-haulage and winding ropes.

NORWAY

Annual Report of the Factory Inspectorate, 1944

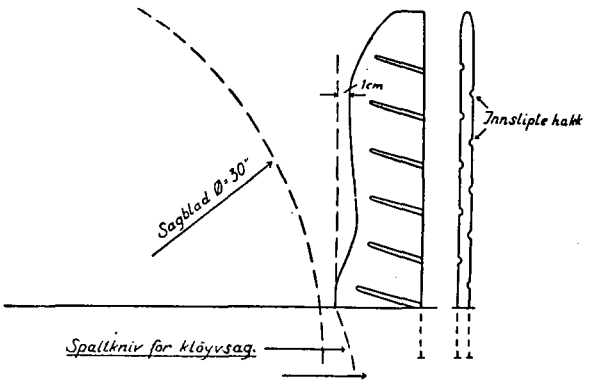
During the year the Inspectorate issued new or revised circulars respecting explosions in the repair of acetylene generators, reporting of accidents, the sale and installation of certain woodworking machines and protection against benzol poisoning.

In spite of continuing transport difficulties occasioned by the German occupation, the number of inspections (6,730) again shows an increase as compared with that for the preceding year (6,155). The district inspectors visited 6,302 undertakings employing 163,051 workers, the women inspectors visited 309 undertakings employing 16,632 workers, the forestry inspector visited 29 undertakings employing 1,080 workers and the port inspector visited 158 undertakings.

In all, the inspectors issued 10,975 orders of which 3,586 concerned ventilation, hygiene, cleanliness, lighting, heating, etc.; 1,643, woodworking machines; 851, elevators, transport equipment, transmissions, gear wheels, belts, etc.; 453, openings, railings, ladders, stairs, etc.; 319, metal-working machines; and 165, other working machines. The industries in which the largest number of orders where given were: woodworking, 3,498; metalworking 2,203; and food and drink, 1,467.

Shortages of material continued to have adverse effects on the ventilation, lighting, heating and maintenance of factories and on the provision of safeguards against accidents and diseases. Nevertheless, as in previous years, some undertakings were able to effect improvements in these respects. Everywhere the workers suffered from shortage of food.

The inspector for the fifth district reports that there is some unwillingness to guard circular saws properly and especially to use a riving knife in stave cutting and timber sawing operations. The chief objection to its use has been that with twisted or crooked wood, the knife does not meet the cut, so that cutting is impeded. It has, in fact, often been found in practice that the knife does not meet the cut: the top of the blade oscillates slightly across the vertical plane of the blade and the teeth seek the point of least resistance. If the wood is very crooked, and heavy work is done with a large blade, the oscillation may be very considerable. With the usual form of the riving knife, it is the edge of the knife that meets the cut, and that at the place where the blade tends most to move sideways. With the thin blades now in use the lateral movement before the knife enters the cut should be less. If the point of entry of the knife could be lowered to the saw bench, where the blade is considerably more stable, the knife would more easily enter the cut. This view has found expression in connection with the vertical and backward-leaning knives in common use. The disadvantage of these knives is that they



Saw blade, 30" diam.

Riving knife for timber (ripping) saw Ground-in grooves

tend to lift the wood from the bench by reason of their backward slant. To overcome this disadvantage the form of knife shown in the accompanying figure has been designed. It has been found to work well in practice.

It is remarkable how few riving knives and guards are used even on comparatively modern rip saws and combination saws. The reason seems to be that the guards supplied with the machines by the manufacturers and dealers are impractical, and hinder the work, and consequently are removed. Only too often on saws with a vertically adjustable bench the riving knife is fixed to the bench instead of to the machine frame, where its position with regard to the blade is constant. The fixation for the knife should be solid, easily accessible and adjustable by means of a handle or handwheel. All these requirements should, of course, be satisfied by the machine builder, and not by the machine user.

The communal inspector at Bergen describes the effects of the explosion of an ammunition ship and of bombing on the city and more particularly on the hygienic condition of undertakings.

During the year 14,985 accidents entailing more than three days' disablement were reported; of these 137 were fatal. The corresponding figures for 1943 were 18,316 and 151. The industries with the largest accident totals were: building and civil engineering, 3,851 (60 fatal); metals, 2,758 (15 fatal); agriculture and lumbering, 1,873 (9 fatal); and woodworking, 1,748 (6 fatal).

The decline in accidents is attributed to slackening of industrial activity.

A large number of accidents are described under headings such as transmissions; working machines; hoists, cranes, transporters; railways; motor vehicles; boilers, pressure vessels, piping; explosives, etc.

Lumbering accounted for 1,727 accidents (7 fatal), of which 1,333 occurred in tree felling, and 273 in land transport.

There were 525 (2 fatal) accidents in stevedoring, as against 769 (13 fatal) in 1943.

In the section on occupational diseases information is given on pneumoconioses, generator gas poisoning, skin diseases, etc. There were 99 cases of silicosis in 1944, — 33 miners, 22 foundry workers and 12 quartz and feldspar crushers and grinders.

An account of the activities of the Boiler Inspectorate discusses in some detail inspection of welding on boilers, pressure vessels and piping. Such inspection is comprehensive and comprises the testing and licensing of welders, the inspection and licensing of workshops and the inspection of welds. Workshops are divided into three classes: shops constructing boilers and pressure vessels for sale, repair shops, and pipe shops. There are separate testing and licensing arrangements for gas welders and arc welders respectively, and special tests for pipe welding.

Previous to 1944, a large proportion of arc welders failed to pass the tests on account of defects at the root of welds in X-joints due to poor chiselling. Many workshops were found to have badly ground chisels. Defects of this kind largely disappeared in 1944, when the inspectors required large joint openings and complete chiselling of the back of the work.

Thickly covered universal electrodes for welding of steam boilers are tested and approved by the Norsk Veritas, Lloyds and the Shipping Control, and thereafter by the Boiler Inspectorate. One particular brand of these electrodes was found to give a very porous weld and accordingly approval of them has been withheld.

It has been found difficult, not to say impossible, to devise a satisfactory general test for gas welders and accordingly pipe welders have been required only to pass the special pipe-welding test. Experience has shown that only "right hand" welding should be used with pipes and that "left hand" welding results in very poor cohesion, such that bent rods break at a small angle. Gas welding has been approved for pipes with walls up to 5 mm thick; for greater thicknesses arc welding is required.

The regulations for the inspection of workshops have borne good fruit, since managers have gradually been compelled to participate in the training of welders and in the planning of welds. In this way the task of the Boiler Inspectorate has been lightened.

The report contains statistics of boilers, pressure vessels and locomobiles inspected and tested during the year, and describes several accidents with such equipment.

PALESTINE

Industrial Accidents in 1943[1]

There were 5,276 industrial accidents in 1943 as against 4,672 in 1944. In manufacturing in-

[1] Government of Palestine, Department of Statistics: *Annual Bulletin of Statistics of Industrial Accidents, 1943.* For 1942 see *Industrial Safety Survey*, Vol. XXI, No. 4, p. 139.

dustries, the frequency rate per 1,000 fulltime workers was 91 as compared with 91 in 1942, 84 in 1941, 76 in 1940 and 62 in 1939. The severity rates were 5.0 in 1943, 6.0 in 1942, 5.3 in 1941, 4.9 in 1940 and 5.3 in 1939. Since 1939 the total number of undertakings reporting has increased from 417 to 1,630.

The following table gives particulars of the industries with the largest numbers of accidents.

Industry	No. of employees	No. of accidents			Frequency rate	Severity rate
		Fatal	Permanent partial disability	Temporary disability		
Manufacturing:						
Metalworking	7,987	2	67	1,140	165	11.1
Preserves, fruits and vegetables	1,465	—	6	177	114	2.9
Textiles	4,158	1	3	177	54	3.1
All manufacturing industries	32,428	6	122	2,483	91	5.0
Non-manufacturing:						
Extraction of minerals	2,752	1	2	292	132	5.2
Electricity, telegraph, telephone	1,972	2	3	201	96	8.6
Construction	12,984	19	34	738	—	—
Railways	7,800	3	26	298	49	7.8
Road transport	4,016	3	3	307	85	4.9
Mineral oil products	3,220	—	9	407	136	2.4
All non-manufacturing industries	37,691	29	78	2,558	—	—
Total	70,119	35	200	5,041	—	—

The highest frequency rates were 165 for metal working, 136 for mineral-oil products, 132 for extraction of minerals and 127 for stone, sand and gypsum quarries. The highest severity rates were 25.6 for stone, sand and gypsum quarries, 11.1 for metal working, and 10.4 for oil and soap.

Power driven machinery accounted for 674 of the 5,276 accidents in 1943. Other leading causes were falling objects with 682 accidents, handling without machinery 679, striking against or caught between objects 494, persons falling 473, hot or corrosive substances 414, and hand tools 322. There were 242 eye injuries of which 149 were due to flying objects, 27 to hot or corrosive substances and 15 to hand tools.

The average duration of temporary disability was 17.3 days in manufacturing industries and 17.6 days in all industries. Duration was highest in bakeries (41.0 days); grain mills came second with 32.6 and quarries third with 29.2.

UNITED STATES OF AMERICA

Accidents in the Petroleum Industry, 1944 [1]

Both hours of employment and accident rates increased in the petroleum industry in 1944. The general frequency rate was 13.57 (12.87 in 1943) and the general severity rate, 1.46 (1.30 in 1943). The statistics for 1944 cover 214 oil companies employing 346,140 persons as against 202 companies and 335,570 persons in 1943.

The following table summarises the accident statistics for the industry as a whole and for the various departments.

Department	Number of workers	Injuries[1]	Injury rates		
			Injury index	Frequency	Severity
Refining	123,931	3,345 (64)	28.72	11.22	1.75
Marketing (wholesale)	51,360	1,016 (7)	13.95	8.25	0.57
Marketing (retail)	5,762	326 (0)	26.76	22.76	0.40
Marketing*	30,059	1,066 (5)	23.47	15.77	0.77
Exploration	3,502	143 (0)	20.17	16.97	0.32
Drilling	6,772	1,032 (11)	135.24	65.84	6.94
Production	46,713	2,093 (24)	39.61	18.91	2.07
Natural gasoline	9,372	317 (4)	32.61	15.21	1.74
Pipe line (oil)	21,085	666 (5)	22.32	13.12	0.92
Pipe line (gas)	6,645	178 (1)	21.46	12.16	0.93
Marine (ocean)	7,194	300 (4)	27.98	13.88	1.41
Marine (inland)	1,031	33 (2)	58.66	11.26	4.74
Miscellaneous	32,714	663 (9)	18.76	8.86	0.99
Total, all departments	346,140	11,178 (136)	28.17	13.57	1.46

* Wholesale and retail marketing not reported separately.

[1] The figures in brackets are those of fatal injuries and injuries resulting in permanent total disability included in the totals.

Fatal Injuries in the Petroleum Industry, 1944 [2]

The fatal injuries occurring in 1944 are reviewed by department and cause group. The departments included are refining, marketing, drilling, production, natural gasoline, pipe line, marine and miscellaneous. The principal cause groups are fire and explosion, electrical, asphyxiation and traffic. The review consists of brief descriptions of the accidents.

[1] American Petroleum Institute: *Annual Summary of Injuries in the Petroleum Industry for 1944*, New York, Apr. 1945. For 1943 see *Industrial Safety Survey*, Vol. XX, No. 3, p. 105.

[2] American Petroleum Institute: *Review of Fatal Injuries in the Petroleum Industry for 1944*, Sept. 1945.

SWITZERLAND

Accident Statistics, 1938-1942[1]

In the period 1938-1942 there were 430,703 compensated industrial accidents, of which 12,976 were disablement cases (30.1 per mille of the total), and 1,577 fatal (3.7 per mille). In the preceding five-year period (1933-1937), disablement cases represented 29.6 per mille of the total and fatal cases, 3.4 per mille; and in the period 1928-1932, disablement cases represented 32.6 per mille and fatal cases 3.1 per mille of the total.

The number of disablement cases per 1,000 accidents varied considerably from industry to industry. In woodworking it was 47.0, in forestry 38.3, in metalworking 28.4, in construction 27.3 and in textiles 26.3.

The percentage distribution of industrial accidents by severity in the period 1938-1942 is given as follows: 70 per cent. and more disablement, 4.8 per cent.; 20-69 per cent., 58.6 per cent.; 0-19 per cent., 21.2 per cent.; lump sum compensation 15.4 per cent.

The number of accidents per 10,000 full-time workers was 765 in the case of "trivial" accidents and 1,226 in the case of "normal" accidents. The latter figure includes 37 disablement cases and 4.5 fatal cases. The number of days lost per full-time worker rose from 8.49 in 1938 to 10.23 in 1942; while the number of days lost per industrial accident fell from 75.6 to 73.1.

The Swiss Accident Insurance Institute has the power to raise or lower accident insurance premiums according to the accident-prevention measures taken in undertakings. During the period 1938-1942, 436 undertakings had their premiums raised and 516 had them lowered. In general, the lowering of premiums has been justified by results. For instance, joinery works, in which accident costs before premiums were lowered were 34.1 per mille of wages, reduced this figure by 32 per cent. to 23.2 per mille after reduction of premiums. Similarly, factories making stamped, drawn or pressed metal goods reduced their accident costs from 33.8 per mille of wages to 20.0 per mille, or 41 per cent. less.

The introduction of safety goggles has been followed by substantial reductions in the frequency of eye injuries due to flying fragments. In 1928 there were 88 such injuries per 10,000 full-time workers, but in 1941 there were only 41. Disabling eye injuries due to flying fragments dropped from 2.5 per 10,000 full-time workers in 1928 to 1.6 in 1941.

The relative incidence of accidents in the largest industries over the period 1938-1942 is shown in the following table.

Industry	Wages in thousands of francs	Accidents			Cost per mille of wages
		Total	Disabling	Fatal	
Structural metalworking	317,615	22,732	541	37	23.5
Foundries	155,962	8,412	227	29	22.9
Factory metalworking	420,329	20,013	683	42	18.3
Machine, apparatus and vehicle construction	634,896	24,104	671	43	13.7
Fine mechanical construction (precision apparatus, screws, etc.)	489,611	16,539	370	14	9.2
Watches and jewellery	481,325	6,344	179	6	3.5
Wood, cork, horn, etc, without constructional work	279,923	19,189	859	46	27.6
Boots and shoes	125,376	2,369	77	1	4.9
Printing	271,543	3,752	131	9	6.2
Textiles, spinning, etc.	205,038	6,425	228	10	10.8
Mechanical processing of textiles (weaving, etc.)	254,286	5,455	146	4	5.5
Knitting, embroidery, sewing	361,775	5,495	63	4	2.5
Dyeing, bleaching, washing, cleaning, etc.	128,726	3,576	114	3	9.7
Chemicals	245,388	8,838	222	33	15.4
Food	246,464	10,336	279	8	13.4
Underground construction	569,698	49,831	1,374	270	45.1
Building construction	468,351	43,281	1,258	162	40.9
Forestry	152,339	22,098	847	102	58.0
Mechanical woodworking in connection with construction	297,479	22,483	1,100	65	37.3
Auxiliary building trades	176,773	12,017	327	45	28.9
Installation, erection and building operations without mechanical wood- and metal-working and without mechanical manufacture of building materials	340,614	15,818	357	51	18.5
Swiss federal railways	602,199	12,000	273	111	15.4
Other railways	228,830	5,275	139	27	13.0
Warehousing and trade	232,285	11,628	308	41	20.8
Electricity	151,281	4,316	139	56	22.5
Office, technical and sales personnel	1,530,865	5,965	143	24	1.8
Post, telegraph and transport administration	414,171	3,783	60	6	3.1
All industries	10,903,868	430,703	12,976	1,577	17.1

[1] Schweizerische Unfallversicherungsanstalt: *Ergebnisse der Unfallstatistik der fünften fünfjährigen Beobachtungsperiode, 1938-1942.*

REVIEW OF PERIODICALS

Ett beaktansvärt olycksfall vid stålsvarvning. (*Arbetarskyddet*, No. 5, 1945, p. 135.)

During the turning of tough steel in a machine shop long ribbons of turnings were formed, and some fell to the floor by the workman (Fig.1). One ribbon became tangled in the turnings on the floor and at the same time wound round the workpiece, by which it was pulled upwards. As shown in Fig. 2, it had also wound round the worker's leg, with the result that he received a cut in the thigh 6 inches long and an inch wide. Fig. 3 shows how long turnings could wind round the chuck and the workpiece. The moral is that workmen should carefully watch the formation of turnings and remove them from time to time with a hook, for that seems to be the only practical precaution applicable in such cases as this.

Fig. 1

Fig. 2

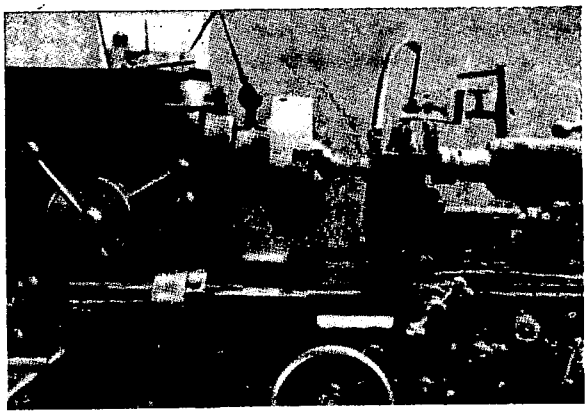


Fig. 3

The Suppression of Dust in Mines: Features of Practical Importance in the Application and Design of Sprays. By A. G. WITHERS. (*Colliery Guardian*, 29 June 1945, p. 806; 6 July 1945, p. 6; 13 July 1945, p. 38.)

The author deals generally with spray design and operation and describes a number of tests undertaken with various types of spray. He contends that dust allayment in mines by water-spraying is not nearly as effective as is desirable, and that very considerable improvement could often be effected by a more suitable selection of sprays best suited to particular conditions, proper maintenance of the sprays and closer attention to the arrangements of the installation. For example, sprays are commonly found operating at only a fraction of their maximum effect because of (1) neglect and choking; and (2) absence of shielding against the dispersive action of ventilation currents.

It is particularly important that spraying methods should be capable of dealing with fine particles of sizes between one and ten microns, but it does not follow that the finer the dust the finer should be the spray. The finest mists may float for a considerable time in the air stream and serve to disperse fine dust rather than lay it. Moreover, it may be more dangerous to inhale wet dust than dry dust.

The author briefly discusses the disadvantages of compressed air and water sprays, including their dispersive action, and the use of cowling as a precaution against dispersion.

The characteristics of a spray or mist which have a bearing on dust allayment are:

(1) Degree of atomisation; density, and homogeneity.
(2) Definition (*i.e.*, cone formation), and kinetic energy of emission.
(3) Features of coalescence and deposition (largely determined by the conditions under which the spray operates).

Operating pressure will largely control these features. These characteristics are dealt with at some length together with their bearing on spray design. Particular attention is paid to the following causes of low performance by compressed-air and water sprays:

(1) Use of unsuitable types of sprays for the particular circumstances.
(2) Omission of essential protection and cowling.
(3) Unsuitable arrangement of jets (in cases of composite sprays).
(4) Employment of unsuitable air and water pressures.

(5) Lack of proper maintenance, resulting in disrepair of cowling and choking of jets.

The tests described were carried out in the experimental tunnel at Chatterley, North Staffordshire, with a constant air velocity and only two water pressures, but in various dust concentrations.

How Painters Get Hurt: A Summary of the United States Navy's Experience. (*National Safety News*, June 1945, p. 23.)

Painters constitute approximately 2½ per cent. of the civilian employees of the Shore Establishments of the United States Navy and account for about the same percentage of the accident total.

According to a recent report prepared by the Safety Branch of the Division of Shore Establishments and Civilian Personnel, 147 accidents (43 per cent.) involved "working surfaces", and 86 (25 per cent.) involved handling or lifting objects or materials. The remaining accidents were distributed among all other cause classifications. Only 9 per cent. involved paint, thinners or cleaners.

Before this study was undertaken, it was expected by many that a large number of cases of lung, liver and kidney diseases would be uncovered, and that scaffolds and ladders would play a large part in the incidence of mechanical accidents. Those expectations were not fulfilled.

While "working surfaces" accounted for more than 40 per cent. of the disabling injuries, these surfaces were the same as those causing trouble to every other employee in a Naval Shore Establishment — uneven roads, railroad tracks crossing a street, sills of doorways, stairways, cluttered floors, decks, and scaffolds.

There was in addition, however, a fairly large number of scaffold accidents of a type more common to painters than to other trades. Because painters cover a large surface in a short space of time, there is a regrettable tendency to provide inadequate scaffolding. The painters themselves contribute to this unhealthy practice by rigging improvised scaffolding.

The article goes on to describe various accidents due to insecure footholds on stagings, ladders, etc., vehicles, welding, hand tools, hot paint, etc.

More than 40 accidents resulted when the painter attempted to move something out of his way to get at his work. A few of these were hand or finger injuries due to some defect or a characteristic of the object being handled. A few were foot or toe injuries received when the object being moved slipped out of the men's grasp. Most of them were strains attributable to the weight of the object or to the awkward position assumed in moving it.

An analysis of 40 accidents due to falling or flying objects indicates that 11 were caused by paint, rust scale, or putty during scraping operations; 11 men were hit by objects falling from overhead; and 4 accidents were caused when the painters themselves dropped or knocked over the article being painted. One man was killed when the frame of the rain cover under which he was eating lunch collapsed under the weight of the men who had climbed out on the roof to watch a wrestling match.

La Commande individuelle et la sécurité. By Michel Malagie. (*Sécurité et prévention du feu*, Nos. 3 and 4, July-August, 1945, p. 98.)

A brief review of the dangers inherent in shafts, pulleys and belts and the advantages of the individual drive is followed by more detailed consideration of the advantages and disadvantages of individual belt and chain drives and gearing, their dangers and the means of eliminating them. A final section deals briefly with electric drives. The author advocates the introduction of individual drives and stresses the great precision and freedom from play obtainable with gearing. He suggests that the various considerations set forth should receive close attention during the reconstruction period.

Friendly Safeguards. By Gerald A. Lewis and Myron Zukor. (*National Safety News*, July 1945, p. 18.)

Electronic safety devices and their many applications in industry are the subject of this article.

The authors point out that guards, such as chains, bars, sweeping arms, contact-bearing gates are anything but ephemeral. The main purpose of these guards is to impress its presence on the operator. Even the electric safety button which keeps the press open, depends upon the energy furnished by the operator. Electronic control obeys signals of such low energy level that the operator does not know they are there; just the presence of a body in the wrong place sets off the protective signals.

Other attributes of electronic equipment are its speed, reliability and ability to protect without interfering. Electronic devices, however, are not the answer to all mechanical safety problems; proper design of machinery, correct use, discipline, education and non-electronic devices are all important.

The article describes in detail the operation of some typical electronic devices and the authors emphasise that with these devices the safety engineer, the production man and the operator now have available some good new tools that properly applied will help to make manufacturing processes safer and, hence, more economical.

Safety Program Aims at No Accidents at All. By Karl Krieg. (*Factory Management and Maintenance*, July 1945, p. 114.)

The author briefly describes the safety programme of the Crosley Corporation. He points out that the two groups of employees having the highest rate of accidents are those who have been on the job less than six months or more than ten years. Many of the first group have not yet learned the importance of safety and the other group with ten or more years' experience have become so accustomed to their work that they are over-confident. Negligence characterises both of these groups.

Recently the company has been able to make some improvements in order to better the safety record; some of them are as follows:

(1) Having the electrical control systems made with dead-front panels and no exposed wires.
(2) Raising the minimum lighting from 15 foot-candles (the equivalent of the intensity of light that would be given by 15 candles one foot away from a given area) to 35 foot-candles in all areas.
(3) Obtaining better ventilation through forced circulation of air, air conditioning, and fume control at the source by the use of down-draft tables, in which fumes are immediately sucked down before escaping into the air, instead of the old method of expelling them through an overhead hood.
(4) Installing automatic control of temperature, steam flow, and time factors in degreasing operations.

The author further describes the organisation of the safety activities, pointing out that a staff of instructors spend their time exclusively in training Crosley employees in safety methods.

RECENT BOOKS

Ulykker ved laste- og lossearbeid. By Kurt JENSEN, State Labour Inspector. Published by the Association "Vern og Velferd", Oslo, 1942. Second Edition. 58 pp.

This booklet dealing with the prevention of accidents in loading and unloading operations in ports was written by the principal port inspector of Norway and published by the Norwegian Association "Protection and Welfare".

Clearly and concisely written and profusely illustrated, the booklet first describes the accident situation in loading and unloading operations as compared with other occupations, giving statistical data showing the number of accidents, the number of man-years worked and the number of days lost during the period 1922-1936. The distribution of accidents according to causes and to parts of the body injured is also shown by means of tables and diagrams.

Three very important chapters are devoted to accident causes and safe working practices. In the first of these the author deals with the operation of hoisting machinery, the slinging of loads, the risk of persons falling, and handling of goods; in the second, with the special risks obtaining in the handling of different kinds of goods, such as stone, iron and steel (girders, tubes, etc.), barrels, boxes and crates, timber and wood products, bales and bags, coal, ore and other goods shipped in bulk; in the third, with the dangers inherent in the various tools and implements (crane hooks, chains, slings, ladders and gangways, etc.).

Another important chapter deals with the prevention of accidents in warehouses, storehouses and silos. Further chapters discuss work hours and rest periods and alcohol as a cause of accidents.

There are also tables showing permissible loads for scaffolds and gangways, and steel wire ropes and a chapter on the treatment of chains (annealing, etc.) contributed by a special expert.

That the book has been found useful is shown by the fact that the first edition of ten thousand copies has been sold out; another edition of ten thousand is now being distributed.

Drill Presses. Mill and Factory Industrial Safety Charts. Series A. Mill and Factory, New York, in collaboration with U.S. Department of Labor, Division of Labor Standards, Washington, January 1945.

The Division of Labor Standards in collaboration with Mill and Factory is bringing out a series of Industrial Safety Charts designed to promote safe working practices around common types of industrial equipment. The first of the series is concerned with drill presses, and consists of six small posters each with one "do" and one "don't" drawing. The charts are supplemented by a page of text entitled "Safe Drill Press Operation".

The publication, which illustrates a few simple but vital safety rules in a striking manner, should be very useful, especially to inexperienced workers.

The Hazard of Hydrogen Fluoride Poisoning in the Mineral and Allied Industries. United States Bureau of Mines, Information Circular 7311. Washington, March 1945. 51 pp.

Most of this paper consists of a review of the literature of fluorine poisoning. It begins with a description of the properties of fluorine and hydrogen fluoride and a brief history of fluorine poisoning. The literature study is divided into sections dealing respectively with the industries and occupations entailing exposure to fluorine, types of fluorine poisoning, the toxicity of hydrogen fluoride as a function of its concentration, the pathology of fluorine poisoning, the function of fluorine compounds in physiological processes, the diagnosis of fluorine poisoning, and the prevention and treatment of fluorine poisoning. The concluding bibliography contains 81 references.

Curso de Higiene del Trabajo. Published by the Madrid Provincial Department of Health under the direction of Dr. Primitivo de la QUINTANA (Provincial Director of Health, Madrid) and Dr. Juan DANTÍN GALLEGO (Chief of the Industrial Hygiene Section of the Madrid Provincial Department of Health. Vol. 1, Madrid, 1944. 620 pp.

The Madrid Provincial Department of Health has collected into a two-volume book the lectures delivered during a course on industrial hygiene. To complement the book, the texts of the lectures have been supplemented with a large quantity of material pertinent to the practice of medicine in industry.

The war has shown in a very real way the enormous importance to the production and economy of a country of the protection of workers against occupational hazards. The book is very well put together for this purpose and is in such a form as to be useful in the spreading of knowledge on industrial hygiene in Spanish-speaking countries which are showing more and more interest in this knowledge and the means of applying it.

The reader will find not only a fairly complete, modern bibliography but also suggestions regarding the investigation and the practical and efficient application of new, recently developed processes. His attention is focused particularly on "a moment in the social life of every citizen — the working day" and not on a particular social class.

The subjects discussed are mainly concerned with:

(1) The neighbourhood of factories;
(2) The worker's standard of living;
(3) Hygiene in work rooms;
(4) Hygiene in manufacturing processes;
(5) Psychotechnical guidance and selection;
(6) Occupational diseases;
(7) Statistical study.

As can readily be seen, these subjects cover practically the entire field of industrial hygiene except as regards its relation to public health and social insurance services which will be dealt with in a further publication.

Doenças Profissionais do Pulmão. Silicose. By Dr. Decio PARREIRAS. Published by the Department of Labour, Industry and Commerce, Industrial Safety and Hygiene Division, Rio de Janeiro, 1945. 42 pp.

This pamphlet, published in connection with a campaign launched by the Brazilian Department of Labour, Industry and Commerce is extremely interesting and fulfils all the requisites for a publication of this kind, presenting, as it does, all aspects of the problem in such a way that the matter can be understood not only by experts but by the general public.

The author, basing himself on the work of various Brazilian and other research workers, describes, in an instructive and detailed manner every aspect of the problem of silicosis. To facilitate its use and understanding by the reader, the pamphlet is divided into various sections, the object being to cover all the details to be considered in learning about and combatting this disease.

Seats for Workers in Factories. Ministry of Labour and National Service. Welfare Pamphlet No. 6, 1945. Fourth edition. London, 1945. 41 pp.

This profusely illustrated pamphlet, "prepared to direct attention to the importance of providing seats for workers in factories and to serve as a guide in the choice of the right type of seat", will be very useful not only for em-

ployers but also for employees since it states general principles of the advantage of good seating, change of posture and good sitting posture, that must be known by both.

It has been found that industrial fatigue is often due to unnecessary discomfort and strain in working conditions and it is generally realised that the prevention of unnecessary fatigue promotes efficiency. One of the most common sources of fatigue is prolonged standing at work; for this reason all employers should provide seats for the workers where work can be done sitting. It is necessary to abolish the erroneous idea that many employers have sometimes by tradition, that workers will work better standing permanently at their work.

Many investigators have drawn attention to the value of frequent changes of posture as a means of affording relaxation and reducing fatigue In accord with the experience of investigators and Factory Inspectors "the ideal arrangement is one which permits of the work being done standing or sitting as the worker may from time to time prefer". But a great number of persons do not know how to adopt a good or correct sitting posture and sometimes a bad position may interfere with circulation and breathing, aggravating or maintaining ailments; therefore it is important to point out that a comfortable posture is "one which does not impede the breathing, hamper the circulation, interfere with muscular action or hinder the normal functions of the internal organs".

For the designing of seats for work the pamphlet emphasises two important general principles:

(1) Seats should be so designed and adjusted that work can be carried out in comfort and safety.
(2) The arrangements should wherever possible allow of a voluntary change of posture.

To complete the interesting text, the pamphlet is supplemented with a great number of photographs and drawings showing good and bad types of seats actually in use.

Tentative Inspection Standards for Anthracite Mines. U.S. Bureau of Mines, Information Circular 7282, Washington, May 1944. 48 pp.

Explanation of Tentative Inspection Standards for Anthracite Mines. U.S. Bureau of Mines, Miners' Circular 46, Washington, 1945. 118 pp.

The Inspection Standards have been prepared as a guide for the federal inspection of anthracite mines. They are in three parts and 25 sections.

Part 1, surface conditions, contains 12 sections relating to breaker and cleaning plant, head frame, hoisting, steam and compressor plants, lamp houses, surface fire protection, etc.

Part 2, mining methods, conditions and equipment, contains nine sections dealing with timbering, explosives and blasting, ventilation, surface haulage, underground haulage, electricity, machinery, fire protection underground and miscellaneous hazards.

Part 3, general safety conditions, consists of four sections on supervision, safety organisation, safety rules and standards, and first aid and mine rescue.

The explanatory volume follows the arrangement of the Standards, on which it is a detailed commentary. It concludes with a substantial bibliography.

Como Fazer Diminuir o Número de Acidentes do Trabalho. Published by the Department of Labour, Industrial Safety and Hygiene Division. Rio de Janeiro, 1945. 163 pp.

This book is a collection of papers dealing in an interesting way with the details of various accidents which occurred in industrial establishments and indicating practical preventive measures.

The material is extremely instructive and emphasises the importance of prevention and supervision to industrial safety.

At the end of each chapter is a questionnaire comprising questions pertinent to the subject matter.

The last chapter includes a copy of the part of the Brazilian Labour Law dealing with industrial safety and hygiene.

Developing Safe Employees. Issued by the Safety Bureau, Welfare Division, Metropolitan Life Insurance Company, NewYork. 46 pp.

This is a report based on a study of accident prevention activities in a number of industrial organisations. The report is in eight sections each of which discusses an important aspect of safety; for example, job placement for safety, safety training, accident repeaters, maintaining employee interest, safety advertising, etc. Although it is not a comprehensive review of safety methods it should facilitate the selection of safety programmes to meet individual needs.

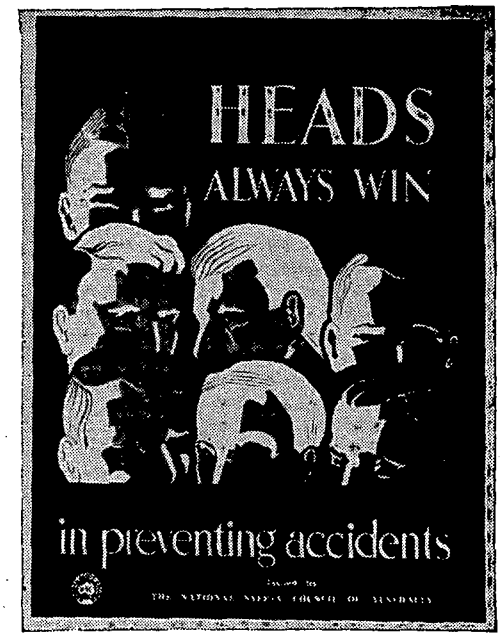
A bibliography is included.

Note to our Readers

In the article "Twenty Years — The Industrial Safety Survey, *1925-1944", published in Vol. XXI, No. 4, of this journal, reference was made to a suggestion that reviews of periodicals and books should be made available as offprints with the text on one side of the paper only (clipsheets) to facilitate cutting out and filing for reference. Whether this suggestion can be adopted or not will depend on the demand for such offprints, and readers are accordingly invited to state whether they would be willing to subscribe to them. Correspondence on the subject should be addressed to the International Labour Office, 3450 Drummond St., Montreal 25, Quebec, Canada.*

NEW POSTERS

A Golden Rule, also at work: Use your brain first and your hands afterwards. Thoughtlessness is the mother of many accidents.
(Sandvikens Jernverks A/B, Sandviken, Sweden)



(National Safety Council of Australia, Melbourne)

(Humble Oil and Refinery Co., Houston, Texas)

The Leaning Tower is worth seeing, but a leaning pile is disgusting and dangerous
(Sandvikens Jernverks A/B, Sandviken, Sweden)

INTERNATIONAL LABOUR OFFICE

INDUSTRIAL SAFETY SURVEY

(*Industrial Accident Prevention Association, Toronto*)

Published Every Three Months

VOLUME XXII, No. 2
APRIL-JUNE 1946

Price per Number: 2s.; 50 cents
Annual Subscription: 6s.; $1.50

CONTENTS

Published by the INTERNATIONAL LABOUR OFFICE, 3450 Drummond St., Montreal, 25, Canada.

The dimensions of the two abrasive wheels used are shown in figs. 2 and 3, and the design of the flanges for securing them, in fig. 4.

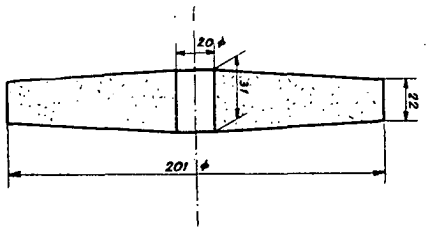


Fig. 2

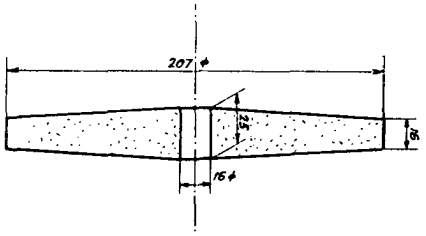


Fig. 3

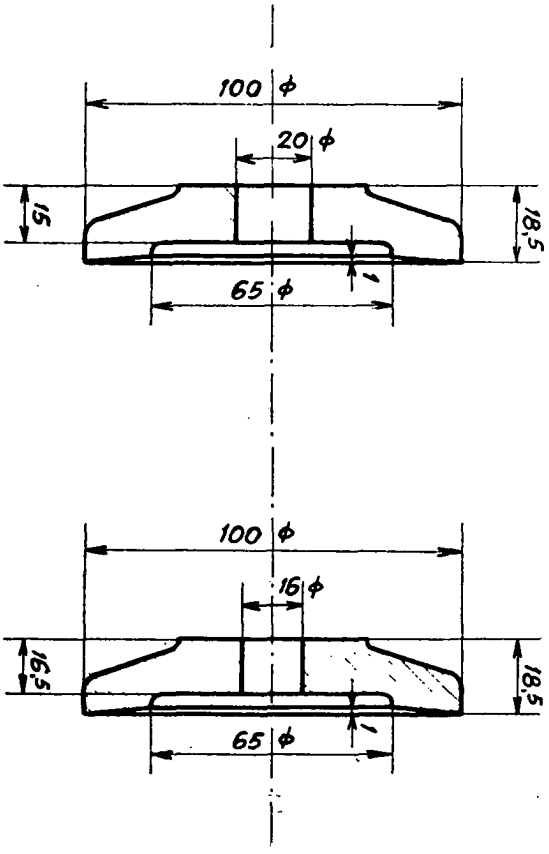


Fig. 4

The revolutions were read from the built-in tachometer of the centrifugal installation, which had been previously verified with an officially graduated tachometer of the Federal Material Testing Institute.

The first test was made with the wheel shown in fig. 2. This did not burst until 6,800 revolutions per minute had been reached, that is, a peripheral velocity of 71 m/sec. Practically all the fragments flew out, but not, as might have been feared, because of the breakage of the spindle between the flanges. Fig. 5 shows the burst wheel. It must be assumed that the fracture occurred in the bakelite seams and that the further fragmentation of segments was

Fig. 5

Conical grinding wheel, 200 mm diam. Spindle, 20 mm diam.

caused by the impact of the fragments on the walls after flying out of the flanges. Neither on the spindle nor on the flanges could any deformation be observed.

The rather thinner abrasive wheel shown in fig. 3 burst at no more than 4,600 revolutions a minute, or a peripheral velocity of 48 m/sec, that is to say, approximately the operating velocity, but even at this speed, the flanges failed to retain the fragments. Fig. 6 shows the fragments of this wheel. The spindle on which it was mounted was slightly bent after the test.

After this surprising result, it was decided to discontinue the tests and resume them later without elastic washers, which, if they are not fully pressed on to the flange, allow the fragments to escape.

INDUSTRIAL SAFETY SURVEY

MONTREAL APRIL-JUNE 1946 VOL. XXII, No. 2

PROTECTION OF PORTABLE GRINDING MACHINES

By M. HELFENSTEIN, formerly Chief of the Accident Prevention Service, Swiss Accident Insurance Institute, Lucerne

The protection of portable grinding machines presents special difficulties because what would be the only effective safety device, namely, a hood covering at least three quarters of the circumference of the abrasive wheel, has not yet been devised. What has been required in Switzerland as a makeshift has been an attachment for abrasive wheels such that in the event of a breakage of the wheel, the fragments would be held by the flanges. The design considered for this purpose is shown in fig. 1.

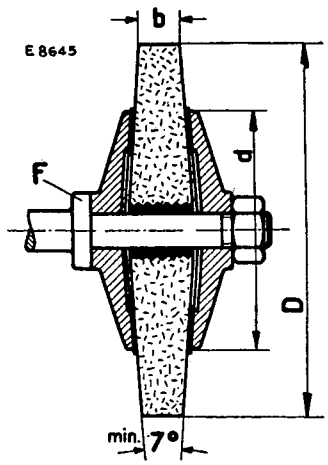


Fig. 1

Since there was no knowledge of bursting tests that might give information on the requisite conicity of the abrasive wheel, the British Standard Specification was adhered to. Provided that the peripheral velocity does not exceed 25 m/sec, the conicity of 7° laid down in this standard should suffice. Industrialists, however, declared that for the working of certain alloys much higher velocities were necessary. The grinding of welded seams on objects made of stainless steel, for example, was said to require a peripheral velocity of about 45 m/sec. The Swiss Accident Insurance Institute demurred. Calculations showed that in the event of a breakage of the wheel at a peripheral velocity of 45 m/sec, the thin spindle between the mounting flanges would probably break and then the fragments would fly off. Before authorisation was given for so high a velocity it had to be established by tests whether apprehensions based on mere approximate calculations were justified. The proof that flanges of the design shown in fig. 1 would retain fragments had never been forthcoming. All that had been done was to mount the fragments of an abrasive wheel that had previously been shattered by blows, and then to bring the machine up to the desired number of revolutions. In such a test the sudden stresses set up by the breakage of a wheel at full speed were left out of account. (They cannot, unfortunately, be exactly determined by calculation.)

The Swiss Accident Insurance Institute entrusted the carrying out of the tests to the Federal Material Testing Institute in Zurich. The abrasive wheels were provided by the Schweizerische Schmirgelscheibenfabrik A.-G., Winterthur. The bursting of the wheels took place on 11 April 1944, in the centrifugal installation of A. G. Brown Boveri and Co., Baden, which is particularly well equipped for the purpose.

Since abrasive wheels with bakelite bonding withstand peripheral velocities of over 100 m/sec, while breakage of the wheel was desirable at a velocity approximating to the operating velocity of 45 m/sec, the breaking strength of the abrasive wheels used for the tests had to be reduced artificially. This was done before the test by breaking the wheels into four segments and subsequently cementing them together with bakelite.

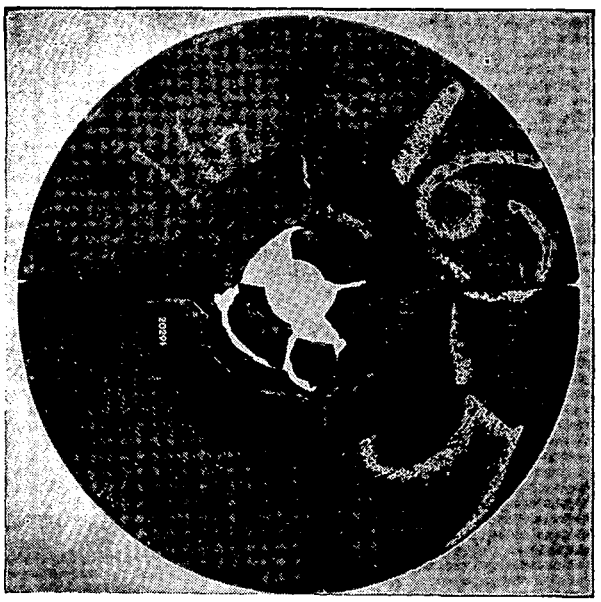


Fig. 6

Conical grinding wheel, 200 mm diam.
Spindle, 16 mm diam.

The following considerations may point to the desirability of falling back upon protective hoods, even in the case of portable grinding machines. Excluding eye accidents, grinding machine accidents due to breakage of the wheel amount only to about 6 per cent. of all accidents on such machines. Most accidents are caused by accidentally touching the grinding wheel with the hands, and a small number of accidents can be attributed to the article being ground, but the only means of preventing these numerous accidents appears to be the protective hood. For portable grinding machines special requirements were laid down for this hood and they were largely met by the model devised by the Swiss Accident Insurance Institute and placed on the market in 1942. The construction of this safety device is seen in figs. 7 and 8. As compared with the designs previously available, the new hood possesses two advantages: the rapid and accurate adjustment of the hood to the diameter of each abrasive wheel, and the

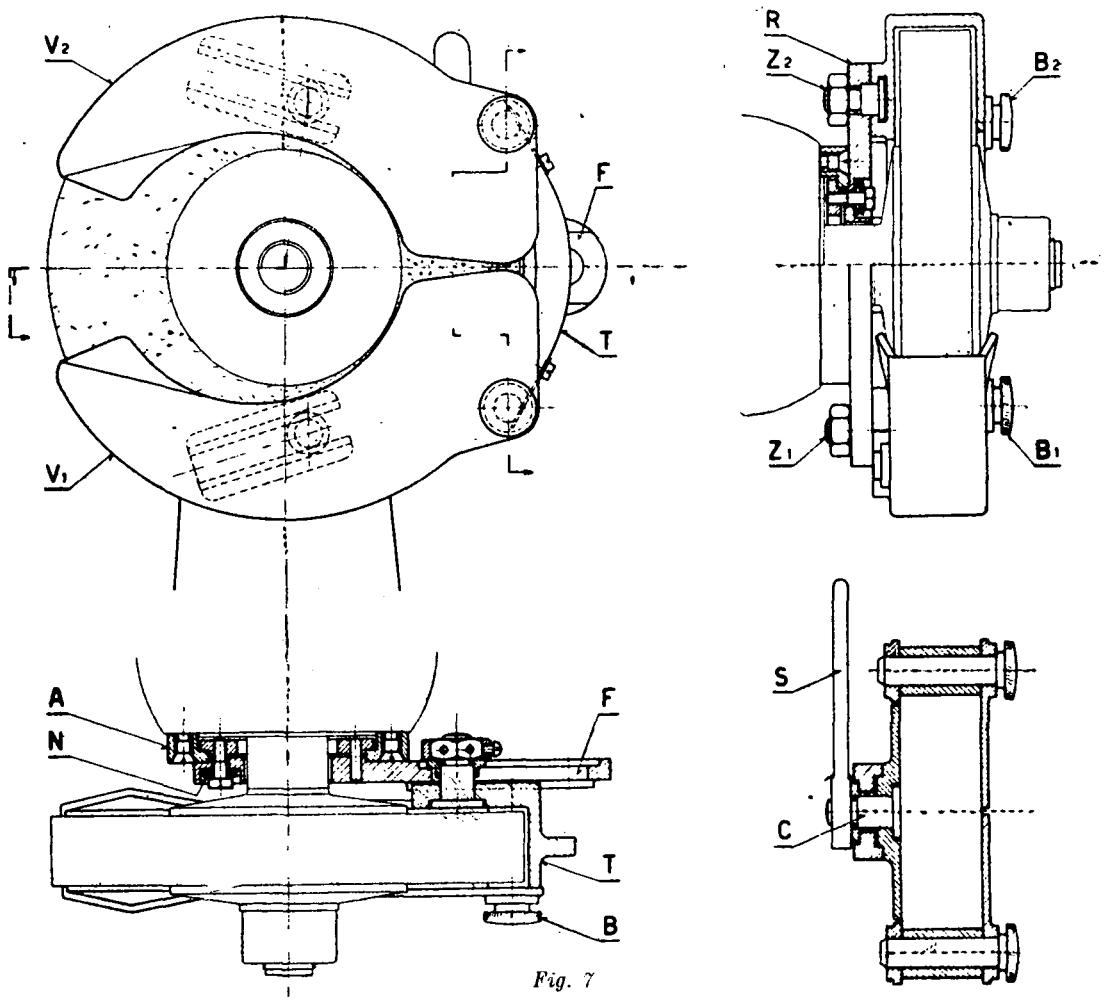


Fig. 7

possibility of quickly and easily bringing the open side into any desired position. These two

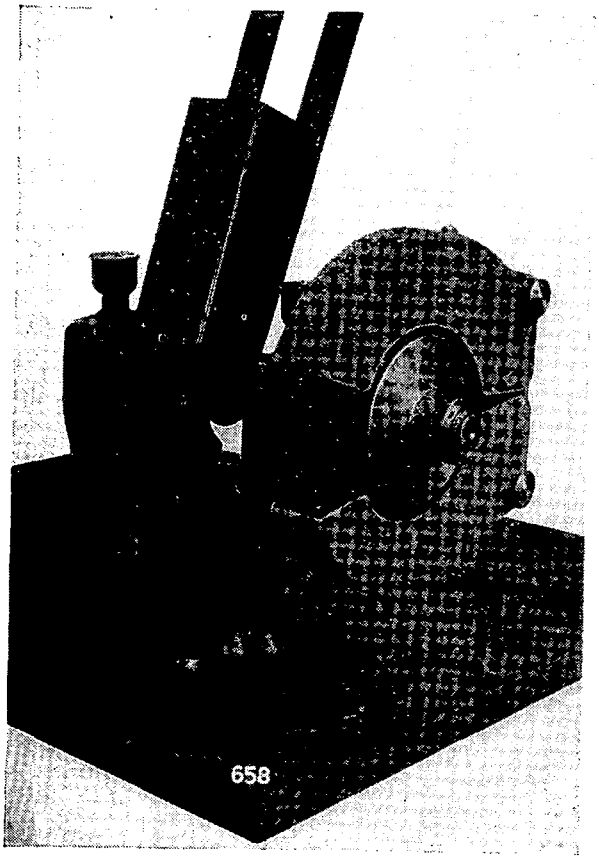


Fig. 8

advantages, together with a lightness of weight, constitute a guarantee that portable grinding machines can be satisfactorily equipped with protective hoods.

The Swiss Accident Insurance Institute has equipped a flexible-spindle grinding machine with a protective hood, as shown in figs. 7 and 8, and placed it at the disposal of industrialists for tests. This hood is shown in figs. 9-13: it

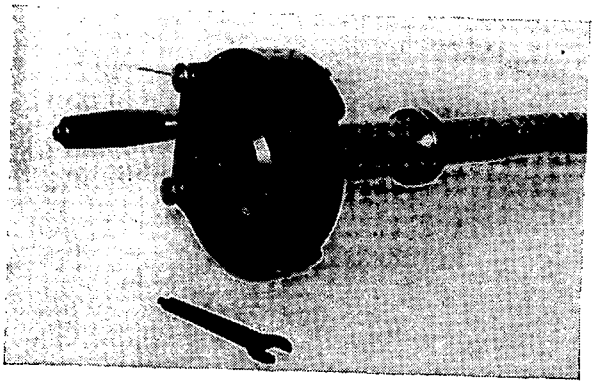


Fig. 9

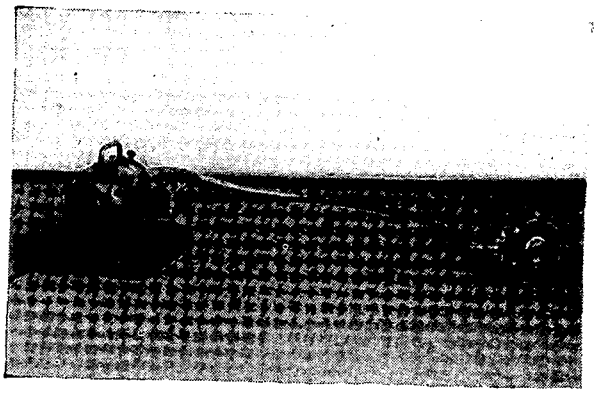


Fig. 10

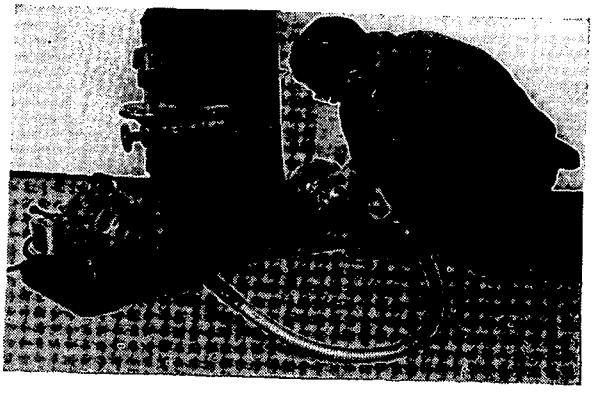


Fig. 11

Fig. 12

Fig. 13

weighs 1.5 kg, while the grinding machine without the hood weighs 4.5 kg. The additional 1.5 kg is doubtless a disadvantage, but the elimination of most of the danger of contact should make it easier for the worker to handle the machine. A special advantage is the possibility of laying down the machine without having to wait for it to stop (see fig. 10). Some concession, however, had to be made on the safety side: the angle of the opening in the protective hood that is fixed at 40° for stationary grinding machines had to be increased to 90° for portable grinding machines.

Further bursting tests and exhaustive tests of the machine equipped with the protective hood have had to be postponed owing to the high pressure at which industry has been working. It will be some time yet before the final solution to the problem of protecting portable grinding machines is reached. On the other hand, it can be stated that the hood in question has given excellent results on stationary machines. It has been found efficient by both employers and workers. The leading Swiss manufacturers of grinding machines equip them with the hood shown in figs. 7 and 8.

TABLE OF COMMON HAZARDOUS CHEMICALS

PREPARED BY COMMITTEES OF THE NATIONAL FIRE PROTECTION ASSOCIATION AND THE AMERICAN CHEMICAL SOCIETY[1]

(Tentatively adopted 1928, adopted 1929, amended 1931, 1935, 1938, 1939, 1941, 1942 and 1944)

The International Labour Office is indebted to the National Fire Protection Association, Boston, Mass., and the American Chemical Society, Washington, D.C., for the permission to reprint this table.

Name	Usual shipping container	Fire hazard	Life hazard	Storage	Fire fighting phases	Remarks
Acetic acid (glacial)	Glass carboys and barrels	Dangerous in contact with chromic acid, sodium peroxide or nitric acid; yields moderately flammable vapours above flash point 40° C. (104° F.).	May cause painful burns of skin	Safeguard against mechanical injury. Isolate from oxidising materials as noted under "Fire hazard"	Extinguishing agent, water	Expands on solidification and may burst container unless kept at a temperature above 16° C. (60.8° F.)
Acetone	Carboys, steel drums, tank cars	A volatile liquid. Gives off vapours which form with air flammable and explosive mixtures. Flash point −16° C. (3° F.). Explosive range 2.55% to 12.8% (upward propagation). The ignition temperature is comparatively high, being within the range 538° to 566° C. (1000° to 1050° F.). The vapours are heavier than air (vapour density 2). Fire hazard slightly less than that of gasoline	Toxicity of a comparatively low order	Safeguard containers against mechanical injury. Only electrical equipment of the explosion - proof type, Group D classification permitted in atmospheres containing acetone vapour in flammable proportions	Lighter than water. (Sp. gr. 0.792) but soluble in it in all proportions. Water, particularly in the form of spray, is the best extinguisher. Carbon dioxide may also be used. Automatic sprinkler systems or total-flooding carbon dioxide systems may be employed for protection in storage rooms	
Aluminium dust	Barrels or boxes	Forms flammable and explosive mixtures with air		Keep in dry place. In case of fire do not use water; it may cause an explosion	Smother with sand, ashes, or rock dust. Do not use water, which may cause explosion.	
Aluminium resinate	Wooden barrels	Combustible		Storage should be ventilated and safeguarded as for oil storage buildings.		
Ammonium perchlorate	Wooden barrels or kegs and glass bottles	Oxidising material. May explode in a fire. Hazard classes with potassium chlorate		Safeguard against mechanical injury. Isolate from mineral acids, also from combustibles		
Anhydrous ammonia	Steel cylinders or steel tank cars	Gas density 0.60 (air = 1). Not flammable in air except in comparatively high concentration, which is seldom encountered under practical conditions, the low limit of the flammable or explosive range being about 15% to 16% and the upper limit about 25% to 26% by volume (horizontal propagation). The presence of oil will increase the fire hazard. Ammonia aqua does not burn	Irritant. An outstanding serious effect produced by ammonia in concentrations of the order of ½% by volume for duration of exposure of the order of ½ hour is blindness. A concentration of 0.03% of ammonia in air for duration of exposure of the order of ½ to 1 hour, according to Lehmann, does not cause serious effects	Safeguard against mechanical injury and excessive heating of cylinders or tanks. Fire-resistive storage recommended. In combustible buildings or if near combustibles, sprinklered storage recommended. Isolate from other chemicals, particularly chlorine, bromine, iodine and mineral acids	Soluble in water. Hose streams comparatively effective in removing the gas from the atmosphere	

[1] NOTE. These columns are informative only; it is not considered necessary that the material be kept or stored only in the containers as listed, nor that each package be labelled. The requirements in the table on the storage of containers refer to chemicals in usual containers, and are not intended to apply to small bottles of chemicals such as are found in drug stores and chemical laboratories.

TABLE OF COMMON HAZARDOUS CHEMICALS (*cont.*)

Name	Usual shipping container	Fire hazard	Life hazard	Storage	Fire fighting phases	Remarks
Antimony pentasulphide (golden antimony sulphide) Sb_2S_3	Fibre drums or tins	Combustible. Readily ignited by a small flame. Hazardous in contact with oxidising material. Yields flammable hydrogen sulphide on contact with mineral acid	Gaseous products of combustion contain sulphur dioxide and are irritating and corrosive	Safeguard against mechanical injury. Isolate from acids, chlorates, nitrates, and other oxidising agents	Practically insoluble in water. Use water	Used in manufacture of matches, ammunition and fireworks, and of certain rubber compounds
Barium chlorate	Wooden boxes, barrels or kegs	Oxidising material. Hazard classes with potassium chlorate.		Isolate	See Potassium chlorate	
Barium nitrate	Wooden boxes; barrels	Oxidising material. Hazard in class with sodium nitrate	Soluble in water. Poisonous when taken internally	Do not store with combustible materials	See Sodium nitrate	
Barium peroxide	Tightly closed metal containers packed in wooden boxes or barrels; or in bulk in metal barrels or drums	Oxidising material. Hazard in class with sodium peroxide		Do not store with combustible materials	Smother with sand, ashes, or rock dust. Do not use water	
Benzoyl peroxide (dry granular or powdered wet)	Dry granular material in individual one-pound containers inside wooden boxes; finely powdered material wet (30% water by weight) in glass containers placed inside tightly sealed metal containers in wooden boxes or in aluminium drums	Highly flammable in the dry state. Strong supporter of combustion. Do not subject dry material to heat of friction or grinding	Dust irritating to eyes and lungs. Use goggles and dust respirator in dusty atmospheres	Store in a cool ventilated place. Powder should be stored with not less than 30% water by weight. Keep away from all sources of heat and separate from all combustible materials and acids	Water, carbon dioxide, foam, sand, soda ash, or rock dust may be used as extinguishing agents	Not miscible with water.
Bleaching powder Calcium hypochlorite Chlorinated lime Chloride of lime (incorrect name)	Air-tight tin containers, wooden barrels, and steel drums	Not combustible but evolves chlorine and at higher temperatures oxygen. With acids or moisture evolves chlorine freely at ordinary temperatures. See chlorine	Corrosive. Irritating to skin, eyes, and lungs. See chlorine	Store in cool, dry, well ventilated place away from combustibles. See chlorine. Rupture of drums containing bleaching powder, particularly if the chlorine content is high, may result from exposure to heat	Fires where the compound is present may be fought with water, preferably spray. Protect eyes and skin, using gas mask of a type approved by Bureau of Mines	Encountered in paper, textile, disinfectant and alkali industries; also where water purification processes are employed
Borneol	Barrels, kegs, boxes and tins	Combustible. Hazard similar to camphor		Store in well-ventilated compartment or building.	See Camphor	
Bromine	Glass bottles; earthen jugs	Causes oxidising effect, resulting in heating and may cause fire when in contact with organic material	Corrosive; at ordinary temperatures gives off poisonous suffocating vapours	Isolate; safeguard against mechanical injury		Bottles should be surrounded by incombustible packing
Bronze dust	Barrels or boxes	When aluminium is present forms flammable and explosive mixtures with air. Composition usually free from aluminium			Smother with sand or ashes	Bronze dust free from aluminium not considered dangerous
Butane	Steel cylinders	Flammable gas under pressure. Classes with gasoline vapour in fire hazard		Safeguard against mechanical injury		Keep cool
Calcium carbide	Iron drums and tin cans	Gives off acetylene gas on contact with water or moisture	Serious under fire conditions	Store in dry, well-ventilated place in accordance with N.F.-P.A. Standards	Smother with sand or ashes. Do not use water	
Calcium oxide	Wooden barrels and bags	Heats upon contact with water or moisture and may cause ignition of organic material. Swells when moist and may burst container		Isolate; store in dry place away from water or moisture		
Camphene	Tins	When heated gives off flammable vapours. Classes with turpentine		Isolate; keep in unheated compartment away from fire or heat	Smother with sand or ashes. Avoid water	
Camphor	Tins and wooden kegs	Flammable: gives off flammable vapours when heated which may form explosive mixture with air. Flash point 82° C. (180° F.)		Detach from other storage. Keep in well-ventilated room remote from fire	Smother with sand or ashes. Chemical streams. Avoid water	
Carbolic acid — See Phenol						

TABLE OF COMMON HAZARDOUS CHEMICALS (*cont.*)

Name	Usual shipping container	Fire hazard	Life hazard	Storage	Fire fighting phases	Remarks
Carbon disulphide	Small glass, earthenware, or metal containers packed in outside barrels or boxes (See I.C.C. Regulations). Steel drums, steel tank cars	A highly volatile liquid with an offensive odour, giving off even at comparatively low temperatures vapours which form with air flammable and explosive mixtures. Flash point −30° C. (−22° F.). Flammable range 1% to 50% (upward propagation). The ignition temperature is dangerously low, being about 100° to 106° C. (212° to 223° F.). It is endothermic, and the vapour may be ignited by a heavy blow. The vapours are heavier than air (vapour density 2.62), and may travel a considerable distance to a source of ignition and flash back. More hazardous than gasoline	Toxic. 3200 to 3850 parts of vapour per million (0.32 to 0.385% by volume) may cause dangerous illness in ½ to 1 hour. Direct contact with the skin should be avoided. Products of combustion contain sulphur dioxide, which in concentrations of 0.2% by volume in air may cause serious injury in ½ hour or less. Often poisonous carbon monoxide is present in the products of combustion	Isolate and safeguard containers against mechanical injury and metallic blows, and keep in unheated compartment away from sunlight and any source of ignition, including electric lighting fixtures and other electrical equipment. Storage tanks should be constructed over concrete basins containing water, and the carbon disulphide kept blanketed with water or inert gas at all times	Heavier than water (Sp. gr. 1.29) and sparingly soluble in it. Use sand, carbon dioxide, or other inert gas as extinguishing agents. Cooling and blanketing action of water may be utilised in case of fires in metal containers or tanks. Total-flooding carbon dioxide systems may be employed for protection in storage rooms. Foam not effective. Do not use carbon tetrachloride. Use of gas masks or oxygen helmets of the type approved for the purpose by U.S. Bureau of Mines recommended	Carbon disulphide should never be transferred by means of air. Use inert gas, water, or pump. Use a wood measuring stick for measuring contents of storage tanks or tank cars. Tank cars when being loaded or unloaded should be well grounded. Do not dispose of carbon disulphide by pouring it on the ground. Provide a safe place for burning it
Charcoal (wood)	Boxes, barrels, bags, or bulk	Spontaneously ignitable when freshly calcined and exposed to air, or when wet; hazardous when freshly ground and tightly packed	There is danger from carbon monoxide poisoning during burning unless adequate ventilation is provided	Isolate; prevent dust accumulations; ventilate well; make daily inspections	Use water, completely extinguishing the fire, after which the storage pile should be moved	
Chinese wax	Burlap bags and wooden barrels	Combustible		Detach from other storage		
Chlorine	Steel cylinders and tank cars	Is not combustible in air but reacts chemically with many common substances and may cause fire or explosion when in contact with them. See remarks under "Storage"	Corrosive. Irritating to eyes and mucous membrane. Toxic, 0.004% to 0.006% by volume in air causes dangerous illness in ½ to 1 hour.	Isolate from turpentine, ether, ammonia gas, illuminating gas, hydrocarbons, hydrogen, and finely divided metals. Safeguard against mechanical injury of containers	Use gas masks on entering atmospheres containing chlorine gas. If, however, concentration is high, or there is doubt as to the degree of concentration, use oxygen helmet of a type approved for such use by U.S. Bureau of Mines	Dangerous to neutralise chlorine in a room with ammonia
Chromium trioxide or Chromium anhydride CrO_3 (often called "Chromic acid")	Iron drums and glass bottles	Oxidising material; will ignite on contact with acetic acid and alcohol. Chars organic material such as wood, sawdust, paper or cotton, and may cause ignition. Combustible material in presence of chromium trioxide when ignited burns with great intensity. May cause explosion in fire	Irritating to skin. Poisonous	Isolate	Use water, completely extinguishing the fire, after which the storage pile should be removed	It is used in chromium plating, in electric batteries, and in photography
Cobaltous nitrate	Wooden barrels	Oxidising material. Classes with sodium nitrate		See Sodium nitrate		
Colophony	Barrels	Combustible; gives off flammable vapours when heated		Ventilate storage; avoid dust; keep away from fire or heat		
Copper nitrate	Wooden barrels and kegs	Oxidising material. Hazard classes with sodium nitrate	Poisonous when taken internally. Soluble in water	Safeguard against mechanical injury; isolate. See sodium nitrate		
Cyclopropane	Steel cylinders	Highly flammable gas. Forms flammable and explosive mixtures with air or oxygen. Explosive range 2.40% to 10.4% (upward propagation)	Anaesthetic	Isolate from oxygen cylinders and store in a cool, well ventilated storeroom	Use water to cool cylinders not on fire. If gas is burning at valves or safety releases, usually the best course to follow is not to disturb or attempt to extinguish flame. To do so will cause the release of unburned gas and quickly create highly dangerous explosive atmospheres. If cylinder is mounted on an anaesthetic machine or truck, it may be possible to move it to a safe place. Carbon dioxide or carbon tetrachloride are best extinguishing agents	Only electrical equipment of the explosion-proof type, Group C classification, permitted in atmospheres containing cyclopropane in flammable proportions (Group C classification for cyclopropane tentative pending further tests.)

TABLE OF COMMON HAZARDOUS CHEMICALS (*cont.*)

Name	Usual shipping container	Fire hazard	Life hazard	Storage	Fire fighting phases	Remarks
Didymium nitrate	Wooden kegs	Oxidising material. Classes with sodium nitrate		Isolate. See Sodium nitrate		
Dioxan	Glass bottles, metal cans, and metal drums	Moderately volatile flammable liquid. Flash point 12° C. (54° F.). Explosive range 1.97% to 22.25% (upward propagation). Vapours are heavier than air (vapour density 3.03). Capable of forming peroxides under certain conditions, and there may be danger of explosion if redistilled, unless certain precautions are taken.	Irritant and toxic in high concentrations	Isolate and safeguard against mechanical injury	Water best extinguishing agent	Slightly heavier than and completely soluble in water (Sp. gr. 1.03)
Ether, ethyl	Glass bottles or tin cans in boxes, steel drums	A highly volatile liquid, giving off even at comparatively low temperatures vapours which form with air or oxygen flammable and explosive mixtures. Explosive range 1.85% to 36.5% (upward propagation). The ignition temperature is comparatively low, being approximately 180° C. (356° F.). Spontaneously explosive peroxides sometimes form on long standing or exposure in bottles to sunlight. The vapours are heavier than air (vapour density 2.6) and may travel a considerable distance to a source of ignition and flash back. More hazardous than gasoline	Anaesthetic	Safeguard containers against mechanical injury. Isolate and keep in unheated compartment away from sunlight and any source of ignition. Only electrical equipment of the explosion-proof type, Group C classification, permitted in atmospheres containing ether vapour in flammable proportions	Lighter than water. (Sp. gr. 0.7135.) Soluble in about ten times its own volume of water. Water may be utilised only to cool metal containers. Best extinguishing agents are carbon dioxide and sand, also carbon tetrachloride in case of fires involving limited amounts of ether. Total-flooding carbon dioxide systems may be employed for protection in storage rooms	See National Board of Fire Underwriters' Recommended Safeguards for the Installation and Operation of Anaesthetical Apparatus Employing Combustible Anaesthetics
Ethylene	Steel cylinders	Highly flammable gas. Forms flammable and explosive mixtures with air or oxygen. Explosive range 2.75% to 28.6% (upward propagation). Ignition temperature about 450°C. (842°F.). Slightly lighter than air (density 0.97). The gas is spontaneously explosive in sunlight with chlorine	Anaesthetic	Isolate from oxygen cylinders and store in a cool, well ventilated storeroom	Use water to cool cylinders not on fire. If gas is burning at valves or safety releases, usually the best course to follow is not to disturb or attempt to extinguish flame. To do so will cause the release of unburned gas and quickly create highly dangerous explosive atmospheres. If cylinder is mounted on an anaesthetic machine or truck, it may be possible to move it to a safe place. In a closed storeroom carbon dioxide or carbon tetrachloride are best extinguishing agents	Only electrical equipment of the explosion-proof type, Group C classification, permitted in atmospheres containing ethylene in flammable proportions
Ferric nitrate	Wooden barrels	Oxidising material		Isolate. Safeguard against mechanical injury.		
Formic acid	Barrels and carboys	Flammable; gives off flammable vapours which may form explosive mixtures with air	Corrosive; has caustic effect on the skin	Safeguard against mechanical injury		
Fulminate of mercury		High explosive (primary class)		Explosives restrictions		
Fulminate of silver		High explosive (primary class)		Explosives restrictions		
Hydrochloric acid (muriatic acid)	Tank cars (rubber-lined), carboys, and glass bottles	Not combustible (in air) but if allowed to come in contact with common metals hydrogen is evolved, which may form explosive mixtures with air	Aqueous solution is corrosive, irritating, and poisonous. Fumes are corrosive and irritating to mucous membranes	Safeguard containers against mechanical injury. Keep away from oxidising agents, particularly nitric acid and chlorates. Avoid contact by leakage or otherwise with all common metals	Use water or chemically basic substances such as soda ash or slaked lime	

TABLE OF COMMON HAZARDOUS CHEMICALS (*cont.*)

Name	Usual shipping container	Fire hazard	Life hazard	Storage	Fire fighting phases	Remarks
Hydrocyanic acid (prussic acid)	Cylinders, or when completely absorbed in inert material in metal cans with outside wooden boxes	Forms flammable and explosive mixtures with air. Explosive range 6% to about 40% by volume (horizontal propagation)	Poisonous. Few breaths may cause unconsciousness and death. Avoid contact with the skin	Isolate. Keep away from any source of heat. Safeguard containers against mechanical injury	The gas is slightly lighter than air. Soluble in water. Water is the best extinguisher. When entering premises where used or stored during a fire, use oxygen helmet or gas mask equipped with canister of a type approved by the Bureau of Mines for hydrocyanic acid	Concentrations of the gas ordinarily employed for fumigation (1% or less) are considerably below the lower limit of flammability (6% by volume). Some methods of fumigation, however, are employed which temporarily yield flammable mixtures even though the final concentration is low
Hydrofluoric acid (HF)	Aqueous solution in lead carboys and wax or gutta percha bottles	Colourless volatile liquid. Not combustible but reacts with glass and most substances, platinum being an exception. Aqueous solution also attacks glass and several metals	Acid and its vapours highly toxic and irritating to skin, eyes and respiratory tract. Fumes produced by contact with ammonia and many metals poisonous. May be neutralised with chalk. Bicarbonate of soda solution may be immediately applied to burns as first-aid and used as gargle	Isolate. Ventilate. Safeguard against mechanical injury	Use water in case of fires involving hydrofluoric acid. Use oxygen helmet of a type approved for such use by the U.S. Bureau of Mines on entering atmospheres known to contain hydrofluoric acid vapours	Encountered in glass works and chemical laboratories. Used to remove sand from castings and in the manufacture of filter paper. Vapours have been known to cause serious corrosion of sprinkler piping and heads
Hydrofluosilicic acid	Lead carboys, hard rubber or paraffin bottles	None	Corrosive	Safeguard against mechanical injury		
Hydrogen peroxide (27.5 per cent. by weight)	Glass carboys, aluminium drums, aluminium tank cars (all containers must be vented)	Oxidising liquid. May cause ignition of combustible material if left standing in contact with it. May decompose violently if contaminated with iron, copper, chromium, and most metals or their salts	Prolonged exposure to vapour irritating to eyes and lungs. Causes skin irritation. Use goggles to protect eyes from splash	Store in a cool place in ventilated containers remote from combustible material and catalytic metals such as iron, copper, chromium	Use water	
Hydrogen sulphide (sulphuretted hydrogen)	Steel cylinders	Flammable gas. Forms flammable and explosive mixture with air or oxygen. Explosive range in air (upward propagation) 4.3 (low limit) to 46. Heavier than air. Specific gravity 1.19 (air = 1). Ignition temperature 346°-379° C. (655°-714° F.)	Toxic. 0.05% to 0.07% by volume in air causes dangerous illness in ½ to 1 hour. Should be used under hoods in chemical laboratories to avoid danger of breathing dangerous concentrations	Store in ventilated place away from fuming nitric acid and oxidising materials	Use gas masks in entering atmospheres containing hydrogen sulphide. If, however, concentration is high, use oxygen helmet of a type approved for such use by U.S. Bureau of Mines	Encountered in chemical laboratories, metallurgical and smelting works, gas works, sewers
Lead nitrate	Wooden barrels	Oxidising material. Classes with sodium nitrate	Poisonous	Isolate; safeguard against mechanical injury		
Lead sulphocyanate	Fibre and stainless steel drums	Slow-burning. Products of decomposition by heat in the presence of air include sulphur, carbon disulphide and nitrogen	Poisonous when taken internally. Products of combustion contain sulphur dioxide	Store in a dry place away from oxidising materials	Water is a good extinguishing agent	
Lime (unslaked) — See Calcium oxide						
Magnesium	Shavings or powder in tightly closed metal or metal-lined containers. Ingots and bars in ordinary boxes	Combustible, particularly in the form of powder, shavings, or thin sheets. When powder is disseminated in the air, explodes by spark. In finely-divided form liberates hydrogen in contact with water. In massive form (ingots or blocks) comparatively difficult to ignite	Serious under fire conditions. Danger of explosion and from flying particles. Do not attempt to smother unless at a safe distance, or else if protection is provided for eyes and face	Store remote from water or moisture, oxidising materials, chlorine, bromine, iodine, acids, and alkalis	Smother with an excess of dry graphite. Dry sand may be used on small fires. Not advisable to use sand around machinery Do not use water, foam, carbon tetrachloride, or carbon dioxide	
Magnesium alloys (high percentage of magnesium)		In compact or bulk form (castings, plates, etc.) difficult to ignite. Readily combustible in form of dust, turnings, and hazardous in such form with chlorine, bromine, iodine, oxidising agents, acids, and alkalis	Protect eyes and skin from flying particles in case of fire	Store dust, shavings, and turnings in metal containers in detached building or fire-resistive room	Smother with an excess of dry graphite. Dry sand may be used on small fires. Not advisable to use sand around machinery. Do not use water, foam, carbon tetrachloride, or carbon dioxide	Detailed safety precautions for handling are usually supplied by manufacturers of magnesium alloys

TABLE OF COMMON HAZARDOUS CHEMICALS (*cont.*)

Name	Usual shipping container	Fire hazard	Life hazard	Storage	Fire fighting phases	Remarks
Magnesium nitrate	Wooden boxes	Oxidising material. Classes with sodium nitrate		See Sodium nitrate	See Sodium nitrate	
Muriatic acid — See Hydrochloric acid						
Naphthalene	Tins, barrels, and burlap bags	Gives off flammable vapours when heated. Flash point 80° C. (176°F.). Naphthalene dust forms explosive mixtures with air. Ignition temperature 559° C. (1038° F.)	Irritant. Slight narcotic effect on the skin. The hot vapours produce itching, pain, and eczema	Isolate; keep away from fire or heat	Water is the best extinguishing agent	Foam or water applied to molten naphthalene at temperatures over 110° C. (230° F.) will cause foaming
Nickel nitrate	Wooden kegs	Oxidising material. Classes with sodium nitrate	Poisonous when taken internally	Safeguard against mechanical injury		
Nitric acid	Carboys and glass bottles	May cause ignition when in contact with combustible materials; corrodes iron or steel; may cause explosion when in contact with hydrogen sulphide and certain other chemicals	Corrosive; causes severe burns by contact; deadly if inhaled	Safeguard against mechanical injury of containers; isolate from turpentine, combustible materials, carbides, metallic powders, fulminates, picrates or chlorates		
Nitraniline or nitro aniline	Wooden kegs	In presence of moisture causes nitration of organic materials and may result in spontaneous ignition	Poisonous	Store in dry place; safeguard against mechanical injury		
Nitro-chloro-benzine	Wooden kegs	Gives off flammable vapours when heated, which may form explosive mixtures with air	Serious under fire conditions	Isolate, preferably in the open; if inside should be in unheated compartment or building		
Phenol		When heated yields flammable vapours. Flash point 78° C. (172.4° F.)	Poisonous	Soluble in water. Never store with or above food products		
Phosphorus, red	Hermetically sealed tin cans inside of wooden boxes	Flammable. Explosive when mixed with oxidising materials	Yields toxic fumes when burning	Isolate from other chemicals; safeguard against mechanical injury of container	Flood with water, and when fire is extinguished cover with wet sand or dirt. Under certain conditions at high temperatures reverts to white phosphorus	Not as dangerous to handle as white phosphorus, and when afire, more readily extinguished
Phosphorus, white or yellow	Under water usually in hermetically sealed cans enclosed in other hermetically sealed cans with outside wooden boxes, or in drums or tank cars	Highly flammable. Explosive in contact with oxidising material. Ignites spontaneously on contact with air	Poisonous. Serious under fire conditions. Yields highly toxic fumes when burning. Contact of phosphorus with the skin causes severe burns	Isolate from chemicals. Store large quantities under water in underground iron or concrete tanks	Deluge with water until fire is extinguished and phosphorus solidified; then cover with wet sand or dirt.	
Phosphorus pentasulphide	Glass bottles and sealed drums	Slow-burning. Readily ignited by small flames. Ignition temperature about 287° C. (548.6° F.). Danger of spontaneous heating in presence of moisture	Reacts with water, evolving hydrogen sulphide. Products of combustion include sulphur dioxide and phosphorus pentoxide. Poisonous when taken internally	Store in sealed containers away from oxidising materials	Carbon dioxide is an effective extinguishing agent. Water is also effective but reacts with unburned material, forming hydrogen sulphide	Used in synthesis of organic chemicals. Has a peculiar odour and is very hygroscopic
Phosphorus sesquisulphide	Wooden boxes, iron drums, glass bottles	Highly flammable. Ignites by friction	Fumes in fire toxic	Isolate from chemicals. Safeguard container against shock		
Picric acid	Wooden kegs, boxes, bottles	Flammable, explosive. Oxidising material	Classes with high explosives in respect to life hazard	Isolate or store under water, keep away from other material, including metals, with which it forms sensitive and explosive picrates		
Potassium (metallic potassium)	Hermetically sealed steel drums, tin cans, and tank cars	Oxidises rapidly on exposure to atmosphere, igniting spontaneously if warm enough. Water is decomposed suddenly by contact with potassium, sufficient heat being generated to ignite spontaneously the evolved hydrogen (in the presence of air). Its reaction with water is more violent than that of sodium	Strong caustic reaction. Dangerous	Do not tier if it can be avoided. Keep away from water, avoiding sprinkler systems. Safeguard against mechanical injury of containers	Smother with an excess of dry graphite or dry sand. Do not use water. See "Remarks"	It is difficult to extinguish fires in large quantities of potassium

TABLE OF COMMON HAZARDOUS CHEMICALS (*cont.*)

Name	Usual shipping container	Fire hazard	Life hazard	Storage	Fire fighting phases	Remarks
Potassium chlorate	Wooden barrels or kegs	Oxidising material; explosive when in contact with combustible material	Dangerous under fire conditions	Isolate from combustible material, acids, and sulphur	Water is the best extinguishing agent	
Potassium cyanide	Tightly closed glass, earthenware, or metal containers; wooden boxes with inside metal containers, or with hermetically-sealed metal lining; metal barrels or drums	Cyanides not flammable but evolve hydrocyanic acid (see) on contact with acids or moisture	Highly poisonous when taken internally. Evolves hydrocyanic acid gas (poisonous) on contact with acids or moisture	Isolate. Safeguard containers against mechanical injury		
Potassium hydroxide	Wooden barrels, glass bottles	Generates heat on contact with water. Classes with calcium oxide (lime) in hazard		Store in dry place; keep remote from water or moisture		
Potassium nitrate	Bags, tins and glass bottles	In contact with organic materials causes violent combustion on ignition. Classes with sodium nitrate		Store in dry place, prevent contact with organic material	See Sodium nitrate	See Sodium nitrate
Potassium perchlorate	Paper-lined metal containers	Oxidising material. Combustible in contact with organic materials. More stable than chlorates. Explosive in contact with concentrated sulphuric acid		Store in dry place away from acids and combustible material	Use water to prevent the spread of fire	
Potassium permanganate	Tins	Oxidising material. Explosive when treated with sulphuric acid, and in contact with alcohol, ether, flammable gases, and combustible materials		Isolate from other chemicals, especially those noted under fire hazard		
Potassium peroxide	Tins and steel drums	Does not burn or explode *per se* but mixtures of potassium peroxide and combustible substances are explosive and ignite easily even by friction or on contact with a small amount of water Reacts vigorously with water and in large quantities this reaction may be explosive.	Strong caustic reaction and dangerous under fire conditions. Avoid breathing dust in handling, and wear goggles to protect eyes	Store remote from organic substances and water. Do not expose to sprinkler systems	Smother with dry sand, soda ash, or rock dust. Do not use water	
Potassium persulphate	Glass bottles and stone jars	Oxidising material. May cause explosion in a fire		Keep dry; safeguard against mechanical injury of containers		
Potassium sulphide	Iron drums, cans, glass bottles	Moderately flammable, yields flammable hydrogen sulphide on contact with mineral acids and sulphur dioxide when burning	Yields irritating and corrosive gases when burning	Safeguard against mechanical injury of containers		
Salicylic acid	Bottles, cartons, kegs and barrels	Combustible solid. Flash point 157° C. (315° F.). Ignition temperature 545° C. (1013° F.). Salicylic dust forms explosive mixtures with air		Store in dry place	Slightly soluble in water. Extinguish with water or smother with carbon dioxide or sand	Used in manufacture of aspirin, salol, and methyl salicylate; also in manufacture of azo dyes. Preservative. There have been explosions in sublimation chambers
Saltpetre — See Potassium nitrate						
Silver nitrate	Amber or black glass bottles	Oxidising material	Corrosive and poisonous	Store in dark place; keep cool and away from combustible material		
Silver picrate		High explosive (primary class)	Poisonous when taken internally	Explosives restrictions		Used in diluted form as an antiseptic and prophylactic
Soda, caustic — See Sodium hydroxide						
Sodium	Hermetically sealed steel drums, tin cans, and tank cars	Water is suddenly decomposed by contact with sodium with the evolution of hydrogen, which may ignite spontaneously (in the presence of air). Classes with potassium in respect to fire hazard but its reaction with water is less violent than that of potassium	Strong caustic reaction. Dangerous	Do not tier if it can be avoided. Keep away from water, avoiding sprinkler systems. Safeguard against mechanical injury of containers	Smother with an excess of dry graphite or dry sand Do not use water. See "Remarks"	It is difficult to extinguish fires in large quantities of sodium

TABLE OF COMMON HAZARDOUS CHEMICALS (*cont.*)

Name	Usual shipping container	Fire hazard	Life hazard	Storage	Fire fighting phases	Remarks
Sodium chlorate	Wooden barrels, glass bottles	Oxidising material. Classes with potassium chlorate. See Potassium chlorate	See Potassium chlorate	See Potassium chlorate	See Potassium chlorate	
Sodium chlorite ($NaClO_2$)	Wooden boxes with inside containers which must be glass or earthenware not over 2¼ lb. capacity, or metal not over 5 lb. capacity each	Strong oxidising material. Decomposes with evolution of heat at about 175° C. (347° F.). Explosive in contact with comustible material. See potassium chlorate. In contact with strong acid liberates chlorine dioxide, an extra hazardous gas	Poisonous when taken internally. Dangerous under fire conditions	Isolate from combustible material, sulphur, and acids	Soluble in water. Water is best extinguishing agent	Used in bleaching textiles and paper
Sodium cyanide — Cf. Potassium cyanide						
Sodium hydrosulphite	Wooden barrels, kegs, or boxes with inside glass bottles of capacity not exceeding 5 lb. each or metal containers	Combustible. Heats spontaneously in contact with moisture and air, and may ignite nearby combustible material		Store in dry place away from combustible materials	Smother with sand or foam	Bleaching agent for removing dyes
Sodium hydroxide	Iron drums	Classes with potassium hydroxide and calcium oxide		Isolate from heat and water. See calcium oxide and potassium hydroxide		
Sodium nitrate	Bags, tins and glass bottles	Oxidising material. Bags or barrels may become impregnated with nitrate, in which condition they are readily ignitable. In contact with organic or other readily oxidisable (combustible) substances will cause violent combustion on ignition		Store in dry place; prevent contact with organic or combustible material	Most fires involving sodium nitrate can safely be fought with water in the early stages; at such times it should be flooded with water. When large quantities are involved in the fire, the sodium nitrate may fuse or melt, in which condition application of water may result in extensive scattering of the molten material, and, therefore, care should be taken in applying water to the material after fire has been burning for some time	Fire hazard less if removed from bags and stored in non-combustible bins
Sodium perchlorate	Paper-lined metal containers	See Potassium perchlorate		See Potassium perchlorate	See Potassium perchlorate	Sodium perchlorate in anhydrous form is very hygroscopic and not used much in industry
Sodium peroxide — Cf. Potassium peroxide						
Sodium sulphide	Iron drums and bottles	Moderately flammable. Classes with potassium sulphide	See Potassium sulphide	See Potassium sulphide		
Strontium nitrate	Barrels and boxes	Oxidising material. Classes with sodium nitrate		Safeguard against mechanical injury; keep away from other materials	See Sodium nitrate	
Strontium oxalate	Metal cans	Slow-burning	Poisonous. Decomposes by heat, evolving carbon monoxide and carbon dioxide	Store in dry place away from oxidising materials	Water is a good extinguishing agent	Used in manufacture of pyrotechnics
Strontium peroxide (SrO_2)	Metal cans	Oxidising material. Hazards in class with barium peroxide		Store in dry place away from combustible materials	Smother with sand, ashes, or rock dust. Do not use water	
Sulphur	Sacks, boxes, barrels and box cars	Flammable. Dust or vapour forms explosive mixtures with air. Hazardous in contact with oxidising material	When burning forms sulphur dioxide, which in concentrations of 0.2% by volume in air may cause serious injury in ½ hour or less	Provide good ventilation. Isolate from chlorates, nitrates and other oxidising materials	Water in form of spray best extinguisher. Small fires may be smothered with sand or additional sulphur. (Sulphur dioxide does not support combustion.) Avoid use of pressure hose (solid) streams, and do not scatter sulphur dust	If spray nozzle is not available, water may be allowed to flow out of hose (without nozzle) on to a burning pool of sulphur, or saturated steam may be used. See N.F.P.A. Code for the Prevention of Sulphur Dust Explosions and Fires
Sulphuric acid	Carboys, iron drums, glass bottles and tank cars	May cause ignition by contact with combustible materials. Corrodes metal	Corrosive; dangerous fumes under fire conditions	Safeguard against mechanical injury, isolate from saltpetre, metallic powders, carbides, picrates, fulminates, chlorates and combustible materials	Smother with sand, ashes, or rock dust, but avoid water	

TABLE OF COMMON HAZARDOUS CHEMICALS (*concl.*)

Name	Usual shipping container	Fire hazard	Life hazard	Storage	Fire fighting phases	Remarks
Thorium nitrate	Wooden kegs	Oxidising material. Classes with sodium nitrate		Store in dry place, remote from water or moisture	See Sodium nitrate	
Uranium nitrate	Glass bottles, boxes	Oxidising material. Classes with sodium nitrate		See Sodium nitrate		
Vinyl ether	Glass bottles and metal cans	Highly volatile flammable liquid. Flash point below −22° F. Gives off even at comparatively low temperatures vapours which form flammable mixtures with air or oxygen. Explosive range 1.70% to 27.0% (upward propagation). Hazard in a class with ethyl ether	Anaesthetic	Isolate. Safeguard containers against mechanical injury Store in a cool, well ventilated storeroom	Lighter than water (sp. gr.0.774). Not soluble in water. Water may be used only to cool metal containers. Best extinguishing agents are carbon dioxide, sand, and carbon tetrachloride	Only electrical equipment of the explosion-proof type, Group C classification, permitted in atmospheres containing vinyl ether vapour in flammable proportions (Group C classification for vinyl ether tentative pending further tests.)
Zinc chlorate	Glass bottles, iron drums	When in contact with organic material explodes by slight friction, percussion or shock. Classes with potassium chlorate	Serious under fire conditions	Safeguard against mechanical injury; avoid tiering; isolate		
Zinc powder or dust	Cartons, wooden barrels, or steel drums	Hydrogen is evolved when commercial zinc is in contact with acids, sodium hydroxide, or potassium hydroxide. Hydrogen is also evolved by acid-forming combinations containing zinc, such as zinc chloride and moisture. Dust may form explosive mixtures with air. Zinc dust in bulk in a damp state may heat and ignite spontaneously on exposure to the air	Zinc is comparatively volatile at elevated temperatures. Under fire conditions precautions should be taken to avoid breathing fumes, which may cause metal fume fever	Store in dry, ventilated place away from water or moisture. Isolate from acids	Smother with sand, ashes, or rock dust. Do not use water	
Zirconium	Wooden kegs, glass bottles	Has comparatively low ignition temperature. Highly flammable in dry state. Burns with an intensely brilliant flame. Explosive in contact with oxidising agents. Powder very susceptible to ignition by static electricity, and explosion may be caused when dispersed into a cloud in air by the static charges generated		Store only in wet condition and in small quantities. Isolate from oxidising materials	Investigation of this phase not complete, but available data indicate fires can be controlled by foam or sand. Carbon tetrachloride, carbon dioxide, soda and acid extinguishers ineffective	Encountered in granular, finely-divided powder; also in form of small, friable, spongy lumps

SAFETY INSTITUTIONS, ASSOCIATIONS AND MUSEUMS

INTERNATIONAL

International Association of Industrial Accident Boards and Commissions

The 1945 Session of the Association, held at Winston-Salem, North Carolina in November 1945, was attended by delegates from 35 States of the United States, the District of Columbia and five Canadian provinces. The Chair was taken by Mr. Thurston A. Wilson, Chairman of the Industrial Commission of North Carolina, and President of the Association for 1944-45. Resolutions were adopted on various matters of workmen's compensation.

Mr. L. O. Arens of the Oregon Industrial Accident Commission, and Mr. Edgar C. Nelson, Chairman of the Workmen's Compensation Commission of Missouri, were elected President and Vice-President, respectively, for 1945-46. The Secretary-Treasurer of the Association is Mr. Verne A. Zimmer, Director, Division of Labor Standards, United States Department of Labor.[1]

The Committee on Safety and Safety Codes presented a report on the safety activities of insurance carriers in which it urged that all carriers should have definite safety programmes, and should actively participate in the organised safety work of employers. In this connection, it addressed the following recommendations to carriers:

1. Each service representative must be an advocate of safety who believes that accidents are caused and that they can be prevented. He should be familiar with the accident experience of the risks which he services, and he should stress the advantages of accident prevention in his discussions with employers and employees.

2. Safety departments should be informed of all injury circumstances and costs which could be used as arguments in favour of hazard control for accident prevention purposes.

3. Employers should be furnished periodically with tabulations of the injuries reported by them. This tabulation should stress the factors responsible for each injury. This is important for, irrespective of their cost, the factors responsible for the injuries must be known in order to devise means of controlling the hazard involved.

4. Good safety bulletins, shop posters and other safety literature should be provided to the insured in quantities sufficient for the needs of their safety programme.

5. Safety bulletins should be sent out regularly and in sufficient amount to provide at least a new bulletin for each bulletin board each week.

6. Slogans, bulletins, contests procedure, etc., developed by an insurance carrier, and also its publications and films dealing with accident prevention, should be exchanged freely with all other carriers, with the privilege granted to other carriers to use or republish such material.

7. All workmen's compensation insurance carriers should avail themselves of every opportunity to inform the general public as well as insured and their employees how to recognise hazards, and how to remove or avoid them. Excellent mediums for this purpose are schools and universities having manual training and domestic science courses, and public forums or other gatherings at which home, farm, industrial or civic problems are discussed.

8. Both employers and employees should be convinced that safe practice is an integral part of efficient operation and cannot be separated from work procedure.

9. The efficiency and safety advantages to be gained through properly conducted job analyses and job training programmes should be stressed to small operators as well as large ones. Reconversion will entail many changes in work procedure which will necessitate the training of new employees and the retraining of returning war veterans and older employees.[1]

[1] *ABC Reporter*, Dec. 1945, p. 1.

CHILE

Industrial Hygiene "Days"[2]

In December 1945 the Chilean National Health Service, in collaboration with other federal and private institutions organised several "Industrial Hygiene, Safety and Industrial Medicine Days". The object was to analyse the various problems relating to industrial environment and the prevention of occupational diseases and industrial accidents, and at the same time to emphasise the importance of these problems to national economy.

During the course of these "Days", which met with great success, numerous papers were read. There was also an exhibition of photographs, statistical tables, and various modern equipment used for the prevention of occupational disease and industrial accidents.

[1] *California Safety News*, Mar. 1946, p. 6.
[2] Information communicated to the I.L.O.

In closing the "Days" it was decided to establish a scientific association which would be charged with the study and publication of material on all industrial hygiene problems.

UNITED STATES OF AMERICA

"Occupational Medicine"

A New Monthly Publication of the American Medical Association

The American Medical Association, which for some time has been concerning itself with matters of industrial hygiene, is now issuing this magazine with the object of informing all doctors of the results of various studies and investigations undertaken to solve the numerous problems of industrial medicine.

The contents of the first number of the new review show that its field of action will embrace all the various problems related to the prevention of disease and the care of the health of millions of people. We are certain, therefore, that this publication will be of great use to the medical profession since the conditions of work in industrial undertakings definitely affect the health of a large part of the population of a country.

We extend our best wishes to the American Medical Association for the success of this publication.

LAWS AND REGULATIONS, SAFETY CODES

INTERNATIONAL

Ratification of the Dockers Convention by Canada

The Convention (No. 32) concerning the protection against accidents of workers employed in loading or unloading ships (revised 1932) has been ratified by the Government of Canada. Regulations to give effect to the Convention in Canada were approved by an Order in Council under the Canada Shipping Act in 1938 and amended in 1943.

The Convention has now been ratified by Canada, Chile, China, Italy, Mexico, New Zealand, Spain, Sweden, United Kingdom and Uruguay.

CANADA

Alberta

Regulations under the Coal Mines Regulation Act, 1945. Dated 27 August 1945[1]

An Order in Council of 27 August 1945 issued the following regulations and rules:

Regulations made pursuant to the Coal Mines Regulation Act.

Regulations covering care and use of explosives, made pursuant to section 175 of the Coal Mines Regulation Act.

Regulations covering electrical installations and appliances in coal mines.

Regulations in connection with rock-dusting.

The first-mentioned regulations deal with various matters such as ventilation, precautions against fire and explosion, wash houses, first-aid kits, storage of carbide and signalling.

The explosives regulations deal with magazines, the handling and keeping of explosives underground and shotfiring.

The electrical regulations contain general provisions, provisions relating to the housing of electrical equipment, insulation, earthing, switch-gear, cables, qualifications and duties of personnel, precautions against firedamp and coal dust, electric relighters, etc.

The rock-dusting regulations apply to all coal mines unless written exemption is granted by the District Inspector.

[1] *The Alberta Gazette*, 31 Aug. 1945, p. 937.

British Columbia

Accident Prevention Regulations. Effective 1 November 1945[1]

There are 24 parts to these Regulations, as follows: General, Supervision, Accident-Pre-

[1] Published by the Workmen's Compensation Board, 411 Dunsmuir St., Vancouver.

vention Committees, First Aid, Ladders and Stairways, Machinery, Cranes and Derricks, Rigging, Electrical, Welding and Burning, Explosives, Construction, Saws, Woodworking, Sawmills, Shingle-Mills, Logging, Punch-Presses, Foundries, Laundries, Painting, Window-cleaning, Refrigeration, and Storage-Batteries.

The general part includes regulations dealing with guards, safety of premises, bins and hoppers, tanks and vessels, lighting, ventilation, protective equipment, clothing, tools, handling material, vehicles, transportation of workers, supervision, and accident-prevention committees.

Section 6 lays down that when new machines are being purchased, specifications shall, if possible, require them to be equipped by the manufacturer or dealer with suitable guards.

Under Section 53, safety hats must be worn in all occupations in which there is a recognised hazard from falling objects.

Very few countries have regulations about hand tools. In the present regulations they are dealt with in the two following sections:

59. Hammers, chisels, punches, flatners, hardies, fullers, drills, and other similar tools shall not be used if they have burrs or mushroomed heads. Such tools shall be properly tempered.

60. Handles shall be of sound material, kept smooth, and securely fastened to tool-heads.

Section 91 on supervision reads:

91. Superintendents, foremen, and other key men shall be carefully chosen and qualified by experience to supervise the safe performance of the activities under their direction. Such supervisors shall be responsible for seeing that workmen are properly instructed in their duties and that workmen observe and obey all rules and regulations necessary for the safe conduct of the work.

Under Section 95 the management of every operation in which 25 or more workmen are employed must maintain an accident-prevention committee consisting of not more than 12 and not less than four members. The members are to be designated in equal numbers by the workmen and the employer. The duties of the Committee are set out in much detail in Section 96.

Detailed rules relating to the construction, maintenance and use of ladders are laid down in Sections 101-123.

The following are the regulations relating to conveyors:

195. Elevated conveyors that cross over thoroughfares shall have side-walls of sufficient height to prevent material falling at such points.

196. The nip points of belt conveyors shall be guarded when exposed to contact.

197. Where workmen may pass under return strands of conveyors, a shallow trough shall be provided of sufficient strength to carry the weight resulting from a broken chain.

198. Screw or worm feeding or conveying devices shall be guarded against accidental contact. The hands shall not be used for feeding such equipment but a suitable plunger shall be provided for that purpose.

199. Where parts of conveyors or other equipment are located over burners, workmen shall use safety lines when servicing such equipment and shall be accompanied by another workman.

There are numerous rules concerning pile drivers in Sections 276-295.

The following is the text of the part relating to foundries:

Ventilation

1000. Where smoke, steam, gases, or dust arising from any of the operations in the foundry are injurious to health or eyes and where a natural circulation of air does not carry off such smoke, steam, gases, or dust, there shall be installed and operated hoods, ventilators, fans, or other means of ventilation of sufficient capacity to reduce such impurities in the air to not more than the recognised maximum concentration for the impurities involved.

1001. Where tumbler mills are used, exhaust systems shall be installed to effectively carry off the dust arising from the cleaning of castings. This does not prohibit the use of a water barrel for the purpose of cleaning castings.

1002. No cores shall be blown out of castings with air unless such work is done in the open air or in a ventilated dust-proof enclosure provided for that purpose.

Inspection of Equipment

1003. All ladles, shanks, crucibles, crucible-shanks, crucible-tongs, yokes, skimmers, slaghoes, chains and cable slings, ropes and slings used in handling heavy moulds and castings or pouring of molten metal shall be inspected daily prior to their use by the workman using them in regard to their safe condition.

1004. Equipment found upon inspection to be defective shall not be used while in that condition.

Protective Equipment

1005. When the eyes of workmen are liable to injury by dust, flying chips, or molten metal, they shall wear suitable safety-goggles which shall be provided by the employer.

1006. Workmen engaged in cleaning castings with air or sand or abrasive blasting shall wear adequate positive pressure respirators, hoods, or helmets adapted to the work to be done. Gauntlets and aprons shall also be worn, when necessary for protection of the workmen engaged in such work.

1007. Moulders' shoes, or shoes with tops that cover the ankles, shall be worn by all workmen working in the vicinity of molten metal.

Equipment

1008. Bottom-poured ladles and all other types that are suspended by bails shall have daily inspection of bails and trunnions.

1009. All lip-pouring ladles handled by crane or trolley shall be equipped with a worm gear or other self-locking device. All ladles of two thousand pounds (2,000 lbs.) capacity or more shall be equipped with worm gear.

1010. All crane, truck, and trolley pouring ladles shall be equipped with a dog to prevent premature overturning and shall be so constructed that when they are full of metal the centre of gravity shall be below the centre of the trunnion, unless each ladle is equipped with a gear mechanism and a latch, either of which will prevent premature overturning of the ladle.

1011. All slings used to suspend flasks from jib-crane beams shall either be so designed that there are safe clearances for a hand grip, or handles shall be provided to hold the sling.

1012. The use of high explosives for breaking scrap shall not be permitted, except with written permission of the Board.

1013. The breaking of castings or scrap by the use of a drop-weight inside the foundry during the regular working hours is prohibited.

1014. Where a drop-weight is used for the breaking of castings or scrap outside of the foundry, a permanent shield of four-inch (4-in.) planking or equivalent protection shall be provided. Such shield shall be at least eight feet (8 ft.) high to protect workmen in the vicinity from injury by flying fragments of metal.

1015. Foundry materials and equipment shall be placed in a stable, orderly way, on level and substantial foundations, and arranged in order as to size and type.

1016. Where castings are cleaned or chipped in moulding or casting rooms, there shall be provided suitable screens, partitions, or other effective means to protect workmen against flying chips and excessive dust. All castings shall, wherever practicable, be cleaned or chipped in rooms separated from rooms used for other purposes.

1017. Where finishing rails or benches are used, they shall be sufficiently far apart to allow the operators to pass between them without being endangered by falling castings.

1018. Galleries where molten metal is poured into moulds shall be provided with solid leak-proof floors and partitions of molten-metal resistive material. The partitions shall be not less than three feet six inches (3 ft. 6 ins.) high and installed on the open side of such gallery.

Manitoba

Regulations under the Mines Act. Manitoba Regulation 57. Dated 12 December 1945[1]

The regulations are divided into 21 sections, of which the most voluminous is Section 14, comprising 336 rules for the protection of miners. These rules deal, *inter alia*, with ventilation, sanitation, fire protection, first aid, protection against water, explosives and shotfiring, protection in working places, shafts, winzes, raises, etc., shaft equipment, winding of men and material, signals, haulage, protection of machinery, mills and metallurgical works, cranes, elevators and hoistways, and electricity.

Rule 35 requires every mine producing over 100 tons of ore per day, and such other mines as the inspector may specify, to be equipped with apparatus for the introduction of ethyl mercaptan or other approved warning gas or material.

Rule 98 requires every person employed underground to wear a protective hat.

The matters dealt with in the other sections of the regulations include the fencing of abandoned workings, qualifications of hoisting-engine operators and shotfirers, mine rules, responsibilities of managers, and reporting of accidents.

Rules and Regulations respecting Elevators and Hoists. Manitoba Regulation 62. Dated 13 December 1945[1]

The six sections into which these regulations are divided deal with general matters, passenger elevators, power-driven freight elevators, hand-power freight elevators, hand-power dumb waiters, and power-driven dumb waiters. There are 103 rules in all.

GREAT BRITAIN

The Coal Mines (Training) General Regulations, 1945. Dated 28 September 1945[2]

These regulations, which embody recommendations put forward by a Committee on the Recruitment of Juveniles in the Coal Mining Industry, replace the training regulations introduced during the war and deal comprehensively with the whole problem of training coal miners.

They specify the classes of miners who must undergo training, indicate the nature of the training, provide for the organisation of training schemes and prescribe the duties of training officers.

The provisions dealing with the classes of miners to be trained and the nature of the training include the following:

1. No person shall be employed in or about a mine on any work on which he has not been employed before the coming into force of these regulations, except under competent instruction and supervision, unless and until he

[1] *The Manitoba Gazette*, 22 Dec. 1945, p. 294.

[1] *Ibid.*, p. 367.

[2] *Statutory Rules and Orders*, 1945, No. 1,217.

has been adequately trained and is competent to do the work without supervision.

2. Without prejudice to the generality of the provisions of the preceding regulation, no person who has not been employed on work below ground in a mine to which the provisions of either the Coal Mines Act, 1911, or the Metalliferous Mines Regulation Act, 1872, apply, shall be employed in a coal mine on work below ground until:

(*a*) Such person has been employed about a coal mine on work above ground for at least such period as is necessary to enable him to receive training as mentioned in the next following regulation;

(*b*) Such person has received such training during the period immediately preceding, as near as may be, the day on which he is first employed on work in a coal mine below ground; and

(*c*) There has been issued by a training officer appointed under these regulations a certificate (in the prescribed form) that such person has duly received such training.

3. Except as otherwise provided in a scheme approved by the Minister in pursuance of Regulation 10 of these regulations or in an exemption granted by the Minister in pursuance of Regulation 16 of these regulations:

(i) The training referred to in the preceding regulation shall comprise adequate instruction in safe and efficient methods of work below ground and suitable physical training, given under and in accordance with a scheme approved by the Minister as aforesaid;

(ii) All such training as aforesaid shall be given in the course of the normal working hours (excluding overtime) during which the person being trained can lawfully be employed in or about a mine;

(iii) At least two hundred and sixty-four hours shall be spent in such training as aforesaid, of which at least one hundred and thirty-two hours shall be spent in practical instruction in and demonstrations of mining operations and at least one hundred and thirty two hours in attending classes in subjects relating to mining operations and other subjects of educational value and in physical training.

At least sixty-six hours of the time spent in practical instruction in and demonstrations of mining operations as aforesaid shall be spent in such instruction and demonstrations below ground in a suitable part of a mine; such instruction shall be given only at a place specified for the purpose in the relevant scheme approved by the Minister as aforesaid;

. . . . . .

(iv) In the case of any person who has not attained the age of sixteen and a half years on the day on which he first receives any training as required by these regulations, the training shall be spread as evenly as is practicable over a period of six months.

4. (1) Without prejudice to the generality of the provisions of Regulation 1 of these regulations, no person who has not been employed on work at the coal face shall be employed, otherwise than at a training face, on such work until:

(*a*) Such person has been employed for at least eighty working days on work below ground in a coal mine;

(*b*) Such person has spent at least sixty working days (whether or not part of such eighty working days as aforesaid) under the close personal supervision of an instructor or supervising workman in training (which shall comprise adequate instruction and practical training) at a training face in performing safely and efficiently one or more of the following operations, that is to say:

(i) The getting of coal, including the filling or loading of coal for removal from the coal face;

(ii) The building of packs or the withdrawal of supports from the waste, or, in a case in which packs are built and supports withdrawn from the waste in the mine in which such person is to be so employed, the building of packs and the withdrawal of supports from the waste;

(iii) The ripping of the roof or floor, including the building of roadside packs in a case in which such packs are built in the mine in which such person is to be so employed;

(iv) The shifting of mechanical conveyors and gate-end loaders;

(v) The use of machines for cutting coal or for getting and loading coal;

provided that in a case in which a person is receiving such training in more than one of such operations the said minimum period of sixty working days shall be increased by twenty working days for each of such additional operations; and

(*c*) There has been issued by a training officer appointed under these regulations a certificate (in the prescribed form) that such person has duly received such training as aforesaid and is competent to be employed at the coal face.

. . . . . .

(2) Every person receiving training shall be given adequate instruction in the use of all tools, appliances and materials necessary for performing safely and efficiently the operation in which training is being given and in the methods of safely and efficiently performing the operation in respect of which he is receiving training.

(3) References in this regulation to any operation shall be construed as including references to all such subsidiary and incidental work as is normally carried out in connection therewith in the mine in which the person is to be employed as aforesaid.

The training scheme for each mine must be submitted for approval to the Minister after consultation with the local education authorities. Every scheme must specify detailed particulars of:

(*a*) The subject matter of and the time to be allocated to the class work, the practical instruction and the physical training required to be given in pursuance of the regulations before a person is employed in a mine on work below ground;

(*b*) Where and at what times each kind of training is to be given, and the nature of the accommodation and equipment to be provided;

(c) The nature of the arrangements to be made which will secure adequate correlation between the class work and the practical training; and

(d) The arrangements for training persons for work at the coal face.

All mine managements must appoint training officers, who must be full-time officers in mines employing more than 1,000 persons.

Regulation 5 provides that persons employed below ground for the first time shall be given at least 20 days' close personal supervision of an instructor or supervising workman, if not employed at the face, and 40 days' such supervision if employed at the face.

The duties of training officers include:

(a) Superintending the training and supervision carried out in pursuance of the regulations on the premises of the undertaking or at the mine or mines for which he has been appointed;

(b) Keeping records of the training given to every person in pursuance of Regulations 3 and 4 and making weekly reports to the manager of the mine at which such person is employed on the progress of every such person during training;

(c) Keeping records of the supervision given to every person in pursuance of Regulation 5 and making weekly reports to the manager of the mine at which such person is employed on the progress of every such person during supervision;

(d) Making recommendations to the manager of the mine as to the training of any person employed in or about the mine for employment on work of which he has had no experience;

(e) Making to the manager of the mine quarterly reports in writing on the progress of every person employed in the mine on work below ground, whether at the coal face or not, who has not had eighteen months' experience of work below ground in coal mines until he has had such experience for eighteen months;

(f) Supervising the personal welfare, while they are at work, of persons employed in or about the mine who have had less than six months' employment in or about a mine.

PALESTINE

Employment of Women Ordinance. Dated 10 July 1945[1]

The Ordinance empowers the High Commissioner in Council to make rules:

(a) Declaring which trades or occupations are dangerous trades or occupations for the purposes of the Ordinance;

(b) Prescribing the conditions under which women may be employed in any undertaking;

(c) Imposing obligations upon persons when employing women in any undertaking;

(d) Exempting any undertaking from all or any of the provisions of the Ordinance;

(e) Providing for the registration of industrial undertakings in which women are employed.

Annexed to the Ordinance are the Employment of Women Rules, 1945, which contain lists of trades and occupations prohibited to women either absolutely or subject to conditions prescribed by the Director of the Department of Labour.

Employment of Children and Young Persons Ordinance. Dated 10 July 1945[1]

Under this Ordinance the High Commissioner in Council is empowered to make rules:

(a) Declaring which trades or occupations are dangerous trades or occupations for the purposes of the Ordinance;

(b) Prescribing the ages under which children or young persons are not to be employed in any particular trade or occupation;

(c) Prescribing the conditions under which children or young persons may be employed in any undertaking;

(d) Imposing obligations upon persons when employing children or young persons in any undertaking;

(e) Exempting any undertaking from all or any of the provisions of the Ordinance;

(f) Providing for the registration of industrial undertakings in which children or young persons are employed.

If an inspector is of the opinion that the employment of any child or young person in any undertaking, process or kind of work is prejudicial to the health of such child or young person, or to the health of any other person, he may require the employer to discontinue such employment, and employment may not then be resumed until the child or young person has been examined and certified fit for it by a Government medical officer.

The Ordinance is accompanied by the Employment of Children and Young Persons Rules, 1945, which deal in detail with conditions of employment.

They include lists of trades and occupations prohibited respectively to children or young persons, children, and female children or female young persons.

[1] No. 20 of 1945. *Palestine Gazette Extraordinary*, No. 1423, 11 July 1945. *Supplement No. 1*, p. 101.

[1] No. 19 of 1945. *Palestine Gazette Extraordinary*, No. 1423, 11 July 1945. *Supplement No. 1*, p. 87.

UNITED STATES OF AMERICA

American Standard Method of Compiling Industrial Injury Rates. Z16.1 - 1945. Approved 11 October 1945

The new standard is the revised version of one dating from 1937. It defines industrial injuries generally, fatal injuries, permanent total disability, permanent partial disability, temporary total disability, temporary partial disability and medical treatment cases. Rules are laid down for the measurement of time charges for each of these classes of injury, for the measurement of exposure to risk, and for the calculation of frequency and severity rates.

OFFICIAL REPORTS, ETC.

FINLAND

Industrial Accidents in 1942[1]

The total number of man-years worked in insured undertakings was 553,203 and the total number of accidents giving rise to compensation exceeding 200 marks was 36,094, of which 723 were permanent disablement cases and 238 were fatal.

In 19.1 per cent. of the cases, lost time did not exceed one week; in 27.3 per cent., it was 1-2 weeks; in 26.9 per cent., 2-4 weeks; in 19.6 per cent., 4-13 weeks; in 2 per cent., 13-26 weeks; and in 5.1 per cent., over 26 weeks.

Information concerning the principal causes of accidents is given in table I.

TABLE I

Cause	Accidents				Days lost per accident
	Temporary disablement	Permanent disablement	Fatal	Total	
Working machines...	5,341	263	15	5,619	113
Hoists, cranes, etc...	1,245	52	33	1,330	249
Transport.....	5,092	80	74	5,246	137
Stumbling, falling....	3,703	46	30	3,779	91
Falling objects.....	1,837	17	9	1,863	63
Handling objects....	6,603	58	2	6,663	28
Hand tools.....	4,894	95	1	4,990	41

The distribution of accidents among the industries with the largest accident totals is shown in table II.

[1] *Sosiaalinen Aikakauskirja*, No. 9-10, 1945, p. 346.

TABLE II

Industry	Accidents					Days lost per man-year
	Temporary disablement	Permanent disablement	Fatal	Total	Per 1,000 man-years	
Machine shops...	3,869	59	19	3,947	100.4	6.7
Woodworking....	4,809	135	32	4,976	148.4	14.3
Construction....	4,118	79	32	4,229	98.2	9.6
Agriculture and subsidiary industries; fisheries...	6,087	152	27	6,266	54.2	4.9
Lumbering, timber floating.....	3,067	32	14	3,113	92.2	5.7
Transport; loading and unloading.....	2,827	53	42	2,922	98.3	13.6
All industries.....	35,133	723	238	36,094	65.2	5.9

The numbers of accidents per 1,000 man-years were highest in the extraction and dressing of minerals (253.7) and woodworking (148.4); and the numbers of days lost per man-year were highest in the extraction and dressing of minerals (32.2) and chemicals (17.8).

GREAT BRITAIN

Interim Report of the Committee on Road Safety[1]

This Committee was appointed by the Ministry of War Transport "to consider and frame such plans as are possible for reducing accidents on the roads and for securing improvements in the conduct of road users in the interests of safety; and to review the recommendations of

[1] Ministry of War Transport, H.M. Stationery Office, London, Dec. 1944.

the Select Committee of the House of Lords on the Prevention of Road Accidents and to advise on those which should be adopted as measures of post-war policy for the reduction of accidents".

The Committee has produced an informative report divided into a general section and three sections dealing with the education of road users, improvement of roads and traffic in order to reduce the number of accidents, and the design and maintenance of vehicles.

It emphasises that propaganda cannot be divorced from other road safety measures and that it should be considered as an integral part of a comprehensive plan for the promotion of safety of road users. It also points out that in the early post-war period, conditions generally will present certain abnormal sources of danger, the more obvious of which are mentioned under the following heads:

(*a*) Increased volume of motor traffic to which road users will be unaccustomed.
(*b*) Carelessness of road users.
(*c*) Inadequacy of street lighting.
(*d*) Bad driving due to lack of practice and to sense of immunity acquired by drivers under wartime conditions.
(*e*) Poor roadworthiness of vehicles arising out of the lower standard of maintenance during the war and the fact that many vehicles have been laid up for a considerable time without adequate attention.
(*f*) Inadequacy of parental supervision of children.
(*g*) Time lag in the removal of wartime obstacles, *e.g.*, air-raid surface shelters.
(*h*) Time lag in the introduction of physical safety measures.

The Committee's main recommendations include the following:

Propaganda must be persistent and continuous, and directed to all types and ages of road users.

Early post-war propaganda, although possibly different in character, should form part of a long-term campaign.

The Highway Code should be the basis of all propaganda.

The Highway Code should be revised.

Local safety organisations, if not already existing, should be set up in all local authority areas.

The police should be represented on the local safety organisations.

The Royal Society for the Prevention of Accidents should play an important part in the organisation of post-war propaganda.

The support of the press and the B.B.C. should be sought.

Local authorities should be informed of the detailed plans, how they can help, and how they will be assisted.

Statistics and intelligence reports should be used in planning propaganda.

Measures for child safety are required on an extensive scale.

A universal speed limit should not be imposed.

The 30 m.p.h. speed limit should be applied with discretion.

A more restrictive speed limit should not be introduced in the early post-war period.

Driving tests for applicants suffering from diseases or physical disabilities should be reintroduced immediately.

Material used for training driving examiners and mobile police patrols should be made available to driving schools.

Driving tests should be made more searching.

Control of the return of traffic to the roads should be effected by means of a basic ration of petrol for private motoring for a short period.

Cyclists should be required to report accidents in which they are involved.

Vigorous action should be taken to remedy bad or inadequate road conditions.

Those responsible for the planning of roads and their lay-out, and for town and country planning, should have regard to the principles of segregation of traffic and classes of traffic.

The lay-out and construction of roads should be improved in accordance with the principle suggested.

Traffic signs and signals should be improved.

The wartime prohibition on standing vehicles facing the "wrong" way at night should be continued in non-built up areas.

The parking of vehicles in busy streets should be prohibited.

Parking spaces should be provided at places of public resort.

Obstructions on the highway should be removed as quickly as possible.

Street lighting should be improved and standardised and the function controlled by one central department.

Accident investigation and review should be

undertaken by the police and the engineers of the department and highway authorities.

Every police force should have a traffic department manned by specially trained officers.

The Committee on Road Safety should be retained as a permanent feature of the Ministry of War Transport's organisation.

Motor vehicle testing stations should be set up.

The powers and arrangements in relation to the testing of vehicles on the highway should be strengthened.

There should be intensive research with regard to vehicle lights and the prevention of dazzle.

Vehicles, other than pedal cycles and solo motor cycles, should carry two red rear lights and a reflector.

Pedal cycles should have two efficient brakes.

Cyclists should be compelled to carry bells on their machines.

Pedal cycles should carry a red rear light at night in addition to a red rear reflector and a white patch.

Pedal cycles should be required to conform to a standard of fitness.

Jute Industry Advisory Committee

Interim Report on the Spacing of Machinery in Jute Factories

A Joint Advisory Committee was appointed at the end of 1944 by the Factory Department to consider practical methods of improving conditions of employment in the jute industry. The members were representatives of the Department, employers and operatives.

The present report covers spinning (including preparatory processes), weaving, finishing and making-up, and deals separately with new and existing factories.

The Committee's recommendations on machine spacing are as follows:

It is recommended that *in the Preparing Department, the clearance spaces between machines should wherever possible, be not less than those specified in paragraph 3* (a) - (f).

In departments subsequent to Preparing, the spaces between machines should be not less than those specified in (g) *to* (j) *below.*

(*a*) *Batching house.* Working space in this department is broadly satisfactory and we make no recommendation.

(*b*) *Barrow storage.* The passage for moving of barrows to or from storage should have a clear width of 6 feet. As it is the normal practice to have only one squad moving barrows we do not consider the separate incoming and outgoing passages are necessary. Where in existing factories a clear width of 6 feet cannot be secured spaces should be left between the barrows in the storage area in which a worker can stand whilst a barrow is passing.

(*c*) *Breaker cards.* On the feed side there should be a clear working space of 5 feet between the outer end of the feed band and the nearest wall or other fixed object. In the case where two cards are arranged back to back the clear space between the feed bands should be 7 feet 6 inches. These spacings are intended to accommodate the operator and the dollop table; if barrows are to be brought into the space it should be increased accordingly.

In considering spacing on the delivery side of the breaker cards, we have taken account of the current trend towards the introduction of roll formers producing rolls up to 4 feet in diameter. The clear space between the peripheries of the rolls at their maximum size or between the breaker cans and the finisher card feed should be 4 feet. In the case of cards set back to back the spacing between rolls should be 8 feet or between breaker cans 6 feet.

When cards are arranged in rows there should not be more than four cards together without a passage at least 6 feet 6 inches wide through the row, measured between the outer edge of the driving belts and the side gear wheel guards.

(*d*) *Finisher cards.* The space between adjacent machines on the delivery side should be not less than 2 feet 6 inches measured between the breaker cans or from the periphery of the roll to the nearest point on the next machine as the case may be. In determining this figure we have assumed that the empty cans will be returned through the space under the driving belt. If they are returned within the clear passage its width should be increased by an amount equal to the width of the can.

(*e*) *Drawing frames.* There should be a clear space of 2 feet 6 inches between the back of the finisher cards and the first drawing frames and between the first and second drawing frames. In assessing this clearance cans feeding or receiving from the frame should be regarded as part of the machine and the measurement made from can to can, or where rolls are used, between the periphery of the rolls.

(*f*) *Roving frames.* Additional space is desirable at the roving frames and we consider that the clear space at the feed side of each frame should be at least four feet, cans actually in use being again regarded as part of the machine. The space between frames on the delivery side should be at least 5 feet. If barrows or conveyors are brought into the working space between the delivery sides the space should be increased by the width of the barrow or conveyor.

(*g*) *Spinning frames.* The clear working space between each pair of spinning frames should in no case be less than 4 feet 6 inches, assuming that no barrow enters the space, but this minimum should be increased where local conditions make an increase possible, as provided for in the preamble to this paragraph. If barrows or conveyors are brought into the working space between the frames the space should be increased by the width of the barrow or conveyor.

(*h*) *Winding frames.* The working space inclusive of bobbin and spool or cop boxes should be at least 6 feet.

(*j*) *Beam storage.* Adequate space should be provided at or near the dressing machines for the storage of empty

and full yarn beams. These beams should not be allowed to encroach on the passages or working space. The use of beam racks ensures the orderly storage of beams and we would advise their wider adoption.

(*k*) *Looms.* Spacing between the backs of looms: three cases have been considered —

(1) where the beam is carried to the loom on an overhead runway the clear space between the flanges of beams in successive rows of looms should be 18 inches;

(2) where the beam is carried on a bogie between the backs of one or more pairs of looms before it reaches the loom for which it is intended the clear space between the flanges of beams in successive rows should be the diameter of the flange of the largest beam in use in these rows plus 6 inches;

(3) where the beam is carried on a bogie directly from the broad passage to the loom for which it is intended without passing between the beams of other looms the clear space between the flanges of beams in successive rows should be 18 inches.

We regard the transport of beams by hand along the line of looms as undesirable, and also suggest that runways should, wherever possible, be installed.

Spacing between looms on operating side: the space between the breast beams should not be less than 3 feet.

(*l*) *Passages.* We recommend that *passageways used for the movement of persons or goods and not forming part of the working spaces at the machines should have a clear width between fixed objects not less than that specified below:*

(1) Passage used only by persons and not for the transport of goods — 2 feet.

(2) Passage used for handling materials in cans, skips, barrows, bags, etc. — twice the width of the loaded carrier or container used, plus 6 inches.

(3) Passage used for handling materials by overhead runway or belt conveyor — the width of the loaded carrier or other object suspended from the runway plus 2 feet, or the over-all width of the conveyor mounting plus 2 feet.

The Committee also considered the question of weight lifting, particularly by women and young persons. On this subject the limits shown in the following table were recommended:

Person 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
	lbs.	lbs.
(*a*) Woman of 18 years of age and over.....	65	50
(*b*) Male young person over 16 and under 18 years of age.....	65	50
(*c*) Female young person over 16 and under 18 years of age.....	50	40
(*d*) Young person under 16 years of age.....	40	35

Interim Report of the Joint Advisory Committee of the Cotton Industry on Mule Spinners' Cancer and Automatic Wiping-Down Motions

The matters considered by the Committee are the types of lubricating oils to be used on spinning mules, the methods of lubrication to be used with a view to preventing splashing of oil, medical examination of persons engaged in spinning, and wiping or drying devices. Appended to the Committee's report is a specification for "least-carcinogenic mineral oils for lubricating mule spindles".

SWEDEN

Industrial Accidents, 1942[1]

The total number of full-time workers (man-years) in insured occupations in 1942 was 1,937,274, made up as follows: large undertakings, 1,310,039 (men 931,180, women 378,859); small undertakings, 412,873 (men 190,303, women 222,570); State undertakings, 214,362 (men 161,645, women 52,717).

The total number of accidents reported was 217,820, of which 167,152 occurred in large undertakings (150,163 to men, 16,989 to women); 31,787 in small undertakings (25,521 to men, 6,266 to women); and 18,881 in State undertakings (17,516 to men, 1,365 to women).

In large undertakings there were 2,089 accidents resulting in permanent disability (1,926 men, 163 women), and 583 fatal accidents (562 men, 21 women); in small undertakings there were 850 accidents resulting in permanent disability (699 men, 151 women), and 79 fatal accidents (70 men, 9 women); and in State undertakings there were 244 accidents resulting in permanent disability (222 men, 22 women), and 73 fatal accidents (73 men). In all, therefore, there were 3,183 permanent disability cases (2,847 men, 336 women), and 735 fatal accidents (705 men, 30 women).

Among large employers, excluding the State, absence from work was not more than one week in 39.5 per cent. of the accidents, between one and two weeks in 26.5 per cent., between two and three weeks in 13.3 per cent., between three and four weeks in 7.2 per cent., between four and five weeks in 4.1 per cent., and over five weeks in 9.4 per cent.

[1] Riksförsäkringsanstalten: *Olycksfall i arbete år 1942*, Stockholm, 1945.

In all undertakings (except State undertakings) 1,218 of the men injured and 192 of the women were under 15; 22,972 of the men and 4,947 of the women were aged 15-19; 5,389 of the men and 411 of the women were aged 60-64; 2,892 of the men and 200 of the women were aged 65-69; and 1,204 of the men and 110 of the women were aged 70 and over.

The age groups most productive of accidents were 15-19, 27,919 (22,972 men, 4,947 women); 20-24, 29,356 (24,168 men, 5,188 women); 25-29, 30,650 (27,572 men, 3,078 women); and 30-34, 27,010 (24,726 men, 2,284 women).

The percentage of disability cases in the accident totals for the various age groups is shown in table I.

TABLE I

Age group	Men	Women	Total
Under 15	1.1	0.5	1.1
15–19	0.6	0.4	0.6
20–24	0.9	0.4	0.8
25–29	1.0	1.0	1.0
30–34	1.1	0.8	1.1
35–39	1.5	1.2	1.4
40–44	1.7	2.1	1.7
45–49	2.0	1.7	2.0
50–54	2.3	2.9	2.4
55–59	3.2	5.5	3.4
60–64	4.0	6.6	4.2
65–69	6.0	11.0	6.3
70 and over	6.6	21.8	7.8
Total	1.5	1.4	1.5

Table II gives figures for the industries with the largest numbers of accidents (large undertakings only).

Table III gives information on the principal causes of accidents.

Of the 29,278 accidents with working machines, 767 resulted in permanent disablement and 19 were fatal. Circular saws accounted for 324 disabling and 3 fatal injuries; metalworking presses for 50 disabling injuries; agricultural machines for 49 disabling and 3 fatal injuries; and moulding machines for 48 disabling injuries.

Forty-eight of the disabling and 3 of the fatal accidents were due to adjusting the machine or the work; 530 disabling and 13 fatal to starting, stopping or working at the machine in motion; 7 disabling and 1 fatal to greasing, cleaning or inspecting the machine at rest; 118 disabling to greasing or cleaning the machine in motion; 18 disabling to breakage of machine parts; 27 disabling to breakage of the work; and 19 disabling and 2 fatal to other causes.

TABLE II

Industry	Man-years	Accidents			Accidents per 100 man-years	Days lost per man-year
		Fatal	Permanent disability	Total		
Metalworking and engineering:					25.7	6.30
Men	152,319	28	265	41,147	27.0	
Women	13,733	—	13	1,542	11.2	
Earth and stone:					17.9	10.17
Men	31,727	13	103	5,984	18.9	
Women	3,531	—	1	316	8.9	
Agriculture, forestry, cattle raising:					18.0	8.83
Men	116,013	35	328	22,848	19.7	
Women	15,130	2	7	721	4.8	
Woodworking:					20.9	13.69
Men	47,927	18	245	10,131	21.1	
Women	1,389	—	1	156	11.2	
Paper and printing:					10.0	8.04
Men	50,154	21	124	5,566	11.1	
Women	12,869	2	5	752	5.8	
Food, drink, tobacco:					13.5	5.36
Men	38,730	10	65	6,169	15.9	
Women	21,833	—	18	2,037	9.3	
Construction:					21.2	15.93
Men	4,129	78	314	17,940	21.3	
Women	760	—	1	75	9.9	
Commerce, warehousing, offices:					4.4	1.76
Men	153,202	15	81	8,164	5.3	
Women	103,798	3	30	3,071	3.0	
Communications and transport (except shipping):					15.1	9.58
Men	34,258	21	49	5,340	15.6	
Women	1,568	—	1	70	4.5	

TABLE III

Cause	Accidents	Accidents per 100 man-years	Days lost per man-year	Days lost per accident
Working machines	29,278	2.235	1.021	46
Hand tools, etc	24,995	1.908	0.456	24
Animal-drawn road vehicles	11,319	0.864	0.429	50
Flammable and hot substances; light and heat	5,399	0.412	0.167	41
Slipping and falling of persons	15,067	1.150	0.714	62
Falls of objects	7,250	0.553	0.284	51
Handling of loads	29,591	2.259	0.563	25
Malice of third parties and other causes	21,439	1.637	0.404	25

SWITZERLAND

Swiss National Accident Insurance Institute

Annual Report for 1944[1]

At the end of 1944 there were 52,975 undertakings liable to compulsory accident insurance,

[1] For 1943, see *Industrial Safety Survey*, Vol. XXI, No. 2, p. 65.

as against 52,806 at the end of 1943. The number of accidents in 1944, as reported up to the end of March 1945, was 153,971, of which 109,967 were occupational accidents and 44,004 non-occupational accidents. In addition there were 74,416 trivial accidents and of these 60,672 were occupational and 13,744 non-occupational. In all there were 228,387 accidents, including 351 fatal occupational accidents and 250 fatal non-occupational accidents. During the year 4,018 disablement pensions were awarded, of which 1,468 were in respect of accidents occurring in 1944 and 2,550 in respect of accidents occurring in earlier years.

The Technical Inspectorate of the Institute made 2,517 inspections, of which 388 were in consequence of accidents; the Heavy Current Inspectorate of the Swiss Electrotechnical Association reported on 137 investigations of accidents; the Steam Boiler Owners' Association made 4,314 inspections; the Swiss Acetylene Association made 276, and issued 175 instructions; the Gas Works Inspectorate issued 250 instructions in connection with 103 inspections; the Federal Mines Inspectorate made 148 inspections and investigations in consequence of accidents; and the Accident Prevention Office of the Swiss Building Contractors' Association inspected 361 building sites and undertook three enquiries into accidents.

The Accident Prevention Office of the Central Forestry Office of the Swiss Association for Forestry Management organised a series of courses for woodcutters in different parts of the country on rational and safe methods of tree-felling, the choice and maintenance of tools, etc. The Swiss Research Office for the Prevention of Accidents has continued its work for the prevention of road accidents, sporting accidents and off-the-job accidents in general; in addition it has been making a study for accident insurance companies of accident-prevention problems in agriculture.

The Institute's machinists gave demonstrations of safety devices in 1,129 undertakings, and the fitters installed 1,292 safety devices in 779 undertakings and, as usual, repaired a number of devices already in use and erected some on new machines.

The Safety Service issued 4,793 instructions for the prevention of accidents; of the total, 539 concerned supervision of undertakings and 297 the arrangement and installation of undertakings; 2,193 concerned woodworking machines, 1,060 metalworking machines (of which 998 concerned grinding machines), 222 concerned transmissions and gears, and 153 building construction and civil engineering.

In 74 cases employers' insurance premiums were raised for failure to comply with the Institute's instructions and in 139 cases premiums were reduced after compliance with instructions.

During the year the Institute sold 38,870 safety goggles, 46,035 spare glasses for these goggles, 1,730 riving knives for circular saws, 472 protective hoods for circular saws, 433 guards for spindle-moulding machines, 252 guards for planing machines, 149 finger guards for presses and punching machines and various other items of safety equipment.

One appeal against instructions given by the Institute raised the interesting question whether depots of calcium carbide are places with an explosion risk. Discussions with experts disclosed that there were no records of explosions in carbide depots, whether in Switzerland or abroad. Consequently there was not felt to be any justification for requiring such depots to adopt precautions as strict as those for places with an explosion risk.

The Federal Council's Order concerning calcium carbide and acetylene is now being revised, but the drafting of an Order for the prevention of accidents on grinding machines is still delayed by failure to reach agreement on the protection to be required for portable machines with a peripheral speed of 45 m/sec. Tests are continuing.

Pneumoconiosis cases reported in 1944 totalled 303, of which 169 were accounted for by miners, 30 by foundry workers, 25 by sand-blasters, 23 by quarry workers, 11 by pottery workers, 10 by stonemasons, 8 by tool sharpeners, 5 by metal casters and 22 by workers in various occupations. Of these persons 188 were definitely found to be suffering from silicosis.

Electrical Accidents, 1944[1]

In 1944 the Heavy-Current Inspectorate was notified of 175 accidents in which 28 persons were killed and 154 injured. In addition, eight persons were killed and 19 injured in electric-traction accidents on the Swiss railways. The victims of the non-traction accidents comprised seven persons belonging to the operating personnel of power stations (none killed), 75 other

[1] *Accidents dus à l'électricité en Suisse au cours de l'année 1944.* Communication de l'Inspectorat suisse des installations à courant fort. *Bulletin de l'ASE*, 1945, No. 14. For 1943, see *Industrial Safety Survey*, Vol. XXI, No. 1, p. 27.

power station employees and contractors' fitters (8 killed) and 100 third parties (20 killed). Low tension caused 15 fatal, and 133 non-fatal accidents, and high tension, 13 fatal and 21 non-fatal.

The low-tension accidents of 1944 are classified in table I by cause and status of victims. Fatal accidents included in the totals are shown in brackets.

TABLE I

Cause	Operating personnel of electrical undertakings	Third parties
Parts of live installations or apparatus in service	54 (4)	18 (2)
Parts of installations or apparatus not conforming to the regulations; faulty manipulation by third parties	6	30 (4)
Insulation defects and inadequate protection of live parts	5	35 (5)
Total	65 (4)	83 (11)

Table II gives the distribution of accidents by equipment and voltage. Fatal accidents included in the totals are shown in brackets.

TABLE II

Equipment	Up to 250 V	251-1000 V	Over 1000 V	Total
Power stations and large sub-stations	3	1	8	12
Lines	10 (2)	9 (2)	12 (8)	31 (12)
Transforming stations	2	5	8 (4)	15 (4)
Testing laboratories	1	7	3 (1)	11 (1)
Provisional installations	9	5 (1)	—	14 (1)
Industrial undertakings	12	22 (2)	2	36 (2)
Transportable motors	17 (1)	1	—	18 (1)
Portable lamps	14 (3)	—	—	14 (3)
Fixed lamps	11 (2)	—	—	11 (2)
Medical apparatus	1 (1)	—	—	1 (1)
Other indoor installations	10 (1)	8	1	19 (1)
Total	90 (10)	58 (5)	34 (13)	182 (28)

The largest categories of victims were fitters and labourers of electrical undertakings (7 killed, 56 injured), factory workers (1 killed, 43 injured), other employees of electrical undertakings (2 killed, 15 injured), and building workers (1 killed, 11 injured).

Seventeen of the injured persons were incapacitated for less than one day, 52 for 1-15 days, 41 for 16-31 days, 29 for one to three months, and 15 for over three months.

As usual the report describes a number of typical accidents.

UNITED STATES OF AMERICA

Accidents in 1944[1]

Occupational Accidents

Occupational fatalities are estimated to have totalled 17,500, a decrease of 500 as compared with 1943; and occupational non-fatal accidents, 1,800,000, a decrease of 50,000 as compared with 1943. Approximately 70,000 of the non-fatal injuries resulted in some permanent disability. The time loss directly due to deaths and disabling injuries is estimated to amount to approximately 42 million man-days and indirect time losses to 230 million man-days, the total being equivalent to 900,000 man-years.

Off-the-job accidents resulted in 25,000 deaths and about 2,350,000 injuries, giving an aggregate time loss of 120,000,000 man-days.

The cost of occupational accidents is computed at $2,350 million of which $640 million is charged to compensation costs and wage loss, $100 million to medical care, $300 million to overhead costs of insurance, and $1,300 million to indirect losses, such as property damage, interference with production and decreased productivity due to injuries.

The 17,500 fatal accidents were distributed as follows among the main occupational groups: agriculture, 4,300 (53 per 100,000 employed); trade and service, 3,700 (19 per 100,000); manufacturing 3,100 (19 per 100,000); transportation and public utilities, 2,600 (63 per 100,000); mining, quarrying, oil and gas wells, 2,000 (235 per 100,000); and construction 1,800 (150 per 100,000).

The average frequency rate for all industries was 14.46 per 1,000,000 man hours. The industries with the highest rates were lumbering (56.04), mining (50.53), marine transportation (49.38), meat packing (30.44), woodworking (27.77) and clay products (26.96). The industries with the lowest rates were communications (3.47), tobacco (4.46), electrical equipment (6.98), aircraft manufacturing (7.55), and steel (8.06).

The average severity rate for all industries was 1.21 days lost per 1,000 man-hours. The industries with the highest rates were mining (8.46), quarrying (5.64), lumbering (5.47), gas utilities (3.29), cement (2.96) and marine transportation (2.56). The industries with the lowest

[1] National Safety Council, Chicago: *Accident Facts*, 1945 edition. For 1943, see *Industrial Safety Survey*, Vol. XXI, No. 1, p. 28.

rates were communications (0.13), wholesale and retail trade (0.16), service (0.26), miscellaneous manufacturing (0.33), aircraft manufacture (0.41) and printing and publishing (0.48).

The average frequency rate for all industries was 51 per cent. lower than in 1930, and the average severity rate 43 per cent. lower. The smaller reduction in the severity rate is due to the relatively small decline in serious injuries: permanent disability cases declined only 15 per cent. as compared with 52 per cent. for temporary total disabilities.

In mining the severity rate has risen by 34 per cent. since 1930 although the frequency rate has fallen 27 per cent.

In several industries frequency rates have changed considerably since 1930. Taking the rate for that year as 100, the rate for construction in 1944 was only 12; for chemicals it was 43, for lumbering 58, for automobile manufacturing 59 and for petroleum 59; while for meat packing, it was 150, for wood products 146, for clay products 130, and for shipbuilding 127. Similarly, as regards severity rates, with 1930 taken as 100, the figure for printing and publishing in 1944 was 14, for communications 16, for construction 18 and for glass 30. The highest figures were those for meat packing (169), clay products (146), transit (125), marine transportation (106 — base year 1933), and paper and pulp (105).

The principal source of serious industrial accidents in 1944 was the operation of trucks, railroad cars and other vehicles. Equipment of this kind was involved in 23 per cent. of all fatalities and permanent total disabilities compensated by industrial commissioners. Falling objects accounted for 18 per cent., falls of persons 16 per cent., and electricity, explosions, heat, etc., for 13 per cent. The principal causes of permanent partial disabilities are given as machinery with 25 per cent., handling objects 21 per cent. and falls of persons 16 per cent. As regards temporary total disabilities, handling objects came first with 25 per cent., falls second with 19 per cent., falling objects third with 11 per cent., machinery fourth with 9 per cent., and vehicles fifth with 8 per cent.

An analysis of 185,000 cases compensated in New York, Ohio, Pennsylvania and Wisconsin during the years 1941 and 1942 gives the following as the principal agencies causing accidents: machinery 12.34 per cent., vehicles 11.14, working surfaces (floors, stairways, etc.) 9.51, chemicals 6.54, and hand tools without mechanical power 6.15. Miscellaneous agencies, to which are attributed 49.47 per cent., include metal sheet, plate, rod, pipe, etc., 8.60, and box, bench, chair, table, 3.46.

A classification of 3,112 accidents by unsafe acts occurring during the period 1937-1941 (all industries) shows that the commonest unsafe acts were unnecessary exposure to danger 25 per cent., unsafe or improper use of equipment 15, working on moving or dangerous equipment 14, non-use of personal protective equipment 9, improper starting or stopping 9, overloading, poor arranging 7, making safety devices inoperative 5, and operating at unsafe speed 3. In 13 per cent. of the accidents there was no unsafe act.

A further classification of 4,818 accidents by personal cause (all industries 1937-1941) attributes 50 per cent. to improper attitude, 30 to lack of knowledge or skill, and 2 to bodily defects. In 18 per cent. of the accidents there was no personal cause.

The same accidents classified by mechanical causes are distributed as follows: hazardous arrangement or procedure 34 per cent., improper guarding 25, defective agencies 15, unsafe dress or apparel 6, and improper illumination or ventilation 1. In 19 per cent. of the cases there was no mechanical cause.

Motor Vehicle Accidents

There were approximately 4,800,000 motor vehicle accidents in 1944, but 4,200,000 of them caused no injuries to persons. Of the 601,800 accidents in which persons were injured, 21,800 resulted in loss of life and 580,000 in non-fatal injuries. It is estimated that passenger cars were involved in 68 per cent. of fatal accidents and 78 per cent. of all accidents, trucks in 26 per cent. of fatal and 16 per cent. of all accidents, taxis in 1 per cent. of fatal and 2 per cent. of all accidents, buses in 3 per cent. of fatal and 3 per cent. of all accidents and motor cycles in 2 per cent. of fatal and 1 per cent. of all accidents.

Eighty-eight per cent. of the vehicles involved in fatal accidents and 94 per cent. of those involved in all accidents were free from defects. Defects were recorded in 17 per cent. of the fatal accidents and 11 per cent. of all accidents.

During the fiscal year 1943-44, 128,849 commercial motor vehicles with a total of 1,924,814,000

vehicle-miles had an accident rate of 2.20 per 100,000 vehicle-miles. The corresponding rate for trucks was 2.45, for buses and taxicabs 2.55 and for passenger cars 0.94. The highest individual rates among trucks were those for "for-hire city trucking" (13.93), retail stores (4.22), coal and ice (4.21), newspapers (4.09) and beverages and ice cream (3.66). City buses had a rate of 5.40. The lowest rate of all was 0.66 for private inter-city trucking.

A comparison of death rates per 100 million miles (passenger miles and freight ton miles) in different types of transportation shows the highest rate for motor trucks (11.0) and the lowest (0.22) for buses. Railroad passenger trains had the next lowest figure (0.26) and railroad freight trains were third (0.34).

Shipyard Injuries, 1944[1]

The sustained safety programme sponsored by the U.S. Maritime Commission and the U.S. Navy Department led to substantial reductions in the volume of work injuries in shipyards during 1944. In 1943 the entire group of private shipyards working under federal contracts reported an average of 31.2 disabling injuries for each million employee-hours worked. Those which continued their operations into 1944 had an average injury rate of 30.2. In 1944 the average injury-frequency rate for the reporting yards was down to 23.2 — a decrease of 23 per cent.

It is estimated that these reductions are equivalent to the prevention of 19,000 injuries and a saving of 380,000 man-days of employment. In addition, fully 550,000 non-disabling injuries were estimated to have been prevented and these are equated to 82,500 man-days. The total time saved is, therefore, 462,500 man-days. The corresponding saving on 1942 is 611,000 man-days.

Detailed tables show the distribution of disabling injuries: (1) by part of body injured and nature of injury; (2) by accident type and agency; (3) by unsafe working conditions and agency; and (4) by unsafe act and agency.

The total number of injuries was 50,211. The commonest types of accident were: struck by objects, with a total of 16,663; falls of persons 11,160; slips and over-exertion 9,066; striking against objects 5,417; burns 3,369; and caught in, on or between objects 2,864. Of the 16,663 accidents due to being struck by objects 4,921 are attributed to foreign bodies in the eye.

The principal agencies involved in accidents were: (1) working surfaces with a total of 10,471, of which 3,079 were due to decks, floors and hatches, 2,202 to scaffolding and staging, and 2,036 to steps and ladders; (2) structural parts with 6,403; (3) tools 5,701; (4) foreign bodies 4,697; (5) cranes, vehicles 3,586; (6) cables and other feed lines 2,537; (7) lumber 2,258; (8) pipe 1,787; (9) hot metal, slag, rivets, 1,503; (10) welding radiations 1,374; and (11) machines 1,187.

Unsafe conditions were known to have contributed to 20,496 of the accidents. The commonest unsafe condition was poor housekeeping, with 7,467 accidents; this was followed by lack of, or defective, safety equipment, with 5,473; defects of agencies, with 3,763; and unguarded agencies, with 1,940.

"No goggles" is given as the unsafe condition in 2,293 of the accidents under lack of safety equipment, etc., and "goggles defective or unsuitable" in 1,150 cases. Of the 3,763 defects of agencies 1,137 were "fatigued, decayed, worn, frayed".

In the classification by unsafe acts "gripping insecurely or overlifting" comes first with 9,991 accidents; "taking unsafe position or posture", second, with 8,480; "unsafe operation of, or exposure to, cranes, vehicles and machines", third, with 2,398; "unsafe use of, or failure to use, scaffold or ladder", fourth, with 2,117; and "working without proper (or personal) safety equipment", fifth, with 2,096.

Of the 9,991 accidents due to gripping insecurely or overlifting, 5,041 are attributed to gripping insecurely or taking wrong hold and 2,404 to lifting or carrying too heavy load.

[1] United States Department of Labor, Bureau of Labor Statistics, Bulletin No. 834, Washington, 1945.

West Virginia

Coal-Mine Accidents in 1944[1]

The average number of persons employed during the year was 102,006. There were 313 fatal and 14,657 non-fatal accidents. Five hundred and twenty seven thousand and ten tons were mined per fatal accident and 11,254 per non-fatal accident. There were 2.10 fatalities per 1,000 men employed and 3.70 per 1,000 men employed underground.

[1] West Virginia: *Annual Report of the Department of Mines, 1944.*

Descriptions are given of a number of mine fires and explosions.

Table I shows the mining experience of men killed and injured during the year.

TABLE I

Length of experience	Fatal		Non-fatal	
	Number	Per cent.	Number	Per cent.
Under 6 months	2	0.64	287	1.95
6 to 11 months, inclusive	7	2.25	190	1.29
1 to 2 years, inclusive	17	5.44	761	5.19
3 to 5 years, inclusive	19	6.07	1,182	8.06
6 to 10 years, inclusive	46	14.69	2,002	13.65
11 to 20 years, inclusive	81	25.87	3,830	26.13
Over 20 years	127	40.57	4,242	28.98
Unknown	14	4.47	2,163	14.75
Total	313	100.00	14,657	100.00

Table II shows the length of service of men killed and injured.

The age group 16-17 accounted for 0.31 per cent. of the fatal and 0.21 per cent. of the non-fatal accidents. The corresponding figures for various other age groups were 18-20, 2.87 and 3.26; 41-50, 25.59 and 24.45; 51-60, 17.25 and 15.59; over 60, 8.62 and 4.46.

TABLE II

Length of service	Fatal		Non-fatal	
	Number	Per cent.	Number	Per cent.
Under 6 months	69	22.00	2,733	18.64
6 to 11 months, inclusive	26	8.00	1,311	8.94
1 to 2 years, inclusive	69	22.00	3,462	23.62
3 to 5 years, inclusive	42	13.00	1,974	13.46
6 to 10 years, inclusive	40	12.00	1,464	9.98
11 to 20 years, inclusive	50	13.00	1,326	9.08
Over 20 years	15	4.00	521	3.55
Unknown	2	6.00	1,866	12.73
Total	313	100.00	14,657	100.00

Underground accidents accounted for 90.89 per cent. of the fatal and 88.64 per cent. of the non-fatal accidents. Falls of roof alone accounted for 49.52 per cent. of the fatal and 17.60 of the non-fatal accidents. Haulage accounted for 26.18 per cent. of the fatal and 13.61 per cent of the non-fatal accidents. No fatal accidents were caused by handling materials, but this caused 20.00 per cent. of the non-fatal accidents.

REVIEW OF PERIODICALS

Prevention of Accidents. By H. M. VERNON. (*British Journal of Industrial Medicine*, January 1945, p. 1.)

Dr. Vernon first quotes British statistics to give a general idea of the numbers, frequency and main causes of industrial accidents. His main concern is with personal factors and factory conditions as elements in accident causation. He concludes with a brief discussion of the psychology of accident prevention and personal protective equipment.

The personal factors considered are age and experience, general health and accident proneness; and under the head of factory conditions, Dr. Vernon deals with hours of work and fatigue, atmospheric conditions, and lighting.

The general statistics are interesting as showing the expectation of accident among different classes of British workers. For instance, in 1941, one adult male in 20 suffered a reportable accident, as compared with one adult female in 55, one male young person in 19 and one female young person in 55. In 1934 the fatal accident rate per 100,000 employed was 20.3 for adult males, 1.2 for adult females, 11.1 for male young persons and 1.6 for female young persons, and the ratio of fatal to non-fatal accidents was 1 to 174 for adult males, 1 to 782 for adult females, 1 to 440 for male young persons and 1 to 970 for female young persons. However, in some trades the ratios were much lower: in building construction (1932), there was 1 fatal to every 27 non-fatal accidents and in dock work (1932) 1 to 73. In the munitions industries (1928) 1 worker in 9 suffered a reportable accident and in metal extracting and refining (1928) 1 worker in 11.

As regards the influence of age and experience on accident frequency, it is shown that in 1937,50 per cent. of a group of young persons had accidents in the first six months of their employment, 23 per cent. in the next six months and only 3 per cent. after two years. The young worker was held responsible in 44 per cent. of all the cases and the firm in 36 per cent.; in the remaining 20 per cent. no blame could be attached to either party. Training and supervision are indicated as means of reducing accident frequency among inexperienced workers. There is some evidence to show that accident frequency declines with increasing age, at least among coal miners, up to about 39, after which it rises rapidly.

There also appears to be a distinct relationship between accident frequency and the frequency of minor ailments such as headaches, colds, indigestion, faintness, etc. Hence, medical supervision has a part to play in accident prevention.

Various statistics are quoted to prove the existence of an accident-prone element in the industrial population, and attention is drawn to the desirability of psychological aptitude tests.

The effect of long hours and fatigue on accident frequency is shown to be more serious for women than for men. On the other hand accidents ascribed to fatigue may really be due to other causes such as mental excitement and consequent inattention to work. Such excitement may be due to an entertainment enjoyed immediately before the beginning of a shift, or to the anticipation of an entertainment after the shift. Sustained concentration on work is particularly difficult in the case of monotonous repetitive operations.

The atmospheric conditions under which workers are employed may have a considerable influence on accident frequency. Very high and very low temperatures are conducive to accidents; the safest temperature range would appear to be 65-69° F. Older men are more affected by high temperatures than younger men. Statistics are quoted to support these conclusions.

The article concludes with a useful bibliography.

Lancashire Man-riding Haulage Practice. By A. WRIGHT. (*The Colliery Guardian*, 24 August 1945, p. 225, and 31 August 1945, p. 251.)

4.2.1.2.4

The present article summarises the results of investigations conducted by the Lancashire and Cheshire Safety in Mines Research Committee.

After a general description of the haulage systems in use in Lancashire coal mines, the author deals in more detail with the engines, trains, ropes, tracks and signalling systems. He then describes some safety devices used on engines (*e.g.*, electrically actuated automatic brakes) and trains (*e.g.*, safety ropes spanning the train, track brakes for stopping runaways, overspeed governors). Some information is also given on maintenance procedure. The article concludes with the following recommendations:

Systems of Haulage

(1) Where the gradient is suitable the most satisfactory rope haulage system for man-riding is the balanced direct rope arrangement with a surge wheel drive. Where gradients do not allow this, the reversible endless rope system with two trains should be adopted.

(2) With the development of locomotive haulage in the future, its use for man-riding will naturally follow and is advocated.

General

(3) The general static factor of safety for all ropes, gear and apparatus on man-riding haulages should be not less than six at any time in their working life, and the factor should be uniform for the various components.

(4) Men about to board a train should be constrained to an orderly procession by a system of barrier. Where practicable, men should leave the train by a different road from that used by men who are about to board it.

(5) The train conductor should not signal the train to move until all men are seated, and no man should be allowed to board a train in motion.

(6) The capacity of a train and the frequency of journeys should be correlated to the rate of arrival of men at the shaft bottom.

Engines

(7) All engine houses should be well constructed, lighted and where practicable ventilated by intake air.

(8) Engines should be so constructed and erected that control is easily effected with minimum effort by one man.

(9) Two separate and independently operated brakes should be provided, each capable of controlling the maximum load, and one of these should have automatic operation in emergency. One should be on the surge wheel or drum.

(10) Electricity is recommended as a source of power on account of its smoothness of drive and the facility with which automatic safety devices can be applied.

(12)[1] Both overspeed and overwind control devices, which cut off the power supply and apply a brake, should be fitted to all engines. The overwind device is more satisfactory when operated by a track limit switch.

(13) Engines should be fitted with a travel indicator. Where surge wheels are in use the pointer should be adjustable to allow for slip of the rope.

[1] There is no number 11.

(14) Signals should be audible and visual, and an automatic signal should be provided to give the engine driver audible warning when the train is approaching the end of its journey.

Trains

(15) Trains should be of special cars and used exclusively for man-riding. The box car offers certain advantages in regard to safety and protection from draughts.

(16) There should be a specially constructed stretcher car on each installation and first-aid equipment should be carried on the train.

(17) Cars should preferably have at least two drawbars, which should be continuous through the chassis; couplings would thus be in duplicate.

(18) An alternative to the above is the use of single couplings with two safety ropes spanning the train. These should be secured to a clamp on the rope beyond the capel, to every third car, and to the last car of the train.

(19) Where gradients exceed 1 in 8, automatic track brakes, or alternatively some device such as the Rearer carriage, should be provided to guard against runaways. Drags are not considered to be satisfactory.

(20) In view of the superior mechanical properties of 1.5 per cent. manganese mild steel, and the fact that during service it retains these properties very well, it is recommended that this material be adopted for all couplings, shackles and pins.

Ropes

(21) The permissible life of the rope for a man-riding haulage should be fixed by the manager. The practice of using ropes on man-riding haulages for a relatively short time and utilising the remainder of their useful life on coal haulages, is commendable.

(22) The preformed zinc cone capel is reliable and has many advantages, particularly where recapping has to be carried out some distance from the shaft.

(23) At each recapping a sample of rope should be taken for detailed examination.

(24) An efficient lay-out of rollers and pulleys is essential, and the committee is of the opinion that there is a good field of investigation on the subject.

Tracks

(25) Rails should be of the heaviest practicable section and certainly not less than 35 lb. per yd. The standard of laying and maintenance should be high and approaching that of railway practice. Joints in the same track should be staggered, and where two tracks are laid, long sleepers spanning the roadway should be used at the joints.

(26) Where bends are inevitable some means, such as super-elevation or chock rails, should be provided to guide the train round the curves.

(27) Where heavy cars and/or locomotives are used the track should be ballasted.

Roadways

(28) Gradients should be uniform, but where this is not possible some grading should be done to avoid abrupt changes of inclination. Abrupt changes in cross-section of the roadway should also be avoided.

(29) At each end of the journey the track should extend some distance beyond the normal terminus in case of accidental overwind.

(30) At all loading stations the roadway should be whitewashed and lighted.

Signalling

(31) Signals should be of a type which can be operated from the train whilst in motion. Pull key systems with signal cables are preferable.

(32) Telephonic communication should be provided between all loading stations and the engine house.

Lighting

(33) Trains should be provided with headlamps giving a beam at least 20 yards in length.

Dust Suppression in the Lancashire Coal Field. (*The Colliery Guardian*, 28 September 1945, p. 377; 5 October 1945, p. 412.)

This is a preliminary report on the subject prepared for the Lancashire and Cheshire Joint Coal Dust Committee. It briefly describes the nature of the dust problem in Lancashire and then discusses wet-cutting practice, dnst reduction at loading and transfer points, spraying of tubs in main intake airways, dust reduction at surface screens due to water treatment underground, and the injection of water under pressure into the coal face.

Work Injuries in Breweries during 1944. (*Monthly Labor Review*, August 1945, p. 264.)

The frequency rate of disabling injuries for breweries in 1942 was 38.2 per 1,000,000 man-hours as compared with 19.9 for all manufacturing industries; in 1943 the rate was 35.3 as compared with 20.0 for all manufacturing industries; and in 1944 the respective rates were 46.2 and 18.8. The 1944 rate for breweries is equivalent to about one disabling injury for every 10 men employed. The actual time loss was estimated at 162,000 man-days and the cumulative time loss resulting from serious accidents, at about 900,000 man-days.

The rates for the main groups of departments of breweries were: delivery group 64.1, bottling 52.5, brewhouse 50.8. The most hazardous type of delivery work was the handling of draught beer, for which the rate was 93.1. Pasteurising with a rate of 59.0 was the most hazardous operation in the bottling department, and loading, with a rate of 76.6, the most hazardous occupation in the brewhouse department. Rates were much lower in the filtering department (23.9), brewing department (32.4), and fermenting department (32.8).

Enquiries addressed to a number of brewery safety engineers concerning the causes of bottle explosions elicited various replies. The pressure used to speed the filling operations frequently is great enough to burst weak or defective bottles. In the pasteuriser the beer is heated and the gas contained in the liquid expands, thus increasing the internal pressure which may then burst the bottles. Most of the safety engineers were in agreement that the tendency for bottles to explode is increased when they are roughly handled. Worn machinery and conveyors, which cannot now be replaced because of wartime restrictions add greatly to this hazard by causing the bottles to be bumped and shaken as they pass along the line. The safety engineers also agreed that the larger-size bottles are more likely to explode than are the bottles of standard size.

A few breweries have placed wire-mesh guards over the conveyor lines and have installed metal shields around the filling machines. At the inspection points the mesh guards are replaced by panels of shatter-proof glass. Most of the conveyor guards are constructed in sections which may be raised to permit the removal of rejected or broken bottles from the line. The use of such guards, however, is far from universal. Instead of guards, some breweries provide impact goggles for all bottling-department workers. These goggles prevent eye injuries, but do not eliminate other cuts caused by the broken glass.

At the present time very little beer is put in cans, because of the wartime shortage of metal. From a safety point of view the use of cans has a distinct advantage in that it automatically eliminates all the hazards of bursting bottles.

Other operations for which rates are given include washing in the brewhouse department (58.3), delivering bottled beer (56.5), and malting (81.9).

One Out of Twelve. (*Safety Engineering*, September 1945, p. 26.)

In the fabrication of structural steel, a worker's chance of being injured is said to be one in 12; of being partially crippled for life, one in 25; and of being killed one in 200. Responsibility for the prevention of accidents is laid upon the foreman, whose functions in this connection are outlined. The article includes a "safety check list" of 26 items to be watched, discusses the relationship between material and human causes of accidents and makes recommendations for enlisting the co-operation of the workers in the promotion of safety. Stress is laid on the importance of good technique in investigating accidents.

Shipbuilders' Welding Cables. (*The Travelers Standard*. Vol. 33, No. 4, July-August 1945, p. 69.)

This article briefly describes with the aid of numerous illustrations a method of eliminating falls of workers caused by the tangle of welding cables on the deck of ships, which was originally published in a recent issue of *The Halyard*, the employee publication of the Federal Shipbuilding and Dry Dock Company at Kearny, New Jersey, under the title "A Tree Grows in Kearny to Cage Snarling Cables". The description of this method is as follows:

> Cable for welders is carried up the side of a hull, inside spars that reach higher and higher, resembling a tree, as the building of the ship progresses.
>
> The webbed units of steel construction look like small crane booms. These units carry the cables from the welding machines on the slipway or docks under the hull up to the deck. Twelve cables are carried in each unit. They are fastened to staging towers when making the vertical climb, and rest on specially built tripods when they cross the deck horizontally. This system eliminates the unsightly network of welding cable that formerly hung over the side of a hull; it also eliminates hazardous coils and ruffles of cable that caused workers to trip and fall, such coils being held up off the deck by the spars.
>
> In the wet basin these sections are not used; there a cable containing twelve small electric carriers swings up the side to a bracket on the top of the ship. The cable gives the necessary slack to accommodate rises and falls on the ship caused by the tide or wind.

Fig. 1. — A tree grows at Kearny up a staging tower. Horizontal branches, left and right, are seen at the top

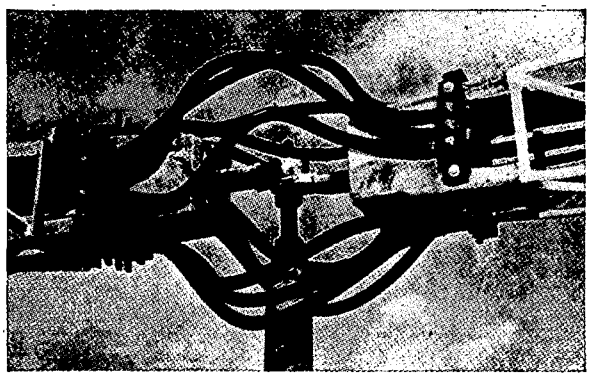


Fig. 2. — Tree grafting as it is practised with spars at Kearny. This picture shows how two branches are connected over the tripod supporting them above the deck

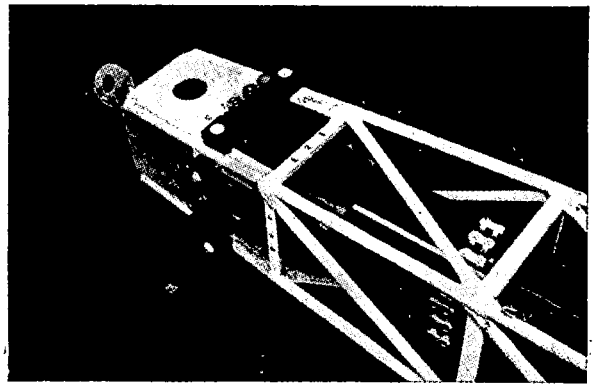


Fig. 3. — A close-up of a spar, showing how the cables are numbered

Memoria sobre accidentes de trabajo en la Compañía Telefónica Nacional de España. By Adolfo Crooke Campos. (*Boletín de Seguridad e Higiene del Trabajo*, Madrid, July-August 1945, No. 4, p. 1.)

In this brief article, the author draws attention to the marked reduction in accidents since the creation of an Industrial Safety and Health Committee in the Spanish National Telephone Company (*Compañía Telefónica Nacional de España*) in April 1942. In that year the average number of accidents per 100 employees was 0.54, as against 0.38 in 1934 and 0.34 in 1944.

These excellent results were achieved by means of constant effort by all concerned.

Among the contributing factors in the reduction of accidents, the author mentions the results achieved by a "Report on Industrial Accidents", a copy of which is reproduced in the article. A detailed study of this report furnishes the information necessary to maintain a constant control of the quality of the tools used by the workers and also respecting general instructions to be issued to the personnel on how to perform all types of work.

Another measure which has had excellent results is the monthly publication of posters with graphic representations of accidents. In the centre of these posters a table is inserted showing the names of those in charge of each group of workers, the number of accidents and the number of man-days lost. These tables are studied fortnightly by the Safety Committee, and decisions are reached both as to the measures to be taken in each case and as to the sanctions to be applied. At these fortnightly meetings recommendations are also formulated for submission to the management, which collaborates wholeheartedly with the Safety Committee.

Low Voltage Hazards. By M. J. Pitre and S. Dahlberg. (*Safety Engineering*, July 1945, p. 22.)

Brief discussion of the factors of low voltage hazards. The authors emphasise that exposures to currents of an intensity below the common 110 volts has caused fatal

electrical accidents. Fatal shocks on low voltage circuits usually occur under certain conditions which are conducive to lowering the skin resistance at points of contact.

The working conditions which are particularly hazardous with low voltage equipment are: wet or damp locations; high temperatures, since these are apt to cause perspiration; locations where the worker is freely exposed to grounded surfaces, for example, inside boilers, drums, tanks, steel structures or other fully or semi-enclosed metallic objects.

The following basic points should be taken into account in the control of electrical hazards:

Proper selection of equipment for the type of exposure for which it is to be used.

Installation of the equipment and circuits in accordance with established safety standards.

Maintenance to keep the equipment and circuits in safe operating condition.

Inspections at frequent intervals by competent personnel to ascertain proper maintenance.

Electrical shock hazard from low voltage utilisation equipment can be greatly reduced by any of the following protective methods, or by a combination of them.

Effective grounding of non-current-carrying parts. Insulation of exposed metallic surfaces.

Insulating the operator.

Using voltage low enough to mitigate the shock hazard.

Grounding of non-current-carrying parts of utilisation equipment is made for the purpose of protecting persons against electric shock from metal enclosures or frames of motors, transformers, switchboards, cranes, portable tools and lamps, etc., in case such parts accidentally come into contact with live parts of the circuit.

Where protective grounding is found to be impracticable, insulation of the non-current-carrying exposed metallic parts may be employed. Such insulation should be made to withstand the abuse expected under working conditions and should be made resistant to oil, grease and moisture.

Where neither grounding nor insulation of non-current-carrying parts is employed, protection in hazardous exposures can be accomplished by insulating the operator by the use of rubber mats or shields, wooden platforms or barriers. The purpose is to prevent any return path for the current through the body of the operator.

Electrical appliances, such as portable tools and extension lights used in extremely hazardous locations such as inside boilers, tanks, other metallic enclosures or in very high temperatures and wet places, should preferably employ lower tension than the standard 110 volt supply. Extension lights in such hazardous locations are now used as low as 12 volts. Such voltages are usually obtained by reducing the 110 volt A.C. supply through a transformer.

Concrete Absorbs Solvent. (*O.I.C. Monitor*, July 1945, p. 108.)

The *Monitor* reproduces the following account of an unusual accident from the E. D. Bullard Company's bulletin *What's New in Safety:*

A western company had been using a very large steel tank with concrete flooring to store a highly poisonous solvent. It was decided to move this tank to another location, so dismantling was ordered.

The tank was drained, aired and steamed for sixty hours. This period of steaming and airing was considered sufficient, and as a matter of fact the air in the tank was absolutely free from vapours

Men went into the tank to proceed with dismantling. In order to do this the concrete flooring had to be dug up to release the steel sheeting. Since precautions had been taken to remove all possibilities of the air being vitiated within the tank, no respiratory protection was issued to the men.

After tearing of concrete had gone on for some time, several of the men were overcome and fainted, and there were two fatalities due to inhalation of poisonous vapours. Immediate investigation showed that through the years the poisonous component of the solvent had accumulated within the concrete and that breaking up had released enough fumes to be fatal.

Note sur l'éclatement d'une vanne en fonte dans le poste d'eau d'une centrale électrique. By M. BRUNELLE. (*Annales des Mines et des Carburants: Mémoires*, March-April 1945, p. 151.)

The author gives a detailed illustrated description of an accident due to the bursting of a gate valve in the water supply system of a power station, analyses the causes, and makes recommendations for the prevention of accidents due to shocks in the piping of such systems. Two persons were killed in the accident.

The installation in question comprised two groups of turbo-alternators (30,000 kW and 20,000 kW) with pumps, preheaters and degasifiers. At the time of the accident only one group was working, but the second group was about to start and valves were being opened and closed to make the necessary changes in the directions of flow of water in the piping. Before all the valves could be changed, one of them, in cast-iron, burst.

In the investigation of the accident three hypotheses were examined: faulty installation of the valve, defects in the manufacture of the valve and water hammer. The last was the only one found to be tenable, and according to detailed calculations, the water hammer must have generated a pressure of some 40 kg/cm² in the valve. In tests carried out to verify this hypothesis water hammer occurred when the load reached 18,000 kW.

Enquiries addressed to other power stations revealed the occurrence of similar incidents, which, however, had not resulted in any damage to installations.

Water hammer in the water supply systems under consideration is attributed to wide differences in temperature at a given instant between the water already in the boiler-feed tanks and the preheated water entering them. These differences in temperature may be accounted for by sudden variations in the output of the pumps or by sudden variations in the load. In the case under consideration the difference in temperature was due to an exceptional cause, the cutting in of alternative piping.

If water entering a tank passes through horizontal piping containing both water and steam the resulting differences in temperature may cause water hammer. In the absence of such piping, differences in temperature may lead to shocks as the result of sudden evaporation of the water leaving the preheaters, if the heating temperature is substantially and quickly raised; or as a result of sudden condensation of the steam in an intermediate space containing both water and steam, if the heating temperature is substantially and quickly lowered.

The author develops his conclusions under two heads: prevention of shocks and elimination of cast-iron valves above feed-water tanks under pressure.

A Guide for the Preparation of Warning Labels for Hazardous Chemicals. (*Chemical and Engineering News*, 10 June 1945, p. 992.)

With the development of new chemical compounds, the wartime necessity of using unskilled labour and the introduction of chemicals into new fields of industry, the need for improved labelling of hazardous chemicals has become more and more evident. With this problem in mind the Manufacturing Chemists' Association of the United States appointed a Labelling and Precautionary Information Committee, composed of competent technical and legal experts, for the purpose of developing certain basic principles, classification of hazards and recommended forms for labels.

The article under review gives a brief summary of the information and recommendations contained in a manual representing the work of this committee and issued recently by the Manufacturing Chemists' Association. General principles for the preparation of precautionary labels together with schedules of classifications of hazards and recommended label cautions are included.

Über die gewerbemedizinische, vor allem dermatologische Bedeutung von Glasfasern (Glasseide, Glaswolle, etc.). By MAX LEDER. (*Zeitschrift für Unfallmedizin und Berufskrankheiten*, Zürich, No. 3, 1945, p. 202.)

The author of this article has made a very detailed study of the cutaneous injuries produced when the skin comes

into contact, either occupationally or experimentally, with glass wool. These injuries are characterised by multiple maculo-papulose eruptions. The papules are the size of a pin head and a histological study of these reveals that they are caused by micro-traumatisms produced by the fibres of glass, accompanied by common inflammation. Occasionally slight suppuration of the skin could be observed, causing some complication.

The injuries are always traumatic in aspect and allergical phenomena never develop.

Various cases showed that contact with glass wool produced a transitory irritation of the conjunctiva and of the upper respiratory tract.

Accidents Still Take Toll of Young Workers. By Miriam Noll. (*The Child*, August 1945, p. 29.)

Statistics of nine States of the United States examined by the Children's Bureau reveal a great increase in industrial accidents of minors under 18 years of age. The following table summarises the figures relating to eight of these States. Except for Pennsylvania, the figures are those of accidents reported to or compensated by workmen's compensation authorities. The Pennsylvania accidents are described as "reported". In New York State, for which the most recent statistics are not available, it is estimated that accidents to minors illegally employed increased sevenfold between 1940 and 1943.

State	Period	Age limit	No. of accidents	Percentage increase
Illinois	1940	18	282	
		16	26	
	1943	18	1,867	562
		16	141	442
Maryland	1940	18	200	
		16	7	
	1944	18	772	286
		16	73	940
Michigan	1942	18	330	
	1943	18	1,027	211
New Jersey	1940	18	308	
		16	25	
	1943	18	893	190
		16	66	164
North Carolina	1942–43	18	341	
		16	28	
	1943–44	18	547	60
		16	52	86
Ohio	1940	18	1,177	
		16	158	
	1943	18	14,127	1,100
		16	1,071	578
Pennsylvania	1940	18	354	
		16	37	
		14	3	
	1943	18	5,115	1,345
		16	351	849
		14	17	467
Wisconsin	1940	18	124	
	1944	18	1,297	946

La selección profesional en la prevención de accidentes. By Dr. Manuel Ossorio. (*Revista del Instituto Argentino de Seguridad*, Buenos Aires, April 1945, p. 16.)

The importance of vocational selection as a means of preventing accidents is emphasised in this article as are also the difficulties in the way of its application, owing to the objection of workers, in the majority of cases, to submit to an examination which, if the result is unfavourable, might deprive them of their means of livelihood.

The author comments on the difference between vocational selection and vocational guidance, although both are psychotechnical methods of prevention. Vocational guidance acquaints the prospective worker with the conditions attaching to a given type of work, whereas vocational selection indicates the aptitude or inaptitude of the subject for a job or a certain type of work. It will be realised from this that the first is directly related to the worker while the second mainly affects the employer. He adds further that "from the point of view of accident prevention selection is more useful than guidance" because "it is easier to discover the inaptitude of an individual by means of a definite task than by investigating his occupational aptitudes".

Further on Dr. Ossorio claims that it is advisable, where possible, to use vocational selection for all kinds of occupations in spite of the difficulties in the way, for "no matter how many warnings are given him regarding the dangers presented by the acceptance of a job contrary to his capabilities, the worker will not be convinced — and this is only natural — that these hazards are greater than those presented by unemployment". These difficulties, however, should not prevent selection in particularly hazardous work or in cases where numerous lives depend on the ability and aptitude of the worker. In this respect the author shows that various countries have understood the responsibility weighing on locomotive drivers on railways and mentions the works of Strauss[1] which analyse the methods adopted by Germany, Belgium, Italy, Bulgaria, Denmark, U.S.A., Finland, France, Great Britain, Norway, Poland, Rumania, Sweden, Czechoslovakia, Switzerland and Yugoslavia in the selection of locomotive drivers.

In the concluding part of the article it is noted that in the opinion of Ichheiser[2] "in spite of the possibilities and advantages of vocational selection it should be exercised with the greatest care and without giving the psychotechnical tests absolute value but merely directive value, the results of which should be weighed with other elements of judgment".

La tâche sociale du médecin d'aujourd'hui. By Dr. L. Carozzi, Professor at the University of Geneva, Switzerland. (*Journal de Genève*, 12 November 1945.)

In this lecture, the second of a series delivered at the University of Geneva, Dr. Carozzi, former Chief of the Industrial Hygiene Service of the International Labour Office, discusses the serious problem of labour-management relations and outlines the social progress made in industry. He mentions the names of the forerunners of industrial medicine and defines the place and role of the specialised physician in modern industry. It is the task of the medical officer to watch over the moral and physical health of the workers as well as over their material welfare; the physician directs the occupational selection at the time of entry into employment; he places the candidate in the place best suited to his skill and resistance; he also performs the periodical medical examinations.

Dr. Carozzi shows, by means of statistics, the results obtained through constant medical supervision, *i.e.*, reduction of disease and higher output of work.

In this way, the collaboration between employers, workers, physicians and technical experts, as well as the interest taken in the worker's standard of living and health, will benefit the employees and the undertaking itself.

The lecturer concludes by expressing his hopes for the future of industrial medicine, the most important chapter of social medicine.

Coordinación de los Trabajos de Salvamento y Profilaxis General del Accidente. By Dr. J. Dantin Gallego. (*Boletín de Información*, Madrid, July-August 1945, Nos. 7-8, p. 1328.)

The author reviews the spiritual stimuli of collective safety and by studying actual statistics analyses the accident situation in general.

---

[1] See *Industrial Safety Survey*, Vol. XII, No. 4, p. 93.
[2] *Idem*, Vol. XV, No. 5, p. 125.

In the third part of his article, Dr. Gallego suggests a logical plan which could be presented to the public as a trial. This plan consists of the following parts:

(*a*) A minimum programme of collective safety for purposes of popularisation;
(*b*) A programme of specialised training by professional groups which will complement and gradually replace the existing repressive action by a real education;
(*c*) The co-ordination, by means of propaganda and scientific study of common problems, of all the agencies which intervene individually in the prevention of accidents or in life-saving.

The programme of specialised training would consist of preparatory courses for various groups of the population, the courses to include extensive and detailed series of lectures, both practical and theoretical.

After considering a series of modern concepts regarding accidents, the author reviews the investigations made by the National Psychotechnical Institute, which show that a minimum amount of intelligence is required to avoid accidents, and that an increase in intelligence over this minimum does not ensure greater safety. In conclusion, after mentioning the various agencies that should unite in the common effort to combat accidents, he suggests the following measures for better co-ordination:

(1) Technical meetings. These should take the form of an exchange of ideas among professional men and not that of "regulation-making".

(2) Research work. This constitutes the "living nucleus" of all progressive organisations. It is indispensable for the effective accomplishment of any non-mechanical work.

(3) Exchange of measures. Economy and efficiency demand this in order to avoid the multiplication of expenses and the useless expenditure of effort. Any serious work represents an economic effort; the primary consideration of a co-ordination action of this kind should be the allocation of funds to subsidise research work.

(4) The organisation of congresses, competitions and public manifestations.

Orientaciones modernas en la higiene industrial. By Dr. Ismael Urbandt. (*Revista del Instituto Argentino de Seguridad*, Buenos Aires, April 1945, p. 1.)

The author points out, with particular emphasis, the close relationship existing between the preservation of workers' health and the economy of a country, stating that "the economic problems of industry walk side by side with its sanitary problems".

In this respect he remarks that the enormous industrial progress of the last few years has brought about great progress in industrial medicine, owing to this relationship, which was known, for that matter, since ancient times. He mentions that Plato, Pliny and Hippocrates concerned themselves with problems of industrial hygiene, particularly Hippocrates, who pointed out the danger to health occasioned by the handling of lead; the author avails himself of this brief historical review to emphasise the important role played by Bernardo Ramazzini in the evolution of industrial hygiene in modern times, calling him "the virtual forerunner in this field".

According to Dr. Urbandt, occupational diseases are due largely to the fact that preventive measures, which actually exist for the majority of industrial processes entailing hazards to the human organism, are not applied, and offers as proof that the application of these measures has resulted in the gradual lowering of the death rates from these diseases.

He contends also that the problems of industrial hygiene are connected significantly with the prerequisites of public health and that every country should solve these problems with due regard to prevailing conditions and taking particular note of the suggestions made in this respect by various international organisations, which, like the International Labour Office, have tackled these problems with growing interest.

He concludes by expressing the hope that, with all the appropriate hygienic measures applied to their full extent, all workers "whatever their social condition, may live their life, voicing an eternal hymn to work".

4 Points to Safety. (*Safety Engineering*, September 1945, p. 14.)

The article discusses eyesight as a factor in accident-proneness. The procedure for introducing visual tests for accident-prevention purposes is set out as follows:

1. Determine visual functions favourable to the prevention of accidents.
2. Set standards with regard to these visual functions which have been selected as significant; and establish visual standards on the basis of those individuals who have been able to protect themselves against accidents.
3. Apply these visual standards at employment to new applicants, and predict which individuals will most likely have the largest accumulation of minor accidents and subsequently become serious accident cases.
4. Bring those up to standard by professional eye correction and by follow-up, thereby determining to what extent those with poor vision before correction have reduced the repetition of minor instances.

Research covering points 1, 2 and 3 has already been undertaken and the results are briefly described. The main conclusion reached was that an accident-free employee possesses better visual functions (acuity, depth perception and eye posture or phorias) than an accident-prone employee.

The establishment of standards of vision for each industry is recommended since standards for one industry are not necessarily applicable to another. The standards should be applied to new employees and the degree of accident-proneness of each predicted. Assignment to jobs can be made in the light of the predictions, and visual standards can be improved by clinical methods.

From statistical records, it was found that accident frequency among new employees varied inversely with their standard of vision.

The article concludes with the assertion that eyesight has a very important bearing on accident prevention.

Die Mineur-Silikose in der Schweiz. By Vera Griesacher-Cristofari. (*Zeitschrift fur Unfallmedizin und Berufskrankheiten*, Zürich, No. 3, 1945, p. 151.)

This interesting article, which examines the various phases of silicosis in Swiss miners, is based on the study of 335 cases reported to the Swiss National Accident Insurance Institute during the period 1936-1942. The results obtained reveal interesting differences as compared with those published in other countries.

Attention is drawn to the fact that a number of cases (17) showed evidence of the disease after an exposure to the action of silica of from 6 months to 2 years' duration, the average term of exposure being 8 years 9 months. This period of exposure is actually very short if compared with that mentioned in other studies of the subject.

According to the author, the interval between the cessation of work and the appearance of evidence of the disease varies from 0 to 25 years, and a long period of exposure is usually followed by a very short latent period, while a short exposure is usually followed by a long latent period.

The disease took the following course: of 165 miners, 47.3 per cent. died; 35.7 per cent. were incapacitated; and only 17 per cent. are in a condition to work. From the time of diagnosis to death, the disease lasted an average of 2.8 years. Symptoms and disturbances generally appeared, in two thirds of the cases, from 0 to 3 years before the beginning of medical treatment. Silico-tuberculosis existed in 52.5 per cent. of the fatal cases.

The article also considers the question of tendency to the disease and heredity in the light of the study of a number of cases in the same family exposed for a very short time. The physical constitution of the diseased does not seem to be of decisive importance.

The Italian miners were found to show greater resistance than the Swiss.

RECENT BOOKS

Good Lighting. Requirements of the National Security (Standards of Lighting) Regulations. Commonwealth of Australia, Department of Labour and National Service, Industrial Welfare Division, Leaflet No. 9, 1945. 9 pp.

Reproduces and comments on the Australian regulations, and gives extracts from the Australian Standard Code for the Interior Illumination of Buildings by Artificial Light to indicate the illumination needed for various industrial interiors and tasks.

Airplane Crash Fire Fighting Manual. National Fire Protection Association, International, Boston, Mass., 1945. 96 pp.

The manual consists of eleven chapters dealing with fire-fighting equipment, fire and rescue hazards, rescue technique, basic fire hazards, aircraft armament and its hazards, fixed and portable fire protection equipment on aircraft, general organisation for dealing with crashes, procedure for dealing with crashes, rescue operations, fire-fighting operations, and airfield organisation. The manual is profusely illustrated with photographs and drawings of aircraft details showing, *inter alia*, access and escape openings, fuel systems, fuel tank installations, oil-distributing systems, oxygen-distributing systems, and fire extinguishing systems. Fire-fighting techniques are also shown pictorially.

The Influence of Packing on Falls of Ground Accidents. Ministry of Fuel and Power, Safety Pamphlet No. 17. Published by H.M. Stationery Office, London, 1945. 12 pp.

This is a memorandum by the South Wales Falls of Ground Advisory Committees discussing the functions of packs and the requirements that they should satisfy, and the design and use of chocks and roadhead supports. Various types of roof support are shown in illustrations.

Use of Salts to Allay Dust on Shuttle-Car Roadways in Coal Mines. U.S. Bureau of Mines, Report of Investigations No. 3828, Washington, September 1945. 15 pp.

Discusses the use of hygroscopic salts as a means of allaying dust in roadways in which rubber-tire shuttle cars are employed in connection with mobile coal-loading machines; describes the tests undertaken and reaches the general conclusion that flaked calcium chloride and unrefined granular sodium chloride are effective dust-laying agents in normally humid mines.

Guarding Trolley Wires in Mines. U.S. Bureau of Mines, Information Circular No. 7332, Washington, September 1945. 19 pp.

Discusses American law and practice as regards the installation and guarding of trolley wires in mines and gives several drawings and photographs of guards.

Accidents from Falls of Rock or Ore in Metal Mines. Metal-Mine Accident-Prevention Course, Section 2. U. S. Bureau of Mines, Miners' Circular No. 52, Washington, 1945. 53 pp.

Section 2 of the Accident-Prevention Course discusses the application of different mining methods to various types of ore deposits and the relative safety of these methods. In particular, the paper describes the causes of accidents from falling rock and methods of preventing these accidents.

There are numerous photographs and drawings.

Accidents from Hoisting and Haulage in Metal Mines. Metal-Mine Accident-Prevention Course, Section 3. U.S. Bureau of Mines, Miners' Circular No. 53, Washington, 1945. 60 pp.

The hoisting equipment dealt with includes hoisting engines, brakes, safety devices; ropes and rope attachments; cages, skips and buckets; signalling appliances; shafts, stations and loading pockets.

The section on haulage covers the roadbed and track, haulage equipment and haulage operations.

The circular is profusely illustrated.

Förebyggande av olycksfall inom träindustrien. By John Nordin. Almqvist & Wiksells Boktryckeri AB, Uppsala and Stockholm, 1945. 528 pp.

As far as the International Labour Office is aware, Mr Nordin's latest book is the most comprehensive safety manual yet written on the woodworking industry. It may justly be described as a monumental work, and in addition it combines all the qualities to be desired in a work of this kind — it is excellently printed, profusely illustrated, concisely written, clearly arranged, and eminently practical.

There are five main parts: (A) General review of conditions in the Swedish woodworking industry; (B) Safety regulations and official inspection; (C) Measures for the prevention of accidents and illness and accounts of actual accidents; (D) Certain special types of accident and disease, and first aid; (E) Statistics of accidents in joinery and furniture making.

Part C which takes up most of the book is divided into 16 chapters dealing with factory premises, personal protective equipment, power plant, engines, transmissions, saw mills, timber yards, drying houses and timber stores, planing mills, joinery and furniture factories, storeplaces, garages, transport, repairs and maintenance, miscellaneous risks, travelling to and from work, and specialised factories (bobbins, brushes, veneers, wheels, houses, coachwork boxes, models, organs and pianos, parquet, skis, wood wool, threshing machines, casks, wagons, cork, etc.).

Chapter IX on joinery and furniture factories, which occupies over 130 pages, deals with a large number of woodworking machines, tools and processes.

There are 231 illustrations; all safety devices are coloured red.

The need for a book of this kind is evidenced by the accident statistics of the Swedish woodworking industry. Over the period 1929-1941 there were 15.2 accidents per 100 man-years, or 1 accident a year for every 6 or 7 men employed. Moreover, the rate has been steadily rising — in 1929 it was 12.1 and in 1941, 17.8.

Hydrogen Sulfide Poisoning as a Hazard in the Production of Oil. U.S. Bureau of Mines, Information Circular No. 7329, Washington, July 1945. 10 pp.

The circular discusses the properties of hydrogen sulphide, its toxicity and physiological action, treatment of hydrogen sulphide poisoning, and the prevention of poisoning. The preventive methods advocated comprise education, the use of personal protective equipment and the use of gas detectors. The circular closes with a bibliography.

Safety of Machine Tools and other Plant. No. 4, Guillotines and Shears. Factory Department, Ministry of Labour and National Service. Form 294, August 1945. Published by H.M. Stationery Office, London 15 pp.

Describes various methods of operating and guarding guillotines and illustrates fourteen kinds of guards.

Destruction of Damaged, Deteriorated or Unwanted Commercial Explosives. U.S. Bureau of Mines, Information Circular No. 7335, Washington, August 1945. 6 pp.

The circular sets out general safe practices; and then deals in more detail with methods of destroying dynamite, black powder, smokeless powder, detonators, squibs, fuses, etc., and with the removal of nitroglycerin from magazine floors.

Detonators: Initiating Efficiency by the Miniature-Cartridge Test. U.S. Bureau of Mines, Technical Paper 677, Washington, 1945. 34 pp.

The report describes a new test, called the "miniature-cartridge test", for quantitatively determining the relative initiating efficiency of detonators. The test is based on the view that the best means of measuring the initiating efficiency of a detonator resides in its capacity to initiate an insensitive explosive. For the test in question various mixtures of TNT and iron oxide were used, and the extent of detonation was measured from the weight of sand crushed in a Bureau of Mines sand bomb.

The paper discusses earlier types of test and then describes the apparatus and procedure for the miniature-cartridge test and the results obtained.

Effect of Pressure on the Explosibility of Acetylene-Water Vapor, Acetylene-Air, and Acetylene-Hydrocarbon Mixtures. U.S. Bureau of Mines, Report of Investigations No. 3826, Washington, September 1945. 17 pp.

The report describes the apparatus and procedure for, and the results of, investigations into the explosibility of acetylene containing various percentages of water vapour, air and hydrocarbon gases at pressures from atmospheric to 15 lbs. gauge.

Admixtures of water vapour and hydrocarbons in acetylene tend to reduce the explosion risk. The stabilising effect of hydrocarbons increases with their molecular weight.

Ammonia. Controlling Chemical Hazards Series, No. 1. U.S. Department of Labor, Division of Labor Standards, Washington, 1945. 12 pp.

A useful pamphlet furnishing technical data on anhydrous ammonia (NH_3) and aqua ammonia (NH_4OH), and outlining safety precautions in connection with refrigerating machinery; unloading, repairing and cleaning tank cars; handling and storage. There are also first-aid rules and a bibliography.

Chronic Pulmonary Disease in South Wales Coal-miners. III. Experimental Studies. Issued by the Medical Research Council, Special Report Series No. 250. Published by H.M. Stationery Office, London, 1945. 94 pp. Price 5s. net.

This report, the third of a series of publications issued by the Medical Research Council dealing with the problem of chronic pulmonary disease in the coal miners of South Wales, completes the presentation of the results of the investigations on this subject.

While the first report (Special Report Series No. 243, London, 1942) shows the results of the medical and pathological examinations and the environmental factors which may contribute to or favour the disease, and the second (Special Report Series No. 244, London, 1943) studies the chemical and physical nature of the dust of the mines, the present report deals with the experimental phase of the study.

The experimental studies included in this report deal with:

(*a*) The mineral content of the lungs of workers from the South Wales coalfield;
(*b*) The estimation of coal and of aluminium in dried lung;
(*c*) Tissue reactions produced experimentally by selected dusts from South Wales coal mines;
(*d*) The solubility of dusts from South Wales coal mines.

These different studies are very interesting and complete, especially the third (tissue reactions produced experimentally by selected dusts), which includes very good photomicrographs of the histological slides to explain graphically the experimental work.

The Committee on Industrial Pulmonary Disease, in its report, emphasises that "despite the great amount of information elicited many doubts and discrepancies have still to be dispelled", and "that this information must be correlated with the features which characterise pneumoconiosis as it develops in man under the every-day conditions of his work". For this reason the aim of the Medical Research Council to extend the programme of these investigations is very commendable.

Aménagement des services médico-sociaux d'entreprises. Fondation française pour l'étude des problèmes humains. Librairie de Médicis, Paris, 1945. 43 pp.

The Foundation has produced a very comprehensive pamphlet on factory medical and welfare services and one that is, moreover, well printed, profusely illustrated and attractively arranged. The three main parts into which the pamphlet is divided deal respectively with services for factories employing 1,500-2,000 workers, inter-factory services, and services in factories employing over 3,000 workers. The items of equipment required for these services are enumerated in appendices.

The following scale of services is suggested:

(1) For factories employing about 100 workers: 1 first-aid room.
(2) For factories employing about 250 workers: 1 first-aid room, 1 consulting room, 1 office for the woman welfare adviser.
(3) For factories employing about 500 workers: 1 first-aid room, 1 consulting room, 1 office for the woman welfare adviser, 1 waiting room.
(4) For factories employing from 1,500 to 2,000 workers: 1 room for treatment, 1 consulting room, 2 offices for the women welfare advisers, 1 waiting room, 1 secretariat for preliminary examinations, 1 cabinet for radiodiagnosis, 1 laboratory, 1 set of undressing rooms.
(5) For factories employing 3,000 or more workers: 1 room for treatment of injured, 1 room for treatment of the sick (supplemented by 1 isolation room and 1 sterilisation room), 1 room for preliminary examinations, 2 consulting rooms, 4 offices for the welfare service, 2 waiting rooms, 1 set of undressing rooms, 1 cabinet for radiodiagnosis (supplemented by a photographic laboratory), 1 laboratory for analyses, 1 rest room for the medical and welfare personnel, 1 cloakroom for the medical and welfare personnel.

First Aid Services for Factories. Ministry of Labour and National Service, Welfare Pamphlet No. 4, Fifth Edition, H.M. Stationery Office, London, 1945. 24 pp.

This illustrated pamphlet, "issued for the guidance of occupiers of factories in order to assist them in establishing efficient first-aid services in their factories", is a handy and very practical publication that should be in the hands of all persons connected with first-aid services.

The pamphlet is divided into seven short chapters and three appendices. Each chapter outlines the working conditions of the different sections of the first-aid services in accordance with the provisions of the Factories Act, 1937, as follows: 1. Introduction; 2. First-Aid Boxes; 3. Ambulance Room; 4. Organisation of First Aid in the Factory; 5. Accident Records; 6. Joint Ambulance Room Services; 7. Medical Supervision.

The first appendix gives the text of the Factories Act, 1937, Section 45, which deals with first-aid services; the second gives models of accident record forms with a view to ensuring the proper recording of the cases treated; and the third provides practical plans of ambulance rooms.

The pamphlet is supplemented by photographs of first-aid installations.

Job Safety Training Manual. By K. L. Faist and S. M. Newkirk. Published by the National Foremen's Institute, Deep River, Connecticut, 1945. 52 pp.

This is a brief and intensive training programme for

supervisors composed of five two-hour sessions and consisting of eight sections, four appendices and three supplements.

The authors have based the programme on the training programme developed and sponsored by the Training Within Industry Branch of the War Manpower Commission, namely: job instruction, job relations, and job methods training.

The book is in loose-leaf form, is very well prepared, and provides an excellent safety training course.

Safety Training Digest: Industrial Rehabilitation. The American Museum of Safety and the Center for Safety Education, New York University, New York, 1945. 91 pp.

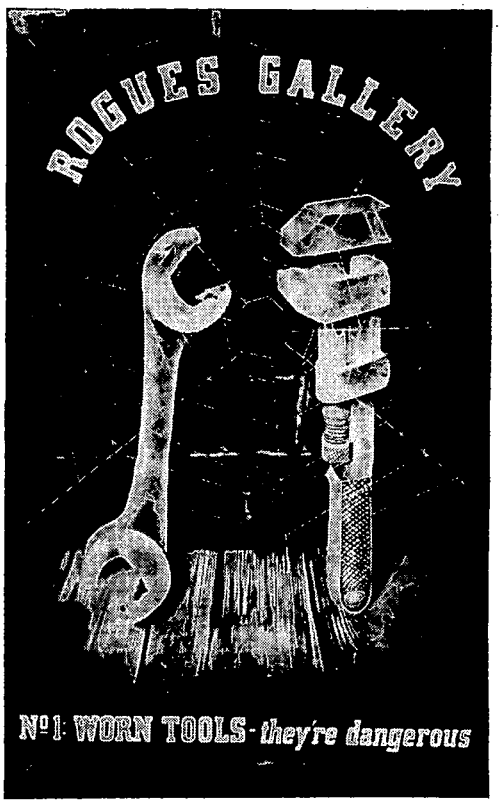
The Digest comprises 19 short articles on the industrial rehabilitation of disabled members of the armed forces. Most of the articles are of direct interest from the safety standpoint, but special mention is deserved by one entitled "The Handicapped Are No Hazard" by L. H Fowler, who describes the policy of a pharmaceutical manufacturing company whose staff of 150 includes 130 disabled persons, and which produced over $6,000,000 worth of goods in 1944 without any injury more serious than a scratched finger.

The first principle of success has been vocational selection. The job is so fitted to the man that the man loses his handicap for all practical purposes. His output is not inferior to that of an able-bodied man, and his morale does not suffer. The men themselves help to make a perfect safety record — they are naturally cautious and do not need to be "sold on safety". They also display an excellent team spirit, and do all they can to help one another. Further, the company has seen to it that they have no serious grievances, realising that the discontented worker is unusually prone to accidents.

NEW POSTERS

Discard worn tools

(Ministry of Labour, Industry and Commerce. Division of Industrial Hygiene and Safety, Rio de Janeiro)



(Issued by the Ministry of Labour and National Service and produced by the Royal Society for the Prevention of Accidents, London)

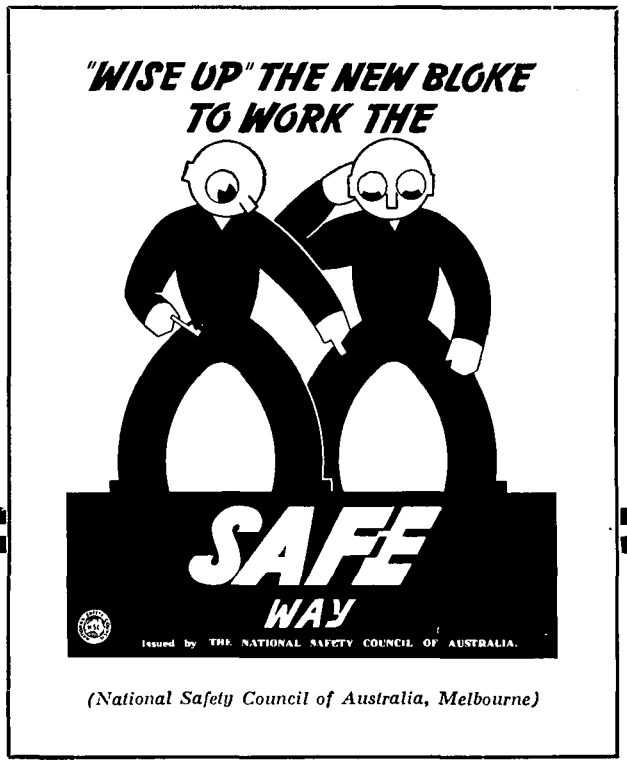
Inattention on the job produces accidents with the rapidity of lightning

(Ministry of Labour, Madrid)

(National Safety Council of Australia, Melbourne)

INTERNATIONAL LABOUR OFFICE

INDUSTRIAL SAFETY SURVEY



(National Safety Council of Australia, Melbourne)

Published Every Three Months

VOLUME XXII, No. 3
JULY-SEPTEMBER 1946

Price per Number: 2s.; 50 cents
Annual Subscription: 6s.; $1.50

CONTENTS

INDUSTRIAL SAFETY SURVEY

VOL. XXII JULY-SEPTEMBER 1946 No. 3

THE DISCOVERY AND ANALYSIS OF MULTIPLE ACCIDENT CAUSES

By ROGER J. DESNOYERS, Training and Safety Supervisor, Industrial Relations, Northern Electric Company Ltd., Montreal

It is becoming increasingly apparent to the safety analyst that accidents occur fairly frequently as a result of a combination of a number of unrelated factors which contribute equally to cause the mishap. This article will deal with cases showing two, three and more contributory factors.

I

One of the most helpful systems used by industry and governmental agencies in the analysis of the causes of accidents is embodied in the *American Recommended Practice for Compiling Industrial Accident Causes*, issued by the American Standards Association. This is a Code that furnishes information on accidents which hardly any other analytic approach had been able to, and it further presents that information in a form which even the less experienced analyst cannot fail to appreciate, and for which the expert is more than thankful.

Its great utility resides in its power to dissect the story of an accident into all the proper and essentially pertinent parts. The greater the number of cases analysed, the more helpful becomes the Code because it has organised the thinking that is so necessary on the subject of:

(1) unsafe acts or practices;
(2) unsafe conditions; and
(3) unsafe personal factors.

The Code's system of tabulation, which comprises five major classifications, including the agency and the accident type, is quite thorough and very selective. However, it may be a little too selective to present the full, true picture of certain accident cases. This over-selectivity is due probably to the desire of the authors of the Code to see that in any group of accidents the total number of unsafe practices and unsafe conditions added to the unsafe personal factors would equal the total number of cases studied, or come as close as possible to the same figure.

It is suggested that the rule for arbitrarily selecting the cause most closely associated with the accident is too strict, although it may be felt that either an unsafe act or an unsafe condition must be recorded as the primary cause, for the purpose of simplifying the resulting statistics. This simplification of statistics, however, results in an incomplete picture of the situation as it really exists. The authors of the Code are no doubt aware of this, and it is suggested that it has been an omission of some magnitude not to mention in the preface of the Code that the majority of the accident cases register *at least* one unsafe act and one unsafe condition.

Experience in analysing hundreds of lost time cases according to the Cause Code shows that approximately two out of three cases show multiple contributory factors, *i.e.* unsafe acts and unsafe conditions. Following is a percentage summary of an analysis of 150 ordinary industrial accident cases:

	Per cent.
Cases showing one or more of both unsafe acts and unsafe conditions	69.3
Cases showing only unsafe acts	18.0
Cases showing only unsafe conditions . .	9.3
Cases showing neither unsafe acts nor unsafe conditions	3.3

As several authorities in the field of accident prevention have continually indicated one of three basic causes (unsafe acts, unsafe conditions, acts of God or uncontrollable occurrences) as the sole cause of accidents, I hesitated to accept my own results as being conclusive until a check was made with other men in the same field. The results of sample analyses showed a curious consistency, because approximately two out of every three cases studied showed *at least* one of both unsafe acts and unsafe conditions.

This does not imply a criticism of the Cause Code itself, because it is only too evident that it points out the proper direction in which accident prevention measures should be applied. Its job is, briefly, to sort out all the specific unsafe

TABLE I

ANALYSIS OF LOST TIME ACCIDENTS — BY AGENCY (Most closely connected with injury)

	Cases	Days lost
Sanders and Grinders	4	69
00012 1– 6		
00040 1– 31		
00045 1– 4		
00058 1– 28		
Riveting and Drilling	10	254
00117 1– 55		
00170 4– 63		
00175 1– 20		
00176 2– 8		
00181 1– 88		
00183 1– 20		
Millers, Planers and Presses	7	311
00203 1– 36		
00239 2– 14		
00291 4–261		
Brakes and Lead Presses	5	92
00306 1– 44		
00309 4– 48		
Saws and Shears	5	284
00426 1– 77		
00430 3–155		
00497 1– 52		
Braiders and Winders	7	170
00560 2– 79		
00592 1– 1		
00594 1– 27		
00595 1– 13		
00596 2– 50		
Miscellaneous – Office Machines	1	2
00614 1– 2		
Solvents, Oils and Compounds	4	73
11356 1– 14		
11377 1– 49		
11999 2– 10		
Inorganic Dusts	2	5
13224 1– 2		
13256 1– 3		
Floors and Stairs	6	125
15302 2– 19		
15303 1– 47		
15305 2– 56		
15821 1– 3		
Barrels, Boxes and Furniture	10	87
19142 1– 7		
19147 9– 80		
Doors, Windows and Gates	4	40
19222 4– 40		
Dust Particles	2	5
19224 2– 5		
Fixtures and Office Equipment	3	13
19307 1– 2		
19308 1– 7		
19383 1– 4		
Platforms and Woodworking Materials	2	7
19503 1– 6		
19504 1– 1		
Pig Lead	2	46
19505 2– 46		
Reels – Wire and Cable	18	345
00887 18–345		
Miscellaneous – Wire Machines	3	45
00921 1– 7		
00924 1– 26		
00940 1– 12		
Pumps and Prime Movers	1	1
01202 1– 1		
Elevators – Passenger and Freight	2	18
02101 1– 12		
02201 1– 6		
Air Hoists	2	26
03302 2– 26		
Vulcanizers	1	23
05226 1– 23		
Hand Trucks and Floats	14	394
06903 12–330		
06904 2– 64		
Transformers, Conductors, Switches and Condensers	5	56
09111 1– 4		
09211 1– 19		
09214 1– 28		
09323 1– 4		
09901 1– 1		
Hand Tools	10	139
10118 1– 2		
10136 1– 5		
10162 1– 76		
10304 2– 19		
10307 2– 5		
10353 1– 21		
10590 1– 11		
Sheet Metal, Bars and Rods	5	60
19542 2– 22		
19543 2– 23		
19544 1– 15		
Nails and Screws	1	2
19581 1– 2		
Reservoirs, Tanks and Vats	1	71
19746 1– 71		
Stairways	6	39
19783 6– 39		
Safety Appliances	1	55
19784 1– 55		
Spools – Wire and Cable	1	16
19786 1– 16		
Trays – Wooden and Metal	2	8
19827 2– 8		
Wires – Unconnected or in Process	3	31
19921 3– 31		
Workbenches	1	9
19922 1– 9		
Total	150	2,921

factors and to enable the analyst to determine which set of factors needs the most urgent attention. For example, in one plant, where a very efficient safety educational programme has been in force for many years, there were about 30 per cent. more unsafe conditions than unsafe acts. Such a discovery shows that the engineering aspect of safety work had not kept up with the educational programme. Very few analyses, made in any other manner, would point out this trouble.

Tables I to V show the analysis of the 150 cases mentioned previously. They represent a consecutive series of accidents to each of which would be assigned only one major contributory factor were the A.S.A. Cause Code applied in the recommended manner. A study of the tables dealing with unsafe acts and unsafe conditions concerning the same 150 cases will show clearly why it is deemed necessary to apply a full analysis to the details of all accidents when searching for preventive measures. One or two recent cases occurring within this chronological series were not included in the general analysis and summary but are treated separately later in this article.

TABLE II

UNSAFE MECHANICAL OR PHYSICAL CONDITION			
Code	Cases	Description	Days lost
00	4	Unguarded	124
01	7	Inadequately guarded	252
10	13	Rough	196
11	10	Slippery	297
13	1	Poorly designed	30
14	4	Low material strength	62
16	1	Inferior composition	49
17	5	Worn, cracked, damaged	66
19	4	Hidden defects	56
20	16	Unsafely stored or piled materials, reels, etc.	207
21	5	Congestion of working spaces	48
23	7	Unsafe planning of work	52
24	15	Unsafe processes, careless operation	449
26	6	Misaligned work	66
50	2	No eye protection	18
52	1	No gloves	19
61	2	High heels	7
X	1	Unclassified	1
Y	46	No unsafe mechanical or physical condition	922
Total	150		2,921

TABLE III

ACCIDENT TYPE			
Code	Cases	Description	Days lost
0	20	Striking against	510
1	72	Struck by	1,061
2	16	Caught in, on, or between	624
3	8	Fall on same level	115
4	6	Fall to different level	119
5	15	Slip (not fall) or over-exertion	136
6	6	Contact with temperature extremes	194
7	2	Inhalation, absorption, ingestion (dermatitis)	63
8	4	Contact with electric current	55
9	1	Not elsewhere classified (occupational blister)	44
Total	150		2,921

TABLE IV

UNSAFE ACTS			
Code	Cases	Description	Days lost
02	26	Failing to lock, block, secure materials, tools or equipment from falling or moving	497
04	1	Releasing or moving loads, materials without warning	48
10	10	Running	57
11	3	Feeding or supplying too rapidly	104
12	6	Driving or trucking too rapidly	93
14	1	Throwing material instead of carrying or passing it	48
15	3	Jumping from chairs, benches, platforms, vehicles	47
24	1	Disconnection of safety devices	13
30	1	Using defective equipment	21
32	5	Using hands instead of hand tools	169
33	18	Gripping objects insecurely or improperly	291
41	1	Crowding	1
42	7	Lifting, carrying or handling heavy loads or weights	84
43	7	Arranging or placing objects or materials unsafely	149
44	1	Combining substances producing fire hazards	76
45	2	Introducing objects or materials unsafely	14
50	2	Exposure under suspended or overhanging loads	140
51	4	Putting body or limbs into openings of equipment or shaftways	305
54	1	Lifting while in awkward position	19
58	3	Exposure to falling or sliding objects	20
60	2	Working on moving equipment	15
61	6	Cleaning, adjusting and oiling of moving equipment	70
63	5	Working on electrically charged equipment	110
72	1	Horseplay	3
80	13	Failing to wear goggles, gloves, etc.	127
81	1	Wearing high heels, loose hair, etc.	19
Y	19	No unsafe act on part of injured	381
Total	150		2,921

TABLE V

UNSAFE PERSONAL FACTOR			
Code	Cases	Description	Days lost
00	19	Improper attitude, wilful disregard of instructions . . .	224
02	15	Absentmindedness	399
04	3	Nervous, excitable, etc. . . .	110
05	5	Failure to understand or remember instructions	65
10	73	Unaware of safe practice . . .	1,388
11	1	Unpractised or unskilled . . .	76
22	6	Muscular weakness	54
Y	28	No unsafe personal factor. . .	605
Total	150		2,921

II

The question of multiple unsafe factors in accident cases gives rise to some concern when about two out of three cases fall into this category. Even the presence of so many cases showing one unsafe act and one unsafe condition will not throw the resulting statistics too much out of line, provided that the tabulation of the unsafe mechanical and physical conditions and of the unsafe acts is done separately with no regard for, or attempt to balance, the number of unsafe factors with the total number of accidents analysed.

With unsafe practices and unsafe conditions appearing together in two-thirds of all accidents in industry as proved by the application of the Cause Code, the first logical step which must be taken by management, through its safety organisation, involves a double-sided protection programme for its employees.

The unsafe conditions, when found, should be eliminated by the application of the proper engineering remedies. The unsafe acts and practices should be attacked with diligence. The educational programme should be broadened to reach more employees; employee training should include safety instruction as an indivisible part of the job; supervision should be enlisted in the fight against the indifference shown by workers towards safety measures and precautions, and they themselves should be persuaded into co-operating more fully with all management-sponsored safety activities.

Safety statistics in themselves are just about the driest reading that anyone can pick up. Yet, there is the most valid reason in the world not only for reading them, but also studying them thoroughly, since it is only through an exhaustive dissection of the story presented in figures that intelligent measures can be planned in the fight to eliminate accidents. What is done with the figures so found will show whether any interest in true accident prevention exists in the organisation.

The unsafe acts generally show a lack of appreciation of the danger of doing things without first thinking of the precautions which should be taken to avoid injuries; they also point to the fact that someone has failed to give proper instruction to the employees; but, particularly, they are an almost infallible sign of indifference towards the principles of self-protection. In this era of efficiency and production, the worker and his immediate supervisor, whose interest lies in getting the material out quickly, consider that accidents and personal injury have no relation whatever to their lives as workers. National accident statistics constantly disprove this very faulty assumption.

The mind has the strange—and beneficial—ability to forget unpleasant things and dwell only on the more pleasant aspects of living. This very forgetfulness enables an injured person to rehabilitate himself with the least psychological disturbance, and yet, it is this lack of memory which makes safety education such a long and, at times, almost ineffectual job.

A person who has already been injured has a feeling, although he may not think of it in precise terms, that mathematically his chances of ever being injured again are very small; lightning not striking twice in the same place, etc. Such an employee is too often unco-operative with regard to safety rules and regulations, and others will try to put the blame on some other factor or agency for the injuries they have received, or for any losses or damage which may have occurred, and it is only by diligent action on the part of the investigator that the true story of accident and injury can be correctly recorded.

Particular care should be taken to note *all* unsafe practices related to the origin of an accident. Later, if it is found logical and feasible, some relatively unimportant practices or conditions may be ignored (if any valid excuse can ever be found at all for ignoring any *unsafe* contributory factor) so as not to obscure the main issue. Yet, when this is done conscientiously, the safety analyst sometimes finds two, three or even more unsafe factors contributing in some measure to an accident. At times, unsafe acts will have the preponderance over unsafe conditions, and at other times the reverse is the case.

The safety man should always present unsafe conditions as evidence of neglect, lack of organisation, or lack of appreciation that safety measures offer tangible, beneficial results. As long as these three attitudes continue to thrive in a business, or anywhere else, there will be unsafe conditions.

Unsafe acts should be construed to represent evidence of lack-lustre supervision and un-

concerned and uninterested employees in relation to the cases studied. However, simply pointing the finger at such conditions, without going into them more deeply, makes the safety man's job resemble that of the gardener trying to eradicate weeds from his garden by mowing them close to the ground instead of pulling them out completely.

III

Many of the 150 cases presented in the general analysis show one unsafe act plus one unsafe condition. The following cases offer other combinations of these two unsafe factors.

Case No. 1

"Two employees were working together putting pans of wire into a small hut. The pans had been brought into the small area on a heavy industrial hand truck. When they were finished, one employee went outside the hut and stood there waiting for his companion to pull the truck out. This, the other man did fairly rapidly, but in doing so, he swerved it over the waiting man's foot, causing a painful injury."

UNSAFE ACT No. 1: Standing too closely to the right-of-way.

UNSAFE ACT No. 2: Pulling truck out too rapidly, and swerving it when care was obviously necessary.

Had the truck been pulled out in a straight line, no injury would have occurred as there was some clearance available. However, each employee contributed his own unsafe act which resulted eventually in accident and injury. It is next to impossible to record the details of this case without mentioning both unsafe acts and had only one act been committed, the accident would not have occurred. There is no doubt whatever that both employees required further instructions on trucking safety.

Case No. 2

"While engaged in one phase of the manufacture of electric cable, two men were working on a large strander. Both men were aligning the end section with the adjacent one by turning it by hand. One of the employees placed a leg inside the frame of the machine to facilitate the job. Both employees, however, had neglected to turn off the motor, and the machine was started by the operator remaining at the front of the strander, causing the other employee's leg to be caught between the revolving section and the frame."

UNSAFE ACT No. 1: Working on a machine with the motor running.

UNSAFE ACT No. 2: Placing limb in an opening in dangerous equipment.

UNSAFE ACT No. 3: Starting large machine without warning, when others were still working on sections of it.

The combination of these three unsafe acts resulted in accident and injury. Had any one of these not been committed, it is easy to see that the injury would not have occurred. The correction necessary in this case involved consideration of all three unsafe actions. The assigning of only one unsafe factor in this case, resulting in a false presentation of the story, would result in incomplete and unsatisfactory prevention.

Case No. 3

"An employee was helping to move a reel of cable weighing 8,000 lb. (3,650 kg) in a 4-wheeled steel winch carrier equipped with steering handle. He was holding the handle from the side, steering the carrier, while another employee pushed the unit from behind with a heavy duty power truck. The wheel of the carrier hit some obstruction on the floor, causing the handle to swerve to one side, thus pushing the man sharply against the frame of the doorway (through which they were expecting to pass) jamming the man's leg between the front of the carrier and the door frame, and causing a severe compound fracture."

UNSAFE ACT No. 1: Using hands to guide four and one-half ton (4,100 kg) load (including weight of carrier).

UNSAFE ACT No. 2: Power truck pushing carrier, instead of pulling it.

UNSAFE CONDITION No. 1: Small obstructions on floor at the time.

The correction in this particular case, in order to be effective, requires instruction related to each of the unsafe factors mentioned. The men must be brought to realise that they are the ones who suffer the injuries, and that a bit of preventive thinking *before* doing a job will often save them much needless suffering. The promotion and development of safe employee attitude can never be given enough emphasis.

Case No. 4

This is the story of a near-accident which would have been fatal had the victim not been saved by a rare stroke of luck. As it was, equipment damage resulted, considerable delay was occasioned in the routing of materials and much time was lost by employees who were in the vicinity of the accident.

"The accident occurred at an elevator on the fourth floor. An employee was waiting with his truck parked very close to the elevator doors. A second employee was pulling a heavy truck along the aisle and attempted to pass the waiting truck. A third employee, in the large open area between the braider sections in front of elevator doors, picked up a packing case and then found that an unloaded truck was in the way. He gave the truck a push with his foot, sending it out rapidly towards the second trucker who was

attempting to pass the first stationary truck at the elevator door. The operator of the loaded truck made a sudden swerve on seeing the coasting truck coming straight at him, and this caused his own truck to crash into the waiting truck which, in turn, smashed the lower elevator door out of its guides so that it fell four stories to the bottom of the pit. Suddenly released from its counterbalance, the upper half of the door flew up out of sight. The operator who had been leaning against this door was beginning to fall into the 52-foot pit when he was saved by another employee who grabbed him and pulled him back."

By the grace of two fortunate occurrences, the accident did not result in actual injury to anyone, since, in the first instance, the freight elevator was above the fourth floor when the large door went hurtling down; and in the second place, a quick-thinking employee was passing by when the other man was toppling over into the elevator shaft.

UNSAFE ACT No. 1: By the operator pushing and allowing a free-rolling truck to endanger others in the main aisle.

UNSAFE ACT No. 2: By the oncoming trucker who swerved against the waiting truck instead of slowing down.

UNSAFE CONDITION No. 1: Allowing trucks to wait so close to the elevator doors.

Among the other necessary corrective measures taken as a direct result of this accident, it was decided to rule that no parking of trucks or materials of any kind would be allowed within a distance of six feet from any elevator door. White lines were painted and maintained on the floor in front of each location, limning a rectangle six feet deep and having the width of the door. Large signs on the walls adjacent to each door proclaim the reason for the painted line.

One result of this safety measure was a marked improvement in the flow of freight traffic from section to section as well as from floor to floor, since former conditions had frequently resulted in delays and traffic tie-ups when materials had to be taken off the elevators at certain floors and truckers found the way out blocked by other trucks or large wire reels that were waiting for elevator service close to the doors.

Case No. 5

"A supervisor was watching a die-setting operator adjusting a press to draw some small-diameter gongs. At one point in the setting-up, the operator ran off a sample part. The supervisor inspected it and saw that the draw had been too shallow for some reason. Then, both supervisor and employee looked closely into the die as the illumination was rather dim at that moment. The supervisor then tripped the press with his foot. The operator, not realising that the press was being tripped, used the second finger of his right hand to feel the inside of the die. Although the ram started slowly, it was still fast enough to amputate the man's finger at the first joint."

UNSAFE ACT No. 1: Working on a machine with the motor running.

UNSAFE ACT No. 2: Operating an unguarded machine without warning the other employee working on it.

UNSAFE CONDITION No. 1: Low illumination, requiring closer inspection of the work being done.

UNSAFE CONDITION No. 2: There was no way of knowing that the motor was running. (See below.)

It may also be claimed that a careful tool and die-setter should block the ram with a substantial wooden block, or its equivalent, to prevent just such an accident; and it is possible to call not taking this precaution an unsafe act.

According to the employees involved, had the illumination been of a higher level and better directed at the work, the man would not have felt the inside of the die as he did; hence this unsafe condition was a major contributory factor in the case.

It should be mentioned that other presses were operating close by, and the general noise and pounding would have a marked tendency to hide motor sound and vibration. There was no provision made on this press to show when the motor was running, either through a signal light, or by means of stripe painting on the flywheel.

It is also debatable whether the supervisor was even looking at the point of operation when the ram came down, which may contribute another unsafe act to the number we already have. To minimise the danger attending the use of punch or draw presses, the set-up man should always make sure personally that no one is near enough to the machine to be hurt, or to cause injury to anyone else.

IV

The mechanical standards of our machine age are very high. It is probably the human element that is failing to keep improving its attitude towards the mechanical element. A fuller, more comprehensive respect for all things mechanical must be instilled into the minds of the workers, and the discovery and analysis of multiple accident causes only serve to emphasize the great need for this respect and caution.

We must now consider whether or not a change in accident prevention technique is required in order to improve the results expected from our safety programme. As the human element is in some way involved in, or responsible for, about 97 per cent. of all accidents, it may be deduced

that a more personal approach to prevention will be more effective.

To summarise

1. Accidents involving several employees are not necessarily to be construed as having been caused by more than one unsafe act or one unsafe condition, or more than one of each; and, at the same time, an accident in which only one person is involved may reveal three or more unsafe acts and/or conditions, so that the number of persons implicated in a case analysis has no direct bearing to the number of contributory factors which may be found.

2. As mentioned earlier in this article, even the "obscure" unsafe contributory factor should be brought out into the open and scrutinised carefully. Under study, it will cease to be "obscure" or far-fetched. The safety man is interested in *prevention*, but first he must find out *what* he has to prevent.

3. In too many cases does the analysis of accidents suggest that the most obvious causes are the basic causes for their occurrence. It would seem that we should look farther back into the history and closer into the details of all injuries and accidents to determine whether the causes so found are not just apparent causes presenting the proper symptoms.

This is not so complicated as it seems, because a more thorough analysis of contributory factors consists in a closer scrutiny of employee behaviour and attitude—after all, it is the employee himself who sustains the injury. The job of accident prevention becomes much more interesting when it involves the study of accident-proneness, and this enables the safety man to become even more valuable as a member of the personnel group.

The writer feels that the best type of safety work consists in the study of accident-proneness and *its* contributory factors. This probe into the background of the apparent causes of accidents will take the safety man into such fields as the identification and correction of fatigue, indifference, lack of, or poor training, restlessness, dissatisfaction, worry, strain, lack of confidence, lack of co-operation, grievances and other factors. When factors like these are revealed, we are much closer to the true story of, and the true causes behind, accidents and injuries. Few managements could then be found who would not appreciate being offered the opportunity of taking more efficient action in accident prevention, based on such studies by the safety organisations in their plants.

A more thorough investigating technique is recommended based, on the one hand, on the application of the Cause Code without limitation of unsafe contributory factors, and on the other, on the Latin philosophy that "the cause of the cause is the cause of the effect".

This weed of accidents has many roots and the job is to pull them all out.

SAFETY INSTITUTIONS, ASSOCIATIONS AND MUSEUMS

SPAIN

Short Course in Industrial Medicine

The National Institute of Medicine, Hygiene and Safety organised a first short course on Industrial Medicine in Madrid.

The programme consisted of 40 lectures on theory compiled from the various subjects to be dealt with in the course: pertinent legislation; industrial accidents and their compensation; occupational poisoning and diseases; industrial hygiene; accident prevention, etc.

These lectures, which will be given by the technical staff of the Institute and by physicians, engineers and other persons belonging to various centres, will be supplemented by practical lessons on clinical cases and visits to undertakings and workplaces.

Persons taking the course who pass the required test satisfactorily will receive a diploma.

SWEDEN

The Labour Protection Association in 1945 [1]

During the year 6,276 persons signed the visitors' book in the Association's Exhibition in Stockholm as compared with 5,909 in 1944; in both years the actual number of visitors was considerably larger.

The number of lectures on labour protection and hygiene further increased from 133 in 1944 to 160 in 1945 and the attendance rose from 2,411 to 2,716. Additions were made to the collections of exhibits and lantern slides.

The Association's publications continued to find a ready market. During the year 5,000 additional copies of the Handbook on Safety (*Arbetsplatsens Skyddsfrågor*) were printed for distribution among the members and a fourth

[1] *Arbetarskyddet*, No. 5, 1946, p. 147; for 1944 see *Industrial Safety Survey*, Vol. XXII, No. 1, p. 16.

edition of the Handbook on the Labour Protection Act had to be issued. Circulation of the Association's journal *Arbetarskyddet* rose to 20,000. The Association again distributed 20,500 copies of the Industrial Inspectors' descriptions of noteworthy accidents and dangerous occurrences.

At the end of the year the permanent members of the Association numbered 179 and subscribing members 400.

SWITZERLAND

The Permanent Advisory Office for Accident Prevention in 1945 [1]

The report for 1945 is mainly devoted to road safety, but contains some information on the Office's activities for the prevention of accidents in sport and agriculture.

With the end of hostilities and the renewed availability of motor fuel there was a revival of motor traffic and an alarming increase in traffic accidents; accordingly various authorities were led to take comprehensive measures for improving road safety. Further progress was made in the removal of danger spots and the Office continued its educational activities. There were no important legislative developments but the amendment of the Federal Act on Traffic is under consideration.

[1] For 1944 see *Industrial Safety Survey*, Vol. XXI, No. 4, p. 132.

For the prevention of accidents in agriculture numerous technical courses and demonstrations were given in agricultural schools in almost all parts of the country. In these courses the woodmen's tools designed by the Central Forestry Office *(Forstwirtschaftliche Zentralstelle)* in the interests of rational working and safety were displayed for the first time. The report again comments on the defects of agricultural machinery. Discussions have been held with manufacturers of this machinery with a view to introducing various improvements. Efforts are also being made to reduce accidents due to tractors.

UNITED KINGDOM

Royal Society for the Prevention of Accidents

Safety Officers' Training Courses

On behalf of the Ministry of Labour and National Service, the Society organises eleven-day training courses of 24 lectures for safety officers of industrial undertakings.

The aim is to give every participant a solid grounding in the basic principles and practice of accident prevention, and the instruction covers mechanical, electrical and chemical hazards, industrial poisoning, the influence of health and

	Morning	Afternoon	Evening
Monday	*Note:* Trainees attend all lectures, discussions and problem sessions throughout the course. There are no optional subjects		A1 Review of accidents, their causes and prevention A2 Arrangement of the course
Tuesday	B1 Buildings, plant, ways and traffic (*a*)	B1 Buildings, plant, ways and traffic	Introductions
Wednesday	B2 Mechanical hazards (*a*)	B2 Mechanical hazards (*b*)	B2 Mechanical hazards (*c*)
Thursday	B3 Chemical and allied hazards	B4 Industrial poisoning	Problems
Friday	B5 Electrical hazards	B6 Personal protective devices	Problems
Saturday	WHOLE DAY AT THE INDUSTRIAL MUSEUM, Horseferry Road, London, S.W. 1		
Sunday	Free time	C1 The Factories Act, 1937	C2 Statutory Rules and Orders and selected sections of the Act
Monday	D1 Every-day human causes	D2 Health factors	Legal problems
Tuesday	D3 Psychological factors	D4 Trades Union Co-operation	Legal problems
Wednesday	E1 A typical safety organisation E2 Managerial support	E3 Works Safety Committees	Problems
Thursday	E4 Works accident statistics	E5 Propaganda	Problems
Friday	E6 Summary of organisation	F1 Fire prevention	F2 Miscellany
Saturday	Trainees may leave at any time after breakfast on Saturday morning		

psychological factors, laws and regulations, and works safety organisation.

Course programmes are largely standardised but vary in detail. A sample programme is reproduced above.

UNITED STATES OF AMERICA

American Standards Association

Award for Work on Safety Standards

At the Navy Headquarters in Washington on 19 March 1946, Mr. John L. Sullivan, Assistant Secretary of the Navy for Air, presented the American Standards Association with the Navy's Certificate of Achievement "in recognition of specialized accomplishment on behalf of the United States Navy and of meritorious contribution to the national war effort".

The certificate contains the following citation:

"This organization, upon whose Executive Board the Navy has representation, performed a commendable service to the Navy through the preparation and development of Safety standards, codes, and specifications, many of which have been adopted by the Navy. This program of the American Standards Association speeded up the process of the development and preparation of such codes which otherwise would have involved considerable research and, most important, would have taken considerable time to prepare and develop, had the Navy undertaken such tasks without the aid, guidance, and assistance which the American Standards Association so ably rendered."

The International Labour Office, which is indebted to the American Standards Association for much willing collaboration and valuable assistance, has very great pleasure in congratulating the Association on this distinguished award.

LAWS AND REGULATIONS, SAFETY CODES

BELGIUM

Order establishing Safety and Hygiene Organisations in Industrial and Commercial Undertakings and in Public Services and Undertakings and Public Utilities. Dated 11 February 1946 [1]

The regulations in this Order appear to be the most comprehensive ever issued by any Government on safety organisation in industrial undertakings. They are further evidence of the increasing importance that Governments are attaching to the human factor in general and safety organisation in particular in the field of industrial safety and health. In view of its interest the Order is reproduced in full below with the exception of a few administrative and penal provisions.

Chapter I. General Principles

1. The present Order shall apply to all industrial and commercial undertakings and to all public services and undertakings and public utilities covered by the Act concerning the safety and health of the personnel employed in industrial and commercial undertakings, even when they are not scheduled as dangerous, unhealthy or offensive.

Undertakings in which the employer works only with members of his family living with him or with household employees or domestic servants, shall be exempted in conformity with the last paragraph of Section 1 of the said Act.

The provisions of the present Order shall not apply to mines, surface mines and underground quarries, which, in this respect, shall form the subject of separate regulations.

2. In every undertaking referred to in paragraph 1 of Section 1 of the present Order, a "safety and hygiene service" shall be organised. This service shall be supplemented by one or more "safety and hygiene committees" in every undertaking employing at least 50 persons.

A Ministerial Order issued after consultation with the Superior Safety and Hygiene Council and the General Joint Committee may extend the application of the present Order to undertakings employing less than 50 persons and determine the conditions and the rules for this extension.

3. The said service and committees shall be placed under the supervision of the competent departments of the Ministry of Labour and Social Welfare.

On the occasion of every appointment and every change of functions, the competent departments of the Ministry of Labour and Social Welfare shall be informed, so that these departments can keep up to date the list of persons appointed.

The rules for appointment and functioning of the safety and hygiene services and committees shall be determined by Ministerial Order.

The names of the head of the safety service and his assistants, and also the composition of the safety committee, shall be mentioned at the foot of, or in an annex to, the shop rules.

[1] *Moniteur Belge*, 15 Feb. 1946, p. 1261.

Chapter II. Safety and Hygiene Services

4. The safety and hygiene service shall be directed by a "chief of the safety and hygiene service" who shall be selected by the head of the undertaking from among the personnel of the undertaking.

5. The chief of the service and his assistants shall possess sufficient knowledge of the legislation relating to safety, health and hygiene in workplaces applicable to the undertaking, and, having regard to the nature of the undertaking, the technical knowledge required to solve the general safety and hygiene problems that will arise.

They shall possess the moral qualities indispensable for the performance of their duties.

They shall, moreover, be invested with all the authority necessary for ensuring the application throughout the undertaking of the safety and hygiene measures that they deem necessary, without having to refer to another chief of service. They shall be directly subordinate to the general management of the undertaking.

The chief of the safety and hygiene service shall be aided by one or more assistants, in so far as the circumstances require, so that the duties imposed on this service may be performed fully and efficiently at all times.

6. The functions of the chief of the safety and hygiene service, and of his assistants if any, shall be determined by a Ministerial Order issued after consultation with the Superior Council referred to in Section 18; they shall comply, more particularly, with the following rules:

(1) They shall make frequent and systematic inspections of the undertaking as well as of the various workplaces ancillary to it, for the purpose of satisfying themselves as to the enforcement of the regulations concerning safety, health and hygiene in workplaces;

(2) They shall take, or propose to the head of the undertaking, the measures that they deem necessary for eliminating causes of danger or harm of any kind that they have noticed or that have been notified to them;

(3) they shall verify the suitability and efficacy of these measures;

(4) they shall give both to the chiefs of service and foremen and to the workers, the orders, instructions or advice requisite for the enforcement of these measures;

(5) they shall employ all appropriate propaganda to instil notions of safety and hygiene into the personnel and to endow them with the safety spirit;

(6) they shall regularly draw up reports: *a*) concerning the conditions of safety and hygiene in the undertaking; *b*) concerning all accidents occurring in the undertaking and affecting the safety and health of the personnel, after collecting all useful information for this purpose. These reports shall make it possible to ascertain the causes of insalubrity and of the accidents and to infer from them the appropriate means of avoiding a repetition. These reports shall be kept at the disposal of the engineers and medical officers of the Labour Protection Service.

7. A complete annual report on the activity of the service in the domains within its jurisdiction shall be addressed to the competent departments of the Ministry of Labour and Social Welfare.

Chapter III. The Safety and Hygiene Committee

8. The safety and hygiene committee provided for in Section 2 of the present Order shall be established by the head of the undertaking. It shall comprise:

(*a*) the head of the undertaking or his representatives;
the chief of the safety and hygiene service and, if appropriate, one or more of his assistants;
one or more members of the supervisory staff;

(*b*) manual workers or salaried employees belonging to the undertaking, chosen by the manual workers and salaried employees of the undertaking. They shall be at least equal in number to the members representing the management as provided for in (*a*).

9. The chairmanship of the safety and hygiene committee shall be assumed by the head of the undertaking or his representative. The Secretariat shall be assumed by the chief of the safety and hygiene service or by one of his assistants.

The committee shall always be entitled to request the presence of an official of the Inspectorate who, if he attends, shall preside over the meeting. Similarly, the competent inspector may *ex officio* require a meeting of the committee, attend any meeting and preside over it.

10. Each committee shall draw up its own rules, which shall not come into effect until they have been approved by the Minister of Labour and Social Welfare, who may delegate his powers to officials of the Directorate General of Labour Protection under rules formulated by Ministerial Order.

Chapter IV. Sections of Committees

11. When the undertaking comprises more than 200 manual workers the committee may be divided into sections to which the regulations governing the functioning of committees shall apply.

12. In undertakings employing at least 25 workers covered by the system of health protection of apprentices as provided for in the Order of 18 October 1945, one or more members of the personnel of the undertaking covered by this system shall be added to the committee; they shall sit only in an advisory capacity if they are under 18 years of age.

Chapter V. Functioning of Committees

13. The safety and hygiene committee shall meet once a month for the purpose of examining the reports of the chief of the safety and hygiene service referred to in Section 6, No. 6, and discussing the effect to be given to them.

In the event of a serious accident or of repeated accidents of the same kind, the committee shall meet immediately.

14. Suggestions on which unanimous agreement has been reached and the proposals put forward at these meetings shall be communicated for information to the chief labour protection engineer, the district chief *(chef de district)* and the competent labour protection medical officer.

At the request of the district chief or the competent labour protection medical officer the committee shall collaborate and seek the causes of risks to the personnel and of insalubrity of the work-

places, and shall participate in the study of preventive measures.

The committee shall employ all appropriate means of propaganda and, if necessary, shall propose the requisite measures for instilling into the personnel notions of safety and hygiene, and shall endow the personnel with the safety spirit, and in general shall concern itself with the questions referred to in Section 5.

Chapter VI. Regional Committees

15. After consulting the Superior Safety and Hygiene Council and the Joint General Committee, there may be established by Ministerial Order joint regional committees *(comités paritaires d'arrondissement)* for safety and hygiene in undertakings in accordance with rules to be determined by Ministerial Order.

These committees may propose to the Minister of Labour and Social Welfare the constitution of sections by industry, type of undertaking or, in so far as concerns undertakings with less than 50 persons, regional sections *(sections régionales)*; in this case the sections shall function under the same rules as the committees.

16. The purpose of these regional committees may be:

(1) to watch over the enforcement of the present Order in the capacity of advisory organisations for labour inspection;

(2) to examine the minutes of the meetings and the reports of the committees of undertakings and also the reports of the personnel referred to in Section 4;

(3) to organise emulation between the undertakings and the joint committees of undertakings in their activities for the safety and hygiene of workplaces;

(4) to propose common or identical measures when such are recognised to be efficacious, more especially through the industrial sections where such exist;

(5) to act as joint committees for undertakings in respect of all undertakings in which less than 50 persons are employed;

(6) to stimulate undertakings so that they will employ all means apt to improve the amenities of workplaces;

(7) to address to the Minister of Labour and Social Welfare all useful proposals likely to improve the conditions in which the work is carried on.

17. The regional committees provided for in Section 15 may include a section for the health protection of young persons; a Ministerial Order shall determine the rules for the constitution and functioning of the section and also the relationship between the said section and the regional committee.

Within the scope of the health protection of young workers the sections shall perform duties identical with those defined in Section 16 with respect to regional committees.

Chapter VII. Superior Safety and Hygiene Council

18. A Superior Industrial Safety and Hygiene Council shall be established and attached to the Ministry of Labour and Social Welfare.

It may comprise a number of sections.

The chairmanship of the council shall be assumed by the Director General of the Technical Organisation of Labour; the vice-chairmanship shall be assumed by the Chief of the Technical Inspectorate and by the Chief of the Medical Inspectorate.

The composition of the Council shall be determined and its organic statute established by Ministerial Order.

19. The Council shall have the duty of giving its opinion on any regulations concerning safety and hygiene or health protection that the Department may propose to issue, and shall make recommendations concerning regulations that it proposes to frame on the same subjects.

It shall examine the reports of the various services of the Labour Inspectorate, and the reports of the safety and hygiene services and committees with a view to drawing all useful conclusions. It shall study all proposals that arise in connection with the health and safety of the workers. It shall draw up an annual report on the enforcement of the present Order.

20. The Council shall study and propose all measures conducive to the embellishment of the workplaces.

21. The Superior Industrial Safety and Hygiene Council shall include a special section with jurisdiction over the health protection of young workers.

BRITISH DEPENDENCIES

Kenya

THE HARBOURS REGULATIONS 1945
GOVERNMENT NOTICE No. 675. DATED 1 AUGUST 1945 [1]

The regulations consist of 310 Sections in 18 Parts.

From the industrial safety standpoint the most important parts are X, Ships Conveying Explosives or Inflammable Liquids; XI, Dangerous Cargoes; and XII, General Safety Regulations, which are concerned with loading and unloading machinery and operations.

CANADA

Manitoba

REGULATIONS CONCERNING DRY CLEANING, DRY DYEING AND CLEANING BUSINESSES
MANITOBA REGULATION 18
DATED 13 NOVEMBER 1945 [2]

The regulations require all owners of dry cleaning and dry dyeing businesses to obtain a certificate from the Department of Labour, and specify the procedure for the issue of certificates.

Under Section 9 the owner is responsible for seeing that all employees are instructed as to the hazards of their work and the precautions necessary for the preservation of life and property.

No cleaning solvent may have a flashpoint below 100° F. (Sec. 10).

[1] *Kenya Official Gazette Supplement No. 35*, 7 Aug. 1945.
[2] *The Manitoba Gazette*, 17 Nov. 1945, p. 1118.

The technical provisions deal with construction, equipment and operation.

The following are the provisions relating to construction of premises:

12. In addition to complying with the provisions of the building by-law of the locality, all rooms in use for dry cleaning or dry dyeing shall comply with the following provisions relating to construction, but where the rooms have been actually in such use prior to the coming into force of these regulations, the Department of Labour may exempt the rooms from such of the requirements respecting equipment as it deems proper.

13. Unless with the approval of the Department of Labour, each room shall be located at least ten feet from the street or property line, except in cases where the wall abutting or adjacent to the street or property line is of standard brick or equivalent construction and is without openings; and in no case shall more than two such walls be blank walls.

14. (1) Each room shall consist of not more than one storey, which shall not be less than twelve feet in the clear from floor to ceiling.

(2) There shall be no basement or cellar or open space underneath the floor, nor shall the floor area exceed twenty-five hundred square feet.

15. All external walls enclosing rooms used for dry cleaning, dry dyeing, drying, clarifying and refining shall be of brick, solid concrete or other incombustible material approved by the Department of Labour.

16. The roof over every room used for dry cleaning or dry dyeing purposes, and over every hall or corridor to which any door from such a room leads, shall be flat and of fire-resisting construction in accordance with the minimum requirements of the local underwriters' association.

17. (1) If due to local conditions, it is desirable to vent possible explosions upwards, the roof shall be of light construction, and of incombustible material, and skylights shall be provided, or such other arrangements for venting possible explosions as are approved by the Department of Labour.

(2) If skylights are used the area thereof shall be equal to one-tenth of the roof area and shall be constructed as follows:

(*a*) frame and sash to be of metal and provided with wired glass;

(*b*) the sash to be of the pivot type, and so hung as to swing out readily in case of an explosion; or in lieu thereof, the skylights may be constructed of metal frame and sash and be provided with plain thin glass, provided that the opening in the roof is protected on the underside by fire doors held open by chains with fusible links and so balanced that the doors will close automatically in case of fire; and

(*c*) a wire screen provided above the skylights.

18. The floors shall be constructed of incombustible material and laid not lower than the surface of the ground surrounding the walls.

19. (1) The doors shall be of approved fire-resisting construction and design equal to the minimum standards required by the local underwriters' association, and shall open in the direction of travel of persons leaving the room.

(2) There shall be two exit doors from every dry cleaning room remote from each other.

20. Windows shall be glazed with wired glass in metal frames, and in cases where it is intended to use them for vent of a possible explosion they shall be so arranged as to swing out under pressure in case of an explosion and to close automatically in case of fire.

21. (1) Every dry cleaning or dry dyeing room shall be separated from the remainder of the building by a wall or walls having no openings other than those required for shafting used in operating the machines, except by an indirect properly ventilated approach having automatically closing fire-resisting doors of standard equal to the minimum required by the local underwriters' association, at each end, which shall not be opposite to each other.

(2) At least two walls of the dry dyeing or dry cleaning room must be external walls.

22. (1) Drying rooms if under the same roof as the dry cleaning and dry dyeing rooms must be separated therefrom by a fire-resisting wall; the entrances to the drying room shall be provided with approved self-closing fire-resisting doors.

(2) Means for the ventilation of drying rooms shall conform to the conditions provided in relation to dry cleaning and dry dyeing rooms, and the provisions for the presence of steam jets for fire extinguishment must be complied with.

(3) If the drying room be a separate building, it must conform in construction and equipment in all respects to the conditions laid down relative to dry cleaning and dry dyeing rooms.

23. (1) All shafting necessary for the operation of the machines and apparatus shall enter the dry cleaning, dry dyeing and dyeing rooms through the smallest necessary openings in the walls.

(2) The openings shall be at least ten feet above the floor and equipped with a stuffing box to make it vapour proof so as to prevent the propagation of flame or explosion through them.

24. There shall be no direct connection with the drainage system of the building or with the sewer system from any dry cleaning room.

25. (1) An approved system of ventilation shall be provided in all dry cleaning and dry dyeing rooms of sufficient capacity to change the air therein completely at least every five minutes.

(2) The spiders, blades and casings of all exhaust fans shall be constructed of non-ferrous metal.

- Equipment in rooms is dealt with in Sections 26-31, reproduced below:

26. (1) No gas or gasoline engine, steam generator, electrical dynamo or motor, fuses or starting equipment, heating or pressing device shall be located, or used inside the dry cleaning or dry dyeing room where an inflammable cleaning agent is used, or within a distance of ten feet from any door, or other opening in the enclosing walls where an inflammable cleaning agent is used, unless approved by the local board of fire underwriters.

(2) The heating of the room shall be secured only by the use of steam or hot water systems.

27. (1) The lighting shall be secured only by keyless socket incandescent electric lights, with globes or bulbs in vapour-proof receptacles.

(2) All switches, cut-offs and fuses used in the installation or operation of lights shall be located and operated from the outside of the room, and the wiring shall be in rigid conduit.

28. (1) All shafting, pulleys, piping and metallic parts of machines shall be properly grounded by at least No. 10 copper insulated wire to a water pipe or other grounded device.

(2) The system of grounding shall be examined and tested by the owner at least once each week and shall be kept in good repair.

29. All tables, racks, shelves and cupboards used for the hanging and storing of fabrics shall be of incombustible material.

30. (1) The rooms shall be provided with steam pipes located near the ceiling; there shall be at least two openings in the pipes, which shall point toward the ceiling.

(2) The steam supply for the pipes shall be continually available for service while the plant is in operation and shall be of sufficient capacity to fill the room space completely in less than one minute.

(3) Outside the building there shall be placed on the steam service line or lines a quick-acting valve which shall be easily accessible for operation in case of fire.

(4) Steam pipe installation shall be subject to approval of the Department of Labour.

(5) One approved hand chemical extinguisher especially efficient for the conditions of the plant and one pail of sand shall be provided for each two hundred square feet of floor space.

31. The rooms shall be equipped with an approved humidifying system whereby the atmosphere will be humidified to at least forty per cent. of saturation and a reliable hygrometer shall be placed in the dry cleaning and dyeing rooms which will readily indicate the saturation of the atmosphere.

Section 32 contains detailed provisions concerning storage tanks.

The provisions concerning operation are as follows:

34. (1) All dry cleaning, dyeing, washing and redistilling shall be carried on in closed machines or vessels which shall be fluid tight. The basket of all extractors shall, when in operation, be covered with canvas or other non-metallic cleaning agent. Washing machines shall have hinged doors so arranged that in case of an explosion the doors will automatically close.

(2) Dry cleaning or dry dyeing in open vessels is prohibited and no dry cleaning liquid shall be settled in an open or unprotected vessel or tank.

35. The transfer of all dry cleaning liquid shall be through continuous piping, and all outlet or drain pipes shall be drained by gravity to settling or storage tanks. Pumps only shall be used in feeding the supply.

36. Electric irons shall not be used in rooms where dry cleaning or dry dyeing is done or in adjoining communicating vestibules, and all electric irons on the premises shall be provided with incombustible stands and with pilot lights of a type approved by the Western Canada Fire Underwriters' Association.

37. Scrubbing and brushing may be performed in the dry cleaning room, but the inflammable liquid shall be contained in a metallic pan or container. All inflammable liquids used shall be returned to the settling or storages tanks as soon as the brushing or cleaning operation is completed.

38. Drying shall not be done in dust wheels unless the same are located in the open air or are directly connected to exhaust fans of sufficient capacity to carry away all gases and fumes liberated by the dust wheels and the other requirements of these regulations in regard to dry cleaning rooms are complied with.

39. At the close of the day's operations all liquid contained in washers, extractors, or other receptacles shall be returned to the storage or settling tanks.

40. Smoking and carrying of matches upon the premises shall be prohibited; notices to this effect shall be conspicuously posted.

CUBA

Resolution No. 907 concerning Electric Sack Conveyors. Dated 25 October 1945[1]

The resolution requires employers who use electric lifts for lifting bags to employ a specialised worker to operate the conveyor. The resolution came into force as from the date of its publication in the *Gazeta Oficial.*

MEXICO

Maritime Inspection Regulations (Machinery). Dated 24 September 1945[2]

These regulations, which apply to all power-driven vessels, comprise 264 sections and fall into two main parts.

The first part consists of administrative provisions and engineer manning scales.

The second part on inspection procedure is technical in character and deals in detail with steam engines, internal combustion engines, pumps, fire prevention and electrical equipment.

Industrial Hygiene Regulations Gazetted 13 February 1946[3]

The new regulations, which replace those of 1934, apply generally throughout the Republic to all kinds of industrial, commercial, agricultural and maritime work.

The matters dealt with include noxious substances, first-aid equipment, medical examinations, authorisation of buildings and building alterations, space requirements for workrooms, roofs, floors and walls of workrooms, lighting, ventilation and temperature, noise and vibration, water supply, cleanliness, sanitary conveniences and medical services.

The safety committees that have to be set up in Mexican industrial undertakings in virtue of

---

[1] *Gazeta Oficial*, No. 331, 2 Nov. 1945, p. 21929.
[2] *Diario Oficial*, Seccion segunda, No. 49, 29 Dec. 1945, p. 1.
[3] *Diario Oficial*, Seccion segunda, No. 36, 13 Feb. 1946, p. 1.

the Federal Labour Act and the Accident Prevention Regulations become safety and hygiene committees, and are entrusted with the general duty of watching over the enforcement of the Industrial Hygiene Regulations.

Employers are bound to arrange for initial and periodical medical examinations of their employees. The periodical examinations must be made at intervals not exceeding two years, and in unhealthy industries, at more frequent intervals specified in detail in a Schedule to the Regulations. Every undertaking must keep medical records of its employees. The medical inspectors are empowered to consult these records, to carry out technical investigations in undertakings and to examine the employees.

No place of employment may be equipped and used without the prior authorisation of the competent authority in so far as concerns industrial hygiene.

The lighting standards range from a minimum of 20-50 lux for passageways, stairs, washrooms, etc., and rough work, to over 1,000 lux for watchmaking.

Protection against noise is required when the intensity exceeds 100 decibels in the case of continuous noises or 80 decibels in the case of intermittent noises.

Medical services must be provided in all undertakings employing over 100 workers. Factory doctors must inspect the undertaking once a month in collaboration with the safety and hygiene committee. They must also address the workers once a month on questions of industrial hygiene.

NORWAY

Royal Resolution respecting Special Measures for Labour Protection in Foundries. Dated 26 October 1945 [1]

The provisions of the Resolution are entirely concerned with the prevention of silicosis. They require every worker who will be exposed to siliceous dust to be medically examined and radiographed before taking up employment. The medical and X-ray examinations are to be repeated every five years in the case of sand-blasters, castings cleaners, fettlers, grinders, crane drivers and cupola attendants, and every ten years for the other workers in question. The Factory Inspectorate may, if it deems this to be necessary, prescribe more frequent examinations.

None of the workers in the categories mentioned in connection with five-yearly examinations may be under 20 years of age.

[1] *Norsk Lovtidend*, No. 24, 1945, p. 201.

PALESTINE

Factories Ordinance No. 11 of 1946 Dated 29 January 1946 [1]

In addition to factories the Ordinance applies to docks, shipyards, sewage works, irrigation works, hydraulic power stations and quarries.

General health provisions are contained in Part III, general safety provisions in Part IV, general welfare provisions in Part V, and special provisions for health, safety and welfare in Part VI.

The general health provisions relate to cleanliness, overcrowding, temperature, ventilation, lighting, drainage, etc.

Among the matters dealt with in the general safety provisions are prime movers; transmissions; working machines; hoists and lifts; chains, ropes and lifting tackle; construction and maintenance of floors, passages and stairs, dangerous liquids and fumes; explosive or inflammable dusts, gases, vapours or substances; steam boilers; steam receivers; air receivers; and fire precautions.

First aid is dealt with in the welfare provisions.

The special provisions for health, safety and welfare include provisions relating to eye protection, humid factories, underground rooms and lifting excessive weights.

UNITED KINGDOM

The Patent Fuel Manufacture (Health and Welfare) Special Regulations Dated 25 February 1946 [2]

The Regulations apply to factories manufacturing briquettes or blocks of fuel consisting of coal, coal dust, coke or slurry with pitch as a binding substance. The matters dealt with include dust and ventilation, washing facilities and clothing accommodation, medical supervision and examination, skin and eye protection and messrooms.

The provisions relating to dust and ventilation are as follows:

4. Mechanical tipping or unloading of coal or coal dust shall not be carried on except in an enclosure which is so constructed and maintained and so provided with a vent or vents discharging into the open air at a suitable height or in conjunction with which there are such exhaust ventilation or other arrangements as to prevent, so far as practicable, the escape of dust into any workroom or into the open air otherwise than through the vent or vents.

Provided that this requirement shall not apply to the tipping or unloading of coal or coal dust so damp that dust is not emitted.

[1] *Supplement No. 1 to the Palestine Gazette Extraordinary*, No. 1472, 5 Feb. 1946, p. 63.

[2] *S. R. & O.* 1946, No. 258.

5. Where pitch is broken up in the open air, permanent or movable screens shall be placed in suitable positions to protect workmen from wind and bright sunlight so far as practicable.

6. Elevators and chutes (including chutes feeding to or delivering from machines) used for conveying material in a state in which it is liable to give off dust, and any spaces through which material in such a state falls on discharge from an elevator or band-conveyor, shall be encased or enclosed throughout their length; and to prevent dust at the ends of the enclosure from escaping into the general air of the workplaces there shall be either mechanical exhaust ventilation arranged for the purpose or an adequate vent or vents in the enclosure and leading to the open air.

7. Band-conveyors shall so far as practicable be enclosed at points where dust is liable to be given off.

8. Dryers, disintegrators and heaters shall be so constructed and maintained as to prevent the escape of dust into the general air of the workplaces

9. Adequate arrangements shall be made for the removal of excess of steam generated at heaters, coolers and pug-mills and for its discharge into the open air.

10. Adequate mechanical exhaust ventilation shall be provided for pitch-cracking machines and at places where pitch is broken up on the floor of a workroom, so as to prevent the escape of dust into the general air of the workplaces.

11. Casings and enclosures required by these Regulations shall be maintained in good repair and in a dust-tight condition.

12. Efficient arrangements shall be made for the collection of dust discharged from mechanical exhaust ventilation apparatus and to prevent it from being drawn into the air of any workroom.

13. Accumulations of coal or pitch dust, other than heaps of material in places in which it is required for purposes of the manufacturing process, shall be removed daily by a suitable method from the floors and other readily accessible places in workrooms, staircases and passages, and floors shall be cleaned at least once in every week by thorough sweeping or other suitable method; and the occupier of the factory shall nominate in writing, by signed entry in or by certificate attached to the general register of the factory, a competent person with the specific duty of seeing, on behalf of the occupier, that the requirements of this Regulation and of Section 1 [1] of the Factories Act, 1937, are complied with.

UNITED STATES OF AMERICA

Code for the Prevention of Dust Explosions in the Plastics Industry ASA Z12.16—1945 [2]

The provisions of the Code are largely based on experience with phenolic resins. The matters dealt with include segregation of buildings, construction of buildings, communications between departments, general precautions for the prevention of explosions, precautions for minimising the effects of explosions, housekeeping and fire fighting. Some of the provisions relating to plant layout and construction are illustrated by diagrams.

Tables show the relative explosion hazards of powders used in the plastics industry and the maximum safe percentage of oxygen in the atmosphere with various types of powder.

An appendix provides typical calculations for determining the size of explosion vents.

Standards of the National Board of Fire Underwriters for the Installation of Pulverized Fuel Systems ASA Z12.1—1945 [1]

These Standards replace those of 1935. They deal with matters such as the arrangement of direct-fired and storage systems, hot-air supply, strength of equipment, piping, lighting of pulverised-fuel furnaces, interlocks and starting sequence, furnace construction, and extinguishing fires in pulverizers or piping.

Oregon

General Safety Manual Applicable to All Dangerous Industries. Revised 15 July 1938, reprinted 15 October 1945

Part I of the manual deals generally with industrial safety, health and welfare, and is largely of an advisory character; Part II consists of regulations. The practice of combining recommendations and regulations in a single text is one that is finding increasing favour in different parts of the world: by providing a suitable setting for regulations, it should promote a higher standard of safety.

Advice is given on matters such as warning notices, the employment of physically impaired workers, sanitary and welfare arrangements, personal protective equipment, first aid, plant safety organisation, plant inspections and good housekeeping.

The regulations relate to excavations, explosives, trucks and gasoline, boilers and engines, hoists and booms, cables and appurtenances, machinery and belting, hand tools, floors and stairways, ladders and scaffolds, lumber standards, illumination, and ventilation.

Few safety regulations contain detailed provisions concerning hand tools. The Oregon provisions are reproduced below.

Rule 76. A tool storage place shall be provided on all jobs where hand tools are used. Portable tool boxes shall have solid bottoms and strong handles to avoid foot accidents from dropping the boxes.

[1] Relates to cleanliness of factories.

[2] Published by the National Fire Protection Association, 60 Batterymarch Street, Boston 10, Mass.

[1] National Board of Fire Underwriters: Pamphlet No. 60A.

Rule 77. The handles of axes, hammers, saws, shovels, picks, files and other tools shall be of firm, straight-grained hardwood and securely attached to avoid any possibility of the tools slipping down or flying off.

Crowbars, cold chisels, saws, peavies, screwdrivers and keen-edged tools should be kept safe by being kept well pointed and sharp.

All tools with mushroom heads, split or defective handles, or with their safety impaired in any manner shall be repaired at once or removed from the job.

Shovels, picks, crowbars and other tools shall not be left lying about the job, or under foot.

Rule 78. The use of tools should be confined to the purpose for which they are intended. Wrenches should not be used as hammers, nor on moving parts, or practices of that kind tolerated.

Rule 79. Heavy leather holsters shall be provided for knives, sharpeners and other keen-edged instruments carried by meat cutters and kindred tradesmen. Safety kilts or guards, when practicable, should be attached to such tools.

Rule 80. Pneumatic or power-driven drills, saws, and other hand tools shall be assigned only to men who have been given thorough instructions as to their safe use and care. Portable, power-driven circular handsaws shall be so guarded that the saw is entirely enclosed when not in the cut. Saws of this character shall not be used on inclined roofs, trusses, or other dangerous places.

OFFICIAL REPORTS, ETC.

BOLIVIA

Industrial Accident Statistics [1]

A few statistics of industrial accidents are contained in the report of the State Insurance Institution for the period 1943-1945.

The percentage distribution of mining accidents by causes for the first half of 1945 is given as follows: explosions of dynamite 30, falls of ground 37, falls of persons 10, electricity 1, crushing 4, burns 3, minor injuries 15.

A table showing compensation paid in respect of manufacturing industries includes the following figures covering the period 1939-1945.

Year	Occupational diseases	Accidents	
		Fatal and permanent incapacity	Temporary incapacity
1939	—	—	31
1940	10	4	105
1941	8	10	273
1942	13	7	508
1943	15	10	542
1944	12	11	334
1945 (1st half)	12	5	89

A general table of compensation statistics includes the following figures relating to the period 1936-1945. Comparison with the preceding table makes it clear that most compensated accidents and diseases in Bolivia occur in the mining industry.

Year	Occupational diseases	Accidents	
		Fatal and permanent incapacity	Temporary incapacity
1936	350	51	4,229
1937	487	99	6,014
1938	392	150	5,503
1939	789	182	5,651
1940	801	194	7,218
1941	402	189	8,288
1942	701	172	8,995
1943	807	196	10,440
1944	1,034	223	13,638
1945 (1st half)	423	129	5,808

CANADA

Ontario

Report of the Department of Labour 1945 [1]

For the first time since the outbreak of the war the accident total showed a downward trend—16,344 including 62 fatal in 1945, as against 16,610 including 68 fatal in 1944.

A determined effort was made to prevent scalping accidents which had been increasing to an alarming extent during the last few years. The 1944 amendment to The Factory Act made the wearing of safe hair-covering compulsory for all female employees in industry and, while resentment has been shown by a number of women, compliance has been quite general, and it is gratifying that since this amendment became effective on June 5, 1944, accidents of this nature

[1] Caja de Seguro y Ahorro Obrero: *Memoria*, June 1945.

[1] For 1944, see *Industrial Safety Survey*, Vol. XXI, No. 3, p. 107.

have been reduced to almost zero. The improvement has been brought about mainly by educational methods on the part of the inspectorate, coupled with co-operation from industrial management, and the realization on the part of the women that head injuries of this type, major or minor, mean permanent disfigurement.

Foot injuries still continue to be numerous and many of these could be prevented by the use of safe footwear. Strains caused by too heavy lifts and improper methods of lifting, and frequently resulting in hernia, have been on the increase.

The Examiner of Reports and Designs approved 735 plans for factory, shop and office buildings during the year.

One hundred and twenty-six field inspections were made by the Examiner to investigate special hazards reported by the inspectors and to facilitate the approval of building plans. Included among the hazards were floor overloadings, insufficient exits, poor ventilation, dangerous processes and faulty elevators. Many orders were issued to owners during the year to limit floor loads to those specified by the Department, registered engineers or architects. The vigilance of the district inspectors in reporting suspected excessive floor loadings has been of the utmost importance in this work. Several premises were condemned for any further use for commercial or industrial purposes.

In all, 635 office interviews with architects, owners and employers were held to discuss the approval of building plans and also the control of special hazards inherent in their equipment.

During the latter half of the year, increasing numbers of drawings for post-war projects were submitted by designers for preliminary discussion and approval. This practice has been always encouraged as it leads to better final drawings of those items which benefit the safety, health and welfare of employees.

The factory inspectors made 15,359 first inspections and 4,031 subsequent inspections; and 2,246 inspections were made by the boiler inspectors.

Very brief descriptions are given of 155 explosions of all kinds of objects and substances, including detonators, molten metal, lamp bulbs, dust, tar, bottles, fuses, oil burners, furnaces, gas, manganese, wood flour, paint, bombs and propane gas meters.

The principal accident causes are given as machinery and connections with 4,598 accidents (18 fatal), falling substances with 2,717 (2 fatal), sprains and strains with 2,416 and falls of persons with 1,971 (5 fatal).

Nearly half of the accidents—8,141—occurred in the metal trades. Transport accounted for 1,678, the pulp and paper trades for 1,177 and the food industry for 1,161.

COLOMBIA

Industrial Accidents in 1943 [1]

A total of 4,538 accidents was reported in 26 manufacturing industries in 1943. Fatal accidents numbered 27, cases of permanent disablement 1,056 and cases of temporary disablement 3,455.

Breweries made the largest single contribution to the total with 4 fatal, 987 permanent disablement and 940 temporary disablement cases; sugar mills came second with 5 fatal, 15 permanent disablement and 713 temporary disablement cases; and textile mills third with 2 fatal, 26 permanent disablement and 564 temporary disablement cases.

The only specific accident causes mentioned are traffic, machinery, electricity, and collapse, explosions and fires. Traffic was responsible for 7 fatal, 3 permanent disablement and 69 temporary disablement cases; machinery for 3 fatal, 44 permanent disablement and 726 temporary disablement cases; electricity for 1 fatal, 2 permanent disablement and 23 temporary disablement cases; and collapse, explosions and fires for 4 fatal, 2 permanent disablement and 133 temporary disablement cases.

Railway workers incurred 19 fatal, 2 permanent disablement and 2,704 temporary disablement accidents—a total of 2,725 of which 103 are ascribed to machinery, 122 to collapse and 2,500 to other causes.

FRANCE

Industrial Accidents in 1941 [2]

Under the Industrial Accidents Act of 1898, French industrial accident statistics fall into two groups—those relating to mining, quarrying and allied industries, and those relating to all other industries and services. All lost-time accidents are reportable. The mining statistics are not to be confused with those for mines and quarries alone, of which the most recent to be published in the *Industrial Safety Survey* are those for 1937 and 1938 [3]. The latest statistics for other industries and services published in this journal are for 1937 [4]. Statistics for the two main groups of industries for the year 1941, published in 1944, reached Montreal in 1946 and are summarised below.

The accident total for the mining and allied industries was 157,080, composed as follows: extractive industries 155,681; chemicals 1,373;

[1] Contraloría General de la República, Dirección Nacional de Estadística: *Anuario General de Estadística*: Colombia, 1943.
[2] *Bulletin technique d'Hygiène et de Sécurité des Travailleurs*, 1944, p. 5.
[3] Vol. XXI, No. 4, p. 136.
[4] Vol. XVI, No. 1, p. 14.

metalworking 5; stonecutting 15, firing of stone, clay and earth 6. The principal causes of these accidents are given as falls of ground, falls of objects, striking against objects 82,037, mechanical haulage, vehicles, animals 21,698, falls of persons 11,313, handling loads 9,591 and hand tools 5,953.

The accident total for all other industries and services was 594,489, which is made up of 1,918 fatal accidents, 5,044 accidents resulting in permanent disability, 579,556 accidents resulting in more than four days' disability and 7,971 accidents the consequences of which were unknown. Figures for the industries that made the largest contributions to the total are given in Table I.

The distribution of the accidents by cause and probable severity is shown in Table II.

Of the 594,489 victims, 40,333 were male young (under 18 years of age), 7,425 female young persons, 48,367 adult females and 498,364 adult males.

TABLE I

Occupational Group	Accidents				
	Fatal	Permanent disability	Temporary disability	Consequences unknown	Total
Working of common metals	225	889	150,497	1,729	153,340
Earth work and stone construction work	416	512	92,868	1,393	95,189
Forestry and agriculture	290	535	45,706	804	47,335
Transport	273	417	38,235	546	39,471
State, department and communal services	221	263	34,571	666	35,721
Metal production	72	555	30,219	752	31,598
Various commercial occupations	74	245	30,198	440	30,957
Woodworking	42	443	26,601	318	27,404
Food	57	167	26,376	323	26,923
Chemicals	54	367	26,296	171	26,888
Textiles	28	188	19,163	148	19,527

TABLE II

Cause		Accidents				
		Fatal	Permanent disability	Temporary disability	Consequences unknown	Total
I.	Engines	4	14	906	18	942
II.	Transmissions	16	65	2,028	43	2,150
III.	Working machines	35	1,212	29,408	604	31,259
IV.	Elevators, cranes, hoisting appliances, winding shafts	25	83	1,898	19	2,025
V.	Steam boilers, autoclaves, etc.	2	—	147	3	152
VI.	Explosives (powder, dynamite, gas explosions, etc.)	170	113	781	32	1,096
VII.	Incandescent, hot and corrosive substances	37	178	30,388	339	30,942
VIII.	Falls of ground, falls of objects, striking against objects	368	1,141	205,954	1,778	209,241
IX.	Falls of persons	448	1,003	94,687	1,430	97,568
X.	Handling loads	18	263	56,886	1,390	58,557
XI.	Mechanical traction vehicles, animals	363	382	18,444	347	19,536
XII.	Hand tools	16	182	35,341	334	35,873
XIII.	Electricity	46	7	886	15	954
XIV.	Anthrax	1	1	13	1	16
XV.	Compressed air	3	1	231	—	235
XVI.	Miscellaneous	341	395	100,084	1,565	102,385
XVII.	Unknown	28	31	1,418	81	1,558
	Total	1,921	5,071	579,498	7,999	594,489

MEXICO

Industrial Accidents in 1942 [1]

The Mexican Yearbook of Labour Statistics published in 1944 contains 17 tables relating to industrial accidents and 12 relating to occupational diseases in industries under federal jurisdiction for the year 1942.

Information is given on the distribution of accidents by province, industry, cause, age and sex, month, day, shift, experience of victim, severity, etc.

Table I shows the distribution of accidents by industry and severity. There were also 12 cases of permanent total disability, nine of which were accounted for by the mining industry.

TABLE I

Industries	Kind of disability			No. of workers in reporting undertakings
	Temporary	Permanent partial	Death	
Mines	8,035	90	45	37,954
Petroleum	2,470	22	—	17,107
Textiles	1,329	31	3	18,802
Metals	1,599	19	—	9,616
Building and Construction	2	2	—	1,135
Food	463	4	1	3,771
Electricity	720	6	2	6,237
Chemicals	30	1	—	548
Paper	4	—	2	2,123
Communications and Transport	13,101	72	15	62,936
Commerce	19	—	—	52
Others	2	—	—	—[1]
Total	27,774	247	68	160,281

[1] Not given.

There were 2,834 eye accidents among the temporary disability cases, and eleven among the permanent partial disability cases. Temporary eye injuries were most frequent in mining (981) and communications and transport (1,055).

Table II shows the distribution of accidents by duration of lost time for the five principal industries under federal jurisdiction.

TABLE II

Duration of lost time	Mines	Petroleum	Textiles	Metals	Communications and transport	All industries
Nil	1,589	696	129	407	3,345	6,618
Less than 1 week	3,944	776	635	585	3,815	10,297
1-2 weeks	1,183	445	313	245	2,824	5,137
2-4 weeks	793	311	159	206	1,878	3,422
4 weeks-3 months	559	223	113	168	1,113	2,228
3-6 months	61	27	10	5	122	230
6-12 months	15	18	2	4	35	76
Instant death	40	—	2	—	9	56
Unknown	2	—	—	—	72	75
Total	8,186	2,496	1,363	1,620	13,213	28,139

[1] Secretaria del Trabajo y Prevision Social: *Anuario de Estadisticas del Trabajo*, Mexico, 1944; for 1938-1941 see *Industrial Safety Survey*, Vol. XIX, No. 4, p. 169.

The distribution of accidents by causes for the same industries is shown in Table III.

TABLE III

Cause	Mines	Petroleum	Textiles	Metals	Communications and transport	All industries
Motors and dynamos	13	7	3	3	9	42
Transmissions	4	4	42	33	4	99
Hoisting appliances	55	18	32	14	200	332
Power-driven tools and equipment	243	138	394	71	736	1,641
Railway locomotives and rolling stock in motion	6	6	1	1	260	277
Ships	—	1	—	1	2	4
Other vehicles in motion	465	52	21	68	303	948
Explosives or fires	43	7	1	4	18	73
Toxic, hot or corrosive substances: dusts	816	389	82	364	1,056	2,831
Electricity	20	13	3	14	43	130
Falls of workers	529	276	104	110	2,354	3,529
Stepping on or striking against objects	166	84	53	43	412	809
Falls of objects	2,995	158	76	182	2,063	5,557
Collapse	13	—	—	—	7	22
Handling objects without mechanical appliances	1,668	973	496	519	1,385	5,413
Hand tools	773	309	36	160	1,599	3,094
Animals	11	14	1	—	68	127
Multiple causes	94	13	11	19	86	244
Other causes	262	30	5	13	2,597	2,938
Unknown	10	4	2	1	11	29
Total	8,186	2,496	1,363	1,620	13,213	28,139

Table IV shows, for the same industries, the distribution of accidents by the length of the victim's experience in the occupation in which the accident occurred.

TABLE IV

Industry	Under 1 week	1-4 weeks	4 weeks-3 months	3-6 months	6-12 months	1-3 years	Over 3 years	Unknown	Total
Mines	177	220	691	625	1,084	1,655	3,694	40	8,186
Petroleum	230	482	289	96	70	139	1,167	23	2,496
Textiles	64	49	66	58	123	217	755	31	1,363
Metals	67	48	136	84	203	347	721	14	1,620
Communications and transport	70	83	215	245	384	959	11,083	174	13,213
All Industries	665	945	1,546	1,182	1,976	3,520	18,008	297	28,139

Of the total of 28,139 accidents, day shifts accounted for 22,124. The eighth (last) hour of the shift with a total of 3,667 accidents appeared to be the most dangerous; next came the third hour with 3,342 and the fourth hour with 3,266. The best hour was the sixth, with 1,656. Night shifts (7 hours only) accounted for 1,909 accidents; the distribution by hours shows the second to be the worst (308 accidents), followed by the third (294). The seventh was best with 217 and the fifth next with 258. Accidents were fairly evenly distributed over the months of the year and the five full working days of the week.

There were 2,178 cases of occupational disease of which 1,498 occurred in mines and 539 in the petroleum industry. The principal cause is given as inhalation of harmful dusts (1,482 cases). The commonest diseases were malaria (498 cases), silicosis (1,272), and tuberculosis (187).

SWEDEN

Annual Report of the Industrial Inspectorate, 1943 [1]

The legislative measures passed during the year include new poisons regulations dated 26 November, 1943. The State Insurance Institute issued new instructions concerning spray painting, and memoranda on circular saws and labour protection on peat bogs.

The staff of the Industrial Inspectorate was increased to strengthen supervision over workplaces with a risk of generator-gas poisoning.

A conference of inspectors was convened by the State Insurance Institute in November 1943, to discuss various questions connected with solvents, acetylene and oxygen factories, the marking of transportable receptacles for gases, building regulations and the revision of the Labour Protection Act.

At the end of the year 19,010 workplaces, employing 795,520 workers, were registered with the state inspectors, and 47,391 workplaces, employing 166,709 workers, with the sub-inspectors. The totals include 19,283 agricultural undertakings employing 67,529 workers. In addition, 65,509 workplaces were registered with the communal inspectors.

During the year the state inspectors and engineers inspected 7,016 workplaces, employing 293,216 workers; the sub-inspectors inspected 18,438 workplaces, employing 103,454 workers and the communal inspectors paid 62,166 visits to undertakings employing 167,106 workers. The state inspectors issued 4,539 written orders and the sub-inspectors, 5,146.

The inspectorate received 2,656 plans for the construction, alteration or extension of workplaces, or the modification of existing working methods. In this connection the inspectors submitted 127 proposals, and took part in 12,209 conferences or consultations.

At the end of the year 6,960 undertakings were known to have workers' safety delegates, 270 undertakings to have safety officials such as safety engineers, and 443 to have safety committees.

In all, 155,205 accidents were reported, and of these 508 were fatal. There were 509 cases of occupational disease, including 3 fatal.

The report also contains statistics relating to the inspection of boilers, docks, lumbering and timber floating, mines, explosives, electrical installations and railways.

Most of the report is taken up with descriptions, many of them illustrated, of accidents, safety devices and health and welfare installations.

In the catering trades there were 1,953 accidents, of which 879 were miscellaneous cuts and punctures, 517 stumbles or falls, 211 burns, 61 due to cutting machines and 28 due to meat mincers. The downward trend in catering-trade accidents noticed in 1942 was reversed; the increase of about 400 over the 1942 figure is attributed mainly to shortage of skilled labour. This led both to overwork and the employment of whatever labour could be obtained, whether it was suitable or not. Employers did not always realise the need for training new workers in safe working methods.

Accidents in logging and timber floating amounted to 23,269, including 27 fatal, as against 15,425, including 22 fatal, in 1942, and 13,192, including 26 fatal, in 1941. The woodworking branch of the industry accounted for 22,078 of the accidents in 1943, as against 14,270 in 1942. This increase also is attributed to the employment of inexperienced personnel.

Statistics of quarry accidents for the period 1937-1943 are given in the table below.

Year	Man-years	Accidents	Accidents per 100 man-years	Fatal Accidents
1937	3,455.1	653	18.9	3
1938	3,853.6	890	23.6	8
1939	3,887.2	763	19.6	5
1940	3,828.5	739	19.3	5
1941	4,337.1	702	16.2	6
1942	4,305.8	878	20.4	8
1943	4,411.7	845	19.2	5

The inspectors continued their educational work during the year by addressing numerous meetings on a large variety of topics.

UNITED KINGDOM

Annual Report of the Chief Inspector of Factories, 1944 [1]

Accident Statistics

The decrease in accidents noticed in 1943 continued throughout 1944. There were 1,003 fatal accidents in 1944 as compared with 1,220 in 1943, a decrease of 17.8 per cent., and 281,578 non-fatal accidents, as compared with 309,924, a decrease of 9.1 per cent. Estimates of employment and accident rates in factory industries for

[1] Riksförsäkringsanstalten: *Yrkesinspektionens verksamhet år 1943;* for 1942, see *Industrial Safety Survey*, Vol. XXI, No. 3, p. 112.

[1] Comd. 6698. For 1943, see *Industrial Safety Survey*, Vol. XX, No. 4, p. 144.

the years 1938-1944 are shown in Table I. The rate is that per 1,000 persons employed.

TABLE I

(000's omitted in employment figures)

Group	1938	1939	1940	1941	1942	1943	1944
Males 18 years and over:							
No. employed.....	3,130	3,420	3,410	3,480	3,500	3,460	3,360
Accident rate.....	37	36	45	49	53	53	51
Males under 18 years:							
No. employed	490	480	500	490	480	470	440
Accident rate.....	46	46	52	55	59	58	55
Females 18 years and over:							
No. employed	1,430	1,590	1,830	2,080	2,500	2,610	2,500
Accident rate.....	11	11	13	21	28	28	25
Females under 18 years:							
No. employed	540	520	530	510	480	460	420
Accident rate.....	14	15	16	18	22	21	20

The distribution of accidents among the industries with the largest accident totals in 1944 is shown in Table II.

The percentage distribution of accidents by main cause groups in 1944 was: power-driven machinery 15.6, use of hand tools 8.3, struck by falling body 11.6, persons falling 13.3, stepping on and striking against objects 8.9, handling goods 26.6, all other causes 15.0. In the same year the percentage distribution of fatal accidents was: lifting machinery 12.8, other power-driven machinery 10.2, transport 11.2, struck by falling body 7.8, persons falling 31.4, all other causes 26.7.

The good effects of strengthening the statutory provisions relating to the safety of machinery are illustrated by statistics of accidents on hoists and lifts for the period 1936-1944. In 1936, there were 490 such accidents of which 20 were fatal; in 1940, the corresponding figures were 355 and 20; in 1942, 246 and 12; and in 1944, 158 and 2.

Accident Prevention

Accidents to Women

The effect of propaganda against accidents to women and the better safeguarding of the machines on which they work is evident in a reduction of 18 per cent. in the industries that produce most accidents to women. In machinery making the reduction was 23 per cent. Inspectors have continued to give particular attention to accidents due to the entanglement of hair in moving machinery. These accidents declined by 22 per cent. on the figures for 1943. Drilling machines accounted for 56.6 per cent. of such accidents, lathe stock bars for 16.9 per cent. and milling machines, 3 per cent.

Accidents to Young Persons

It will be seen from Table I that male young persons have a higher accident rate than adult men. As a rule, however, accidents to adults are more severe; the estimated fatal accident rate per 1,000 adult males is 0.26 as compared with 0.1 for male young persons. The long-term policy required to deal with the accident problem among young workers is undoubtedly more and better training schemes for new entrants to industry. Another necessity is the improvement of supervision in the factory.

The Chief Inspector reports growing interest in training schemes. The Ministry of Labour, in conjunction with the Ministries of Education and Production has done much to encourage sound training schemes, for instance, by securing the release of young people during working hours

TABLE II

Industry	Adults				Young persons				Totals	
	Males		Females		Males		Females			
	Fatal	Non-fatal	Fatal	Non-fatal	Fatal	Non-fatal	Fatal	Non-fatal	Fatal	Non-fatal
Textile	27	4,976	2	4,775	2	827	—	1,238	31	11,816
Metals	116	34,765	5	5,947	3	3,741	—	580	124	45,033
Engineering works, machine and other tools	63	22,566	1	7,243	2	3,736	1	600	67	34,145
Machinery, machinery accessories, etc. . .	98	38,464	24	18,104	9	5,506	—	841	131	62,915
Shipbuilding	104	16,617	—	1,325	6	1,841	—	87	110	19,870
Aircraft	27	11,003	2	5,728	1	860	—	227	30	17,818
General woodwork .	24	4,838	—	1,513	4	1,531	—	268	28	8,150
Chemicals	47	6,808	4	2,467	5	391	—	200	56	9,666
Food	25	3,839	—	2,732	1	650	—	952	26	8,173
Docks	102	9,633	—	56	—	68	—	5	102	9,762
All industries. . . .	908	186,926	47	61,817	45	24,385	3	8,450	1,003	281,578

to attend classes. Many firms also are setting up training schools and encouraging the attendance at classes; the only criticism that might be advanced is that the tendency to keep the training strictly to technical subjects is still too apparent, but advances towards more general subjects are noticeable and several firms are now using the services of the Central Council of Recreative Physical Training to give their young persons physical exercises as a relief from certain types of cramped work as well as a training to correct bodily deformities and trends.

Milling Machines and Power Presses

The distribution of accidents on these machines in the period 1942-1944 is shown in Table III.

TABLE III

Machine	Year	Men	Women	Male young persons	Female young persons	Total
Milling machines	1942	637	751	246	72	1,706
	1943	560	720	197	58	1,535
	1944	430	473	140	38	1,081
Power presses...	1942	342	529	106	67	1,044
	1943	328	620	85	63	1,096
	1944	255	430	72	54	811

The accidents are generally serious and often result in mutilation. No effort, therefore, must be spared to reduce their numbers. The reduction during 1944, 30 per cent. in the case of milling machines and 26 per cent. in the case of power presses, compares favourably with the reduction of 9 per cent. in the case of all reportable accidents. The satisfactory reduction in the case of women must chiefly be assigned to the easing off in the munition industries, but part at least can be claimed for the greater attention given to the guarding of these machines. In the case of milling machines a large number of accidents occur on the underside of the cutters, and attempts have been made to overcome the admitted deficiencies of many guards by the fitting of false tables and by other means. In most cases guards were provided but not properly adjusted. With the rapid advancement in the technique of milling and the development of "negative rake" and other devices it is clear that a radical alteration in the standard of fencing at present adopted in the majority of factories will be necessary if these accidents are to be prevented. With this in view a committee is about to be set up on which the technical experts both of the makers and users of these machines will confer with Inspectors and make recommendations on the technical matters involved.

The Chief Inspector deals at some length with the prevention of accidents on power presses, a subject that has been under exhaustive investigation by expert Committees. [1]

The sphere of employment of hydraulic presses is expanding and the sheet-metal trades particularly are making increasing use of them. The manufacture of small air-frame components by the "rubber cushion" process is now established on a large scale. By this method expensive die-sets can be dispensed with in favour of simpler portable forming blocks, which can be loaded up to the capacity of the table of the press. The rubber cushion fixed on the head of the press moulds the component to the shape of the forming block. This technique has a beneficial effect on accident prevention, for the work of loading the forming blocks and components is done outside the pressing zone, the loaded table being propelled therein by power or hand. Suitable interlocking screens are fitted which must be closed before power can be applied to the ram.

Presses using fixed dies for forming operations are also used to an increasing extent, and the control of these machines, many of which are large, is often complex, valves being operated by pilot or electrical systems. The guarding of such presses has not progressed far.

Accidents due to Fires

An analysis of burning injuries due to fires provided the data shown in Table IV.

TABLE IV

Cause	Number of accidents
I. By ignition of inflammable liquids by flames, sparks or hot bodies	204
II. By flames from furnaces or stoves	91
III. By ignition of gases and in the use of blow-pipes	149
IV. By ignition of clothing at stoves and fireplaces	76
Total classified	520
Unclassified	111
Total accidents	631

The main industries that produced these accidents were mechanical engineering (68), metal extraction and refining (55), metal trades (54), shipbuilding (48), aircraft (42), chemicals (36), motor vehicles (32), and metal founding (32).

Group I accounts for the largest number of these accidents; this is due to the increasing use of inflammable solvents in factory processes which was noticeable before the war and has been greatly accelerated as a result of war requirements. Many of these accidents have been due to grossly careless actions such as throwing tins

[1] See *Industrial Safety Survey*, Vol. XXII, No. 1, pp. 25-29.

of naphtha, thinners or varnish on to fires, or to boiling inflammable liquids over open gas flames in the preparation of compositions. The use of paraffin, particularly as a degreasing and cleansing agent for metal components is another cause; the substitution of trichlorethylene and the use of alkaline washes with the necessary precautions is practicable and preferable.

In Group II are included the burning accidents typical of furnace blowbacks but it also includes too many due to ignition of unburnt gas in stoves that might have been prevented by the use of a good flame failure device.

Many of the accidents in Group III were due to the burning of rubber tubes connecting the cylinders of gas with the blow-pipes, thereby causing ignition of the escaping gas.

In Group IV are placed all those accidents due to the ignition of clothing or overalls. Many of these occur to young persons and far too many through boys standing in front of or passing by an open fire or brazier while wearing overalls or clothing that have become impregnated with inflammable liquids during the course of their work—another illustration of the lack of proper instruction.

Protective Boots

The possibility of making an appreciable reduction in the bulk of accidents by providing workers with really adequate protective footwear has long been realised. Workers' feet are particularly liable to injury either by being trapped by vehicles or articles such as barrels moving over workroom floors or even more often through being struck by falling articles slipping through the hands or being dropped from bench or machine. Though workers in all industries suffer to some extent from this hazard it is most serious in heavy engineering, shipbuilding and dockside work, metal conversion and plate glass manufacture.

A close estimate suggests that not fewer than one in seven of all reportable accidents are of this type and that approximately two-thirds of such mishaps would not cause appreciable injury if the workers' feet were protected by means already familiar.

Safety Organisation in Factories

The Chief Inspector refers to the fact that power-driven machinery caused only 15.6 of the accidents reported in 1944 and indicates factory safety organisation as the means of reducing the remaining 84.4 per cent.

The safety campaign conducted jointly by the Factory Inspectorate and the Royal Society for the Prevention of Accidents continued throughout the year among about 6,800 firms. The campaign's most valuable contribution to accident prevention has been the training of safety officers, who are envisaged as technical experts in safety and at the same time executives of the Safety Committees. Three courses for such officers were held during the year. These were so popular that only a fraction of the firms who applied for permission for members of their staff to attend could be satisfied. One result of the courses has been a considerable increase in the number of local accident prevention groups.

The Chief Inspector considers that the influence of the Works Committees on accident prevention cannot be over-estimated, whether the actual work is carried out by the Works Committee or by a separate or Sub-Committee devoted to Health and Safety. He has been more than ever impressed during the year with the importance in accident prevention of certain environmental working conditions which are usually regarded as being in the province of welfare rather than of safety measures, such as ventilation, temperature, posture, colour, music, freedom of social intercourse and the like, and the proper co-ordination of the work of the different branches concerned—Medical Supervision, Personnel Management and Safety—through a committee. An opportunity of emphasizing these points was given in a series of broadcasts by an Inspector during the course of the year.

The extensive use of Committees for the settlement of problems on democratic lines has been one of the features of the war years, and this development has occurred in factories as in other sides of national life. Mainly under the influence of the Production Committees fostered during the war there has been a growth of committees within the factory, and Inspectors have all drawn attention to this aspect of factory life although in some ways it is not directly concerned with their technical duties. Many Committees, some of them Safety Committees and others with wider functions, existed in the best firms in pre-war days and over one thousand of these Committees were in being in 1937 and 1938.

The increase during the war years has come from a desire to broaden the basis of collaboration in a spirit of mutual understanding and confidence.

The Committees vary in set-up and membership; some are sub-committees of the Production Committee, while others are quite separate both in election and function. In general the works committees consider questions of policy relating to working conditions, safety, health and medical services, welfare, benevolent and hospital funds, war savings, certain aspects of education, discipline and general grievances. The share to be taken by Trade Unions is not yet fully worked out in all cases but it is generally accepted that the purposes of the committee must not conflict

with agreements with Trade Unions and established rights and customs. In fact it can be said that the successful committees are those where the Trade Unions are fully represented, and take their full share of responsibility and in many cases lack of success is noticed in the badly organised firms.

The biggest single contribution made by these committees is undoubtedly the improvement in the atmosphere within the works, and the ease with which changes to new processes and new methods can be carried through when the reasons are fully discussed and explained. From the point of view of improving conditions the work of these committees is of real importance because they deal with matters which though small in themselves often mean a great deal to individual workers —an extra drinking-water fountain is installed in a convenient position, lighting is improved in a particular corridor, the ventilation of a point in a workroom is dealt with or a safe means of access is provided to a certain task by a method which may only be obvious to the workers affected. Some of these are points that are easily overlooked by the best Inspector or the most scrupulous manager. Day to day questions of maintenance and cleanliness of floors, clearance of gangways, and questions of safe working discipline are often too much for a Safety Officer to deal with single handed. The fact that these matters receive attention through the channel of the works committee instead of through the agency of an outside body also leads to improved relations.

At the end of the year, committees of one form or another dealing with aspects of work of special concern to the Factory Inspectorate were in existence in over 3,000 factories. Separate committees existed dealing with Safety (943), Health and Welfare (652), Canteens (1,904), while in addition there were 1,658 committees dealing with more than one of these subjects.

Shipbuilding and Ship Repairing

New methods of construction have continued to develop in the shipyards, particularly in regard to the increased use of electric welding. The welding of large portions of the hull alongside the slipway means that greater weights of structure have to be lifted, and it is difficult for slingers to estimate these weights. It is satisfactory, therefore, to note that in many yards steps are being taken to meet this difficulty by painting the calculated weight on the load or by the affixing of tables giving the weights of unit areas of plates and lengths of section. The increased use of tubular steel scaffolding, similar to that so extensively used on buildings, has been marked both in shipbuilding and repair work. The application of this type of scaffolding was equally useful in the construction of parts of the "Mulberry" harbours where work on scaffolds at a height of 60 feet was often necessary. Opinion in the yards emphasizes the necessity of using tubes of greater thickness than on buildings, mainly owing to the increased risk of damage to which shipyard staging is liable.

Progress is reported in methods of preventing falls through openings in decks and tank tops; the new idea is a fence of stanchions and rails so designed that they lend themselves to quick and easy fixing to plate edges and lugs. They have the additional advantage of providing a secure handhold above deck level, and altogether are an improvement on the method of protecting manholes by loose covers which were often found off instead of on.

Pottery

The fact that in 1944, for the first time in the history of this industry, there has not been a single case of lead poisoning reported in the year, is an event of such importance as to be classed as a landmark in Factories Act administration. The records go back to 1897 when the total number of cases reported was 432.

Electricity

The number of electrical accidents reported (1,072) shows a slight reduction on the maximum of 1,255 reported in 1943. The war years have seen a great number of new applications of electricity to factory processes, and both the degree of risk and the method of dealing with it have had to be assessed and devised under the pressure inevitable in war production.

Some of the most difficult problems have arisen in connection with the aircraft industry and although, with increasing experience, the major risks have been reduced to manageable proportions, the use for testing and other purposes of large volumes of petrol necessarily presents an element of danger.

Chemical and Engineering Industries

On October 1st, 1944, the Engineering Branch of the Inspectorate became the Engineering and Chemical Branch working under the joint supervision of a Senior Engineering Inspector and a Senior Chemical Inspector. This change was a natural development brought about through the increase in the amount of work, the greater degree of specialisation necessary in many directions and the rapid development in chemical processes in industry.

Industrial Health

The increase in appreciation of the importance of industrial health is evident in many ways

and is widespread. The Royal College of Physicians has issued a valuable report [1] on the subject, the T.U.C. a statement and a resolution, the Universities of Durham, Glasgow and Manchester are in process of establishing departments of industrial health with the assistance of substantial grants by the Nuffield Foundation. The Nuffield Foundation has also made provision for Fellowships in Industrial Health for men and women of sufficient attainments who wish to qualify for senior teaching and research posts in the field of industrial health. The Society of Apothecaries is taking steps to institute a Diploma in Industrial Health. The Medical Research Council has set up a Research Unit at Cardiff to study pneumoconiosis in coal miners following the recommendation of a Committee appointed by the Minister of Fuel and Power. The Medical Research Council's Department of Industrial Health Research at the London Hospital is actively prosecuting research. The Royal College of Nursing carries on with its valuable work in training nurses for the industrial field.

The Universities of Bristol, Leeds, Sheffield, and Manchester, with the London School of Hygiene and the Birmingham Accident Hospital provide brief courses of instruction in aspects of industrial health as opportunity offers.

Work done at the Birmingham Accident Hospital and in the Birmingham area has advanced knowledge of the causes of infection of industrial injuries and in first-aid treatment. Similarly, at the Royal Albert Dock Hospital the special courses of training for the Nursing Services of the Royal Ordnance Factories have fostered a very high standard of surgical technique and a corresponding appreciation of the special problems of rehabilitation of injured workers in these factories.

The Leeds Joint Council on Industrial Medicine constituted from employers, employees, and the medical profession, has done pioneer work of great value. Its primary function is the co-ordination of activities in the sphere of Industrial Medicine for the common good. Similar Joint Councils have been set up at Derby, Burton-on-Trent, Leicester, Nottingham and Stratford.

The St. John Ambulance Association, the British Red Cross Society and the St. Andrew's Association are collaborating in raising the standard of knowledge and practice of first aid in industry.

Large industrial concerns are interesting themselves in research into problems of industrial health, contributing their own valuable applied professional and technical resources and collaborating with the basic facilities for research afforded by the Universities, Medical Schools, the Medical Research Council, and the Departments of Technical Colleges and Societies associated with research on industrial processes of various industries. The subjects of these researches cover a wide field and include asbestosis, silicosis, fluorosis and others referable to the chemical industries.

Arrangements have also been made for the provision of further training or refresher facilities for medical men returning from the forces, and it is anticipated that some Universities and Medical Schools will give short courses dealing particularly with industrial medicine and hygiene.

The Senior Medical Inspector stresses the need for educating the individual worker in self protection in specific occupations and specific industries. Opportunity for educational services directed to this end will be provided by the retraining and resettlement schemes accompanying the change-over from war to peace.

There is evidence that many persons do not intend to return to their pre-war occupations, and that in the post-war world a much nicer discrimination in the choice of his employment will be evinced by the worker. Apart from wage levels there will be other determining factors such as safety and standards of amenities. It is believed that with the extension of education in matters of industrial health the degree of healthiness of different occupations will become increasingly the dominant factor in the choice of an occupation. Unhealthy industries must be made healthy or they will languish and die.

The Industrial Health Advisory Panels

During the year the Radiological Panel and the Ophthalmological Panel were established. A very wide range of problems have been considered by the various Panels. Among other subjects, the Dermatitis Panel has considered oil dermatitis and research into this subject; industrial dermatological clinics; dermatitis due to heat radiations. The Panel also collaborated with the special sub-committee of the Pharmaceutical Society set up to consider the possibility of suitable formulæ for barrier preparations being included in the British Pharmaceutical Codex. The sub-committee met and recommended certain experimental work which is in progress. Contact has been made between the Dermatitis Panel and the Therapeutic Requirements Committee of the Medical Research Council.

Amongst the matters considered by the Ophthalmological Panel the most important are the degrees of eye protection from infra-red radiation required by welders (referred by the British Standards Institution); first-aid treatment of eye injuries including the most suitable type of eye-drops for general use in industry; the main-

[1] ROYAL COLLEGE OF PHYSICIANS OF LONDON; Social and Preventive Medicine Committee: *Second Interim Report*, January 1945. Industrial Medicine.

tenance of visual health in industry; infra-red drying processes; keratitis associated with exposure to *n*-butyl alcohol; epidemic kerato-conjunctivitis.

The Radiological Panel at its first meeting specially surveyed the measures in force for the protection of luminisers in the light of the results of inspection of the factories, the results of the tests made by the National Physical Laboratory, including those of radon in the expired air of operatives and direct gamma ray estimations, and examinations of blood. The Panel also considered the significance of certain skin lesions.

First Aid

The training of first-aid personnel in industry has received much attention from the Voluntary Societies and the Factory Department during the past two years. Following discussion first between the St. John Ambulance Association and the Senior Medical Inspector, and subsequently between medical representatives of the Association and the British Red Cross Society, the Ministries of Health, Fuel and Power, Supply, and the Factory Department, it was agreed that (1)Industrial First Aid should have an attractive career value, (2) the institution of a National Certificate in Industrial First Aid under the joint auspices of the St. John Ambulance Association, the British Red Cross Society and the St. Andrew's Association is desirable, (3) a special course of training should be drawn up, and (4) a special text book of instruction on Industrial First Aid should be compiled and published.

Industrial Diseases

The diseases most commonly reported were lead poisoning (41 cases), aniline poisoning (55), epitheliomatous ulceration (205, of which 99 were due to pitch, 61 to tar and 45 to oil), and chrome ulceration (121).

The report discusses the various diseases reported during the year.

Fumes and Gassing

There were 450 cases of gassing during 1944, including 25 fatal. Carbon monoxide accounted for 209 including 21 fatal, chlorine for 59, nitrous fumes for 55, including one fatal, and nickel carbonyl for 37. Numerous gassing accidents are discussed.

Pneumoconiosis

Under this head the Senior Medical Inspector deals with the incidence of silicosis and asbestosis in various occupations. In 1944 there were 445 deaths in England and Wales from silicosis, including 277 in coal mining, 32 in pottery manufacture and 26 in sandstone quarrying and dressing.

Dermatitis

The number of cases of dermatitis notified voluntarily in 1944 was 8,180 as compared with 8,926 in 1943 and 8,802 in 1942. A smaller incidence (1,151) this year as compared with 1,700 in 1943, in chemical manufacture (including manufacture of explosives and shell filling) accounted for nearly three-quarters of the total decrease on last year's figures. Other decreases on the previous year's records were in the manufacture and use of cement, in docks, sugar refining and metal plating. Increases were, however, recorded for woodworking, printing and textile industries, all with the highest figures yet reached.

As far as can be judged from the classification of dermatitis cases according to industries, adopted since 1939, the proportion due to contact with oil has steadily increased in these years. To remove mineral oil from the skin there has been an extending use in industry of a special cleanser in the form of a neutral sulphonated castor oil with a wetting agent. Although because of other factors it has been difficult to assess with precision the part played by sulphonated castor oil in the control of oil dermatitis, the evidence is suggestive that where oil is the contaminant, the theoretical soundness of its use as a skin cleanser is borne out by practice.

Without a comparison of the numbers at risk no definite conclusions can be drawn from the statistics which, by the voluntary system of notification, mainly serve as pointers to the location of dermatitis hazards. The evidence seems, however, to suggest that in the industries where dermatitis is recognised as a hazard the continuous and intelligent adoption of measures of protection (which must include reduction to a minimum of contact and the detection of early cases of skin irritation) will lead to a minimal incidence of disability from dermatitis. It is on these lines that the dermatitis problem in industry can be controlled, for reliance on any single measure as barrier preparations or even good washing facilities alone will not defeat the hazard.

Dermatitis has not been uncommon from the handling of boxes formerly used for T.N.T. or tetryl, or from the re-use of the wood for other purposes.

A firm reports satisfactory decontamination of old T.N.T. boxes by spraying them during mechanical transit through a tunnel with a hot solution of sodium carbonate. Acetone from an oil can was used for testing boxes after washing, the presence of T.N.T. being indicated by a red discoloration. This treatment would seem suitable also for old tetryl boxes.

Radioactive Substances and X-rays

Considerable space is devoted to the use of monitor films for the protection of workers exposed to X-rays and radioactive substances, and to an analysis of the cases in which the films have revealed excessive dosages. This section of the report also discusses cases of dermatitis of the fingers and blood disturbances.

Medical Supervision

The development of medical and nursing services has been hampered by shortage of doctors and nurses, but the services have continued to improve in quality. The Senior Medical Inspector pays a tribute to the far-sighted firms who installed such services before the war and to their personnel. Without the nucleus of specialists provided in this way the essential war needs of industry in the field of industrial medicine could not have been met, and the necessary expansion achieved.

At the end of 1944 there were approximately 180 doctors exercising full-time medical supervision in 275 factories, and at least 890 exercising substantial medical supervision in 1,320 factories on a regular part-time basis. Since then the lesser demands of war and the commencing change-over of industry to peace-time operation have on the one hand been accompanied by a reduction in these numbers owing to closure of factories, and on the other hand have enabled some factories formerly unable to get medical and nursing personnel to install these services.

The number of women nurses in industry from the most recent figures available would seem to be about 7,600, a slight reduction on the 1943 figures. In addition there are about 200 male nurses. Some 50 per cent, of the women and 10 per cent. of the male nurses are State Registered.

To meet the needs of industry for State Registered nurses with industrial training the short intensive courses of instruction sponsored by the Ministry for suitable candidates over the age of 27 years have been continued.

Interesting information is given on medical services in ordnance factories and at ports.

In 1944 a total of 242,714 persons were examined for certificates of fitness for employment in factories. Males numbered 138,287, this figure including 129,132 between the ages of 14 and 16; females numbered 104,427 and of these 102,414 were between the ages of 14 and 16. 1,152 males and 2,426 females were rejected—3,578 persons in all.

Industrial Advisory Committees

This section of the report gives valuable information on the work of various committees in which representatives of an industry meet with representatives of the Factory Inspectorate for the solution of problems of safety and health in the industry concerned.

One of the earliest attempts to achieve effective co-operation on these lines was in 1912, when conferences were held in Lancashire and Yorkshire with a view to obtaining a more uniform standard of safety particularly in the cotton and woollen industries, both of which were highly mechanised and showed records of a high incidence of machinery accidents. Many technical points were involved, including engineering problems and process difficulties which had to be resolved before agreed types of fencing could be decided upon. In both of these trades agreed recommendations, with regard to the guarding of machinery, with some provisions relating to temperature, the cleaning of machinery, the spacing of looms and the lifting of heavy weights, were drawn up. Two years later a similar procedure was adopted with regard to cotton bleaching, dyeing and printing works. Since that time there have been a number of examples of similar reports on agreements relating to such diverse industries as iron and steel, jute, tinplate, engineering and allied trades, printing and flour milling.

One disadvantage of the earlier scheme of joint conferences or industrial advisory committees was the fact that no machinery was set up for reviewing the agreements then reached in the light of newly developed methods of safe-guarding or to deal with new problems which might arise. In 1926 it was decided to set up another conference to draw up new agreements in the cotton spinning and weaving trade and one of the most important achievements of this conference was the establishment in each section of the trade of a joint standing committee which was representative of interested parties and was charged with the task of keeping the agreements abreast of developments and current problems. It was arranged that these Committees should meet regularly every six months and in this way the agreements are constantly kept under review. Useful and important provisions have in fact been added to the original agreed recommendations from time to time and a live interest is thus maintained in matters of safety throughout the trade.

In the cases of some industries in which there is a Joint Industrial Council, advisory committees on safety, health and welfare matters have been set up at their suggestion or with their full co-operation. The flour milling industry affords an interesting example of such a committee.

The establishment of these committees is sometimes the outcome of representations from the workers' side. One interesting example

of this was the committee set up in 1935 in the paper milling industry. The National Union of Printing, Bookbinding and Paper Workers put forward the suggestion that a standing joint committee which had formerly existed to deal with safety matters should be resuscitated. This was done and a tripartite committee was formed to study the incidence and causation of accidents in paper mills and to suggest methods of prevention.

For certain cases, however, such as those relating to the provision of safeguards for particular types of machines, the committees have been constituted on a more restricted technical basis. For example early in 1938 a committee was set up in the rubber trade comprising members of the two employers' associations concerned and representatives of the Factory Department with a view to devising efficient and practical safeguards for calenders and extruding machines used in that industry, the secure fencing of which had remained an unsolved problem for many years. Agreement was finally reached, and recommendations made which have already gone some way towards eliminating the distressing accidents formerly associated with these machines.

A short time before the war a committee was set up to consider the question of fencing heavy power presses and in 1939 that committee issued its report which not only contained a specification for guards to be used in connection with such machines but included other proposals for ensuring the safety of the operators; it also recommended the appointment of a Standing Joint Committee to consider any developments which might call for revision of its recommendations. In particular, it advised that such a Committee should consider the very difficult question of providing adequate safeguards for bending brakes or presses and guttering presses. The incidence of accidents at these machines and the increase in the use of them led in 1940 to the appointment of such a committee consisting of technical representatives of users of the machines and the Factory Department and a beginning was then made of the consideration of the problem.

Also in 1940 a very strong committee was appointed to consider the prevention of accidents between the punches and dies of those types of power presses which are most commonly used. The committee included representatives of the power press makers, press users and makers of safety devices as well as Inspectors of Factories and others having a direct interest in industrial safety. This committee felt that the press makers, the guard makers and the press users had each a major contribution to make in securing the safety of operators of these very dangerous machines and decided to divide its members into three sub-committees to consider press design, guard design and tool design.

The safeguarding of workers in various industries from dust of a siliceous nature has been a problem before the Factory Department for very many years and two joint industrial committees have published reports during the war, as to the Pottery Trade in 1943 and the Foundry Section of the Steel Industry in 1944.

The Factory Department has planned a development of this committee system to deal with many post-war problems in industry. For example, the textile industries have to face the problem of modernising many old mills. All these are highly mechanised and had tended in their earlier years to crowd as much machinery within the four walls of their factories as possible regardless of the safety and welfare of the operatives. The disregard for the proper spacing of machinery resulted in

(1) a higher accident rate;
(2) lack of proper working space;
(3) an undue amount of handling of goods and often the prevention of the installation of any alternative mechanical or labour saving devices;
(4) the prevention of improvements in amenities, *e.g.*, washing and cloakroom accommodation, seating facilities, etc., were crowded out because all available space was occupied by operative machinery;
(5) the production of unduly high temperatures owing to the dissipation of frictional and/or process heat from the large number of machines installed in a limited space.

Although the spacing and layout of machinery and plant are not subject to statutory requirements, the opinion of a technical committee, after considering the various practical production considerations involved, may go far to bring about preliminary improvements on agreed lines.

Committees for the cotton, woollen, and jute industries are now functioning.

UNITED STATES OF AMERICA

Injuries and Accident Causes in the Slaughtering and Meat-Packing Industry, 1943 [1]

Accident-frequency rates are higher in the slaughtering and meat-packing industry than in food industries generally and in manufacturing industries generally. In 1940 the rate for slaughtering and meat packing was 26.8, as against 20.2 for all food industries and 15.3 for all manufacturing industries; the corresponding figures for 1943 were 47.6, 29.7 and 20.0; and for 1944, 35.9, 27.1 and 18.4.

Slaughtering is the most dangerous branch of the industry; its frequency rate for 1943 was 60.5.

[1] U.S. Department of Labor, Bureau of Labor Statistics: *Bulletin No. 855*, 1945.

Analysis of 5,053 disabling injuries in 29 establishments in 1943 shows that the principal agencies involved were hand tools with 983 accidents, vehicles with 759 and working surfaces with 750. Of the 983 hand tools 753 were knives, of the 759 vehicles 658 were hand-operated and of the 750 working surfaces 640 were floors.

The distribution of these accidents by type of accident shows that 1,475 were 'striking against', 1,113 'struck by ', 849 falls of persons, and 801 slips and over-exertion. Under the head of 'striking against ', knives accounted for 646 accidents.

In the analysis of the accidents by unsafe working conditions 'defects of agencies ' comes first with 1,061 accidents and in 601 of these cases the defect was 'slippery '. 'Hazardous arrangement or procedure in, on or around selected agency ' comes second with 594 accidents, of which 322 were due to unsafely stored or piled tools, materials, etc.

The commonest unsafe act was 'using unsafe equipment, hands instead of equipment, or equipment unsafely ', with 1,599 accidents (includes 1,485 due to 'gripping objects insecurely or taking wrong hold of objects '). Next comes 'taking unsafe position or posture ' with 609, and 'lifting incorrectly or lifting too heavy loads' with 549.

A study of non-disabling injuries was made in three plants. Out of 30,499 injuries only 337 were disabling—a ratio of 90 to 1.

In one plant employing 330 persons 1,279 injuries were investigated from the standpoint of accident proneness. Two workers had over 25 injuries each, 4 had 21-25, 6 had 16-20, 17 had 11-15, 6 had 10, 16 had 9, 10 had 8, 7 had 7, 14 had 6 and 18 had 5 each. 3.6 per cent. of the employees accounted for 19.5 per cent. of the accidents, 10.6 per cent. accounted for 40.7 per cent. of the accidents, 15.5 per cent. for 52.0 per cent., and 20.6 per cent. for 62.1 per cent. In other words one-fifth of the employees accounted for over three-fifths of the accidents.

The principal recommendations made for the prevention of accidents in slaughtering and meat packing plants are the following:

1. Take steps to reduce the hazard of slippery floors.
2. Improve housekeeping conditions, with particular attention to the piling and storage of materials and the placement of hand trucks when not in actual use.
3. Regularly inspect all tools, material, and equipment for defects, and immediately repair or replace all defective items, particularly in respect to knives, floors, hand trucks, and conveyors.
4. Provide and require the use of adequate personal safety equipment in all operations presenting hazards which such equipment can overcome.
5. Provide and require the use of guards on all machinery and elevators.
6. Provide knives which are guarded to prevent the workers' hands from sliding down over the blades.
7. Install guards on all monorails to prevent the wheels from leaving the track.
8. Provide mechanical equipment or sufficient assistance when heavy or bulky materials are to be lifted or moved.
9. Provide rules and traffic-lane markings to govern the movement of vehicles inside the plant and require supervisors to enforce these rules.

The report gives brief descriptions of 68 typical accidents.

Alabama

DEPARTMENT OF INDUSTRIAL RELATIONS: DIVISION OF SAFETY AND INSPECTION

Annual Statistical Report, 1943-1944

The report is interesting as it gives frequency and severity rates for numerous industries, and percentage distribution of accidents by causes, length of service and age. Examples of rates in the largest industries for 1943 are given in Table I.

TABLE I

Industry	Man-hours	Lost-time accidents				Frequency rate	Severity rate
		Temporary	Permanent partial	Fatal and permanent total	Total		
Aluminium and alloys	15,081,793	439	24	2	465	30.84	1.62
Automobile	8,939,758	160	1	—	161	18.01	0.45
Cloth products	11,118,528	95	4	—	99	8.90	0.51
Coke,by-products	5,062,210	38	6	3	47	9.28	4.53
Explosives	5,720,586	13	1	—	14	2.45	0.35
Pressure-pipe foundries	15,679,636	269	17	1	287	18.30	1.35
Laundry	9,755,522	78	3	1	82	8.41	1.33
Lumbering	29,344,133	1,001	26	7	1,034	52.97	4.57
Machinery	7,491,282	297	5	1	303	40.45	2.09
Metal products	8,768,505	263	9	1	273	31.13	1.47
Paper and pulp	7,995,792	153	5	1	159	19.88	1.38
Public utilities	23,626,151	279	13	5	297	12.57	1.80
Railroads, Class I	54,615,311	1,070	11	21	1,102	20.18	3.06
Ship and boat works	75,005,254	1,256	17	11	1,284	17.12	1.11
Steel and iron	56,011,872	471	81	10	562	10.03	2.48
Steel fabrication	11,111,403	358	23	2	383	34.47	2.64
Textile spinning	15,116,519	245	6	—	251	16.60	0.44
Textile weaving and spinning	91,347,527	863	48	7	918	10.05	1.02
All industries	551,276,785	9,825	383	93	10,301	18.69	1.76

The distribution of 3,791 lost-time accidents in 1943-1944 by length of service is shown in Table II.

TABLE II

Length of Service	Male	Female	Total	Per cent.
Under 12 months	1,189	112	1,301	34.32
1 to 2 years	696	33	729	19.23
3 to 5 years	340	15	355	9.36
5 to 10 years	238	10	248	6.54
11 to 15 years	107	3	110	2.90
16 to 20 years	153	2	155	4.09
21 to 25 years	137	—	137	3.61
Over 25 years	136	3	139	3.67
Unknown	557	60	617	16.28
Totals	3,553	238	3,791	100.00

Falling objects accounted for 14.69 per cent. of accidents in manufacturing plants, machinery for 13.53, falls of persons for 8.03, lifting objects for 6.69, caught between objects for 6.49, burns for 6.34 and punctures for 5.39.

In 1943-1944, the Alabama coal mines employed 22,933 workers—3,071 on the surface, 12,277 at working faces and 7,585 on other inside work. There were 36 fatal and 60 other serious accidents. The fatality rate measured by output was 1 per 506,318 tons.

The distribution of these accidents by mining experience of the victims is shown in Table III.

TABLE III

Length of Experience	Fatal	Serious	Total
Under 6 months . . .	6	—	6
6 to 11 months . . .	3	3	6
1 to 2 years	2	5	7
3 to 5 years	3	1	4
6 to 10 years	5	1	6
11 to 20 years	8	9	17
Over 20 years	9	3	12
Unknown	—	2	2
Totals . .	36	24	60

The total number of accidents in all Alabama mines was 1,722 (1,502 in coal mines, 214 in metal mines and 6 in quarries).

The distribution of these accidents by length of service is shown in Table IV.

TABLE IV

Length of Service	No.	Per cent.
Under 12 months	379	22.00
1 to 2 years	456	26.48
3 to 5 years	289	16.79
6 to 10 years	254	14.75
11 to 15 years	132	7.67
16 to 20 years	89	5.17
21 to 25 years	32	1.86
Over 26 years	28	1.62
Unknown	63	3.66
Totals . . .	1,722	100.00

Occupational injuries among railroad employees totalled 1,144. Striking against objects accounted for 13.29 per cent. of them, falling objects for 9.10 per cent., falls from a higher level for 9.00, caught between objects for 7.61, objects in eyes for 6.56, and strains from bad footing for 6.12.

REVIEW OF PERIODICALS

There's Power in Color. (*National Safety News*, August 1945, p. 16.)

This article deals with the effect of colours and their application in the industrial field. During the period between the two world wars colour engineers were proving that paint had vitally important functions beyond the utilitarian tasks of protection and decoration. Engineers were carrying on tests with the 18 basic colours and they found particular characteristics which created physiological as well as psychological reactions. Those whose wave lengths most nearly approached the heat wave lengths in the ether were identified as warm colours and those farthest removed from heat vibrations as cold colours. Also, it was proved that one colour is complemented by another with the complementary colour possessing the ether vibrations lacking in the other. This factor is of great significance in view of its effect upon the human eye, which has the power to receive impressions of the three primary colours: yellow, blue, and red.

Research in this field has led to the development of a series of focal and receding colours which could be utilised on a scientific basis in industrial operations.

Considerable progress has been made in the correlation of light and colour in the industrial field.

In the past factories were painted with little or no regard for the co-ordination of illumination and colour, usually with inadequate lighting. In one factory it was revealed that the eyes of 40 per cent. of the employees were in need of professional care.

Experiments produced colour schemes for use in industrial plants in which the ceiling would reflect at least 75 per cent. of the light rays to the working areas while the walls would maintain a 50 to 60 per cent. light reflecting power with proper distribution. Tests have proved that white reflects 85 to 90 per cent. of the light; ivory 74 to 79 per cent., yellow 66 to 72 per cent., orchid 70 per cent., peach 69 per cent., light buff 68 per cent., light blue 66 per cent., light green 62 per cent., beige 58 per cent., light gray 56 per cent. These values were obtained under indirect, semi-indirect, direct and natural lighting. Green was revealed to be the most restful colour under any type of illumination.

The colours which can be most readily identified under various types of lighting are yellow, orange and blue with yellow being the most visible and orange the most attention-arresting. White and black represent theorctically the ideal extremes, but the combination is not satisfactory because in intensive light, the white with a high reflecting index tends to blur the vision. After several tests a proper plan was established to aid illumination in three ways : reflection, diffusion and conservation of light.

In essence, the scientific use of colour is based upon principles somewhat similar to camouflage but in application it is diametrically opposite. In the industrial colour system, colour is used to reveal, to emphasize, to highlight, and to utilise. The first job of colour, in its application to machinery, is to separate the critical from the non-critical parts and, where possible virtually to divorce the critical parts from the material worked upon. Applying this principle to machinery, the operating parts are given a colour that comes quickly to the eye, one that moves in contrast to the stationary or non-critical parts of the machine. These are known as focal colours. The purpose of focal colour is in combination with the complementary colours, to call the worker's attention where it should be, with the least possible effect on the eye muscle.

The Prevention and Suppression of Coal Dust in Mines. By H. Watson SMITH and H. F. BANKS. (*Transactions of the Institution of Mining Engineers*, Vol. CIV, Part 11, August 1945, p. 602.)

The theme of this paper is the desirability of suppressing coal dust rather than adding stone dust to it and thus increasing the total quantity of dust in the mine. The authors describe the results of experiments in dust suppression in the various phases of coal-getting and transport.

In coal-cutting a reduction of 34 per cent. in gummings was obtained by reducing the kerf from six to four inches, and the use of mechanical gummers resulted in the suppression of up to 42 per cent. of air-borne dust.

For seams having a moisture-content of less than six per cent. wet cutting has been found beneficial. In the experiments described by the authors, in which dust was collected on trays for measurement, very considerable improvements were achieved by wet cutting, as can be seen from the following tables.

TABLE I

Reduction in -60 Mesh Dust deposited with Wet Cutting and Loading-Out of Gummings

Region of sampling	Air velocity ft./min.	Weight of -60 mesh dust on trays, g		Reduction in -60 mesh dust deposited, per cent.
		Dry Cutting	Wet Cutting	
1. On face	430	1.179[1]	0.185	84.3
2. In conveyor gate (out-bye face transfer) . . .	150	3.310[2]	0.672	79.7
3. On main road (out-bye loader)	196	1.346[2]	0.068	94.9

[1] Deposit over 40 yds. of cut using 5 trays.
[2] Dust deposited during the whole of the shift.

TABLE II

Reduction in -60 Mesh Dust deposited during the Coal-filling Shift

Region of sampling	Weight of -60 mesh dust on trays, g[1]		Reduction in -60 mesh dust deposited, per cent.
	Dry cutting	Wet Cutting	
2. Conveyor gate (out-bye face transfer) . . .	1.361[2]	0.750[2]	44.9
3. Main road (out-bye loader) . .	2.403	1.356	43.6

[1] Dust deposited during the whole of the Filling-shift.
[2] Fewer trays used than on the Cutting-shift.

The dust produced in drilling shot-holes varies in fineness with the system of drilling and the type and condition of the drill bits. The modern electric or rotary compressed-air hand drill, operated at a suitable speed and fitted with a well-designed and correctly ground bit, produces relatively coarse drillings.

The production of fines during blasting can be considerably reduced by careful choice of explosive and correct procedure in its use. Simultaneous shotfiring is preferable to the firing of individual shots. Experiments showed that a 12 per cent. reduction of air-borne dust could be obtained by firing shots in pairs, and a 32 per cent. reduction by firing shots in rounds of six.

Turning to dust suppression in the transport of coal, the authors consider the qualities of various types of water-spray. The results obtained out-bye of the gate belt transfer point in experiments using sprays at the transfer point are shown in Table III.

TABLE III

Condition of test	Total weight of -60 mesh dust deposited, g[1]	Reduction of -60 mesh dust deposited, per cent.	Water consnmption, gal./hour, (80 lb./sq. in.)
1. Without spray	8.618	—	—
2. Using Royle spray ...	4.845	43.8	10
3. Using Four Oaks spray	5.602	35.0	28
4. Using Varispray	5.286	38.7	17

[1] On a basis of 150 tubs filled in each test.

Table IV shows the results achieved at conveyor junctions in roadways.

TABLE IV

Point of sampling	Dust, -60 mesh, deposited in 5 hours on trays, g/sq. ft.			Reduction in -60 mesh dust	
	Without trap or sprays	Dust-trap only	Dust-trap and spray	Dust-trap only, per cent.	Dust-trap and spray, per cent.
Trunk conveyor (samples taken in-bye over 32 yds.)	10.426	4.634	2.340	55.5	75.5
Gate conveyor (samples taken in-bye over 37 yds.)	3.922	1.933	1.399	50.7	64.3

For the collection of dust from the return or under belt of conveyors at delivery points, steel-wire brushes and water-sprays were used. The results are shown in Table V.

TABLE V

Tests	Weight of dust deposited g/100 tons	Increase or decrease, per cent.
(*a*) Without sprays or brushes	2931.0	—
(*b*) With sprays only	3344.7	+ 14.1
(*c*) With brushes only	466.5	— 84.1
(*d*) With sprays and brushes working	555.1	— 81.1

The effect of sprays at conveyor loading points is shown in Table VI.

TABLE VI

Weight of -60 mesh dust per 200 tons of coal filled	g	Dust reduction, per cent.
(*a*) Without sprays	21.455	—
(*b*) With spray working under chute	19.075	11.1
over chute	14.491	32.5
(*d*) Both sprays working	13.787	35.7

In view of the limitations of open water-sprays and the disadvantages of chute loaders, a general study of loading points was made at the mines in question in order to determine the desirable qualities that an efficient loading station should possess. In the light of this study a discharge-loader end for belt conveyors was designed and patented. This is described by the authors. Its performance in tests on a roadway is indicated in Table VII.

TABLE VII

Distance in-bye from loading point, yds.	Weight of -60 mesh dust deposited, g/sq. ft.		Reduction in dust deposited, per cent.
	Open chute without sprays	New type of loader	
0-10	20.086	2.485	87.6
10-35	3.936	1.432	63.6
35-55	0.290	0.272	6.2
Total. . .	24.312	4.189	82.8

Dust in Return Roadways. By W. A. TERRELL. (*The Iron and Coal Trades Review*, 7 December 1945, p. 885; 14 December 1945, p. 935.)

In this contribution to the study of dust problems in coal mines, the author considers first the various factors producing dust and then the various means of reducing dust.

In connection with the production of dust, consideration is given to the type of coal, length of the coal face, type of conveyors, width of conveyor belts, position of tension ends of conveyors, method of cutting coal, quantity of air and air velocity.

Test data are quoted to show that the rate of dust production is very much higher during the filling shift than during the cutting shift. In the tests described, the filling shift produced 10 times as much dust as the cutting shift.

Other tests described in the article were undertaken to determine the rate of deposit of dust at various points along a return roadway. The rate was found to decrease with increasing distance from the face.

Means of reducing dust discussed by the author include suitable positioning of the tension end of belt conveyors; the application of water by infusion, wet cutting and spraying; impingement devices; and filtration. The positioning of tension ends is considered at some length with the help of illustrations and a graph.

The article is supplemented by numerous illustrations and data tables and a bibliography.

The Ignition of Firedamp by Explosives. By H. C. GRIMSHAW. (*The Iron and Coal Trades Review*, 19 October 1945, p. 593; *The Colliery Guardian*, 19 October 1945, p. 476.)

The experiments described in this paper were designed to ascertain whether safety could be increased by sheathing the ends as well as the sides of cartridges used for shotfiring. The conditions were intended to imitate those underground when an open parting or break exists at the back of the shothole, and the shots were fired in a nine per cent. firedamp-air mixture. With unsheathed cartridges, seven out of nine shots caused ignition: with cartridges sheathed at the sides three out of 18 shots caused ignition. When a plug of sodium bicarbonate powder was pushed to the back of the hole and into the parting, 18 shots with unsheathed cartridges caused two ignitions; with a plug of moist clay instead of sodium bicarbonate, there were no ignitions in 17 shots.

It is recommended on the basis of these results that in order to provide against the presence of an undetected break at the back of a shothole a plug of clay or other stemming material should be pushed to the back of the hole before the charge is inserted.

Stratosphere Metals. By J. Norval BURCH. (*National Safety News*, September 1945, p. 12.)

This article deals with the hazards encountered in the extraction and processing of tantalum, tungsten, molybdenum and columbium (called by metallurgists "stratosphere metals") and shows how these hazards were met at the Fansteel Metallurgical Corporation's plant in Chicago.

To the safety man, these metals represent a challenge because the processes and subsequent fabrication into usable forms subject the workers to such hazards as pressures measured in hundreds of tons, temperatures that are industry's nearest approach to solar intensity, acids that destroy glass or human tissue, high tension current, strong caustics, and explosive gases, besides all the usual hazards of an ordinary industry.

During the Second World War the Fansteel Corporation's production of tantalum was increased twelve times, tungsten five times, molybdenum six times and carbide tools one hundred times.

The author emphasizes that the success of the safety department of the Fansteel Corporation was due to the foreman in charge of the different operations, to the enthusiastic support of the management and the co-operation of the whole plant personnel.

The control of dangerous acid fumes, caustic fumes, metal fumes and other noxious products from chemicals and high temperatures presented a serious problem and called for the co-operation of the safety, medical, engineering and other departments.

In addition to the protective clothing and respirators worn by operators, an elaborate system was installed to exhaust the gases and fumes at the point of origin.

To prevent contamination of the surrounding atmosphere, the exhaust is run through four large scrubbing towers, where the air is cleansed and the residue is sent to the sewer. Similar systems were installed to guard the furnaces and vats.

In conclusion the author describes in detail the organisation of the safety department at these plants.

Port Arthur Elevator Explosion. By L. C. ANDERSON, Ontario Fire Marshal's Office. (*Quarterly of the National Fire Protection Association*, October 1945, p. 103.)

On 7 August 1945 a dust explosion occurred in No. 5 grain elevator at Port Arthur, Ontario, causing the deaths of 22 persons, injuries to 27 others and property damage to an amount of about three-quarters of a million dollars.

Pool Elevator No. 5 was built in 1918, with a capacity of 2,100,000 bushels. It is composed of three storage units known as Annexes 1, 2, and 3, and a work house which is a building 187 feet in height. The construction of the work house building and of the three annex buildings containing the storage tanks was of reinforced concrete. The work house was of reinforced concrete columns, girders and floor beams with reinforced concrete floor slabs with brick panels or curtain walls between columns and girders forming the enclosing walls. All these buildings were connected by communicating passageways and open doorways at basement level and cupola floor level.

Only one stair and one passenger elevator, both in the same shaft and open at all floor levels to the work house, served as communication between the floor levels of the entire building. No alternative means of descent in the form of exterior fire escapes or tower stairways were provided.

The area of fixed openings in the form of windows was very small and much of the glass in the windows of the work house and No. 1 Annex was wired glass.

The tanks or bins in No. 1 Annex were open and no tanks in any of the storages or elevator heads were vented to the outside of the building.

No dust collection equipment was provided for this elevator other than the cleaning machines and floor sweeps provided for the work house only.

Electrical equipment generally was quite old and much of it was installed when the elevator was built. Electric lighting, excepting in No. 2 and No. 3 Annexes, was exposed by light bulbs controlled by ordinary toggle switches. Extension cords generally used throughout the building were of the ordinary type, the light bulb merely protected by a wire guard.

The operations carried on in the morning of the explosion were: (*a*) the loading of refuse screenings on the Lake freighter *Sonora*, and (*b*) receiving of grain from railway cars. The operations had been going on for a little over two hours when the explosion occurred. The tanks from which refuse screenings were being drawn were located in No. 1 Annex, and due to the absence of dust collecting equipment, the atmosphere inside the work house was such as to reduce visibility to a considerable extent. It has been the practice of elevators at the lakehead to put all dust and refuse resulting from the handling of grain into the refuse screenings bin; consequently this operation was the dustiest of all carried on.

From the statements of eye-witnesses and those of employees outside the building, the primary explosion was in the basement of Annex No. 1 and was immediately followed by other explosions throughout the work house and the cupola house of No. 1 Annex. Owing to the lack of adequate venting, the reinforced concrete wall enclosing the basement of Annex No. 1, which was 18 inches in thickness, was blown 35 feet away from the building. The brick panels or curtains in the work house walls, as well as concrete girders, were scattered for a distance of more than 300 feet and the stair enclosure was completely blown from the building so that practically no evidence of its existence remained after the blast.

The cause of the explosion could not be ascertained.

It is considered that the elevator fell far short of the requirements of the National Fire Protection Association Code for Terminal Grain Elevators.

The coroner's jury made the following recommendations:

(1) That there be regular inspection of Terminal Grain Elevators and similar plants by a qualified inspector appointed by the proper government empowered to enforce his recommendations with such necessary amendments of Provincial or Dominion Legislation as may be required.

(2) That all Terminal Grain Elevators be required to install and maintain at all points were a transfer or movement of grain results in the liberation of dust, efficient dust-removing equipment throughout the elevator and that the dust so obtained be either entirely destroyed or stored in some separate structure, and that the removal of static dust be performed daily by men employed for this purpose, with the number so employed proportional to the amount of grain handled and the dust so taken to be disposed of as above set out.

(3) That alternative means of escape in the form either of fire towers or external metal fire escapes leading directly to the ground level should be provided from all work floor levels, and a maximum distance of travel to such exit to be not greater than one hundred to one hundred and twenty-five feet, such fire escapes to conform with the regulations of the Ontario Department of Labour.

(4) Interior stairways should be completely enclosed, the doors opening into the stairway at all floor levels. Stairways starting in the basement should terminate at the first work floor and a distinct or separate shaft enclose the stair ascending from this level to the upper floors of the work house. Passenger elevators should be enclosed in tight shafts with incombustible doors of self-closing type installed on all floors.

(5) All existing electric equipment not conforming to the regulations of the Hydro Electric Commission of Ontario should be removed and approved types installed. Fire-resistive partitions with fire doors should be provided for all horizontal passageways for conveyors or internal traffic.

(6) All elevators should be provided with an adequate mechanical exhaust system or effective vents to outdoors for all bins, tanks, heads, boots, garners, scales, belt loaders, belt conveyors under chutes, belt

discharges and trippers, all cleaning and similar machines and at car unloading hoppers.

(7) That maximum of possible amount of window areas be provided in basements, cupolas, work houses, galleries and tunnels in no case less than one square foot of explosion venting area for every 80 cubic feet of total volume and explosion type sash installed.

(8) No smoking be permitted on the premises.

(9) All equipment to be grounded for static electricity.

(10) Adequate fire extinguisher equipment should be provided internally and externally and maintain the said parts in good working condition by a specified qualified person.

(11) That adequate standpipe installations should be made in all Terminal Grain Elevators.

(12) That adequate rescue equipment, including Stokes or equivalent stretchers, long ropes and long ladders be maintained at each elevator.

(13) That the City Council and other local authorities give immediate consideration to the adequacy of the existing fire equipment. The disaster which is the subject of this inquiry would indicate that a pump with a capacity of at least 800 gallons is necessary and that an aerial ladder not exceeding 85 ft. would have materially assisted the fire department and might prevent a recurrence of a similar disaster.

Safety Rules for Welding. (*Safety*, September 1945, p. 185.)

This brief article deals with some important precautions in oxy-acetylene welding and contains numerous concise recommendations.

It is pointed out that the wide use of oxy-acetylene processes in shipbuilding presents a particular problem since carelessness may result in unburned acetylene being released in confined spaces, such as a ship's double bottom. The shipyards have specific rules which should always be followed in addition to the following general rules:

1. Blowpipes and hoses should never be left unattended in a closed or unventilated space, whether connected to an oxy-acetylene outlet header or not.
2. If any odour of acetylene is noticed, the blowpipe valves should be closed immediately and the blowpipe and hose removed to an open space.
3. Flames, fire and sparks should be kept away from the space until the atmosphere in the area is completely purged.
4. All connections and equipment should be tested for leaks.
5. The blowpipe should be lighted immediately after the blowpipe valves are opened. The oxygen or acetylene should never be allowed to blow for purging the hose; the purging should always be done before going below deck.

Similar rules are laid down for welding and cutting in other confined spaces, such as tanks, boilers, etc.

The article closes with safety rules for welding work on containers that have held flammable substances and on closed containers and hollow parts.

First Things First for Safety. By L. W. DUTTON and G. G. GRIEVE. (*Railway Age*, 10 November 1945, p. 754.)

A recent study made by the National Safety Council of 515 reports of lost-time accidents in locomotive shops and engine houses, giving a cross-section of accident experience on various railroads, is analysed in this article.

The authors point out that accidents in railroad shops may involve many kinds of materials, tools and machines but most of them occur in relatively few types of work and from relatively few causes. This characteristic provides a logical sound approach for preventing injuries by concentrating on the causes that produce most of the trouble at the principal sources.

An analysis of 515 lost-time accidents in locomotive shops and engine houses shows that the largest proportion, 30 per cent., of accidents in engine houses and shops, happens in working on or around locomotives. The greatest cause of these accidents are a few inefficient practices in repairing steam lines and other parts under pressure, and in starting fires. This cause can be easily eliminated by issuing a few instructions and following them up.

The prevention of falls in working on locomotives is a difficult problem because most of them are due to uncertain footing. Numerous falls are also due to running boards that do not afford a safe working place.

The use of ladders in making repairs on certain parts may eliminate some injuries. Others may be prevented by warning workers on running boards and other places before locomotives are moved. The authors emphasize that the elimination of hazards by mechanical means, such as guards or other safety devices, or a change in design or method is generally far more effective than the observance of safe practices.

The second major problem—using tools—accounts for 24 per cent. of the total amount of accidents. These kinds of accidents should receive the most attention from supervision. In order to avoid eye injuries in using tools, the authors recommend compulsory use of goggles in engine houses and shops.

The third largest problem was found to be "handling and placing materials and tools". This type of accident involves numerous different unsafe practices that can be easily observed and corrected in watching the progress of a job. Instructions on safe handling should include placing materials and tools in a secure position.

The operation of cranes and hoists frequently results in serious injuries, especially with overhead cranes. The principal trouble in railway shops is poor slinging of loads, a less frequent cause in other industries using this equipment. Many injuries are also caused by chain hoists and small air or electric hoists. Unsafe slinging, improper balancing of the load and failure to allow for swinging when picking up loads are the most frequent causes involved in these accidents.

Power Presses—Their Safety, Use and Abuses. By William HADFIELD, District Engineer of the American Mutual Liability Insurance Co. (*American Mutual Magazine*. Vol. XXI, No. 1, September 1945, p. 6.)

In many plants proper guards are found for belts, pulleys, gears, etc., but little attention has

been paid to the safeguarding of the power press, which is known to be the most dangerous tool and which should be the best guarded.

This article describes the principal factors which, besides insufficient, ineffective or improper guards, contribute to the causes of power press accidents, such as—clutch failure, defective brakes, improper design and location of foot treadles, and type of dies.

The author emphasizes that a broad supervision is essential not only over the operators of the presses but also over those responsible for die set-up, press maintenance and guard installation and maintenance. Also it is necessary that each operator of a press be made aware of the dangers and hazards inherent in its operation.

Etude relative à la Sécurité des Ouvriers travaillant aux Presses. (*Bulletin technique d'Hygiène et de Sécurité des Travailleurs*, 1944, p. 31.)

The presses under consideration in this article are mostly metalworking presses, but presses used in the boot and shoe, printing and brick and tile industries are also dealt with.

An inquiry covering 1,405 undertakings showed that of a total of 85,405 accidents occurring between 1 October 1941 and 31 March 1942 only 2,134 were caused by presses, but although press accidents are relatively infrequent they are usually severe. Fifty-five per cent. of the accidents were attributed to material causes, 26 per cent. to the worker and 19 per cent. to miscellaneous causes.

The metalworking presses are divided into two groups: (1) automatic and semi-automatic and (2) non-automatic. The article is mainly concerned with the latter and describes, with numerous drawings, safeguards of various types—sweep-away guards, two-hand controls, combined hand and foot controls, electrical interlocks, mechanical interlocks, photo-electric devices, etc.

The article concludes with a list of general safety precautions.

Luminous Radio-Active Substances. (*New South Wales Government Gazette*, 31 August 1945, p. 173.)

A report of the Factory Welfare Board of New South Wales to the Minister, for July, contains an account of development of sore lips by a girl employed on operations requiring the use of radio-active substances. At first the girl sought treatment from a chemist, but an examination in a dark room showed a luminous glow through the make-up. She disclaimed any suggestion that she had "pointed" the brush with her lips. It was, however, disclosed that she had suffered from a "cold" and had frequently used her handkerchief without removing her rubber gloves. The substance was thus conveyed from the handkerchief to her lips, causing the affection mentioned. It was removed by a solvent and a speedy recovery followed.

RECENT BOOKS

Arbejderbeskyttelse. By Kirsten GLOERFELT-TARP, Poul BONNEVIE and Carl WAGNER. Martins Forlag, Copenhagen, 1943. 319 pp.

The entire field of labour protection is covered by this volume. The authors, who are all officials of the Danish Factory Inspectorate, deal in eight chapters with the history of labour protection (I), industrial accident risks and their prevention (II), the occurrence and combating of occupational diseases (III), the installation of industrial premises (IV), rationalisation and labour protection (V), hours of work and rest pauses (VI), special provisions for certain groups of workers (women and young persons) (VII) and labour protection in practice (VIII).

The historical chapter traces the rise of labour protection legislation in Denmark and Great Britain, and touches briefly on international developments. Denmark had regulations for the inspection of steam engines as early as 1832, and the general Act on steam boilers, steam engines and steam receivers dates from 1851. The first general Act on the protection of machinery was passed in 1889, but a general Factory Act did not come into existence till 1901. The Act now in force, which was passed in 1913, is considered out of date and is expected to be replaced by a new Act in the near future.

The chapter on accident risks quotes statistics for the period 1928-1933 showing that 25 per cent. of occupational accidents in Denmark were due to persons falling down or falling over, 14 per cent. to power-driven machinery, 22.5 to striking against objects, etc., 6 to falling objects, 8 to vehicles and transport, 5 to implements and tools, 5.5 to burns, corrosion, poisoning, explosion, etc., 5 to strains, and sprains and 9 to animals. The authors discuss the principal cause groups. The most dangerous machines are stated to be circular saws, spindle-moulding machines, overhand planers, band saws and metalworking presses, lathes and drilling machines. There is a brief section on agricultural machinery. Under the head of explosions the authors deal with pressure vessels (including air receivers, and gas cylinders), acetylene generators, volatile liquids and dust.

Occupational diseases are grouped as follows: inhalation of dust and smoke, inhalation of gases, fumes, etc., absorption (lead, mercury, arsenic, phosphorus, etc.), skin diseases, diseases of other organs (eyes, ears, nose, etc.), infections, heat and cold.

The chapter on rationalisation is very interesting as demonstrating the importance of the human factor in any schemes for improving production. The authors deal with the mechanisation and

specialisation of work, tempo and fatigue, and various physical and psychological factors such as the worker's environment, posture, machine design, training, industrial relations, music and radio, and welfare.

The last chapter is concerned with inspectorates, legal responsibilities, social education and insurance.

There are over a hundred photographs of workrooms, sanitary and welfare installations, machine guards, lighting systems, etc., showing both good and bad practice.

Handbook of Industrial Safety Standards. Seventh Revision. National Conservation Bureau, Association of Casualty and Surety Executives, New York, 1945. 212 pp.

The handbook is a compilation of generally recognised industrial safety requirements, and is based on standards of the American Standards Association and the American Society of Mechanical Engineers, governmental and fire underwriters' codes and regulations and recommendations of authoritative technical bodies.

The latest revision contains 34 chapters dealing with industrial premises (sanitation, illumination, ventilation, etc.), industrial equipment (various types of machinery, boilers, pressure vessels, hoisting appliances, hand tools, etc.), dangerous substances (corrosive, explosive, etc.), dermatitis, protective equipment, first aid and plant safety organisation.

The handbook is concisely written, profusely illustrated and well indexed. It is an extremely useful piece of work.

Industrial Lighting. Commonwealth of Australia, Department of Labour and National Service, Industrial Welfare Division, Bulletin No. 1, 1945. 36 pp.

The Australian Department of Labour has produced a concise, interesting and useful pamphlet. A general introduction to the subject entitled "An A.B.C. of Lighting Principles" is followed by sections on the requirements of good practice, colour in industry, best methods of lighting, lighting equipment and its application, fluorescent lighting and natural lighting.

Data tables give the quantity of illumination required for work of varying degrees of fineness (six classes); typical illumination values for various industrial interiors and tasks; minimum concealment of lamps at various mounting heights in working areas; and requirements for surface brightness of diffusing fittings.

The section on colour in industry has tinted illustrations showing the uses of various tints for brightening workrooms, relieving eyestrain and promoting efficiency generally.

The text is accompanied by 28 photographs and numerous drawings of good and bad lighting effects, lighting equipment, etc.

Air Sanitation and Industrial Ventilation. By W. N. WITHERIDGE. Detroit, Michigan, 1945. 75 pp.

The author of this Manual has collected in a volume his lectures on the subject in extension courses at the University of Michigan between 1941 and 1945, with the object of explaining and publicising effective and practical engineering techniques for the prevention of accidents, diseases, property damage and nuisances to the community caused by industry.

The following matters are discussed in full detail:

(1) Sources of air contaminants, such as dusts, fumes, mists, vapours and gases.
(2) Effects of air contaminants on the health and efficiency of workers.
(3) Detection and measurement of air contaminants, including demonstration of special field and laboratory instruments.
(4) Control of dusts, fumes, smokes, mists, vapours and gases by:
    (*a*) general ventilation—natural draught and mechanical;
    (*b*) ventilation of isolated areas, booths or enclosures;
    (*c*) local exhaust systems—major types.
(5) Necessary provisions for adequate conditioned air supply.
(6) Methods of preventing excessive heat loss due to wintertime ventilation.
(7) Performance of dust collectors, such as cyclones, air washers, filters, and electrostatic precipitators.
(8) Performance of fans, blowers, air ejectors, and natural draught ventilators.
(9) Control of hazards by substitution of safer materials and by alteration or isolation of processes.
(10) Metallic and organic dust explosions; necessary preventive measures.
(11) Temperature, humidity, draughts and radiant heat.
(12) Significance and control of odours in and around industrial establishments.
(13) Control of airborne bacteria by ultraviolet radiation, germicidal mists and vapours (aerosols), and filtration.
(14) Personal protective equipment such as respirators and gas masks.
(15) Correct methods of determining effectiveness of air sanitation equipment.
(16) Standards, regulations and codes on air sanitation and ventilation.

All this interesting material is arranged in several chapters, most of which are supplemented by photographs, diagrams, etc., which facilitate the exposition of problems considered.

Although the Manual is published in a limited edition, as being a tentative publication it will be of the greatest utility for industrial hygiene engineers, as well as safety engineers, ventilation engineers, etc., and for all persons and organisations interested in the conservation of industrial manpower.

La Prévention des Accidents dans les Travaux de Battage. Comité français d'Etudes, "Prévention et Sécurité". Paris. 1943. 76 pp.

A group of French experts have collaborated in the preparation of this very handy pamphlet on threshing machines.

Chapter I is concerned with the prevention of accidents of mechanical origin and deals in detail with the various parts of the threshing machine and its accessories, including transmissions. Annexed to this chapter are a set of working rules and a memorandum on fire protection.

Chapter II on electric threshing sets out general precautions, discusses the risks peculiar to electric

threshing installations, precautions against electrical accidents, fire precautions and procedure in case of accidents due to electricity and fire respectively.

Chapter III is a short first-aid manual.

There are numerous illustrations of guards for threshing tools, gears and transmissions and of first-aid procedures.

Coal Face Supports: Props and Lids. Ministry of Fuel and Power, Safety Pamphlet No. 18. London, 1945. 12 pp.

An illustrated pamphlet dealing with the characteristics of wood and steel props and methods of setting them.

Accidents from Falls of Roof and Coal in Bituminous Coal Mines. Coal-Mine Accident-Prevention Course, Section 2. Miners' Circular 48. U.S. Bureau of Mines. Washington D.C., 1945. 114 pp.

This circular discusses the factors affecting falls of roof and coal, essential measures for supporting roofs, timbering and detimbering and the responsibilities of superintendents, foremen and miners in the prevention of accidents from falls of roof.

An analysis of 1,021 fatal accidents from falls of roof and coal in Pennsylvania gives the following percentage distribution of contributory factors.

	Percent. of total
Insufficient or improper timbering	28.61
Supervision and discipline	18.50
Blast fired between time of official inspection and accident	18.31
Horsebacks, slips (not perceptible)	10.87
Failure to test roof	8.71
Removing post	5.34
Taking down slate	3.62
Post knocked out by car	2.67
Mining machines	2.54
Mechanical loading	0.83
	100.00

These factors are briefly discussed. The working face accounted for 83.27 per cent. of all the accidents — 48.67 on pillar work, 23.10 in seams and 11.50 in entries.

The essential features of any scheme for protection against roof hazards are stated to be:

(1) A systematic method of timbering; the method should establish minimum requirements.
(2) Regulations and diagrams showing how and where to set the timber.
(3) Detailed instructions.
(4) Adequate supervision.
(5) Good discipline.

A model set of timbering regulations is provided and safe timbering schemes are discussed and illustrated.

In connection with responsibilities for accidents, the circular quotes the following table showing the results of a study of 1,619 fatal accidents in Pennsylvania.

(6) Responsibility.	Number of victims
Victim	473
Official and victim	328
Accidental	291
Unavoidable	192
Officials	157
Equipment	141
Others	29
Undetermined	8
	1,619

The booklet contains 83 illustrations and drawings, mostly of roof support systems and devices, and concludes with a short bibliography.

Chocks. Ministry of Fuel and Power, Safety Pamphlet No. 16. Published by H. M. Stationery Office, London, 1945, 11 pp.

In 1940 and 1941 there was an alarming increase in the number of reportable accidents from falls of ground, already by far the most serious source of accidents below ground. In consequenee, the Secretary for Mines appointed in each coalfield Committees consisting of representatives of owners, managers, deputies and workmen, under the Chairmanship of the Divisional Inspector, to inquire into and seek remedies for this position. There was appointed also in each Division a Senior Inspector to carry out special duties in connection with roof control.

The present pamphlet is a memorandum by the Lancashire and Cheshire and North Wales Advisory Committees on Falls of Ground. It deals with the functions, resistance, building and spacing of chocks. Correct and incorrect methods of building chocks are described with numerous illustrations. The Committees urge the use of squared hard wood or steel and deprecate the use of soft round timber.

Testing Safety Catches on Mine Cages: Lake Superior District. U.S. Bureau of Mines, Information Circular No. 7325, June 1945. 12 pp.

Describes, with numerous illustrations, various types of safety catches and testing devices, and also the testing methods used in a number of mines.

A Survey of Airborne Dust Conditions in the South Wales Coalfield. The Monmouthshire and South Wales Coal Owners' Association. Fifteenth Report of the Coal Dust Research Committee. April 1945. 24 pp.

The survey was undertaken with a view to assembling as much information as possible on airborne dust conditions existing in collieries in the South Wales Coalfield under every condition of coal-getting, conveying, etc., and under all conditions of dust production and all methods of dust suppression. It involved visits to collieries in all parts of the coalfield, and collecting all data which had a bearing upon dust production. This data included details such as thickness of seam, nature of roof and floor, rank of coal, extent of slip formation, direction of working relative to line of slip, profusion or otherwise of slip dust, method of coal-getting and conveying, means of dust suppression, intensity of working, etc., etc.

The Committee in their Thirteenth Report suggested certain standards of air cleanliness, based on the surface area of the dust below 5 microns. The standards suggested were that in the anthracite mines the equivalent concentration of airborne dust less than 5 microns in size should not exceed 0.4 g per 1,000 cu. ft., whilst in steam coal mines it should not exceed 0.6 g per 1,000 cu. ft.

During the survey 394 samples of dust were taken of which 282 or 70 per cent. were satisfactory, and 112 unsatisfactory when judged by the above standards. The percentage of satisfactory samples varied with the method of working: 75 per cent. of the samples collected from machine-cut faces were satisfactory as compared with 59 per cent. from faces cut with pneumatic picks and 86 per

cent. from hand-cut faces. Where no dust suppression was used, 66 per cent. of the samples were satisfactory, with wet cutting 81 per cent. were satisfactory, with water infusion 71.5 per cent. and with hand sprays 91 per cent.

Detailed investigations revealed that dust from slips in the coal does not constitute the major portion of airborne dust as had been supposed.

The production of dust can be reduced to some extent by roof control.

Pneumonokoniosis of Coal Workers — The Evaluation of the Health Hazard of Air-borne Dust with Special Reference to Particle Size Analysis. The Monmouthshire and South Wales Coal Owners' Association. Sixteenth Report of the Coal Dust Research Committee. July 1945. 51 pp.

This report is mainly devoted to a discussion of size analysis of fine dust particles by sieves, microscopes, elutriation and sedimentation.

As a result of experience gained at the South Wales Mining Research Laboratory in the use of the various methods, it is considered that the most suitable method available at present for the particle size determination in connection with the health hazard is the light extinction sedimentation method and that the most suitable apparatus are the Modified Heywood's and the I.C.I-Richardson's.

Mathematical methods of assessing the health hazards are outlined.

Water Infusion: Its Application—the Use of Wetting Agents. The Monmouthshire and South Wales Coal Owners' Association. Seventeenth Report of the Coal Dust Research Committee. October 1945. 26 pp.

The Seventeenth report of the Committee discusses factors influencing the effectiveness of water infusion—location, spacing and depth of boreholes; pressure, quantity and rate of flow of the water, etc.; single versus multiple infusion; and the use of wetting agents.

The following conclusions are recorded:

1. Successful dust suppression by water infusion can only be obtained by careful planning of the infusion process having regard to such factors as position of boreholes in the seam, distance apart and depth of boreholes and position of the water seal in the borehole. These factors vary in different coalfaces and infusion must be planned for each individual face.

2. It is not good practice, in fact it is dangerous, to infuse unlimited quantities of water into the coalface. To do so is to invite strata troubles and produce dangerous face conditions. Whilst there are some faces where even controlled water infusion would give rise to roof and floor troubles, the number of these is small and there are few faces which will not submit to treatment without ill-effect if proper control is exercised.

3. A water flow meter is an essential part of the infusion equipment and a definite quantity of water per hole should be stipulated. The rate of flow of water into the hole should be the minimum compatible with practical considerations of time available for treating the face, and water pressure should be kept as low as possible.

4. Due to the difference in the resistances of boreholes to the flow of water, simultaneous infusion of two or more holes is not recommended. Each hole should be treated singly if a uniform distribution of the water is to be obtained.

5. The addition of oil to the water used for infusion makes the treatment more lasting in its effects. For this reason it is strongly recommended for use on slowly moving faces.

6. The use of an oil-water emulsion enables the infusion to be done at a much lower pressure than is the case when water alone is used. It is thus likely to confer great benefits in cases where it is desired to maintain the pressure at a minimum due to the adverse effect of water at high pressure in penetrating the roof and floor of the seam.

7. A higher efficiency of dust suppression can be obtained by the use of an oil-water emulsion in water infusion than by the use of even larger quantities of water.

8. The quantities of oil used need not be high, and since the oil is a waste product the cost factor is of little importance.

Suggested Methods for Installing Dust-Allaying Equipment in Bituminous-Coal Mines. U.S. Bureau of Mines, Report of Investigations No. 3843, Washington, November 1945. 31 pp.

The purpose of this paper is to give practical advice on the arrangement of dust-allaying equipment. It describes, with numerous illustrations, water-supply systems, dust-allaying equipment and methods of installing equipment on cutting and loading machines, conveyors, tipples and cleaning plant.

Prevention of Explosives Accidents in Metal Mines. Metal-Mine Accident-Prevention Course, section 4. Miners' Circular 54, U.S. Bureau of Mines. Washington, D.C., 1945. 50 pp.

The authors first quote statistics of accidents due to explosions in mines and briefly discuss the commonest causes. The greater part of the booklet is taken up with advice on the selection, storage, transport and use of explosives.

In connection with use, the authors discuss at considerable length drilling of shot holes and the loading and firing of shots, with special reference to electric methods of firing.

The booklet contains 62 rules for the handling, storage and delivery of explosives and these include shotfiring rules.

There are 30 illustrations and a bibliography.

Method of Handling Hydrogen Sulfide Gas in the Elk Basin Oil Field of Wyoming. U.S. Bureau of Mines, Information Circular No. 7334, Washington, October 1945. 7 pp.

Describes, with illustrations, precautions adopted by the oil companies in piping oil from the wells to the storage tanks, gauging tanks, bringing in wells and loading oil-tank cars and trucks; and closes with some general recommendations.

Fabricated Structural Steel Industry: The Control of Accidents; Organising for Safety; The Supervisor's Safety Guide; Safety Guide for Workers. U.S. Department of Labor, Division of Labor Standards, Washington. 1945.

These are short pamphlets of an eminently practical character for the use of undertakings manufacturing iron and steel for structural purposes. They explain the chief hazards involved, discuss factory safety organisation and give advice on the formulation of safety rules.

Conseils de Sécurité à l'usage des Ouvriers et Apprentis de tous les Corps de Profession. Organisme professionnel de Sécurité du Bâtiment et des Travaux publics. Paris 1945. 157 pp.

The advice given in this booklet is addressed to workmen. It is practical, concise and straightforward, accompanied by numerous simple illustrations, some technical and some of a propaganda character. There are 24 short chapters on general safety organisation and precautions, construction equipment and operations, fire prevention and first aid. Particular attention is paid to ropes, hoisting appliances, machinery, scaffolds, ladders, roof work and welding. Other subjects include handling and transport of material, electrical accidents, hand tools, excavation, demolition and painting.

This is the kind of safety manual that every construction worker should read.

American Standard Practice for the Inspection of Elevators, Inspectors' Manual. (Second Edition) ASA A17.2—1945. American Standards Association. New York, 1945. 125 pp.

The manual has been designed as a guide for elevator inspectors. As revised, it consists of three parts dealing respectively with routine inspection, initial or data inspection and inspection of escalators. Numerous technical details of elevator installations and data tables are included in six appendices.

The manual is an extremely detailed and thorough piece of work.

Cartilla de Seguridad para el Manejo y Conservación de las Calderas a Vapor y Agua Caliente. By Manuel BARRERA VERGARA. Escuela Nacional de Artesanos, Santiago de Chile, 1945. 36 pp.

This useful safety manual on boilers deals concisely with boiler rooms and boiler operation, maintenance and testing.

La Sécurité et l'Emploi des Presses mécaniques; I. Statistiques — Généralités — Méthodes de Prévention des Accidents. Comité français d'Etudes "Prévention et Sécurité", Paris, 1943. 75 pp.

This is the first of a series of three pamphlets on the safeguarding of power presses. The author is Mr. Pierre BOUYEURE, Chief Engineer of the Normandy Association for the Prevention of Industrial Accidents. The pamphlet is not confined to metalworking presses, but covers presses of all types including printing presses, extruding presses, filter presses and calenders.

The author first endeavours to estimate the proportion of press operators in the total industrial population and to establish the relative frequency of accidents due to presses. Statistics furnished by eight large insurance companies and covering 9,033 workers show that 1,017 of the total were press operators. Out of 519 serious accidents occurring to these workers, 190 were caused by presses. Thus, although press operators constituted only about 11 per cent. of the total number of workers, they accounted for 36 per cent. of the serious accidents. Moreover, while the average cost of a serious accident was 17,836 francs, the cost of a serious press accident was 19,163 francs.

The most dangerous presses are quick-acting, long-stroke, presses without guards. It is estimated that these presses cause one accident in every 20,000 hours of operation, and that the aggregate accident cost is equivalent to between three and five francs per hour of operation.

The author goes on to describe the uses of presses in various industries and to explain the nature of the operations performed by them, *e.g.* blanking, embossing, stamping, moulding, extruding, crushing, rolling, calendering and printing. He discusses the dangers attendant upon each of these operations, and then deals in detail with methods of avoiding these dangers.

He first briefly reviews the various methods available for the protection of press operators—automatic feeds, automatic ejectors, tongs, etc.—and passes to the conditions that these methods must satisfy. This leads to a discussion of the defects of various types of guard.

There are several photographs of presses and numerous simple drawings showing how presses work, how accidents can be caused, and how guards should operate.

P. M. angående skyddsåtgärder vid snickerimaskiner att iakttagas av tillverkare, importörer och försäljare. Yrkesinspektionens chefsmyndighet. Stockholm. 1 May 1945. 24 pp.

This is a memorandum by the Swedish State Insurance Institute concerning safety measures to be taken by manufacturers, importers and dealers in connection with joinery machines. It is divided into two parts, the first dealing with general measures applicable to all the machines concerned, and the second dealing separately with individual machines.

The general part is concerned with matters such as transmissions, cutter spindles, electrical equipment, connection and disconnection devices, fitting of guards, lubricating devices, removal of shavings and dust, brakes and stopping devices, notices and drawings.

The machines dealt with in the second part include circular saws, firewood saws, band saws, planing machines, moulding machines, tenoning machines, drilling machines, combined machines, mortising machines, and sanding machines.

Le Traitement des Accidents du Travail. Manuel du Praticien. Published by the Fondation française pour l'Etude des Problèmes humains, Paris, 1945. 163 pp.

Occupational accidents, even the most trivial in appearance, constitute a grave danger not only to the life of the worker but also to the general economy of a country. The observation of certain simple therapeutic rules can completely change the prognosis of a great number of these accidents.

Consequently, this book, published recently thanks to the collaboration of various physicians specialised in the problems arising from occupational accidents, will certainly be very useful to doctors specialising in industrial medicine. The book makes no literary claim, but it is extremely practical. It presents the essential part of each question and indicates the procedure to be followed in each case in order to obtain the best physical and functional results. It also includes several very useful medical forms.

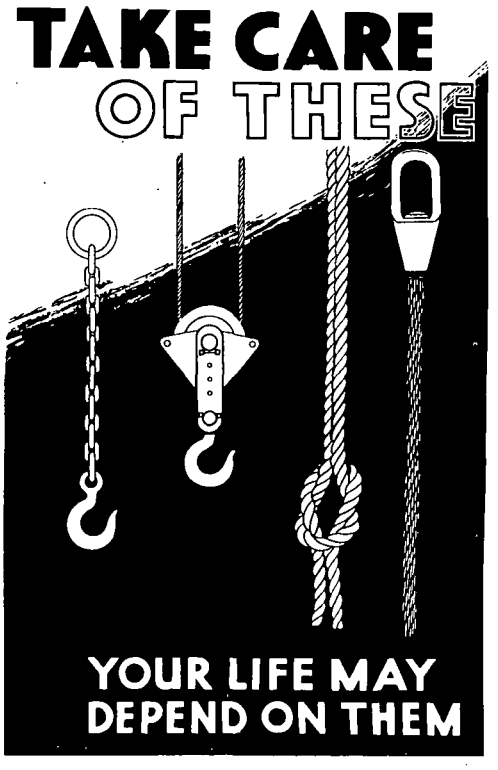
The book is divided into three parts and one appendix:

I. Subcutaneous lesions.
II. Wounds.
III. Special fields (Ophthalmology, otorhinolaryngology, stomatology).

Appendix: Emergency treatment of serious accidents.

NEW POSTERS

(Marine Department, Wellington, N.Z.)



(Marine Department, Wellington, N.Z.)

Cut unsafe practices to-day
and you will avoid unfortunate accidents tomorrow
(Argentine Safety Institute, Buenos Aires)

Which is quicker ?
(Argentine Safety Institute, Buenos Aires)

INTERNATIONAL LABOUR OFFICE

INDUSTRIAL SAFETY SURVEY

(National Safety Council of Australia, Melbourne)

Published Every Three Months

VOLUME XXII, No. 4
OCTOBER-DECEMBER 1946

Price per Number: 2s.; 50 cents
Annual Subscription: 6s.; $1.50

CONTENTS

INDUSTRIAL SAFETY SURVEY

VOL. XXII OCTOBER-DECEMBER 1946 No. 4

SAFETY WORK IN THE NETHERLANDS DURING THE WAR

By N. C. WINKEL, Principal Inspector of Factories, The Hague, Netherlands.

During the occupation of the Netherlands, factory inspection continued, as far as circumstances permitted, and safety work was carried on without any interference from the Germans. Working conditions in factories changed considerably and the new situation demanded new types of guards. On the other hand, however, the normal safeguarding of machines was continued. The results achieved in the Netherlands may be of some interest, during the post-war period, to other countries. They have been published in the Annual Reports of the Netherlands Factory Inspectorate for the years 1940, 1941, 1942 and 1943.

Soon after the beginning of the occupation a number of factories ran very short of coal and the management tried to keep the machinery running by using wood as fuel for the boilers. Only stumps and wood of very irregular dimensions were available, and these had to be cut down to the required size by means of circular saws. Similar conditions obtained when wood had to be used for gas generators, although in these cases the wood had to be cut down to blocks of a much smaller size.

Under normal conditions circular saws were guarded above the machine table with a riving knife and had a hood of the Swiss SUVA type, but the change in working conditions made new guards necessary.

Fig. 1 shows a guard for sawing fairly regular medium-sized wood for firewood. The wood is placed in a kind of trough on a sliding table and kept in place by a lever. The saw is enclosed by a hood. A wheelbarrow or basket is placed on the right-hand side of the machine to receive the sawn material.

A second circular saw for firewood is shown in fig. 2. Here the machine is provided with a swinging trough and this old type now finds a new application. The saw is guarded by a solid steel hood. The lever is specially shaped so as to enable wood of very different dimensions to be fixed in place. Because of the shape of the trough it is usually sufficient to keep the wood in place by hand, the lever being used only when sawing end pieces. Particular care had to be taken to guard the side of the saw on which the wheelbarrow or basket was placed. This was done by means of a blade which made it impossible to touch the saw from the side.

A rigid sliding table, equipped with two levers to prevent any unexpected movement of the wood was used for irregular pieces or for stumps with roots. Either of the levers was used, depending on the size and shape of the wood. A circular saw with this type of guard is shown in fig. 3.

Because of the easy way in which irregular stumps could be handled with these types of guards on the saws, a significant increase in production was realised.

It may be of interest to note that in using this kind of saw, if the wood was not properly fixed on the table, it was thrown back at high speed as soon as the saw was put in motion, without having come into contact with the teeth at the top or the back of the blade. Such was the case,

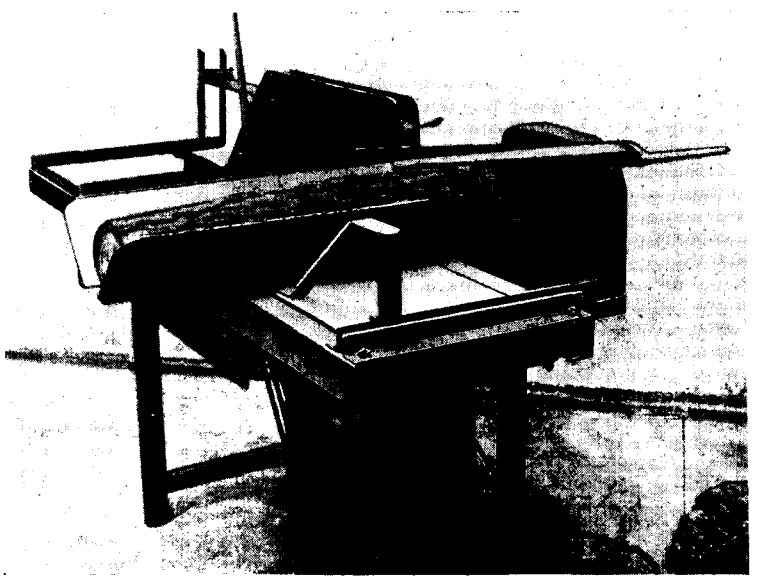


FIG. 1

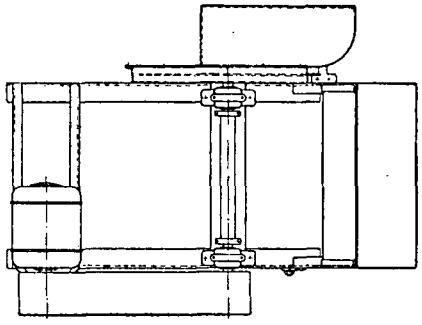
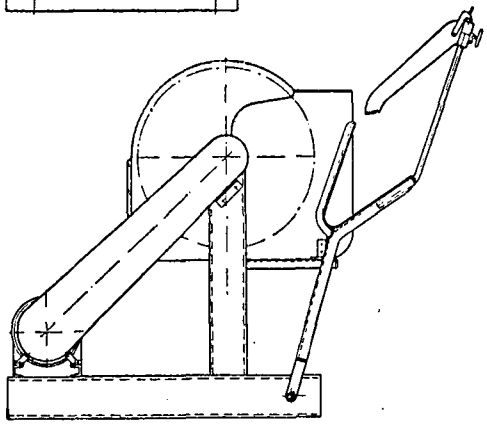
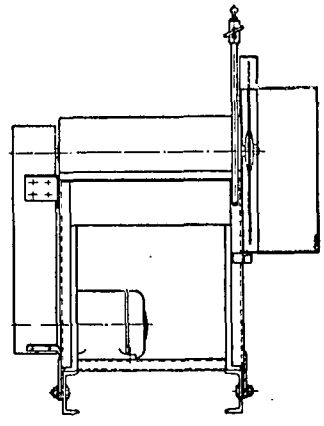


FIG. 2





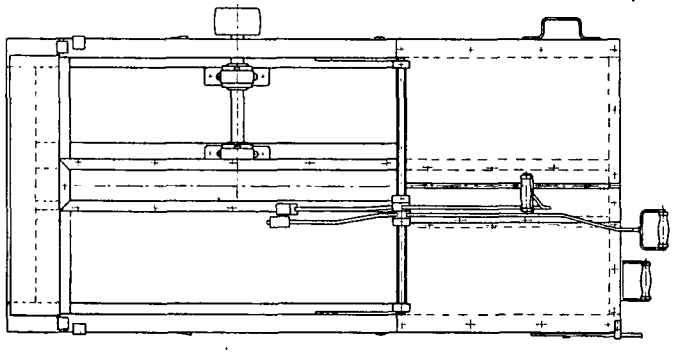
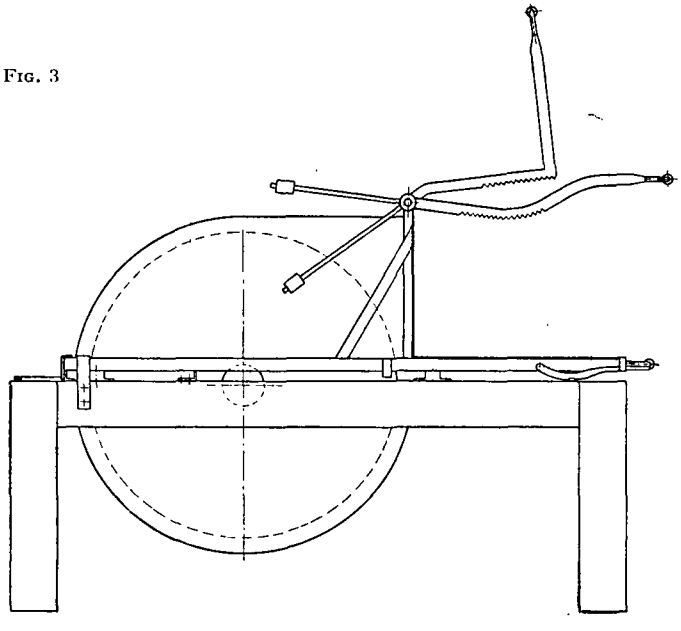
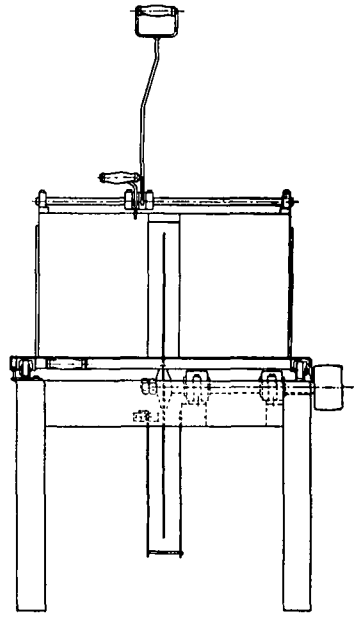


FIG. 3





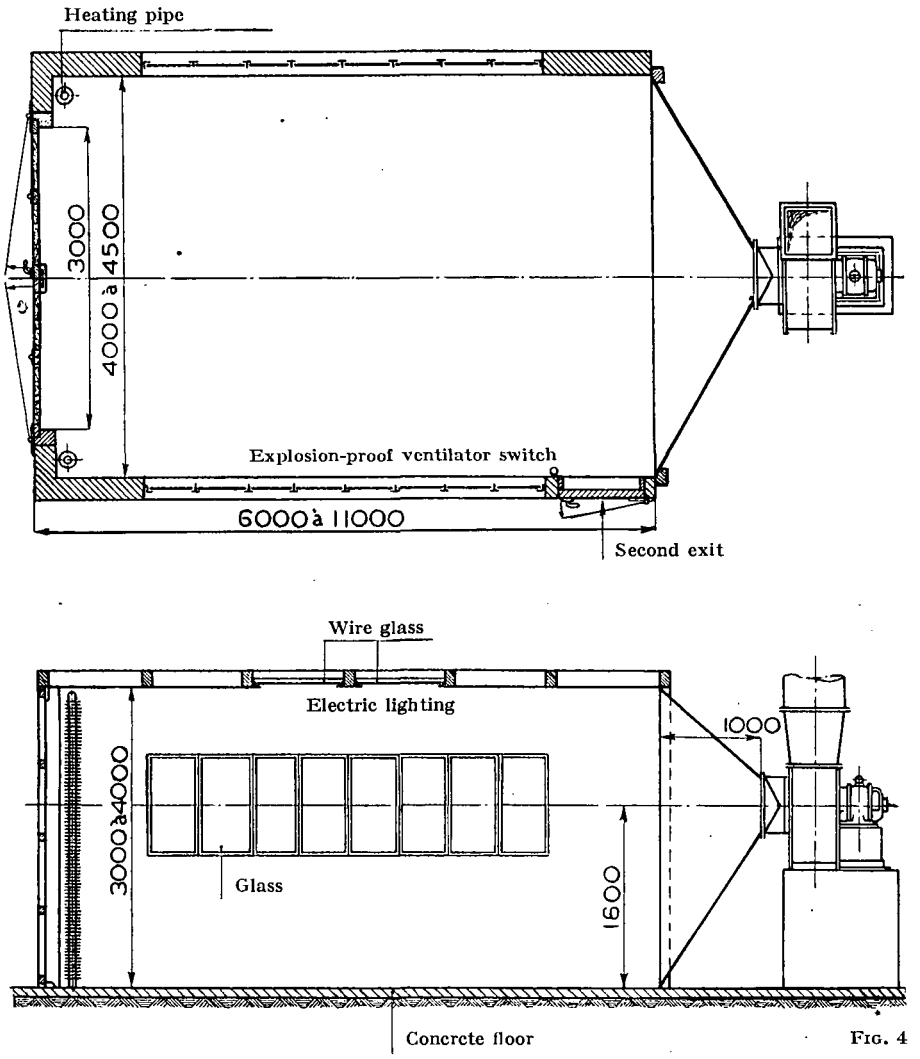


FIG. 4

however, only with round timber. This is due to the fact that the distance between the point of support and the point where the saw first touches the wood, acts as a kind of lever. If the wood is not properly fixed, the force of the saw teeth will rotate it in the opposite direction to that of the saw. Consequently the wood is lifted, held, then thrown into the workshop. Accidents of this kind occurred several times.

Research work was undertaken with regard to the removal of vapours and dust during spray painting of cars and similar objects and during sandblasting operations. In building a special booth for this research work, particular attention was paid to the following points:

1. Vapours must be exhausted in the same direction as that in which the work advances.

2. Air inlet openings must be located opposite the exhaust opening.

3. The air inlet must be so constructed and located that no eddying motion arises and no draught is created.

4. In order to moderate the quantity of air and still have sufficient air speed, the height of the booth must be kept to a minimum, *i.e.* 2.1 to 2.7 m (7 to 9 ft.), provided that the dimensions of the objects to be painted do not make it necessary to exceed the limit.

Accordingly, spray-painting booths were constructed as is shown in fig. 4.

By measuring the air speed at different points, it was found that the maximum speed was in the middle of the booth, just opposite the exhaust opening and that the pyramidal shape of the connecting piece between the booth and the exhaust duct prevented undesirable eddying motion. Consequently, the centre of the exhaust opening is made about 1.5 m (5 ft.) above the floor—the height of the mouth and nose of a standing man.

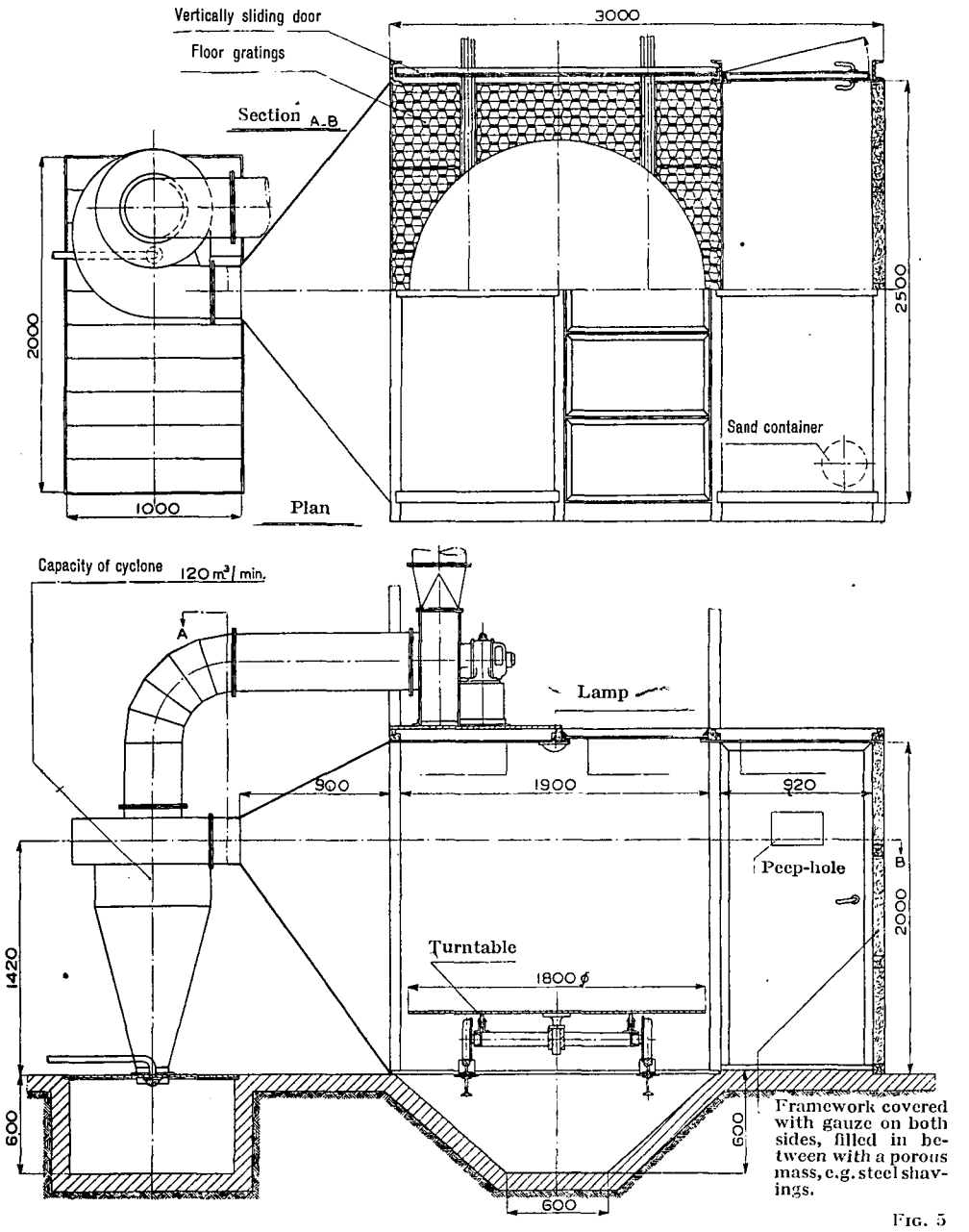


FIG. 5

Special attention has been given to the construction of the fresh-air inlet. Various types of air-inlet openings were made opposite the exhaust openings of the model booth. The results of experiments with these openings are given in the following table:

As a result of these tests, the doors opposite the exhaust openings were made with a double framework of expanded metal having metal shavings between the two frames. This method has given good results even at high air speeds.

The fresh air is heated by means of pipes placed immediately behind the doors. A filter is placed in the exhaust duct to prevent the paint

Complete change of air in the cabin per minute	Quantity of air in m³/min. if the front is completely open (surface 4 m²)	Percentage reduction of quantity of air if the air inlet consists of			
		1 opening (surface 0.075 m²)	2 openings (total surface 0.15 m²)	4 openings (total surface 0.3 m²)	160 round openings 50 mm diameter (total surface 0.3 m²)
5 . . .	68.5	22.6	10.2	2.9	2.9
6 . . .	82.2	22.2	8.7	2.4	1.5
7 . . .	95.9	30.7	16.6	7.2	3.0
8 . . .	110.0	33.6	22.7	10.9	3.6
9 . . .	123.0	39.0	22.8	10.6	5.7
10 . . .	137.0	40.1	23.4	9.5	5.1
12 . . .	164.0	39.6	23.2	11.0	4.3

from penetrating the exhaust mechanism and the duct.

The booth has two exits and wired-glass windows. The dimensions are 6 by 4 by 3 m if used for ordinary cars and 11 by 4.5 by 4 m if used for buses.

The same principles are followed in the construction of cabins for sandblasting (see fig. 5). The heavier sand particles tend to slide down along the steep lower side of the pyramidal surface between the cabin and the cyclone itself. It is, however, the fine dust that is the most dangerous, and after conducting a number of experiments on its behaviour in a current of air, the conclusion was reached that generally a speed of 0.40 m/sec. is sufficient to eliminate the dust. With an average air speed of 0.60 m/sec. all hazards from dust particles are removed.

In order that the exhauster shall not be damaged by sand, the dust is passed through a cyclone before reaching it. The sand pit must, however, be covered with an air-tight cover. A shower is installed in the pit with which to spray the sand before the pit is emptied.

Further, the floors of cabins used for sandblasting must be so constructed that no sand can accumulate on them, and there must be a pit below the floor to collect the sand. In this way, a worker entering the cabin will not kick up any dust.

The objects to be handled are placed on a turntable so that sandblasting can be done in the direction of the exhaust opening.

The walls of the cabin must be perfectly smooth to prevent the accumulation of dust. Fresh air enters the cabin through a porous wall constructed in the same way as for spray-painting booths.

During sandblasting operations, the worker wears a helmet equipped with a fresh air pipeline.

A number of rather serious accidents to workers on ice cream machines made it evident that some safety devices must be provided for these machines. Accordingly a guard was constructed to protect the worker's hair from being caught by the vertical shaft as he bends over to look into the machine (see fig. 6).

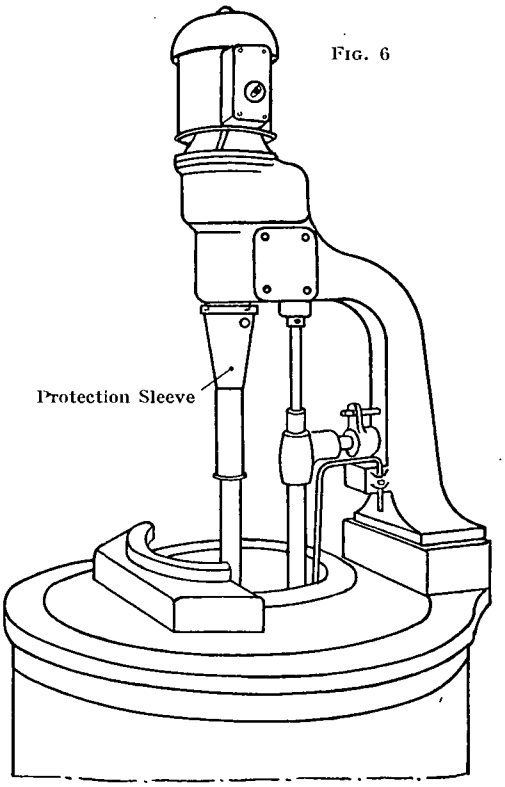


FIG. 6

A new metal-press guard was also constructed that made it impossible for the press to make a second stroke even if the starting gear should fail. Detailed descriptions of this safety device should be available in the near future.

SIR GERALD BELLHOUSE, C. B. E. †

We deeply regret to have to announce the death of Sir Gerald BELLHOUSE who was an active member of the I.L.O. Correspondence Committee on Accident Prevention until 1932, and an honorary member since that date.

Sir Gerald, whose death was briefly announced in "The Times" of September 18, was one of the most distinguished of His Majesty's Chief Inspectors of Factories at the Home Office. He was educated at Fettes College, Edinburgh, and at Trinity College, Cambridge, and joined the Factory Department in 1891. He received rapid promotion and after serving for a short time as District Inspector in Dublin and East London he became Superintending Inspector in Manchester. In 1917 he came to the Home Office as Deputy Chief Inspector of Factories but he only acted in that capacity for a short while before he was appointed to serve under the National Service Department, first as Commissioner for London and the South Eastern Area and subsequently as Chief Commissioner. In 1922 he became Chief Inspector of Factories, a post that he held until his retirement in 1932. Four years later he was appointed Chairman of the Unemployment Assistance Board Advisory Committees for South East London.

His outstanding qualities of impartiality and absolute fairness were realised early in his career, as is shown by the number of committees to which he was appointed as member or chairman—committees dealing with such varied matters as Check-weighing of Piecework Wages in Dock Labour, Health of Munition Workers, Poisons, Employment of Van Boys, Partial Exemption of Children from School Attendance, Wages and Conditions in Road Transport Industry (Goods), etc. Although these committees were chiefly composed of employers and workers, when he had presided all left the conference table feeling assured that their case had received just and impartial consideration. He was trusted equally by employers and employed.

Accident prevention was a subject which greatly appealed to him, and he took the greatest interest in the formation of the British "Safety First" Association, now known as the Royal Society for the Prevention of Accidents, while welfare in industry owed more to him in its initial stages than is generally realised. He took a prominent part in the establishment of the Home Office Industrial Museum.

In 1921 the Factory Department was entirely reorganised: the men's and women's sides of the Inspectorate were amalgamated into a single organisation and the women inspectors were regarded as eligible for all posts. Needless to say, so great a change met with some misgivings in certain quarters and tact and understanding were needed on the part of the Inspectorate. It fell to Sir Gerald Bellhouse to put this great change into operation, and once again he showed his sense of justice and fair dealing with the result that the reorganisation has proved a noteworthy success.

At Geneva he was a prominent figure at the International Labour Conference and acted as chairman of many of the Committees. From the start he was interested in the international side of labour regulation, and much of its subsequent development is due to him. His wide knowledge and progressive views were always in demand, and innovations received his cordial support.

He will be specially remembered for his very distinguished contribution to the work of the Committees preparing the Recommendation on the Prevention of Industrial Accidents, the Convention on the Marking of Weight on Heavy Packages Transported by Vessels, and the Convention and Recommendations concerning the Protection of Dockers against Accidents, all of which were adopted by the International Labour Conference in 1929.

In Sir Gerald Bellhouse the international safety movement has lost both an outstanding pioneer and a capable, energetic and devoted leader. His memory will always be respected by the International Labour Organisation.

SAFETY INSTITUTIONS, ASSOCIATIONS AND MUSEUMS

INTERNATIONAL

International Labour Office: Correspondence Committee on Accident Prevention

Report on the Twelfth Session

At the invitation of the Hon. Earl Warren, Governor of California, the Twelfth Session of the Correspondence Committee on Accident Prevention was held in the offices of the California Department of Industrial Relations at San Francisco, from 8 to 27 July 1946, and comprised 31 sittings.

The following members were present:

Mr. Cyril Ainsworth, Assistant Secretary, American Standards Association.

Mr. Arne Baggerud, Technical Adviser to the Chief Inspector of Factories, Labour Inspectorate, Oslo.

Mr. Roland P. Blake, Senior Safety Engineer, Division of Labor Standards, U.S. Department of Labor, Washington, D.C.

Mr. Leslie N. Duguid, H.M. Senior Engineering Inspector of Factories, London.

Mr. Carl H. Fry, Chief of the Division of Industrial Safety, Department of Industrial Relations, San Francisco.

Mr. Max Helfenstein, formerly Chief of the Accident Prevention Service of the Swiss National Accident Insurance Institute, Lucerne.

Mr. Jorge Medellin, Chief of the Division of Protection, Department of Labour and Social Insurance, Mexico, D.F.

Mr. R.B. Morley, General Manager, Industrial Accident Prevention Associations, Toronto.

Dr. André Salmont, Professor, Conservatoire national des Arts et Métiers, Paris.

Mr. N. C. Winkel, Chief District Inspector, Labour Inspectorate, The Hague.

The meeting was also attended by Mr. Swen Kjaer, Honorary Member of the Committee and Reporter.

The International Labour Office was represented by:

Mr. D. Vaage, Chief of the Safety Section,

Mr. J. E. Wheeler and Mr. I. T. Cabrera, Secretaries to the Committee.

The Committee met to continue the discussion of the preliminary draft of a Model Code of Safety Regulations for Factories.

Mr. Lindsay Rogers, Assistant Director of the International Labour Office opened the session on behalf of the Acting Director. He congratulated the Committee on having specific technical and non-controversial tasks to perform, on knowing how to perform them and being free from political trammels. He was glad that the Committee was meeting in a State that had paid close attention to social legislation in general, and safety legislation in particular.

The Governor of California was prevented from attending the opening session, but sent the following telegram:

> Please convey to members of Safety Committee, International Labour Office, my hearty welcome to California. It has been my constant endeavour to foster and promote industrial safety. Your praiseworthy efforts in this worthy cause have my earnest and unqualified support. I regret that circumstances prevented me from delivering a personal message of greeting and welcome to California.

Speaking on behalf of the Governor, Mr. Paul Scharrenberg, Director of the Department of Industrial Relations of the State of California, welcomed the Committee and wished it every success in its work. He referred to the industrial development of California, described the State machinery for accident prevention and touched upon the State's remarkably good accident record.

Mr. Fry was unanimously elected Chairman.

The Committee then proceeded to discuss the remaining Chapters of the Factory Safety Code, namely VIII, Handling and Transportation of Materials; IX, Dangerous and Obnoxious Substances; X, Maintenance and Repairs; XI, Health Protection; XII, Protective Equipment; XIII, Selection of Workers; Physical Examination; XIV, Medical Aid; and XV, Safety Organisation.

In the course of the discussion there were some interesting exchanges of views on the human factor in accident causation and to the extent that this factor could be dealt with in the Code. This involved the question whether the Code should be confined to legally enforceable rules or should contain additional provisions that could serve as a guide to industry. The latter view prevailed, and it was agreed that the human factor should not be left out of account.

The Committee gave its general opinion on the provisions relating to health, medical examinations, medical aid, and the employment of women and young persons, it being understood that they would be subsequently referred to the Correspondence Committee on Industrial Hygiene.

The Committee devoted much thought to the wording of Chapter XV on Factory Safety Organisation, and more especially to the part to be played by legislation and voluntary effort

respectively in this connection. It was felt that the inter-relationship of physiological, psychological and technical factors, and also the wide variations in the nature, size and organisation of factories, made the subject a particularly difficult one to handle in a Code of Safety Regulations, but after a protracted and most interesting discussion, general agreement was reached on the text of the Chapter.

The discussions on the Draft Model Code of Safety Regulations for Factories concluded with a brief review of the Code as a whole. While it was realised that opinions must almost inevitably differ on many points in a Code of over three thousand paragraphs, and that the discussion of it at an international conference of representatives of Governments, employers and workers would not be an easy matter, yet it was generally felt that the Code would be an extremely valuable document for all countries. There was also general agreement that the fundamental provisions should be embodied in a Convention that would be strictly binding on all ratifying States.

In summing up the discussion, Mr. VAAGE, on behalf of the Acting Director of the International Labour Office, thanked the Committee warmly for its extremely hard work and valuable advice. He expressed the intention of the International Labour Office to prepare a Convention based on the Code, as suggested by some of the members. The Code, together with the Convention would be submitted to an International Tripartite Conference, at which he hoped to see the members of the Committee again.

INTERNATIONAL DOCKERS' CONFERENCE [1]

The International Dockers' Conference, which met in Zurich on 8 May 1946 in conjunction with the Congress of the International Transport Workers' Federation, adopted the following resolutions bearing on industrial safety:

International Dockers Convention [2]

This International Dockers' Conference, meeting on 8 May 1946 in conjunction with the Zurich Congress of the I.T.F.,

Whereas the International Docks Convention of 1932 has still not been ratified by a number of countries, while in others, though ratified, the Convention is not fully enforced;

Whereas port conditions and practices have evolved in certain directions since the adoption of the Convention;

Urges dockers' unions in all countries (1) to ensure that the 1932 Convention is duly ratified and properly enforced in their respective countries, and (2) to consider whether the Convention is in need of revision under some heads and to inform the I.T.F. Secretariat accordingly in order that the appropriate steps may be taken.

[1] *International Transport Workers' Journal*, Sept. 1946, p. 6.
[2] Protection against Accidents (Dockers) Convention (Revised), 1932.

Maximum Weight of Loads

This International Dockers' Conference, meeting on 8 May 1946 in conjunction with the Zurich Congress of the I.T.F.,

Having considered the question of the weight of loads in dock work,

Considers that 75 kilogrammes is the maximum weight which one man can carry without eventual detriment to health;

Urges dockers' unions to ensure that this maximum is not exceeded in their respective countries; and

Requests the International Labour Office to take steps with a view to the adoption of an international Convention on the subject.

AUSTRALIA

NATIONAL SAFETY COUNCIL OF AUSTRALIA

Report for 1945-1946 [1]

In addition to industrial safety the report deals with safety on the roads, in the air and at home, and also the protection of children.

The Industrial Safety Committee has continued to issue safety literature and posters, and to deal with requests for information and advice on specific hazards, such as naked lights near flammable liquids, storage of flammable liquids, spray painting, portable electric lights, and the handling of radio-active paint. Contacts with similar bodies in other countries are extending, and the restoration of international communications has made possible an exchange of literature with European and South American organisations.

During the year under review the Industrial Safety Education Service issued 56,600 posters and 1,217,800 pay-envelope inserts. Attention is now being turned to the designing of posters for particular industries, beginning with the meat industry.

The Industrial Safety Committee has collaborated with the Standards Association of Australia in the preparation of a specification for helmets, handshields and goggles for the protection of welders against harmful radiation.

The Council finds a quickening of interest and practical effort in safety in industry, and more planning by those in control. More plants are setting up works' safety committees, more safety engineers and safety officers are being appointed, and interest in general is increasing among executives. This is particularly pleasing having regard to the number of new men entering industry or returning from active service.

The industrial membership of the Council extends throughout the Commonwealth and its work continues to attract attention in all the Australian States and also New Zealand.

Fatal accidents on the roads are increasing in number and the Traffic Committee is doing every-

[1] For 1944-45, see *Industrial Safety Survey*, Vol. XXII, No. 1, p. 14.

thing in its power to educate road users in safe practices. Booklets dealing with the laws of the road have been distributed to new driving-licence holders, and safety codes have been given to cyclists, pedestrians and children. A scheme for controlled traffic on arterial roads is under consideration by the authorities. Attention has also been given to numerous other matters, such as hazards at intersections, viaducts and level crossings; headlamps; footpaths in country areas; tyres; overspeeding; road signs; parking and rules for pedestrians.

The Council makes special acknowledgement of assistance received from safety organisations in Canada, the United Kingdom and the United States.

The report concludes with a reference to public apathy in regard to accidents and expresses the view that no great relief from the incidence of accidents can be expected until public opinion is aroused.

New South Wales

New South Wales Railways

Safety Organisation

The New South Wales Department of Railways has had a Safety First organisation since 1914, when a Safety First Committee was appointed consisting of eight officers representing the various branches of the Department. In 1919 the control was placed under the Director of the Railways Institute where it has remained ever since. For a short time the Safety First Committee continued to exist as an advisory body attached to the Director. In 1920, however, it was supplanted by an Advisory Board of five officers. Later, in 1927, a Safety First Council, consisting of an officer from each branch of the service and an engineer, was formed to advise the Director.

In addition to this controlling machinery, the safety organisation has, since 1916, included safety-first representatives, who are elected periodically by ballot at the various localities such as stations, workshops and depots where there are more than 25 members of the staff. These representatives, of whom there are now over 300, receive from the staff any suggestions likely to safeguard employees or members of the public against accidents, and enter them in triplicate in a book issued to them for the purpose. The original slips are forwarded to the local officer-in-charge, the duplicates are sent to the Director, and the third portions are retained. These suggestions are discussed at monthly meetings of the safety-first representatives presided over by the officer-in-charge of their locality. The minutes of these meetings are forwarded to the Director and, until receiving them, he takes no action on the suggestions that he has received. It frequently happens that the local officer-in-charge decides at the monthly meetings to adopt suggestions. In other cases the officer-in-charge may be in sympathy with a suggestion but, on account of the expenditure involved, has no power to take action beyond recommending it to the head of the branch concerned, and then the Director follows it up. Where the officer-in-charge considers a suggestion unworthy of adoption even in a modified form, the Director communicates with the local safety-first representatives to secure their concurrence in the decision, and if they still consider the suggestion of value the matter is taken up with the head of the branch. When a suggestion has been carried out the Director writes to the person who originated it asking if, in his opinion, the arrangements made are satisfactory from a safety point of view.

As well as these regular monthly meetings in the various localities, quarterly conferences are held in Sydney and Newcastle, and annual conferences are held in Sydney, between the safety-first representatives and the Director.

In deciding matters involving departures in policy, heavy expenditure, or differences of opinion between senior officers of branches and safety-first personnel, the commissioners and the heads of branches are largely guided by the Safety Council, which meets every month under the chairmanship of the Director.

Safety-first propaganda is conveyed to the staff through the Department's "Weekly Notice" and by means of a quarterly Safety First Bulletin that has been issued during the past few years.

Other means have also been used to keep railwaymen in close touch with safety-first ideas. Safety-first posters are continually displayed where they will come under notice and safety-first poster competitions have been held from time to time. In addition, safety-first talks are given as opportunity offers, and, in normal years, a month is selected for a "No Accident" drive, when lunch-hour addresses are delivered to employees at all suitable locations such as workshops and depots, ten minutes additional time being added to the lunch-hour period on such occasions. At all times every encouragement is given to the staff to bring under notice any hazard that they think may exist, and, as a consequence, approximately 1,000 safety-first suggestions a year are adopted.

In February 1946, concerned over the serious increase in accidents to railway employees since 1940 the Secretary for Railways decided to take additional measures for the prevention and investigation of accidents. A safety engineer for the system has been appointed as assistant to the Director of Safety and under him a number

of safety and welfare officers have been appointed in carriage and waggon shops, permanent way shops, repair depots, power stations, etc.

The duties of these officers are set out as follows:

(*a*) To investigate accidents to employees and submit information thereon to the foreman or other officer immediately in control of staff, and forward duplicates to the Director, Safety First.

(*b*) To bring under notice of local management any hazard, defect or circumstance which it is considered may cause an accident.

(*c*) To follow up with local management the prompt completion of safety-first suggestions submitted by safety-first representatives.

(*d*) To assist generally as may be required in the furtherance of accident prevention and welfare.

Safety, compensation, welfare, first-aid and industrial hygiene will be under the general direction of the Chief Staff Superintendent. Safety and welfare will be under the immediate control of the Director of Safety, and first-aid and hygiene will be under the immediate control of the Chief Medical Officer.

INDIA

Conference of Chief Inspectors of Factories [1]

A Conference of the Chief Inspectors of Factories, presided over by Sir Wilfrid Garrett, Chief Adviser, Factories, was held in New Delhi, towards the end of November, 1946. The agenda of the Conference included consideration of an International Labour Office questionnaire on Factory Inspection, amendment of the Factories Act, measures for training factory inspectors and dissemination of information regarding inspection work. The Conference was attended by the representatives of all Provinces and Indian States, and a representative of the Chamber of Princes.

Mr. S. Lall, Secretary, Labour Department, Government of India, declared that although the workshop for labour legislation in India was the Labour Department of the Government and the Provincial Secretariats, it was the experience of the Factory Inspectorate which should be the basis on which legislation affecting factory workers should be developed. Accordingly, it was essential that factory inspectors should be efficient and be in a position to help to find the proper remedy for the ills which invariably accompanied modern industrial developments.

The Conference recommended that the Chief Adviser's Organisation should function as a centre of information relating to factory inspection and improvement of working conditions in factories, and that it should undertake propaganda to educate employers and workers alike in the meaning of factory laws. The organisation should also provide training for young factory inspectors. The Conference also recommended that a museum should be opened to help in the education of factory inspectors. In connection with inspection standards, it was agreed that an assignment of 150 to 200 factories per inspector could be accepted for the present as a practicable standard.

[1] Information furnished by the New Delhi Office of the I.L.O.

UNITED KINGDOM

Amalgamated Engineering Union

Health and Welfare Enquiry

In 1944 the Amalgamated Engineering Union undertook an enquiry into health and welfare in the engineering trades, which include shipyards, foundries and railway shops. The enquiry covered general workshop conditions, accident risks, hours of work, factory inspection, factory medical services, welfare, special facilities for women, industrial health research and joint committees such as production committees and safety committees. Information was collected from workers in 1,640 establishments and departments with employees ranging in number from less than 25 to over 10,000. The total number of workers employed in these establishments was about 1,341,000 and about 963,000 of them were in the heavy and light engineering trades.

Under the head of general workshop conditions the report deals with complaints concerning ventilation, blackout and temperature, washing facilities, dermatitis, sanitary arrangements, dirt, lighting, overcrowding and provision of seats.

The report states that there was a serious risk of accident in 24 per cent. of the undertakings and a safety committee in 19 per cent. For railway workshops alone the percentage of shops with a serious accident risk is given as 28 and the percentage with safety committees as three. A further analysis shows that of all undertakings with a serious risk only 17 per cent. had a safety committee and of the railway workshops with a serious risk not one had a safety committee.

Thirty-three per cent. of the shipyards were held to have serious accident risks, and 18 per cent. had safety committees. The same percentage of undertakings with a safety committee is found among the yards with serious risks.

Workers were represented on 90 per cent. of the safety committees in privately owned heavy engineering works, on 77 per cent. in privately owned light engineering works, on 86 per cent. in Government establishments, on 67 per cent.

in foundries, on 100 per cent. in railway shops and on 93 per cent. in other industries.

The frequency of safety committees in undertakings of different sizes is shown in the following table.

Size of establishment Number employed	Percentage of establishments having safety committees	Percentage of safety committees with workers' representation
Over 10,000 . .	58	100
5,000–9,999 . .	47	76
2,500–4,999 . .	50	94
1,000–2,499 . .	40	78
500–999 . . .	21	91
250–499 . . .	13	81
150–249 . . .	13	84
50–149 . . .	5	85
25– 49 . . .	8	71
Under 25 . . .	9	100

Thirteen per cent. of all the establishments had arrangements for training juveniles and/or new entrants.

The general conclusions reached on the subject of accident risks are as follows:

(1) We believe that the prevention of accidents can only be achieved by the full and active co-operation of the workers.

(2) That co-operation can be enlisted in a variety of ways, of which the most effective is the establishment of safety committees with workers' representation, such committees to be in regular session and not called only after an accident has occurred.

(3) The first step towards both safety and workers' co-operation to achieve it is the training of new entrants into industry, and the inculcating of correct methods of protection from the start.

(4) While it is recognised that workers will "take a risk" (generally in order to make better time) it is the responsibility of managements and their staffs to plan lay-out, to install guards and fences, to provide protective clothing and to adjust piece earnings so that nothing is gained by risk-taking.

(5) A point not brought out by the shop stewards but on which the Union holds strong opinions is the risk resulting from the introduction of new substances into industrial processes without testing their physiological effects.

The report also sets out some interesting conclusions respecting the relations between the workers and factory inspectors. These read:

We believe that a new situation is in process of development and that for the first time there is an almost unanimous demand amongst the organised workers for direct access to and contact with the Factory Inspector.

In the light of this relatively new enthusiasm there is a tendency on the part of workers to overlook the fact that the "occupier" (*i.e.* employer) is the target of the Inspectors' visits since it is his responsibility to carry out the provisions of the Factories Act, and it is he who will be prosecuted for failure to do so. A certain misinterpretation of the Inspectors' conduct is therefore made by some workers and their "personally conducted tours" in company with an employer's representative are looked upon with a suspicion, bred of long experience of other tours made in managerial company which is generally unfounded. We recommend that the Factory Department should intensify its general publicity and that our Trade Union branches should invite local Inspectors to their meetings, in order that the relationship and functions of the three parties—employer, Inspector and trade unionist—shall be clearly understood.

We believe that direct contact should be made with Conveners and shop stewards in the course of a visit by the Factory Inspector, and that these representatives of the workers should in their turn acquaint the shop stewards committees and, in certain circumstances affecting the entire establishment, should call shop meetings to report the results of their interviews with the inspectors.

It is our view that all matters falling within the scope of the Factory Inspector should be promptly reported by the workers to the Inspector, and that undue delay or failure to remedy legitimate cause for complaint should be reported by the workers to their Union Officials to be taken up if need be, with the Chief Inspector at the Ministry itself—particularly in the course of making the present Enquiry—that the Factory Department is eager and willing to investigate all individual cases and follow up well-founded complaints, both as to conditions and delays in giving their attention.

We recommend that more vigorous steps be taken by the Factory Department to improve conditions in foundries, shipyards and heavy engineering shops, with particular reference in the first and last named types of establishment to the extraction of dusts and fumes.

Approximately nine out of every ten establishments employing over 2,500 workers, and nearly half of those employing between 250 and 2,500 workers, had the full-time or part-time services of a doctor. The corresponding ratio for establishments employing between 50 and 250 workers was one in five. Of the Government establishments 63 per cent. had doctors and 44 per cent. of the doctors were employed full time. On the other hand only 15 per cent. of the shipyards had doctors and none of them was employed full time.

Nurses were employed by 47 per cent. of all the undertakings; among undertakings employing over 1,000 workers the percentage ranged from 73 to 90.

Special health services such as optical, dental and foot treatment, massage, sunray and medical supervision of pregnant women were provided in 18 per cent. of all undertakings.

UNITED STATES OF AMERICA

Annual Convention of the American Federation of Labor, 1946

Resolution concerning Safety Standards [1]

The Sixty-fifth Convention of the American Federation of Labour, which met at Chicago in

[1] 65th Convention of the American Federation of Labor: Summarised Report of Proceedings.

October 1946, adopted the following resolution concerning safety standards:

Whereas, The alarming rate of industrial injuries has become a national scandal, and this is especially reprehensible in view of the fact that the causes for almost unbelievably large numbers of accidents which maim workers can be eliminated, and

Whereas, One of the basic factors contributing to this repugnant state of affairs is the failure of a great many manufacturers to provide or install power safeguards on the machines they produce. Exemplifying this failure is the absence of any guards on unit contained transmission apparatus. This apparatus includes "V" belts and pulleys, chains and sprockets, flat belts and pulleys, or gears on the outside of machines completely exposed to contact by workers or any other persons passing them, and

Whereas, A solution of this serious problem cannot be expected to result from the efforts of one single State, since the problem is national in scope and not confined within the boundaries of any single State dictating the need, therefore an organized national program should be directed toward improving the entire field of industrial machine guarding by manufacturers, and

Whereas, In the interest of safety for millions of workers in the American Federation of Labor organizations and others, it is imperative that we unite our efforts to correct this practice of any and all manufacturers who fail to provide the necessary guards and make a sustained and earnest effort to promote safeguarding of machines, therefore, be it

Resolved, That the 65th convention of the American Federation of Labor hereby goes on record to request the Honorable Lewis B. Schwellenbach, Secretary of Labor, to institute a nation-wide program encompassing all manufacturers of industrial equipment and urging them to install proper safeguards when the machines are manufactured, and be it further

Resolved, That the 65th annual convention of the American Federation of Labor concur in this program and co-ordinate its implementation.

Seventh Annual Congress on Industrial Health

The Seventh Annual Congress on Industrial Health was held at Boston, Mass., from 30 September to 2 October 1946 and was attended by nearly 700 specialists. The Congress was sponsored by the Massachusetts Medical Society, the Council of the New England State Medical Societies and the Council on Industrial Health of the American Medical Association. The general purpose of the Annual Congresses is to provide opportunities for the American Medical Association, labour and management to discuss the medical and health problems of the industrial workers of America.

Over twenty papers were read on topics such as the health of managerial staffs, nutrition, clinical research in industry, and the general health record of the United States.

The Eighth Annual Congress will be held at Detroit, Mich., from 8 to 10 October 1947.

LAWS AND REGULATIONS, SAFETY CODES

BRITISH DEPENDENCIES

Nigeria

THE SAFE MINING REGULATIONS, 1946
GAZETTED 5 FEBRUARY 1946 [1]

The Regulations consist of 148 Sections arranged in 12 Parts. The principal subjects dealt with are machinery, electricity, explosives, protection of surface, underground mining, workmen, responsibility of mine officials, and mine plans. Part VII on underground mining comprises groups of regulations relating to fire, shafts, winding, ventilation, laying of dust, lighting, haulage, dredging, and other matters.

THE EXPLOSIVES REGULATIONS, 1946
GAZETTED 5 FEBRUARY 1946 [2]

These regulations relate to the importation, sale, transport, storage and use of explosives. They establish an explosives licensing system and provide for the appointment of inspectors of explosives. Detailed precautions are laid down for the storage and use of explosives.

MOROCCO

French Zone

DECREE DATED 14 MARCH 1946, RESPECTING SANITARY MEASURES TO BE INTRODUCED IN GLASS FACTORIES WHERE GLASS IS BLOWN BY MOUTH

Under this decree the following sanitary measures must be taken in glass factories by owners, directors or managers.

(*a*) Appointment of a paid physician for the factory.

(*b*) All workers employed in glass blown with a blowpipe must hold a certificate from the factory physician declaring that they do not suffer from any contagious disease that could be communicated by means of the glass blowpipe. This certificate must be renewed:

1. every fortnight in bottle factories; and
2. every time the worker is absent for more than a fortnight in other glass factories.

(*c*) A special register must be kept up-to-date and at the disposal of the labour inspector in which must be recorded for each worker individually:

1. the date and duration of absence caused by any illness;
2. the dates of the medical certificates submitted to justify this absence, and the observations of a medical nature contained in them, mentioning particularly whether the worker is "fit" or "unfit", the name of the doctor who issued the certificate, and the name, age and occupation of each worker.

(*d*) In glass factories where the same blowpipe is used by various groups of workers, all blowpipes shall be disinfected at the beginning of every shift.

(*e*) In glass factories having a blowpipe for each worker, the preceding paragraph does not apply. However, in such factories each blowpipe must have a distinctive mark, and each of the workers shall have, for his particular use, a small cupboard that can be locked, in which to keep his blowpipe or blowpipes.

NORTHERN RHODESIA

THE MINING (SILICOSIS PREVENTION) REGULATIONS, 1946. DATED 15 JULY 1946

The matters dealt with in these Regulations are ventilation, drilling, blasting, transport, rock crushing, and the use of compressed air.

The provisions respecting drilling are as follows:

10. Every approved rock drill shall:
    (*a*) if of the fronthead-vented type have a minimum effective area of release of not less than 0.3 square inch if the piston diameter does not exceed three inches and not less than 0.4 square inch if the piston diameter exceeds three inches, or have been approved for use in scheduled mines in the Union of South Africa before the coming into force of this regulation;
    (*b*) have an undamaged water tube having an inside diameter of not less than five thirty-seconds of an inch and an outside diameter, when new, of not less than 0.255 inch and the end of which is not more than half an inch from the shank end of the drill steel when it is fully inserted; and
    (*c*) have an axial hole in the piston, when new, of not less than 0.260 inch and not more than 0.262 inch in diameter for a length of at least two and a half inches.

11. No percussion rock drill which is not an approved rock drill shall be used except with the written approval of the Chief Inspector of Mines and then only for drilling holes which cannot be drilled satisfactorily with an approved rock drill.

12. No person shall use or cause or permit a subordinate to use a percussion rock drill which is not an approved rock drill unless—

[1] *Nigeria Gazette*, No. 9, 5 Feb. 1946, p. 131.
[2] *Idem*, p. 166.

(*a*) the water tube is undamaged and the end of it is not more than half an inch from the shank end of the drill steel when it is fully inserted;

(*b*) the working water pressure at the machine is at least thirty pounds per square inch; and

(*c*) a ventilating air current of a volume not less than that specified by the Chief Inspector of Mines is being delivered not more than fifteen feet from the machine.

13. All drill steel used in rock drill shall have an unrestricted axial hole of not less than three-sixteenths of an inch in diameter through which water may be fed to the bit.

14. An adequate flow of water shall be maintained through the drill steel of every rock drill when drilling and in the case of an approved rock drill the working water pressure at the machine shall not be less than fifteen pounds per square inch.

UNITED KINGDOM

British Standard Specification: Wire Rope Slings and Sling Legs. B.S. 1290 : 1946

The specification covers sling legs, components for sling assemblies, and sling assemblies. The section on sling legs includes provisions concerning rope construction, permissible working load, thimbles, splicing, serving and seizing. Methods of assembling slings are specified and illustrated. There are several data tables for wire rope, rings, thimbles and eyehooks. Recommendations as to working loads for slings with two, three and four legs are contained in an appendix.

UNITED STATES OF AMERICA

Uniform Building Code of the Pacific Coast Building Officials Conference, 1946 Edition

The purpose of this Code as stated in Section 102 is "to provide minimum standards to safeguard life or limb, health, property, and public welfare by regulating and controlling the design, construction, quality of materials, use and occupancy, location and maintenance of all buildings and structures within the city and certain equipment specifically regulated herein".

The Code is a monumental work running to 300 pages of print. It is divided into thirteen parts and fifty chapters.

Part I, entitled Administrative, deals with municipal building authorities and inspection, and Part II is devoted to definitions.

Part III, Requirements Based on Occupancy, consists of eleven chapters containing regulations relating to different kinds of buildings, such as public assembly halls, places of public entertainment, schools, garages, oil depots, dry cleaning establishments, spray painting rooms, factories and workshops, power stations, cold storage plants and private dwellings.

Part IV, Requirements Based on Location in Fire Zones, lays down special rules for congested districts.

Part V, Requirements Based on Types of Construction, contains special regulations for fire-resistive buildings, heavy timber construction, ordinary masonry, light incombustible frame construction and wood frame construction.

Part VI is entitled Engineering Regulations, Quality and Design of the Materials of Construction, and Part VII contains twelve chapters of detailed regulations on various structural parts such as walls, floors, roofs, stairs, exits and windows.

Part VIII formulates fire-resistive standards for fire protection; Part IX deals with the use of public streets for building purposes; and Part X with plastering.

Special subjects, which include film storage, mechanical refrigeration and heating appliances, are treated in Part XI.

There is a detailed index to the Code.

Safety Code for the Industrial Use of X-Rays. American War Standard ASA Z54.1-1946 Approved 15 April 1946

The new Code is the result of very substantial labours by a large committee of experts. It is concerned with safety in the design, installation, maintenance and operation of industrial X-ray equipment and with the control and examination of workers.

The Code is divided into six main parts: I General, II Use and storage of radium in the field of industrial radiography, III Methods and materials of X-ray protection, IV Specific applications for 400 kilovolts and lower, V X-ray protection for voltages of one and two million, VI Electrical protection. There are also six data tables and several graphs giving transmission and absorption data.

Part I, General, contains definitions, fixes the permissible daily dose at 0.1 *r*, classifies X-ray installations, and lays down rules for the determination of X-ray hazards, the control of personnel, the medical examination of personnel and the maintenance of records. X-ray installations are divided into five classes, as follows: A, Totally protective installations; A-1, Totally protective installations with shields subjected to vibration or wear; B, Protective installations; B-1, Protective installations with shields subjected to vibration or wear; C, All other installations.

The Code is well indexed.

California

LIQUEFIED PETROLEUM GASES SAFETY ORDERS REVISED, EFFECTIVE 1 JANUARY, 1946

Liquefied petroleum gases are defined as petroleum hydrocarbons or mixtures thereof in liquid or gaseous state, having a vapour pressure in excess of 26 lb./in.^{2} gauge at temperature of 100° F. They include propane and butane.

The Orders consist of basic Orders (2000-2028), Orders concerning gas cylinders (2029-2030), Orders concerning systems utilising storage tanks (2031-2037), Orders concerning transportation tanks, tank trucks, etc. (2038-2048), and Orders concerning mobile fuel tanks (2049-2052).

The basic Orders deal with the specifications, approval and licensing of storage, transport and utilisation equipment, and the filling and storage of containers. Detailed requirements are laid down for cylinders, tanks, piping, valves, fittings, safety valves on vessels and vaporisers, vaporiser construction, gauges and transfer of liquids.

Liquefied petroleum gases must be odorised to facilitate detection of escapes and must be substantially free of water before being charged into vessels.

Kentucky

STANDARDS OF SAFETY, 1946 EDITION

These Standards, adopted by the Division of Insurance, comprise 26 Articles and constitute a substantial volume. They deal, among other things, with fire protection in buildings of all kinds, ventilation, refrigeration, flammable liquids, gas wells, garages and service stations, spray painting, explosives, compressed gases, gas welding and cutting, calcium carbide and acetylene generators, and dry cleaning.

Oregon

SAFETY CODE FOR SAWMILL, WOODWORKING AND ALLIED INDUSTRIES
EFFECTIVE 2 JANUARY, 1946

The Code is both voluminous and comprehensive. It is divided into eleven chapters as follows:

(1) General Provisions.
(2) Construction and Isolated Equipment.
(3) Mechanical, Steam and Electrical Equipment.
(4) Transportation — Lumber Handling Equipment, etc.
(5) Loading, Stacking, Storage and Conveying.
(6) Log Dumps, Ponds, Booms and Head Mill.
(7) Saws.
(8) Miscellaneous Woodworking Machines.
(9) Supplement for Lath and Shingle Mills.
(10) Supplement for Veneer and Plywood Plants.
(11) Supplement for Pulp and Paper Mills.

Each chapter contains numerous sub-divisions and these in turn are divided into sections. There are over a hundred sub-divisions in all.

The general provisions are such as could apply to all industrial undertakings. They lay down the general duties of employers and employees, and deal with supervision, works rules, works safety organisation, inspection, personal protective equipment, hand tools, first aid, etc.

Some of the provisions are of unusual interest, for example:

1.16. Superintendents, foremen, and key men shall be carefully chosen and qualified by experience to supervise the safe performance of the activities under their direction.

1.17. (*a*) Superintendents, foremen, and key men shall insist on employees' observing and obeying every rule, regulation and order as is necessary to the safe conduct of the work, and shall resort to disciplinary measures if necessary to compel observance.

(*b*) A copy of all safety orders shall be made available on the job for employees who desire to study them.

(*c*) Every employee shall comply with these rules. Whenever a doubt shall exist as to the meaning, he shall obtain a clear understanding before starting the work involving the rule in question.

1.20. All employees shall be given frequent safety instructions.

1.25. Employees required to work where overhead structures, equipment, or stored materials create a hazard shall be provided with hard hats and are required to wear them at all times while so employed.

1.35. Safety programs shall be conducted in accordance with the standards adopted by the State Industrial Accident Commission.

1.36. Safety councils or committees shall be organised where possible and every effort expended to make their work successful.

1.44. (*a*) Battered or crystallised iron wedges, chisels, punches, hammers and similar equipment, mushroomed more than one-fourth ($^1/_4$) inch from the body of the tool, shall be replaced or properly repaired.

(*b*) Exceptionally hard hammers, wedges and similar tools shall be removed from service.

Chapter 2 deals, among other things, with basements, floors, floor openings, stairways, walkways, ladders, exits, tramways, trestles, runways, inclines, tanks, vats, soaking pits, dry kilns, ventilation, and refuse removal systems.

Chapter 7 has regulations for over 20 different classes of saw, and Chapter 8 covers a large variety of woodworking machines, including cooperage machines.

OFFICIAL REPORTS, ETC.

DENMARK

Annual Report of the Factory Inspectorate, 1944 [1]

As usual the report deals separately with factories, elevators, steam boilers, bakeries and industrial hygiene.

At the end of 1944, the total number of undertakings liable to inspection was 45,634 of which 13,571 were subject to all the provisions of the Factory Act, 30,430 were subject only to the provisions respecting power-driven machinery and 1,633 were dairies. In all 40,596 inspections were carried out, and the percentage of undertakings inspected was 78.

During the year the Inspectorate issued new regulations respecting air receivers, water tanks under air pressure, etc., and circulars, etc., respecting opencast lignite mining, vulcanising, carding machines and shoddy machines, fire and explosion risks in the application of solution in vulcanising shops, explosion risks with fluxes in aluminium foundries, and starting up of machines. A number of circulars were also issued on various matters affecting industrial health.

Members of the inspection staff continued to contribute papers on industrial safety and health to social and technical journals, and to address meetings.

Some information is given respecting approvals of circular saws, abrasive wheels, and first-aid boxes. The composition of "small" and "large" first-aid boxes as now decided upon by the Inspectorate is given in the Report.

Most of the Report is taken up with illustrated notes from the district inspectors on safety, health and welfare topics. There are many interesting photographs showing good and bad practice in workroom arrangement, canteen installations, lighting, etc., and also safety devices of various kinds. Descriptions are given of several noteworthy accidents.

The Report gives the usual statistics of boiler and elevator inspection activities.

The main researches in the field of industrial hygiene were continued. They relate to matters such as silicosis, lead poisoning, poisoning by solvents and skin diseases. During the year under review 701 cases of occupational diseases were investigated, of which 102 were cases of silicosis, 209 lead poisoning, 132 poisoning by solvents, 52 carbon monoxide poisoning, 37 other cases of poisoning, and 72 skin diseases. Since 1942 cases of lead poisoning have increased from 105 to 209 and cases of poisoning by solvents from 85 to 132. Silicosis cases increased only from 83 to 102. The total number of occupational diseases was 534 in 1942, and 615 in 1943 as compared with 701 in 1944.

[1] *Beretning om Arbejds- og Fabriktilsynets Virksomhed i Aaret 1944.* For 1943, see *Industrial Safety Survey*, Vol. XXI, No. 3, p. 100.

FINLAND

Annual Report of the Industrial Inspectorate, 1944 [1]

During the year, the number of inspection districts was reduced from nine to eight. The inspection staff comprised nine male and four female industrial inspectors, 22 assistant industrial inspectors and 13 workmen's inspectors, but some were unemployed. There were also 597 communal inspectors.

Undertakings employing at least 10 workers, or if mechanical power is employed, three workers (Group A) are directly supervised by the State industrial inspectors. All other undertakings subject to inspection (Group B) are within the jurisdiction of the communal inspectors.

In 1944 there were 9,463 undertakings in Group A employing 249,313 workers, and 56,109 in Group B, employing 226,201 workers. In Group A 5,708 undertakings (60.3 per cent.) employing 185,133 workers (74.3 per cent.) were inspected during the year. The corresponding figures for Group B are not given.

The total labour force of 475,514 included 212,091 women over 18 years of age, 28,354 boys under 18 and 16,664 girls under 18.

The greater part of the report is taken up with the repercussions of the war on industry and labour. Shortages of materials continued to hamper safety activities. Lack of metal, for instance, made it impossible to install effective dust exhausts and ventilation equipment in new factories. It was also difficult to provide adequate heating.

There was overcrowding due to shortage of suitable factory premises and some use had to be made of unsuitable premises, in basements, for example. Supplies of working clothes, including boots and gloves, were extremely short.

The State inspectors issued 4,370 orders and instructions, of which 1,962 concerned hygiene and various shortcomings at workplaces, and 1,132 technical matters of safety.

NETHERLANDS

Accident Statistics for 1941 [2]

On 31 December 1941 the number of undertakings liable to insurance under the Accident Act of 1921 was 198,212 as compared with 194,861 on 31 December 1940, and the number of man-years of employment in 1941 was 1,504,867 as compared with 1,365,158 in 1940. The largest

[1] *Sosiaalinen Aikakauskirja*, No. 9-10, 1945, p. 340; for 1943 see *Industrial Safety Survey*, Vol. XXI, No. 4, p. 136.

[2] *Ongevallenstatistiek betreffend het kalenderjaar 1941.* Druk de Bussy, Amsterdam, 1943.

industries were trade and transport with 81,953 undertakings and 482,042 man-years; building, etc., with 48,923 undertakings and 235,948 man-years; and food, drink and tobacco, etc., with 26,692 undertakings and 159,236 man-years.

Undertakings with approved medical services numbered 189 and accounted for 171,513 man-years. The corresponding figures for 1940 were 181 and 151,926.

An analysis of 197,308 undertakings shows that 162,422 (195,048 man-years) employed fewer than five persons; 30,986 (386,240 man-years) employed from 5 to 49; and 3,900 (923,579 man-years) employed 50 or more.

General accident figures covering the period 1930-1941 are given in table I.

TABLE I

Year	Number of accidents				
	Medical treatment only	Disablement not exceeding 6 weeks	Disablement exceeding 6 weeks	Fatal	Total
1930	47,461	132,789	9,867	402	190,519
1935	42,888	96,151	6,570	289	145,898
1937	54,418	116,374	7,871	319	178,982
1938	63,669	131,398	8,742	336	204,145
1939	68,359	149,248	9,661	358	227,626
1940	66,784	166,731	12,455	548	246,518
1941	81,790	244,624	16,938	389	343,741

In 1941 there were also 221 cases of occupational diseases of which 119 were bakers' eczema, 25 lead poisoning, 24 poisoning by benzene or its homologues and 20 silicosis.

The distribution of accidents by severity since 1930 is shown in table II.

TABLE II

Consequence of accidents	Number of Accidents per 1,000 Man-years						
	1930	1935	1937	1938	1939	1940	1941
Disablement not exceeding 6 weeks	93.3	82.1	91.3	98.9	107.7	122.1	162.4
Temporary disablement exceeding 6 weeks	6.0	5.1	5.6	6.1	7.0	9.1	11.3
Permanent disablement	0.92	0.49	0.56	0.50			
Death	0.28	0.25	0.25	0.25	0.26	0.40	0.26
Disablement and death	100.5	88.0	97.8	105.8	115.0	131.6	174.0
Medical treatment only [1]	34.6	38.7	46.2	51.9	53.8	53.1	59.6

[1] Excluding undertakings with recognised medical services.

The distribution of accidents by severity and by industry in 1941 is shown in table III.

The number of accidents per 1,000 man-years was highest for metal foundries (637.3), followed by iron foundries (537.5), meat products (511.5), fish drying, etc. (509.6) and canal construction (507.0). The lowest rates were for newspaper printing and publishing (29.6), hospitals, etc. (35.5), shops (40.0) and posts, telegraphs, telephones (40.0).

The frequency of accidents by size of undertaking since 1930 is shown in table IV.

TABLE III

Industry	Number of Accidents							
	Disablement not exceeding 6 weeks		Disablement exceeding 6 weeks		Fatal		Total	
	No.	Per 1,000 man-years	No.	Per 1,000 man-years	No.	Per 1,000 man-years	No.	Per 1,000 man-years
Pottery, glass, lime	10,983	336.1	619	18.9	13	0.40	11,615	355.4
Diamonds, jewellery, etc.	11	38.2	1	3.5	—	0.00	12	41.7
Printing	1,804	53.0	140	4.1	1	0.03	1,945	57.1
Building, etc.	68,136	288.8	5,060	21.4	88	0.37	73,284	310.6
Chemicals	4,098	104.9	246	6.3	5	0.13	4,349	111.3
Wood, cork, straw, etc.	12,872	292.1	1,011	22.9	10	0.23	13,893	315.2
Clothing, cleaning	5,318	71.3	323	4.3	6	0.08	5,647	75.7
Arts and crafts	19	52.3	—	0.0	—	0.00	19	52.3
Leather, oil-cloth, rubber	4,077	139.9	209	7.2	4	0.14	4,290	147.2
Ore, coal, peat	15,222	347.1	687	15.7	35	0.80	15,944	363.6
Metal-working	17,588	329.4	1,006	18.8	12	0.22	18,606	348.4
Manufacture of steam plant, working machines, etc.	18,964	213.2	954	10.7	20	0.22	19,938	224.1
Ship, vehicle, building	9,964	250.3	676	17.0	14	0.35	10,654	267.7
Paper, etc.	3,259	145.8	251	11.2	6	0.27	3,516	157.3
Textiles	6,993	102.3	441	6.5	7	0.10	7,441	108.9
Gas, electricity	2,124	102.9	150	7.3	6	0.29	2,280	110.5
Food, drink, tobacco, etc.	21,882	137.5	1,296	8.1	19	0.12	23,197	145.7
Trade, transport, etc.	35,572	73.7	2,828	5.9	119	0.25	38,519	79.9
Agriculture, horticulture	2,347	571.6	114	27.8	1	0.24	2,462	599.6
Total	241,233	163.7	16,012	10.9	366	0.25	257,611	174.9

TABLE IV

Number of employees per undertaking	Frequency per 1,000 man-years [1]						
	1930	1935	1937	1938	1939	1940	1941
Less than 5	80.2	87.1	87.0	90.7	95.6	99.8	110.7
5—49	101.5	92.2	97.1	107.3	115.4	125.6	156.5
50 and over	105.5	85.9	101.0	108.9	119.4	141.3	194.7
Total	100.5	88.0	97.8	105.8	115.0	131.6	174.0

[1] Excluding cases of medical treatment only.

The number of undertakings liable to insurance on 31 December 1941 under the Agricultural and Horticultural Accidents Act 1922 was 113,822 as against 112,405 on 31 December 1940. The accident figures for 1941 were: medical treatment only, 703; disablement not exceeding 6 weeks, 5,255; disablement exceeding 6 weeks, 358; fatal, 5; total, 6,321. The total for 1940 was only 3,793. The general frequency rate was 228.1 per 1,000 man-years; for agriculture it was 264.1, cattle farming 118.2, horticulture 158.9, and forestry 436.7.

Statistics of accident causes are not given.

Annual Report of the Labour Inspectorate, 1943 [1]

The report is a substantial volume of 279 pages divided into 12 chapters, of which the following are of special interest from the standpoints of industrial safety and hygiene: V — Enforcement of the Safety Act and Accidents, VA — Accidents in Agriculture, and VII — Medical Examinations and Information respecting Occupational Diseases. Chapter V provides numerous statistics of accidents grouped by cause and agency, describes typical accidents in each group and discusses the principal causes.

In 1943, as in 1942, restrictions on travel seriously impeded the work of the Labour Inspectorate. The shortage of materials grew more acute and it became almost impossible to obtain supplies. Workplaces not entirely in conformity with the regulations had to be accepted, and in view of the prohibition of building, there could be no question of substantial improvements to existing factories, nor could alterations be made in unsatisfactory dormitories, washplaces, toilets, etc. The shortage of workers, cleaning materials, paint and tools led to a visible falling off in maintenance in most factories and many workplaces had a neglected appearance. The ties between worker and factory steadily loosened and many workers showed not the slightest inclination to contribute anything to the undertaking. That this attitude militated against accident prevention can hardly be doubted. If to this is added that very many factories had to carry on with inexperienced workers, two important reasons are forthcoming for the noteworthy fact that notwithstanding the slackening off of industry there was no decline in the number of accidents as compared with the preceding year.

In 1943, 15,395 orders and written instructions were issued under the Safety Decree of 1938 concerning factories and workplaces and 1,208 under the Electrotechnical Safety Decree of 1938.

[1] *Centraal Verslag der Arbeidsinspectie in het Koninkrijk der Nederlanden over 1943.* 's Gravenhage—ter Algemeene Landsdrukkerij. 1944.

Factories and Workplaces

Factory Premises

The installation of factories and workplaces gave rise to 2,392 orders, etc., of which 402 concerned sanitary conveniences, 379 ventilation and temperature, 266 noxious gases and vapours, 253 natural lighting and 231 fire prevention. In connection with dust prevention the report gives an illustrated description of an exhaust system in a flax mill. Dust is usually exhausted from swingle wheels through a wooden hood mounted between the wheel and the shaft, but these have not proved very satisfactory because the dust particles which are thrown off radially must be caught axially. Improvement has been effected by enclosing the wheel in a helicoidal hood, broad in front, and tapering at the back. The exhaust opening is at the back so as to take advantage of the speed acquired by the particles from the rotation of the wheel.

Accident Statistics

Table I gives summary accident statistics for the years 1940-1943:

TABLE I

Year	Reported accidents		Fatal accidents	
	Factories and workplaces	Peat undertakings	Factories and workplaces	Peat undertakings
1940	156,289	451	84	—
1941	255,710	1,014	143	—
1942	275,720	1,453	148	—
1943	286,708	1,167	268 [1]	—

[1] Includes at least 171 due to military action.

Table II gives the corresponding figures in respect of steam boilers and prime movers:

TABLE II

Equipment	Accidents			
	1940	1941	1942	1943
Steam boilers (power and heating) . . .	70	43	73	92
Steam engines .	11	9	10	7
Automobile engines . . .	236	222	335	261
Other internal combustion engines . . .	140	113	184	214
Electric motors .	4	5	9	9
Windmill sails. .	—	2	3	—

Transmissions accounted for 742 accidents in 1943, as compared with 670 in 1942, 549 in 1941 and 519 in 1940. The principal causes in 1943 were: mounting belts on moving shafts from the floor 155; crushing between belt and belt pulley otherwise than in mounting belts 144; belt fasteners 105; caught by a belt 65.

Accidents due to the inadvertent starting of machines numbered 143 (125 in 1942, 104 in 1941, 132 in 1940). Cleaning, wiping and oiling machinery caused 666 accidents (850 in 1942, 531 in 1941 and 531 in 1940); gear wheels 300 (249 in 1942, 300 in 1941 and 244 in 1940); and loose clothes, loose hair, rings 83 (104 in 1942, 69 in 1941 and 90 in 1940)—32 of these accidents in 1943 were due to loose hair and 8 to rings.

During the year 2,327 lifts and hoists in factories were registered with the Labour Inspectorate and these gave rise to 116 accidents, including 2 fatal. Lift accidents in 1942 numbered 134, in 1941 108 and in 1940 120. The two leading causes of lift accidents in 1943 were closing and opening of shaft doors (18 cases) and insufficiently smooth shaft walls (13 cases).

Hoisting appliances, winches and transport equipment caused 1,099 accidents (1942, 841; 1941, 700; 1940, 692).

Hot or molten metal and hot or corrosive liquids are given as the cause of 5,995 accidents (1942, 6,532; 1941, 5,314; 1940, 3,912); and fire and explosion as the cause of 2,993 (1942, 4,210; 1941, 2,896; 1940, 1,984). Accidents due to welding and cutting and acetylene totalled 1,006 excluding burns from splashes of metal (1942, 798; 1941, 318; 1940, 248).

Abrasive wheels caused 8,356 accidents in 1943. These are classified as follows:

Abrasions (lost-time)	2,093
Abrasions (no lost-time)	242
Flying out of the wheel	47
Crushing between wheel and support	176
Eye injuries (lost-time)	1,962
Eye injuries (no lost-time)	3,678
Others	158

The total for 1942 was 7,417; for 1941, 7,151; and 1940, 4,916. The report describes tests with two welded hoods, one of which is shown in a drawing. Both had proved satisfactory in use. One was designed for wheels of 300 mm diameter and the other for wheels of 175 mm. In the larger nine, and in the smaller eight, wheels were tested to destruction. Before each test the insides of the hoods were coated with red lead to show where the pieces of the wheels had struck them. The tests showed that the hoods had been sheared open over a length of about 10 cm at the bottom, but were not otherwise deformed. It was therefore concluded that they were strong enough to withstand the stresses set up by the bursting of the wheels. The report also describes, with illustrations, a satisfactory screen for use with universal grinding machines at which a number of workers have to work.

With circular saws there were 2,356 accidents in 1943, as against 1,910 in 1942, 1,599 in 1941 and 790 in 1940. The report deals at length with the causes of these accidents.

Planing machines caused 1,021 accidents (1,065 in 1942; 813 in 1941), and spindle-moulding machines 308 (317 in 1942; 208 in 1941 and 140 in 1940).

As regards machine tools, power presses caused 385 accidents (1942, 444; 1941, 355; 1940, 808). The reduction is probably due to the closing down of factories. Most of the accidents are attributed to defective guards. The Director General of Labour promoted researches into the guarding of power presses, and, as a result, a new type of guard was designed. It was still undergoing tests at the time of writing the report. The Director General also appointed a small Committee of experts to study existing methods of guarding presses.

Textile machinery caused 1,462 accidents (1942, 1,336; 1941, 1,453; 1940, 1,605). Many were due to flying shuttles.

Stairs and ladders (exclusive of those in shipyards and on buildings under construction) were the cause of 2,818 accidents (1942, 3,698; 1941, 2,732; 1940, 1,701); floors, gangways, etc., caused 364 (1942, 288; 1941, 312; 1940, 588); and floor and wall openings 140 (1942, 196; 1941, 121; 1940, 171).

In building construction, including dredging, foundation work, pile driving and water works, there were 53,848 accidents, of which 34 were fatal. These accidents are classified as follows:

A. — *Building construction other than dredging, foundation work and pile-driving.*		
Falls from scaffolds		608 (2)[1]
Falls owing to breaking or displacement of a scaffold part		206 (8)
Falls through open flooring		106
Falls through floor opening or skylight		91
Falls from roof or roof gutter		151 (2)
Struck by falling objects		6,355 (1)
Ladder accidents		653 (2)
Collapse of buildings		57 (5)
Slight accidents:		
Eye accidents	2,206	
Nails	2,700	
Stumbling	4,421	9,327
Other accidents		21,873 (9)
B. — *Dredging, foundation work and pile driving*		14,421 (5)

Electricity

During 1943, 238 electrical accidents were reported, and of these 13 were fatal. Low tension (65-300 V to earth) was responsible for 7 of the fatal and 192 of the non-fatal accidents, and high tension (over 300 V) for 6 of the fatal and 33 of the non-fatal. Two of the fatal accidents and 45 of the non-fatal were caused by direct current;

[1] Figures in brackets are those of fatal accidents included in the totals.

and 11 of the fatal and 180 of the non-fatal, by three-phase current. The report tabulates figures of electrical accidents since 1909, the totals for 1909-1943 being 372 fatal and 3,636 non-fatal accidents. An extract from the tabulation is given in table III.

TABLE III

Year	Low-tension		High-tension		Total
	Fatal	Non-fatal	Fatal	Non-fatal	
1909 . .	—	8	2	—	10
1910 . .	—	21	1	—	22
1915 . .	5	36	2	—	43
1920 . .	8	68	5	20	101
1925 . .	16	101	5	40	162
1930 . .	22	131	4	29	186
1935 . .	6	82	2	25	115
1940 . .	6	86	5	15	112
1941 . .	5	132	1	30	168
1942 . .	12	155	10	29	206
1943 . .	7	192	6	33	238

Table IV shows the distribution of the accidents in 1943 by cause.

The items of electrical equipment most frequently involved in accidents were: portable tools and appliances, 28 accidents; insulated wiring indoors, 16; portable wiring, 15; plug and socket connections, 13; electrical measuring instruments, 12.

Of the 238 victims of electrical accidents 83 were electrical fitters, 41 metalworkers, 41 factory personnel, 22 building workers and 10 railway and tram employees.

TABLE IV

Cause	Fatal accidents		Non-fatal accidents		Total
	High tension	Low tension	High tension	Low tension	
Machines, appliances and wiring out of order	—	4	3	55	62
Defective machines, appliances and wiring	—	—	2	12	14
Defectively insulated connections	—	1	—	2	3
Defective or severed earth connections . .	—	1	1	6	8
Faulty installation or erection	—	—	1	14	15
Closing switches under load	—	—	1	1	2
Operating disconnecting switches under load	—	—	3	—	3
Inserting or removing fuses under load or tension	—	—	—	8	8
Short-circuiting in working on or near live parts	—	1	10	37	48
Working on or near live parts	3	—	1	12	16
Inadvertent contact with live parts . . .	2	—	8	32	42
Contact with live parts thought to be dead .	1	—	2	10	13
Approaching too close to high-tension live parts	—	—	1	—	1
Other causes	—	—	—	3	3
Total . . .	6	7	33	192	238

In all, the 238 accidents caused 308 injuries, of which 140 were burns on hands or arms, 25 burns on face or head, and 21 contusions due to falls caused by shock.

Agriculture

In 1943, accidents reported under the Agricultural and Horticultural Accidents Act 1922, totalled 67,111 as against 60,861 in 1942. The report furnishes statistics of accidents due to various causes that require special attention from the prevention standpoint. These include threshing machines, 846 accidents, ploughs 684, eye injuries in mechanical threshing 299, cutting bands in mechanical threshing 287, prime movers and transmissions 283, straw presses 262, harrows 230, beet cutters 226, and circular saws for firewood 208.

There is also a classification of harvesting accidents; these include potato lifting with 3,630 accidents, beet lifting with 1,464, mowing and reaping with 1,870 and flax pulling 739.

Horses were directly accountable for 2,247 accidents and indirectly for 1,176; cattle directly for 931 and indirectly for 57.

Health and Occupational Diseases

In Chapter VII, on medical examinations and occupational diseases the report gives particulars of examinations in various industries and of the cases of occupational diseases reported during the year. The commonest diseases were: carbon-monoxide poisoning, 177 cases, of which 106 were accounted for by fitters in garages and drivers of gas-driven vehicles; lead poisoning 17 cases; purulent inflammation of the synovial capsule of the knee 56 cases among coal miners; and skin diseases 1,065 cases in various occupations, of which agriculture contributed 869. In this connection numerous industrial poisons and other noxious substances are discussed.

PALESTINE

Annual Report of the Department of Labour, 1944

The activities of the Inspectorate are steadily increasing. In 1944, 5,747 industrial and business indertakings were inspected, as compared with 3,779 in 1943 and about 700 in 1942. As a result of visits by inspectors, 6,393 contravention notices and recommendations were issued, 1,600 more than in the preceding year. About sixty per cent. of the total were concerned with matters of safety, principally the fencing of dangerous machinery. Of 2,865 notices concerning the fencing of machinery, 1,698 were in respect of transmission machinery. About a thousand notices related to the employment of children and over a thousand concerned welfare, chiefly first

aid arrangements. A total of 316 industrial accidents were investigated on the site.

The number of undertakings registered on 1 January 1945 was 4,119, including 2,830 with power-driven machinery.

About a dozen pamphlets on safety and health were prepared during the year, the subjects including fire precautions, power presses, abrasive wheels, lead poisoning, steam boilers and repairs to drums that have contained flammable liquids.

Shortages of materials continued to militate against the provision of guards for machinery.

Increases in the numbers of accidents reported between 1939 and 1943 are attributed to better reporting, increase in employment, broadening of the basis of reporting, dilution of labour and overcrowding of workplaces. The proportion of machinery accidents remained very steady during the war years, at between 11 and 13 per cent. of the total.

From an early date it has been considered by the Department that a Safety Council might usefully be established in each of the larger towns of Palestine, on which representatives, both employers and workers, of all communities should sit. In each of the large towns the first steps have been taken towards setting up such councils and considerable interest has been aroused in the subject. Regional safety councils now exist in Jerusalem, Haifa and Tel Aviv.

These Councils will, it is hoped, disseminate safety propaganda and encourage safety education. Special sub-committees may consider special subjects such as dangers in particular trades, special risks, individual machines, investigation of accidents, lectures and other methods of education.

The movement is at present only in its infancy, but in view of the seriously high accident rate in Palestine it is hoped that good may come of it and that eventually a national body may be set up similar to the Royal Society for the Prevention of Accidents in Great Britain.

UNITED KINGDOM

Railway Accidents in 1944 [1]

In 1944 eight servants of railway companies and contractors were killed and 18 seriously injured in train accidents, 255 killed and 492 seriously injured in movement accidents, and 37 killed and 1,808 seriously injured in non-movement accidents.

There were 402 train accidents involving more than three hours' delay to traffic, as against 393 in 1943. Of the total 114 were collisions and 265 derailments. Failure of the train crew is given as the cause of 122 train accidents, failure of signalman as the cause of 30, failure of train crew and/or signalman and/or other staff as the cause of 27, and failure of other staff as the cause of 9. In addition, 49 accidents are ascribed to defective draw-gear, 38 to defective stock other than draw-gear, 12 to defective engines, 21 to defective track and/or signalling apparatus, 27 to faulty loading and 9 to snow, landslides, flooding, etc. In all, failure of the human element accounted for 188 of the 402 accidents, as against 195 of 393 in 1943.

At level crossings 54 persons, including 2 railway servants, were killed, and 10, including one railway servant, were injured.

As regards movement accidents, 86 servants of railway companies and contractors were killed and 38 seriously injured while walking or standing on the line on duty or when proceeding to or from work, 59 were killed and 20 seriously injured while working on the permanent way, 40 were killed and 192 seriously injured in miscellaneous shunting accidents, and seven were killed and 49 seriously injured while coupling or uncoupling vehicles.

The causes of accidents to staff through being struck by engines or trains while working on the line are given as follows: protection inadequate, killed four, injured four; look-out men at fault, eight killed; failure to act correctly after warning, killed 14, injured two; want of individual care or lack of care on the part of others, killed 30 injured four; accidental, slipping or other causes, killed two, injured one.

In non-movement accidents nine servants of railway companies and contractors were killed and 583 injured in handling goods; one killed and 144 injured when attending to engines at rest; eight killed and 370 injured by falls on railway premises; and three killed and 338 injured whilst working or walking on the permanent way.

Accidents to Dock Workers in 1945 [1]

At docks, wharves and quays in Great Britain, there were 70 fatal and 9,261 non-fatal accidents to dock workers in 1945. The chief causes of these accidents were: handling goods in manufacturing, etc. processes, with 2,431 non-fatal accidents; struck by falling body, with 8 fatal and 1,774 non-fatal; lifting machinery, with 34 fatal and 1,454 non-fatal; persons falling, with 16 fatal and 1,369 non-fatal; stepping on or striking against objects, with 533 non-fatal; and railway locomotives and rolling stock, with 4 fatal and 522 non-fatal.

Electricity in Mines during the Year 1945 [2]

On 30 June 1945 the horsepower of motors in use for all purposes at mines under the Coal

[1] *Report to the Minister of War Transport upon the Accidents which occurred on the Railways of Great Britain during the Year 1944.* H.M. Stationery Office, London.

[1] Information communicated by the British Government. For 1944, see *Industrial Safety Survey*, Vol. XXII, No. 1, p. 29.

[2] *The Mining, Electrical and Mechanical Engineer*, July 1946, p. 10; for 1944 see *Industrial Safety Survey*, Vol. XXII, No. 1, p. 22.

Mines Act was 1,175,158 at the surface and 1,396,677 underground, a total of 2,571,835.

Table I classifies all accidents due directly or indirectly to the use of electricity in mines in question in 1945.

TABLE I

	Fatal		Non-fatal	
	1945	Totals 1936-1945	1945	Totals 1936-1945
Nature of accident:				
Electric shock and/or arc burns	3	53	54	430
Ignition of firedamp or coal dust	2	24	2	32
Fire arising from electrical defects	0	4	7	97
Other causes	0	3	4	33
Totals	5	84	67	592
Contributory cause:				
Design or unsuitability of apparatus	0	10	0	26
Installation or maintenance	2	22	29	200
Misuse, negligence, ignorance	3	36	37	347
Organisation or lack of equipment	0	8	1	1
Unforeseeable	0	8	0	18
Totals	5	84	67	592
Apparatus involved:				
Switchgear and fuses	0	20	25	265
Flexible cables and plugs	3	36	18	211
Overhead lines, bare or insulated	0	5	0	19
Unarmoured cables and wiring conduit	0	0	2	
Lighting accessories	0	0	3	19
Motors and transformers	1	5	7	22
Coal-cutting machines	0	5	0	1
Armoured cables and accessories	0	10	11	53
Signalling bells	0	0	1	2
Miscellaneous and unknown	1	3	0	0
Totals	5	84	67	592

The classification of persons killed and injured in these accidents is given in table II.

TABLE II

	Killed		Injured	
	1945	Totals 1936-1945	1945	Totals 1936-1945
Electric shock and/or arc burns:				
Surface workmen	2	9	3	47
Electricians	0	17	30	196
Coal-cutter machinemen	1	16	6	97
Machinery attendants	0	4	3	24
Other underground workers	0	14	20	115
Totals	3	60	62	479
Ignition of firedamp or coal dust	7	194	5	133
Fire	0	19	0	17
Other causes	0	6	2	18
Totals *(all causes)*	10	279	69	647

Descriptions are given of the five fatal accidents and of selected non-fatal accidents.

The Inspector briefly discusses drilling cables, arc welding and accidents involving electricians.

The use of arc welding for the repair of fabricated cases or cracked castings and for the building up of worn journals in shafts is increasing both in coal mines and in quarries and is likely to increase rapidly in the future, and the necessary safety precautions should be considered.

The Inspector considers that when working in closed spaces such as boiler interiors, welders should have available ready means by which they themselves can disconnect the electrode from the supply. Such means might be:

(1) A switch in the handle of the electrode holder capable of breaking the welding current, which may be 300 ampères.

(2) A pilot switch in the handle of the electrode holder to interrupt the operating coil circuit of a contactor (*i.e.* remote control).

(3) A device by which the open-circuit voltage applied to the electrode is limited to a safe value and the full voltage is applied only when the electrode touches the work.

(4) A single-pole plug and socket connector placed in the welding cable close to or associated with the electrode holder.

Method (1), until recently, was considered impracticable owing to the temperature and the heavy current. Three well-known electrical manufacturing firms have, however, collaborated in producing a satisfactory holder on these lines and this will shortly be in production. This device also ensures that the switch in the handle cannot be closed while an electrode is being changed.

Method (2), entails the complication of a contactor at the transformer and a three-core flexible cable to the electrode holder.

Method (3) requires a contactor and auxiliary transformer winding but no alteration to the welding cable or electrode holder. If maintained in a reliable condition it is probably the safest of the alternatives, since the opening and closing of the main circuit occurs automatically when the electrode makes and breaks contact with the work.

Method (4) means that the plug and socket connector, on account of the current to be carried, is clumsy and adds to the weight to be handled by the operator. It is doubtful whether it would be used in practice.

Welding equipment operating at 100 volts direct current is undoubtedly much safer than that supplied by a transformer at 80 to 100 volts a.c., and is unlikely to cause a fatality. The electrode holder with switch handle (method (1) above) would seem to be the appropriate safety device. The use of d.c. equipment is strongly recommended when welding is required in boilers and in other places where temperature and humidity are such as to induce perspiration.

If due allowance is made for psychological factors such as strain and anxiety, the Inspector considers that the majority of accidents to elec-

tricians could have been avoided by the exercise of forethought, concentration and common sense.

The Inspector pronounces against the use of rubber gloves for electrical staff in mines since the protection afforded by them is unreliable in mining conditions.

UNITED STATES OF AMERICA

Steam Railway Accidents, 1944 [1]

In 1944, 978 employees on duty were killed and 47,330 injured. The corresponding averages for 1935-1939 were 574 and 18,993. The fatal rate per million man-hours in 1944 was 0.254 as compared with 0.234 for the period 1935-1939; and the non-fatal rate 12.32 as compared with 7.74 for the period 1935-1939.

The distribution of accidents in 1944 by class of accident was as follows: train accidents, 151 killed, 1,133 injured; train-service accidents 652 killed, 22,625 injured; non-train accidents 175 killed, 23,572 injured.

The distribution of accidents to employees by causes is shown in table I.

TABLE I

Kind of accident	Killed	Injured
Train accidents		
Collisions	61	625
Derailments	50	376
Locomotive-boiler accidents	12	23
Other locomotive accidents	1	9
Miscellaneous	27	100
Train-service accidents		
Coupling or uncoupling:		
Cars or locomotives	30	794
Air hose	15	476
Operating locomotives	16	2,742
Operating hand brakes	19	1,821
Operating switches	1	877
Coming in contact with fixed structures	32	404
Getting on or off cars or locomotives	50	5,846
Accidents at highway grade crossings [1]	11	71
Struck or run over, not at public crossings	291	429
Miscellaneous	187	9,165
Non-train accidents		
Total non-train	175	23,572
Total, all accidents	978	47,330

[1] Excludes 8 fatalities and 47 injuries classified above as train accidents.

Table II shows employee casualties per million man-hours for the period 1940-1944.

[1] Interstate Commerce Commission, Bureau of Transport Economics and Statistics: *Accident Bulletin No. 113.* Washington, 1945; for 1943 see *Industrial Safety Survey*, Vol. XXI, No. 1, p. 31.

TABLE II

Group	Killed	Injured
I. Executives, officials and staff assistants; II. Professional, clerical, and general	0.037	1.28
III. Maintenance of way and structures	0.286	8.80
IV. Maintenance of equipment and stores	0.119	7.84
V. Transportation (other than train, engine and yard)	0.078	10.76
VI. (*a*) Transportation (yard-masters, switch tenders, and hostlers)	0.187	9.54
VI. (*b*) Transportation (train and engine)	0.663	20.42
Total employees on duty	0.249	9.98

Of 16,258 train accidents in 1944, 7,457 are attributed to negligence of employees, 4,551 to defects in or failures of equipment, and 2,050 to defects in or improper maintenance of way and structures. Damage to railway property in train accidents amounted to $24,989,476, an average of $1,537 per accident. Collisions accounted for 4,867 of the accidents and derailments 8,673. Negligence of employees is given as the cause of 4,623 collisions and 2,192 derailments.

The distribution of non-train accidents to employees on duty is shown in table III.

TABLE III

Class of accident	Killed	Injured
(*a*) Shop machinery, stationary engines and motors, cranes, etc.	6	506
(*b*) Locomotive cranes, steam shovels, dredges, pile drivers, etc.	9	149
(*c*) Transmission apparatus (belts, gears, shafting, ropes, etc.)	5	70
(*d*) Use of hand tools, apparatus, etc.	2	1,828
(*e*) Flying particles	1	875
(*f*) Explosives and inflammable, hot or corrosive substances	8	719
(*g*) Electric currents	9	63
(*h*) Collapse, fall, etc., of objects	14	2,487
(*i*) Handling rails, ties, bridge timbers, etc.	5	2,340
(*j*) Maintenance of way and structures hand cars (non-train accidents only)	1	208
(*k*) Maintenance of way and structures motor cars (non-train accidents only)	38	1,252
(*l*) Handling freight or supplies	1	3,541
(*m*) Falls of employees not included in classes (*a*) to (*l*)	35	4,101
(*n*) Miscellaneous non-train accidents	41	5,433
Total	175	23,572

The principal causes of "miscellaneous" train-service accidents to employees on duty were: sudden stopping, starting, etc., of locomotive, car or train, 10 killed, 2,008 injured; stepping or tripping on coal, boards, stone, rubbish, etc., or in holes, 2 killed, 807 injured; sparks, cinders, dust, etc., in eye, 613 injured; falling from locomotives or cars, 68 killed, 518 injured; handling dishes, utensils, etc., on cabooses, dining cars, etc., 699 injured.

Work Injuries in 1944 [1]

During 1944, 2,230,400 persons were injured in industrial accidents. This figure compares favourably with that of 2,414,000 for 1943; it is 7.7 per cent. lower, although employment declined only 3 per cent. The year 1944 marks the first decline in the industrial accident total since 1938. Taking the 1926 frequency rate as 100, the rates for manufacturing industries over the period 1937-1944 are 1937, 85.8; 1938, 71.7; 1939, 73.4; 1940, 75.3; 1941, 85.8; 1942, 93.5; 1943, 94.4; 1944, 88.3. In 1938 all industrial accidents totalled 1,375,600.

The actual time loss resulting from industrial accidents in 1944 is estimated to be 43,614,400 man-days, or about 145,000 man-years; and the ultimate time loss, taking account of deaths and permanent disabilities, to be 222,944,000 man-days, or 743,000 man-years.

The 1944 accident total includes 15,900 fatalities, a decline of nearly 14 per cent. as compared

[1] U.S. Dept. of Labor, Bureau of Labor Statistics: *Work Injuries in the United States during 1944.* Bulletin No. 849, Washington, 1945. For 1943, see *Industrial Safety Survey*, Vol. XXI, No. 2 p. 66.

TABLE I

(Difference between number of total injuries and injuries to employees represents injuries to self-employed workers)

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]	311,900	75,400	4,800	1,200	400	100	15,600	3,700	291,100	70,400
Mining and quarrying [2]	92,100	87,300	1,700	1,600	200	200	4,000	3,800	86,200	81,700
Construction [3]	99,600	60,000	1,100	700	100	100	3,600	2,200	94,800	57,000
Manufacturing [4]	786,900	773,500	2,900	2,800	300	300	35,400	34,800	748,300	735,600
Public utilities	19,300	19,300	400	400	[5]	[5]	500	500	18,400	18,400
Trade [3]	273,800	219,000	700	600	100	100	6,000	5,000	267,000	213,300
Railroads [6]	92,400	92,400	1,200	1,200	300	300	6,400	6,400	84,500	84,500
Miscellaneous transportation [3]	135,100	116,000	900	700	100	100	4,100	3,500	130,000	111,700
Services, government, and miscellaneous industries [3]	419,300	359,200	2,200	2,000	200	200	18,800	16,100	398,100	340,900
All groups	2,230,400	1,802,100	15,900	11,200	1,700	1,400	94,400	76,000	2,118,400	1,713,500

[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.

TABLE II

Industry	Number of employees	Number of disabling injuries	Percentage of disabling injuries resulting in			Days lost per temporary total disability	Frequency rate	Severity rate
			Death and permanent total disability	Permanent partial disability	Temporary total disability			
Chemical products	543,268	17,301	1.2	4.0	94.8	17	14.3	1.7
Food products	453,793	31,599	0.3	4.2	95.5	14	27.1	1.8
Iron and steel and their products	1,269,857	70,440	0.6	4.3	95.1	21	24.3	1.8
Lumber, lumber products and furniture	290,711	26,811	0.6	4.5	94.9	17	40.4	3.9
Machinery (not transportation)	1,413,759	50,091	0.2	4.9	94.9	17	16.7	1.0
Paper and allied products	245,348	14,901	0.5	3.1	96.4	16	25.3	1.8
Textile and textile-mill products	837,176	26,807	0.1	3.1	96.8	16	13.4	0.7
Transportation equipment	2,699,833	104,362	0.4	4.2	95.4	18	16.3	1.3
Ordnance and accessories	796,696	27,078	0.4	6.8	92.8	21	13.3	0.9
Transportation	244,660	18,894	0.6	3.9	95.5	18	33.2	3.5
All industries	11,515,169	472,875	0.5	4.4	95.1	17	18.4	1.4

with 1943; and the permanent disability cases, 1,700, the same as in 1943. Permanent partial disability cases numbered 94,000, a decline of 13 per cent.

The distribution of accidents by industry group is shown in table I.

Figures for some of the individual industries making the largest contributions to the accident total are given in table II.

It will be seen that the average frequency rate for all industries is 18.4. Statistics for branches of industries with the highest frequency rates are given in table III.

The highest severity rates were those for vegetable and animal oils (8.4), logging (13.6), and stevedoring (10.6).

The percentages of fatal and permanent total disability cases in the accident total were highest for explosives (2.7), petroleum refining (2.0), cement (2.3), and highway construction (2.3). The corresponding percentages of permanent partial disability cases were highest for general machine shops (10.0), engines and turbines (11.2), miscellaneous rubber products (16.2), carpets and rugs (12.0), radios and phonographs (10.9), and small arms (10.5).

TABLE III

Industry	Number of employees	Number of disabling injuries	Percentage of disabling injuries resulting in			Days lost per temporary total disability	Frequency rate	Severity rate
			Death and permanent total disability	Permanent partial disability	Temporary total disability			
Food products:								
Breweries	54,759	5,745	0.2	8.1	91.7	15	46.2	5.9
Iron and steel and their Products:								
Enamelling and galvanizing	7,412	659	—	2.9	97.1	18	41.8	1.3
Foundries, iron and steel	187,417	18,982	0.4	1.5	98.1	15	43.0	2.3
Miscellaneous heating equipment	24,742	2,283	0.4	2.9	96.7	14	42.8	3.1
Plate fabrication and boiler-shop products	31,399	3,401	0.5	1.8	97.7	14	44.7	1.8
Lumber, lumber products and furniture:								
Logging	19,744	3,414	1.5	2.6	95.9	22	85.4	13.6
Sawmills	68,205	8,040	0.6	3.4	96.0	19	55.6	5.0
Wooden containers	42,347	4,552	0.4	5.4	94.2	15	47.1	3.7
Stone, clay and glass products:								
Brick, tile and terra cotta	27,838	2,532	0.9	2.0	97.1	16	43.9	3.9
Miscellaneous manufacturing:								
Brooms	1,763	165	—	—	—	7	42.9	0.6
Transportation:								
Stevedoring	40,431	5,545	0.5	3.9	95.6	23	88.1	10.6

United States Bureau of Mines

Studies on Explosives and Explosions 1944-1945 [1]

The studies fall into six main groups: I Inflammability of gases and vapours; II Investigation of hazards in the use of Diesel engines underground; III Explosives control (properties of materials); IV Explosives research; V Chemical and physical tests on explosives; and VI Storage of explosives.

The studies on inflammability related chiefly to isobutane-air mixtures, benzene-air mixtures, benzene-air-nitrogen mixtures, benzene-air-carbon dioxide mixtures, the prevention of explosion of inflammable mixtures by adding inert gases or reducing the oxygen content, the effect of pressure on limits of inflammability of natural gas, and acetylene-generator explosions.

The researches described under IV, Explosives Research, are concerned with the sensitivity of explosives to initiation by electrostatic discharge; charge limits for permitted explosives; effect of the condition of the borehole, the method of loading and the charge weight on the probability of ignition; properties of potassium perchlorate-charcoal-oil mixtures and explosibility of potassium perchlorate; effect of sheaths on gaseous products from permitted explosives; and black powder.

[1] U.S. Bureau of Mines: *Studies on Explosives and Explosions: Fiscal Year 1945.* R.I. 4031. Washington, October 1946.

TABLE I

Cause group	Industry group								
	Total	Agriculture, etc.	Mining	Construction	Manufacturing	Trade	Finance, etc.	Transportation etc.	Services
Non-machine causes:									
Handling objects	27.0	19.2	19.1	25.0	28.5	29.0	23.2	32.6	21.7
Falls of persons	16.4	20.2	7.4	29.6	13.3	22.8	40.7	17.4	28.1
Vehicles	7.2	19.9	23.2	5.0	3.0	8.0	1.2	21.4	7.7
Falling objects	5.6	4.0	17.9	6.4	4.5	3.2	2.3	3.7	3.1
Hand tools	4.7	7.0	7.4	5.8	4.4	5.1	2.1	3.2	3.7
Striking against objects	4.4	1.2	1.9	4.1	4.8	4.8	5.4	3.7	4.4
Hot substances, flames	3.0	1.4	0.9	2.0	3.2	5.0	0.7	1.8	3.5
Occupational diseases	2.0	0.5	0.1	0.6	2.9	1.0	1.7	0.4	0.7
Explosions	0.8	0.9	0.8	0.4	0.7	1.1	2.4	0.5	1.1
Other non-machine causes	9.7	18.0	7.4	12.0	8.8	10.3	10.1	10.8	15.3
Machine causes:									
Power-working machines	14.6	5.8	6.4	4.5	21.1	6.2	2.6	2.1	6.9
Other machinery causes	4.6	1.9	7.5	4.6	4.8	3.5	7.6	2.4	3.8

Illinois

Industrial Accidents in 1944 [1]

The total number of industrial accidents reported in 1944 was 58,496 of which 453 were fatal.

The percentage distribution of these accidents by cause for the various industry groups is shown in table I.

The number of fatalities per 1,000 injuries reported was 7.7 as against 9.2 in 1943, 12.2 in 1942, 9.9 in 1941, 12.0 in 1940 and 11.3 in 1935.

Of the 453 fatal accidents, 126 were caused by vehicles, 64 by machinery, 60 by falling objects, 51 by falls of persons and 37 by explosions.

The percentage distribution of compensation costs by severity of accidents over the period 1940-1944 is shown in table II.

TABLE II

Year	Per cent. distribution by extent of disability					
	Permanent partial	Fatal	Temporary total	Permanent total	Disfigurement	Temporary partial
1944	70.1	11.6	15.4	1.2	1.7	Less
1943	69.8	13.4	13.2	1.9	1.7	than
1942	65.7	14.6	16.0	2.0	1.7	0.5
1941	66.9	14.2	15.4	1.7	1.8	
1940	65.7	15.6	14.7	2.4	1.6	

Table III gives information on actual compensation costs of cases closed during 1944.

TABLE III

Extent of disability	Cases closed		Compensation paid		
	Number	Per cent. total	Amount $	Per cent. total	Average per case $
Fatal	373	0.8	1,316,219	11.6	3,529
Permanent total	25	0.1	136,209	1.2	5,448
Permanent partial	15,177	31.6	7,927,595	70.1	522
Disfigurement	1,744	3.6	190,321	1.7	109
Temporary total	30,603	63.8	1,744,602	15.4	57
Temporary partial	37	0.1	3,747	0.0	101
Total	47,959	100.0	11,318,693	100.0	236

Cases closed during 1944 included 7,156 in respect of accidents with working machines. Particulars relating to the machines causing over 100 accidents each are given in table IV.

TABLE IV

Working machines	No. of cases	Average compensation per case $	Fatal and permanent total disability	Permanent partial disability			Temporary disability		
				No.	Average compensation $	Average days lost	No	Average compensation $	Average days lost
Punch press	776	411	1	584	523	32	191	52	25
Power saw	744	401	3	472	583	29	269	50	26
Emery wheel	623	213	—	356	342	15	267	41	21
Presses, n.o.c.	477	376	—	317	542	31	160	46	24
Lathe	449	241	—	273	366	21	176	46	23
Drill press	389	189	—	204	323	16	185	43	23
Cutters, n.o.c.	312	265	—	187	411	26	125	47	26
Milling machines	238	299	—	149	454	30	89	39	21
Mining machines	210	247	3	102	270	18	105	109	45
Rolls, n.o.c.	174	446	1	116	615	34	57	40	22
Shears	171	297	1	113	390	29	57	50	26
Planer	146	301	—	94	437	25	52	55	27
Portable power tools	140	219	—	57	460	28	83	53	26
Hammers, forging machines	117	400	1	66	609	31	50	45	22
Printing press	104	330	—	68	477	33	36	53	27

Further information on working-machine accidents is given in table V.

[1] Illinois Department of Labor, Division of Statistics and Research: *Annual Report on Industrial Accidents in Illinois for 1944*; for 1943 see *Industrial Safety Survey*, Vol. XXI, No. 4, p. 146.

TABLE V

Part of working machine	Adjusting machine, tool or work	Starting, stopping and operating machine	Cleaning and oiling machine	Repairing of machine	Breaking of machine tool or work	Flying objects set in motion by machine striking		All other	Manner of occurrence not reported	Total
						Operator	Person other than operator			
Point of operation. .	249	3,875	133	28	5	—	—	220	5	4,515
Belts	48	98	14	7	8	2	—	30	1	208
Counter-weights . . .	—	2	—	1	—	—	—	—	—	3
Cranks or eccentrics .	8	43	2	—	5	29	—	11	—	98
Flywheels.	5	11	1	1	1	1	—	4	—	24
Gears	15	67	16	3	—	—	—	13	4	118
Material worked on .	8	141	1	1	6	544	14	24	—	739
Set screws, keys, bolts	1	6	—	1	2	3	—	1	—	14
All other	84	466	42	19	183	254	9	255	2	1,314
Part of machine, not reported	5	61	9	3	—	7	—	13	25	123

Ohio

Accidents in 1944[1]

Figures for the industries with the largest numbers of accidents are given in table I. Employment figures are not published in the Industrial Accident Commission's report, but an idea of the frequency rates for the industries in question can be obtained by comparing accidents with payrolls. In Ohio all industrial injuries are reportable whether they result in loss of time or not.

[1] *1944 Annual Statistical Report*, issued by the Industrial Accident Commission of Ohio, Columbus, 1945.

Coal mining with a payroll of only $44,001,038 reported 4,747 accidents, of which 156 were fatal, 68 resulted in permanent disabilities, 1,726 resulted in temporary disabilities over seven days, 694 in temporary disabilities under seven days and 2,103 in no lost time. The total number of days lost was 1,085,606, more than in any other industry except metal goods, for which, however, the payroll was 24 times as large.

Table II shows the number of accidents and the time loss due to the six chief causes.

TABLE I

Industry	Payroll $	Accidents						Total days lost
		Fatal	Permanent disabilities	Temporary disabilities			Total	
				Over 7 days	7 days or less	No time loss		
Building erection and demolition	152,630,834	55	56	1,986	1,173	8,121	11,391	449,196
Chemicals and allied products	139,540,872	42	56	1,448	743	8,170	10,459	331,980
Foods and beverages . . .	126,259,347	44	88	2,399	1,530	9,303	13,364	393,502
Blast furnaces, steel works, rolling mills and shop fabrication	328,756,896	63	214	2,536	1,397	11,975	16,185	608,699
Machinery manufacture . .	460,160,264	35	252	3,251	2,532	19,182	25,252	458,944
Metal goods	1,052,955,574	186	952	12,509	8,668	69,764	92,079	2,075,589
Vehicles	393,691,424	29	160	2,864	1,224	17,155	21,432	370,653
Commercial	430,645,756	57	139	3,472	2,247	15,418	21,333	564,864
Care and custody of buildings and grounds	200,980,184	40	34	1,844	934	6,874	9,726	328,795
All industries	4,912,000,682	1,131	2,500	46,490	27,851	205,662	283,634	10,034,133

TABLE II

Cause	Accidents						Total days lost
	Fatal	Permanent disabilities	Temporary disabilities			Total	
			Over 7 days	7 days or less	No time loss		
Machinery	37	1,661	5,776	4,471	45,119	57,064	1,405,791
Hand tools	15	123	2,971	2,502	21,324	26,935	271,064
Bundles, barrels, boxes, benches, etc. . . .	28	34	4,591	2,260	13,774	20,687	332,102
Flying objects	—	5	159	612	12,302	13,078	14,223
Pipes, rods, sheets, plates	9	80	2,305	1,489	9,168	13,051	157,089
Other metal stock	7	94	3,710	3,101	28,703	35,615	209,306

REVIEW OF PERIODICALS

Engineered Color for Safety. By E. D. PECK. (*Safety Engineering*, December 1945, Vol. 90, No. 6, p. 14.)

This article discusses a survey of 46 plants which used the "colour dynamics system". The survey covered 17 different types of industrial and manufacturing activities, from aircraft and automotive production to assembly of electronic devices, including large scale operations such as textile production and food and drug preparation.

In analysing the information it was found that the basic characteristics of colour were being employed in three distinct, but integrated patterns as follows:

A. — The psychological characteristic of colour was used for—
   1. Inducing orderliness and cleanliness in the working area, or in other words, developing a sense of good housekeeping.
   2. Minimising the effect of weight or bulk.
   3. Changing the apparent physical proportions of an area or the visual elimination of an undesirable structural feature such as an overhead mass of pipes and girders.
   4. Changing the apparent temperature of a working area.

B. — The physical characteristic of colour was used for—
   1. Reducing eyestrain and body fatigue.
   2. Eliminating specific safety hazards.
   3. Minimising illumination maintenance costs.

C. — The symbolistic characteristic of colour was used for—
   1. Identification of machinery and equipment.
   2. Speeding production by adoption of colour codes, particularly for assembly line techniques.
   3. Improving the over-all morale of workers.

The author describes in some detail how colour was actually used, in the plants surveyed, to achieve the various purposes enumerated above. For instance colours were used to identify safe or dangerous parts of machines, to simplify complicated wiring jobs, to brighten machine shops, to promote cleanliness, to produce an effect of coolness or warmth, to reduce eyestrain, to improve illumination, etc.

Contact door een Ring. (*De Veiligheid*, November 1945, p. 22.)

The oil gauge rod of an automobile engine was jammed by the crank shaft, and to disengage it the engine had to be turned through part of a revolution. For this purpose the starter contact was actuated and the positive lead of the 6-volt battery disconnected. While the engine was being turned, the lead touched the positive terminal of the battery. While he was working, the driver made contact with his wedding ring between the cable shoe and the positive terminal of the battery and so the current required for starting passed through the ring. The ring fused on the cable shoe and the driver received a ring-shaped burn on his finger. The fused ring and the burned finger are shown in the accompanying illustrations.

FIG. 1

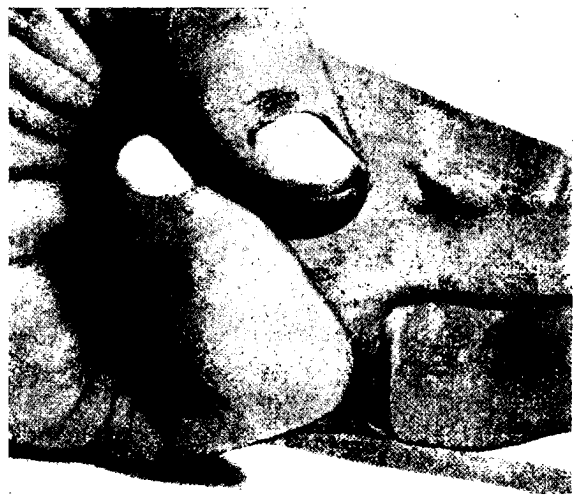


FIG. 2

Lighting in Hazardous Situations. By S. W. RICHARDS. (*The Iron and Coal Trades Review*, 23 November 1945, p. 809.)

The author first discusses the grouping of gases by degree of explosibility in relation to the use of intrinsically safe and flameproof electrical apparatus respectively. He then deals with the requirements to be satisfied by each type of apparatus in atmospheres laden with explosive dust, and finally turns to colliery lighting.

He refers in particular to the danger residing in the increase of heat due to the deposit of dust on flameproof fittings. This danger is particularly explicit where cellulose solutions may be used. Tests have been made under strict research conditions as to the effect of temperature rise by dust deposits. In one specific instance the normal temperature of the fitting was 34° C. but when fitting and glass were covered with dust, the temperature rose to 142° C. That has a threefold effect. Firstly, the danger temperature in cellulose would be far exceeded; secondly, the life of the lamp must be considerably shortened; and, thirdly, the danger of affecting the rubber and other insulation on the fitting is definitely increased.

No filament lamp can be considered inherently safe, but discharge types of lamp may be inherently safe if the current is automatically cut off when the tube breaks.

In factories lighting conditions can be improved by giving walls and ceilings a light-coloured and reflecting surface, and in some collieries improve-

ment has been sought by whitewashing. Very good results have been obtained in one colliery where main roads are sprayed daily by special portable sprayers. Tests have shown that as a result illumination has increased 67.8 per cent. Incidentally the manager of the colliery considers whitewashing to be the quickest and most effective method of removing coal dust from the roof and sides.

Hood and Booth Types Available to Solve Typical Ventilation Problems. By Arthur C. STERN. (*New York State Department of Labor Monthly Review*, Vol. 25, No. 1, January 1946.)

Describes with illustrations various types of canopy hoods, lateral exhaust hoods, booths with exhaust ventilation and down-draught exhaust equipment.

Precautions against Overwinding. By A. E. CROOK. (*The Institution of Mining Engineers, Transactions*, Vol. 105, Part 11, August 1946, p. 597.)

Mr. Crook, who is an Inspector of Mines, has written a substantial and well-documented paper on the technical problems of overwind prevention. He begins by reviewing the British regulations on the subject,[1] then briefly discusses overwind-prevention equipment and selected accidents due to overwinding, and concludes with a detailed consideration of the design and testing of protective equipment.

One of the major problems created by the regulations of 1937 was the application of the necessary additional braking power to existing winding engines. Trouble was also encountered with automatic overwind-prevention devices, most of which proved unsatisfactory.

An analysis of six serious overwinding accidents shows that all occurred on steam-winding engines, that the inadvertent application of power in the wrong direction is still the most frequent cause of accidents, and that some of the equipment installed subsequent to the Regulations of 1937 was not capable of preventing these accidents.

In connection with the design and testing of protective equipment the author deals with engine torque, brake torque, ancillary apparatus, speed-distance curves, and testing. He describes stringent tests that can be made without any danger to the winding plant.

Accident Prevention in the Brewing Industry. (*Monthly Labor Review*, July 1946, p. 72.)

The United States Bureau of Labor Statistics publishes an analysis of accident risks in the brewing industry together with recommendations for reducing the risks.

The greater part of the article is concerned with unsafe working conditions, which are divided into hazardous arrangements and procedures, defects causing accidents, and inadequate guards. Information is also given on unsafe acts, which include unsafe position or posture and use of unsafe equipment or using equipment unsafely.

The following general safety precautions are recommended as being likely to effect substantial improvements in the accident record of the brewing industry.

1. Machines and conveyors which carry bottles should be completely enclosed to eliminate the hazard of flying glass in the event of a bottle explosion.
2. The nip points on all power conveyors should be fully guarded and all conveyors should be equipped with rails or guides to prevent materials from falling from the conveyors.
3. The space under conveyors should be closed off so that employees cannot pass under them except at designated passageways. Where there is insufficient head room for passageways under conveyors, steps or stiles should be built to provide safe cross-overs.
4. Adequate guards should be provided at the point of operation of all machines and over all gears, pulleys, belts, or other moving parts of machines.
5. All delivery trucks and trailers should be equipped with steps and hand-holds to provide safe access to the body of the vehicles.
6. All bottles should be tested under pressure for strength before filling.
7. All barrels, cartons, and cases should be inspected for rough edges, projecting nails, and embedded pieces of glass or metal as well as for other defects.
8. All premises, equipment, and hand tools should be inspected frequently and immediately replaced or repaired if found to be defective.
9. Guard-rails or hand-rails should be installed on all platforms and stairways. Stiles over conveyors should have hand-rails on each side.
10. All portable ladders should be equipped with ladder safety shoes. Substantially anchored permanent ladders should be provided wherever frequent access to particular elevations is necessary.
11. Guide rails or runways should be provided wherever it is customary to move barrels or kegs by rolling. These runways should slope slightly toward the destination of the barrels to prevent their rolling back.
12. Nonslip surfaces should be provided in all working areas and on all stairways and steps.
13. Personal protective equipment should be provided where needed and employees should be required to use such equipment.
14. Adequate provision should be made for the safe removal of broken glass from machines, conveyors, and floors; and employees should be thoroughly trained in the safe performance of this function.
15. Mechanical equipment should be used in the moving of filled barrels, kegs, and cases wherever possible both in the plant and in making deliveries. Where mechanical equipment cannot be used, limits should be set upon the weights to be handled by individuals and adequate assistance provided when overweight or awkward materials must be lifted.
16. Housekeeping conditions generally should be improved, with particular attention to the prompt removal of tripping and slipping hazards.

The article deals in some detail with accidents due to the handling of loads, storage and piling of materials, poor housekeeping, falling and tripping, striking or being struck by objects, cleaning tanks, moving machinery, climbing in and out of trucks, defective floors, etc., defective vehicles and inadequate guards.

Safe Practices in Chemical Laboratories. By G. C. TOONE, K. H. FERBER and L. H. FLETT. (*Chemical and Engineering News*, 10 April 1946, p. 902.)

This is the text of a *Safe Practice Notice* that is given to new employees of the Allied Chemical and Dye Corporation, New York.

[1] The Coal Mines General Regulations (Winding and Haulage), 1937, summarised in *Industrial Safety Survey*, Vol. XIII, No. 6, p. 172.

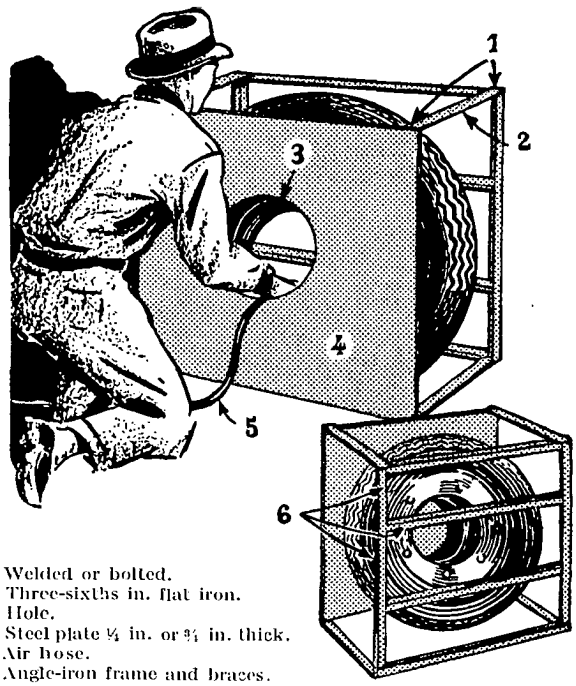
It deals first with safety equipment such as goggles, respirators, masks, fire extinguishers, emergency showers and medicine cabinets.

The second part is concerned with laboratory operations and contains 18 Sections on handling glass tubing and rods, cork borers, gas, agitators, electric furnaces, glass apparatus, extractions, suction flasks, vacuum distillations, Parr bombs, pipettes, spillage and residues, etc.

The third part on chemicals deals briefly with a few common types of dangerous substances.

Safe Tire Inflation. (*Ohio Industrial Commission Monitor*, Vol. XIX, No. 2, February 1946, p. 31.)

In order to avoid the recurrence of an accident in which a repairman was seriously injured by one of the lock rims flying off a newly repaired truck tire during re-inflation, the owner of a fleet of trucks in Youngstown, Ohio, made a cage like the one shown in the figure below in which to house the tire while inflating it. The cage is welded together from angle iron, the front consisting of a steel plate with a large opening through which the air hose is inserted.



1. Welded or bolted.
2. Three-sixths in. flat iron.
3. Hole.
4. Steel plate ¼ in. or ⅜ in. thick.
5. Air hose.
6. Angle-iron frame and braces.

An "Impossible to Guard" Power Press Made Safe. (*Ohio Industrial Commission Monitor*, December 1945, p. 190.)

The two illustrations demonstrate how a large plant solved the problem of guarding one of those so-called impossible guard jobs, giving some degree of safety to the operation of a power press.

The guard consists of two sweep arms, 11 inches apart, each travelling one-third of the distance necessary for a single-arm type, and a 12-inch wide fence to block the space between the arms, located 8 inches away from the danger zone.

The guarding device may appear inadequate because of the large openings in the guard but since the work is fed from the side, a mesh would be impractical as it would obscure the vision of the operator.

Fig. 1 shows the machine in the normal position

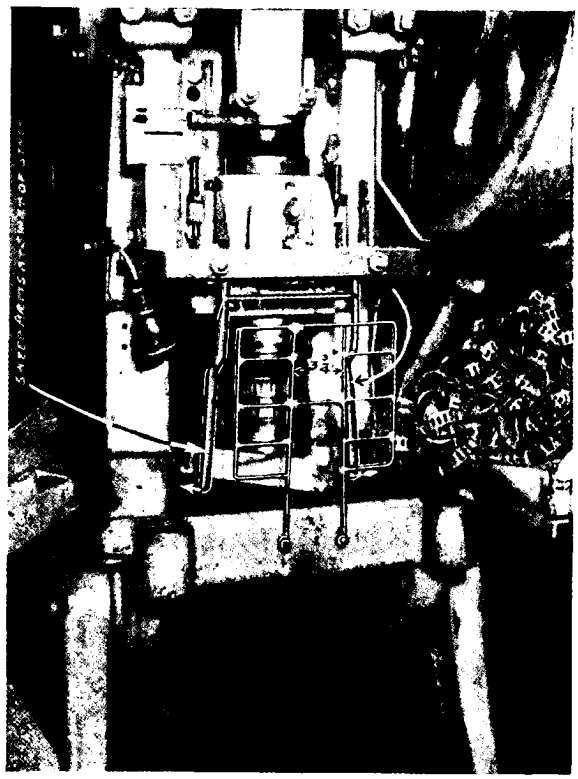


FIG. 1

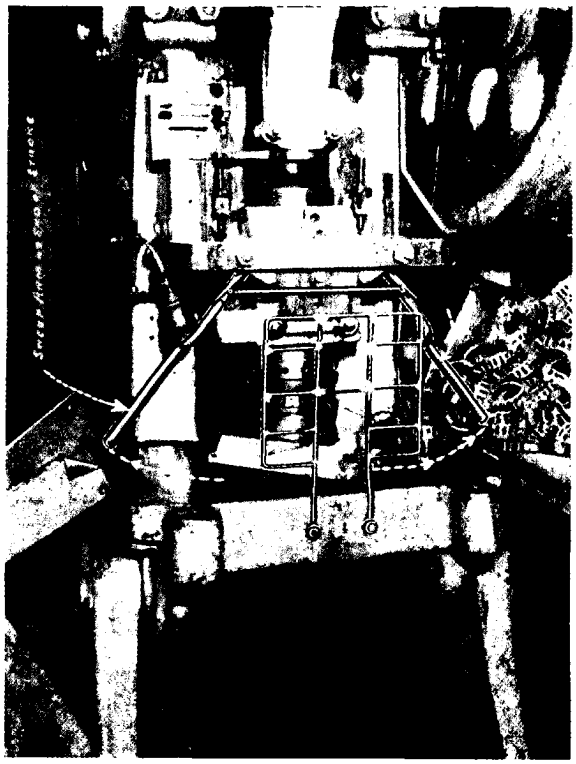


FIG. 2

for receiving the stock and fig. 2 shows it on the downward stroke and the arms at the limit of their travel.

Safeguarding Drop Hammers. (*Production and Engineering Bulletin*, November 1945, p. 401.)

Describes, with numerous illustrations, various types of props and catches for supporting tups while dies are being set, adjusted or oiled.

Safe Practices for Welders. By Don Hanna. (*Ohio Industrial Commission Monitor*, January 1946, p. 8.)

Briefly mentions the different types of welding and the risks arising from gases, solid particles, radiation and electricity.

Safety with Locomotive Cranes. By William R. Stewart. (*Marine Progress*, April 1946, p. 44.)

A useful recapitulation of the principal precautions to be taken in the operation of locomotive jib (boom) cranes used in shipyards and other industrial plants.

Guards on Industrial Machines. (*Production and Engineering Bulletin*, January 1946, p. 433.)

After briefly discussing the general problem of machine guarding, with special reference to general-purpose machine tools, the article describes with illustrations guards and other safety devices for dough-mixing machines, heel-making presses, printing presses and metal-working presses.

Mining Electrical Machinery. Intrinsically Safe Remote Control Circuits. (*Colliery Guardian*, 4 October 1946, p. 424.)

In a letter circulated to owners, managers, manufacturers and secretaries of owners', officials' and workmen's associations, H.M. Chief Inspector of Mines brings to their notice a possible source of danger recently revealed by research on the intrinsic safety of electrical apparatus.

Although certificates issued to manufacturers of switchgear for the remote control of coal-cutting machines, conveyors and shot-hole drilling machines signify that sparks which may be produced when the remote control circuit is broken will not ignite firedamp, recent tests have shown that by using a slow break, it is possible to ignite firedamp by the spark thus produced. Pending further investigation into the matter, the Chief Inspector recommends that the following precautionary measures should be taken:

(1) There can be no dangerous sparking unless a remote control circuit is deliberately or accidentally interrupted at contacts which are exposed to the atmosphere. The deliberate bridging of pilot and earth contacts, when the plug has been withdrawn from the socket, as a means of testing the operation of the remote control switch should be avoided.

(2) A remote control circuit includes an earthing conductor. Care should be taken to see that it is not interrupted by loose connections or faulty contact between the parts of a plug and socket coupler, and the continuity of the earthing conductor should be tested at frequent intervals.

(3) Plug and socket couplers are likely to be subjected to very rough handling. They should be examined daily and replaced as often as may be necessary, and in so far as this is practicable dispensed with altogether.

(4) Finally, there can, of course, be no danger of a firedamp explosion unless firedamp is present in the air. Therefore, look after the ventilation. This is specially important in fast ends, particularly if driven to the rise where electric drilling machines may be used.

Tubular Scaffolding. By W. R. Stewart. (*Safety Engineering*, April 1946, p. 22.)

The author emphasises the advantage of the tubular type of scaffolding over the built-up wood scaffolding in many industrial activities and especially in shipyards.

The tubular type of scaffold has been adopted in many shipyards, not only for the factor of safety involved, but for its compactness in storage. Another important feature is its fire-proof quality.

A detailed description of the type of scaffold used in shipyards is also given and the article concludes with the following rules that should be observed by erectors and safety inspectors:

(1) Bents (scaffold towers) should be braced at intervals of not more than 6 feet 6 inch centers by horizontal girts in two directions and diagonal braces longitudinally and laterally at each upright.

(2) The diagonal braces must be of sufficient length to reach at least one full sectional height of 13 feet.

(3) Should suitable provision be provided for connecting adjacent bents with 2-inch standard pipe as tie members, these same members on the front part of the bent may be used as a guard rail; they should not be located more than 40 inches or less than 36 inches above the spawl containing the work platform.

(4) There are two types of couplers for use in the erection of a bent consisting of tubular pipe; one is known as a fixed coupler and the other an adjustable swivel type. The spawl coupler is of special design to hold the channel iron. Spawl couplers should not be used at the upright joints.

(5) Uprights should be supported with a suitable footing of ample size to distribute the load, with braces to uprights, in order to prevent sway and vibration and support the bent in a rigid manner.

(6) It is recommended where scaffold is in use for an extended length of time, that periodical inspection of bolts be made for tightness.

Scaffold Ropes. (*Safety Engineering*, April 1946, p. 36.)

This brief article deals with the care and maintenance of ropes for light-weight swinging scaffolds, commonly used for painting, cleaning, repairing and other work, both inside and outside buildings.

Some of the main causes of deterioration of scaffold ropes are continual exposure to the elements, contact with sharp corners and rough surfaces, alternate wetting and drying, and friction resulting from passing through the blocks.

Ropes that have been used in connection with acid-cleaning operations should be specially inspected and tested. The acid is likely to soak into rope and destroy the strength of the inner fibres even though there may be little change in the external appearance of the rope.

In order to protect scaffold ropes against acid, it is recommended to have the free ends of the fall lines coiled in barrels on the ground.

Machines are available that can be mounted on swinging scaffolds to raise and lower them. These machines use steel suspension cables instead of fibre ropes and the cables are wound on drums, which are part of the machine, thus eliminating dangling rope ends which may be fouled and may pull the scaffold down.

The cables of these machines do not hang below the scaffold platform and thus are seldom affected by acid. However, for the prevention of possible damage by acid, as well as for lubrication, the

cables should be kept well coated with heavy grease.

Attention is also drawn to the storage of ropes and the effect on ropes of dry heat which may cause the fibres to become brittle. In hot dry weather an occasional wetting is considered to be beneficial to the ropes, provided that they are afterwards allowed to dry out naturally.

Characteristics of Unit Dust Collectors. By Arthur C. STERN and others. (*New York State Department of Labor Monthly Review*, Nos. 13, 14 and 15, August, September and October 1946.)

The authors describe the common characteristics of unit dust collectors, which combine exhaust and separating equipment, and lay down the requirements that a unit collector should satisfy as follows:

1. It should maintain not less than its rated air flow capacity in cfm throughout the collection of a reasonably large quantity of dust without requiring servicing, such as cleaning of air filters or emptying of hoppers.

2. Its effluent air should at all times have a dust count no higher than that of the atmosphere outside the factory building.

3. Cleaning of the filters or emptying of the hoppers should be simple and should increase neither room dust concentration nor effluent air dust concentration.

4. It should be quiet in operation.

5. It should be of substantial construction so that it will continue to meet the four previously stated requirements throughout normal use and operation.

6. It should not require: (*a*) filter rapping or shaking more frequently than once per eight-hour day; (*b*) hopper cleaning or filter brushing more often than once a week; (*c*) filter removal for replacement, washing or cleaning, more often than once a month.

The authors proceed to describe tests designed to determine the degree of conformity with the above requirements. The dust selected for the tests was obtained from a foundry tumbling mill exhaust system. The test equipment was designed to allow the simultaneous measurement of:

(1) Rate of air flow in cfm; (2) rate of dust feed in grains per minute; (3) dust count of effluent air, mppcf (million particles per cubic foot); (4) inlet static pressure of the unit, inches of water; (5) pressure drop across each dust collecting element in the unit, inches of water.

The test results are described and discussed. The authors conclude that they indicate a real need for standardisation of rating and sizing procedure, because they reveal a wide divergence between manufacturers' rated capacity and actual usable capacity. The tests also confirm the view that air from a dust collector can only be recirculated in the workroom under exceptionally well-controlled conditions. In fact only eight of the sixteen units tested had a visibly clean effluent and only one had an acceptable effluent dust count.

RECENT BOOKS

Labour Protection and Accident Prevention in the U.S.S.R. By N. ALEXANDROV. Published by *Soviet News*, London, 1946. 44 pp.

An illustrated booklet describing, in a series of interviews, various phases of industrial safety organisation and activities in the U.S.S.R. The subject matter ranges from the All-Union Central Council of Trade Unions, as the supreme authority for industrial safety in the Soviet Union, to safety organisation in the individual factory. Interesting information is given on the practical work of the various inspectorates and research institutions.

El Problema de la Prevención de Accidentes. Instituto Argentino de Seguridad. Pamphlet No. 56, Buenos Aires, 1946. 15 pp.

An interesting analysis of the losses resulting from accidents, the reasons for preventing accidents and the ramifications of accident prevention. The author discusses the human, social and economic aspects of accidents and their prevention, and shows how prevention is linked with other aspects of social life such as industrial hygiene, nutrition, housing and welfare generally.

Safety in Industry. Issued by the Department of Labour, Victoria. Melbourne, 1945.

This volume comprises a series of lectures delivered to inspectors of factories by Mr. H. A. Kinnish, Instructor, Department of Industrial Management, Melbourne Technical College. In a preface, the Secretary for Labour explains the *raison d'être* of the volume in the following terms:

> In presenting this series of lectures dealing with the subject of Safety in Industry, it may be necessary to explain that its production has been suggested by a disturbing increase, both in this State and elsewhere, in the incidence of mishaps in factories.
>
> It is significant that accidents due to the operation of machinery have not increased appreciably, a state of affairs accounted for, possibly, by the fact that machinery guarding and protection may be controlled, and have been controlled to a great extent, by external inspection. The serious increase in what may be termed "housekeeping" accidents, however, suggests that, for various reasons, there has been a deterioration in the internal control by managements, and in the co-operation of workers, with regard to safe working. The economic loss and necessary suffering caused by these mishaps are mainly beyond the power of any external inspection to prevent but, on the other hand, are almost entirely a matter for education of both executive and operative.
>
> With the object of further informing its officers in the principles of control by managements and of co-operation by workers, the Victoria Department of Labour sought the aid of the Melbourne Technical College, which, happily, was in a position to make available the services of an expert to deliver lectures to the Department's Inspectors.
>
> So highly instructive and educational were these lectures found to be that it has been decided to issue them, with the necessary modifications, in a form suitable for general publication. By this means it is hoped to give wide publicity to the necessity for a determined attack on the problem of industrial accidents and to point the way to such organisation within individual industries as will accomplish a substantial saving of the present losses suffered by the community, by the employer, and by the worker.

There are six lectures, of which the first is introductory and the other five deal, respectively, with accidents and their causes, accident control in manufacturing methods, plant maintenance, personnel control in accident prevention and works safety organisation.

Taken together the lectures constitute a compact accident prevention manual beginning with general principles and ranging over the technical, administrative, educational and psychological problems common to all industrial undertakings. As the Minister of Labour says in a foreword the volume should be of very great value to both employer and employee. It is also of great interest to all who work for industrial safety.

Effect of Relief Vents on Reduction of Pressures Developed by Dust Explosions. U.S. Bureau of Mines, Report of Investigations 3924. Washington, May 1946. 22 pp.

The report describes, with illustrations and graphs, experiments conducted with coal dust, wood flour, soybean, cornstarch, phenol formaldehyde resin, magnesium and aluminium.

A preliminary series of tests was undertaken to investigate the effects of various air pressures on the dispersion of dust, the position of the dust cups, the position of the source of ignition, the timing of ignition in relation to dust-cloud formation and the relation between dust concentration and explosion severity.

Then tests were made under different conditions of venting—free vent openings, single and multiple vents, vents with paper diaphragms, vents with diaphragm cutters, swinging panels and hinged doors. The results of the various tests are given in tabular and graphic form.

The principal findings are summarised as follows:

1. Aside from the chemical and physical properties of the dust, the violence of a dust explosion in a given enclosure is affected by the method of formation of the cloud, particularly as it influences the uniformity of distribution of the dust particles, by the position and nature of the source of ignition, by the timing of the ignition relative to the formation of the cloud, and by the concentration of the dust in the cloud.

2. Explosions initiated by short sparks are not as violent as those ignited by the flame from a small quantity of guncotton or other ignition source of similar intensity, when the flame initially raises the temperature of a greater proportion of the dust cloud to the ignition point.

3. Explosions initiated at the instant when all the dust is in suspension in the air produce higher pressures (provided the concentration is not too great) than explosions initiated either prematurely or after some of the dust has settled on the surrounding surfaces.

4. Under the test conditions, the several dusts produced the strongest explosions at definite concentrations, ranging in value from 0.2 to 0.5 ounce per cubic foot of enclosure.

5. Under similar test conditions the strongest explosions in the gallery were produced by dust clouds of stamped aluminium powder. Next in approximately decreasing order of intensity were explosions produced by magnesium, atomized aluminium, phenol formaldehyde resin, cornstarch, soybean protein, wood flour, and coal dust.

6. Data were obtained for all dusts tested, by aid of which the reduction of the maximum explosion pressures with increase in the area of unrestricted or free relief vents could be established. The relations were shown to be expressible by an exponential equation of the form:

where $P = Ae^{-kr}$

P = maximum explosion pressure;

r = ratio of relief vent area to volume of enclosure;

A and k = empirical constants, whose values were computed from the test data for each dust.

7. In this gallery explosions could be vented as effectively by several small, unrestricted vents as by a single vent whose area equalled the combined areas of the small vents. This will not necessarily be true of much larger structures or those of different shapes.

8. To release explosions through vents closed off by heavy-paper diaphragms, larger vent areas must be provided than are necessary for unrestricted or free vents.

9. Saw-toothed cutters placed along the peripheries or near the centres of paper diaphragms on vents greatly facilitate their rupture when an explosion starts and permit the use of smaller relief vents than are needed if no cutters are used.

10. Unrestricted rectangular vents were found to be as effective as square vents of the same areas. Square vents closed by heavy-paper diaphragms proved to be somewhat more effective in releasing explosion pressures than rectangular vents with similar diaphragms.

11. For releasing relatively slow explosions, as for coal dust, light, hinged, swinging panels are nearly as effective as unrestricted vents, but heavy swinging panels are not so effective. For rapid explosions, as with aluminium powder, even vents closed by light swinging panels must have larger areas than unrestricted vents for equal effectiveness.

12. Swinging panels are more effective than vents closed by heavy-paper diaphragms (without cutters) for releasing slow dust explosions. For rapid, violent dust explosions these two types of vents are about equally effective.

13. In using swinging panels, windows, or other hinged devices, care must be taken to prevent closure of the relief opening after the initial positive pressure wave of the explosion subsides, in order that destructively high negative pressures should not be developed in the explosion space.

14. The average and maximum rates of pressure rise and the impulses (pressure $\times$ time) in the experimental dust explosions decrease with increasing size of relief areas in about the same manner as do the maximum pressures.

Extinction of Gasoline Flames by Inert Gases. U.S. Bureau of Mines, Report of Investigations 3871. Washington, April 1946. 14 pp.

Describes, with numerous tabulations, the results of experiments with gasoline-laden atmospheres with admixtures of nitrogen, automobile exhaust gas, carbon dioxide, dichlorodifluoromethane (CCl_2F_2), trichloro-monofluoromethane (CCl_3F) and dichloromonofluoromethane ($CHCl_2F$). Gasoline-air mixtures can be rendered non-flammable by the addition of 42.4 per cent. nitrogen, 28.9 per cent. carbon dioxide, 12.4 per cent. CCl_2F_2, 11.1 per cent. CCl_3F, 15.6 per cent. $CHCl_2F$ and 36.0 per cent. exhaust gas.

Explosion can also be prevented by limiting the percentage of oxygen in the atmosphere. No gasoline-air mixture is flammable when diluted with nitrogen until the oxygen content is below 11.6 per cent., when diluted with carbon dioxide until the oxygen content is below 14.4 per cent., when diluted with CCl_2F until the oxygen content is below 17.6 per cent., when diluted with CCl_3F until the oxygen content is below 17.9 per cent. and when diluted with $CHCl_2F$ until the oxygen content is below 17.2 per cent.

Thus volume for volume, CCl_3F is the most effective of the inert gases.

Employee Organization for Fire Safety. National Fire Protection Association. Boston, Mass. 1945. 40 pp.

The National Fire Protection Association has produced a very readable and useful pamphlet on the prevention and extinction of fires in industrial premises and the safety of personnel in case of fire. Many essentials are made clear by means of simple illustrations.

Brief sections on general precautions, planning and organisation are followed by more detailed recommendations concerning inspections of fire extinguishing equipment, watchmen, supervision of valves, repairs and alterations of extinguishing equipment, co-operation with municipal fire departments, fire alarm systems, plant fire brigades, fire drills and training, and procedure in case of fire.

Watch Your Step. Avoid Farm Accidents. U.S. Department of Agriculture, Safety Council. Miscellaneous Publication No. 608. Washington, 1946. 32 pp.

This is a brief general pamphlet on farm safety. It is suitably written in a conversational style and the principal precautions are well brought out in questionnaires. It deals with matters such as machinery, livestock, wells, ladders, railings, stairways, floors, doors, windows, roofs, poisoning, electricity, fire and motor vehicles.

Wetting-Agent Concentration in Water Solution Determined by the Drop-Number Method. U.S. Bureau of Mines, Information Circular 7351. Washington, March 1946. 6 pp.

Describes experiments made with a Traube's stalagmometer, and concludes that this instrument is suitable for determining the concentration of a wetting agent in solution.

Electronic Chronoscope for Measuring Velocities of Detonation of Explosives. U.S. Bureau of Mines, Report of Investigations 3879. Washington, March 1946. 18 pp.

For measuring the velocity of detonation of explosives under a wide variety of conditions the Bureau of Mines set out to design an instrument that could be used for intervals ranging from 10^{-6} seconds to one millisecond. The report describes with drawings and photographs the principles on which the instrument, an electronic

chronoscope, was designed, the details of its construction and the method of operation.

Operating Diesel Locomotives Underground in European Mines. U.S. Bureau of Mines, Information Circular 7378. Washington, September 1946. 13 pp.

Notes on practice in Germany, Belgium, France, Italy, Spain, and the United Kingdom. The conclusion is reached that Diesel locomotives have proved successful underground in both gassy and non-gassy coal mines and in metal mines. In gassy mines they appear to be safer than electric locomotives, provided that the ventilation is adequate.

Safe Practices in Mine Hoisting. Miners' Circular 61. U.S. Bureau of Mines. Washington, 1946. 55 pp.

The U.S. Bureau of Mines has produced a very comprehensive booklet on hoists and hoisting in mines, covering construction, maintenance, inspection and operation of hoisting equipment. It deals in particular with winding engines and their accessories, ropes, sheaves and drums, rollers, cages, safety catches, guides, winding operations and signalling, shaft sinking and precautions against fire and flood. The various operating recommendations made throughout the booklet are summarised in a set of 35 suggested safety rules for hoisting. The booklet is well illustrated and provided with a bibliography.

Accidents from Hoisting and Haulage in Bituminous-Coal Mines. Coal-Mine Accident-Prevention Course, Section 3. Miners' Circular 49. U.S. Bureau of Mines. Washington, 1946. 59 pp.

Section 3 of the bituminous coal-mine course is concerned chiefly with shafts, slopes, hoisting appliances (including ropes, cages and skips), haulage roads, locomotives, cars and haulage operations. It concludes with 32 haulage safety rules and a bibliography. There are 39 illustrations.

The Use of Wetting Agents for the Suppression of Airborne Dusts. The Monmouthshire and South Wales Coal Owners' Association. Eighteenth Report of the Coal Dust Research Committee. January 1946. 20 pp.

Describes tests with various wetting agents and discusses the economic advantages of such agents.

The Suppression of Dust from Pneumatic Picks. The Monmouthshire and South Wales Coal Owners' Association. Nineteenth Report of the Coal Dust Research Committee. May 1946. 24 pp.

Describes various types of picks and wetting appliances and the tests undertaken with them; concludes that dust from pneumatic picks can be suppressed by using wet picks and spraying appliances.

Report upon Lighting Performance of Safety Lamps in Coal Mines in Lancashire and North Wales. Ministry of Fuel and Power. Published by H.M. Stationery Office, London, 1946. 13 pp.

Observance by inspectors of Mines of the poor quality of light given by some safety lamps in use at coal faces and at rippings led the Ministry of Fuel and Power to have a special investigation carried out into the general conditions of lamps in the coal mines of Lancashire and North Wales, with special reference to maintenance in lamp rooms.

The report describes the methods of testing and the results of the tests.

In all 1,750 flame lamps and 3,120 electric lamps were tested. The general performance of the lamps is indicated in the following table.

Type of lamp	Percentage of lamps	Percentage of original candle power
Flame . . .	29	over 75
	24	60—75
	18	50—60
	15	40—50
	10	30—40
	3	20—30
	1	under 20
Electric . . .	24	over 75
	24	60—75
	16	50—60
	14	40—50
	11	30—40
	7	20—30
	4	under 20

Of 751 cap lamps tested 84 registered less than 20 per cent. of the approved candle power, 71 between 20 and 30 per cent., 71 between 30 and 40 per cent., 83 between 40 and 50 per cent., 134 between 50 and 60 per cent., 243 between 60 and 75 per cent., and 65 over 75 per cent.

Test results improved considerably at mines where maintenance of the lamps was improved.

An appendix to the report includes a brief discussion of causes of deterioration in lamp performance and recommends that lamp rooms should be staffed by trained personnel.

Explosions and Fires in Bituminous Coal Mines. Coal-Mine Accident Prevention Course, Section 4. U.S. Bureau of Mines, Miners' Circular 50. Washington, 1946. 107 pp.

As regards explosions the main divisions of the course are concerned with ventilation, mine dusts, and prevention of gas and dust ignition.

In connection with ventilation the course deals with matters such as mine fans, aircourses, factors affecting mine resistance, crosscuts and stoppings, doors, overcasts, curtains and brattices, regulators, bleeder entries (return airways from old workings), testing mine air and detection and measurement of methane.

The part on dusts deals chiefly with methods of reducing the coal-dust hazard (water, rock dusting, etc.)

The matters treated in connection with the prevention of gas and dust ignition include miners' lights, smoking, explosives and shotfiring, and electricity.

The second division of the course, on mine fires, discusses the chief causes of fires, fire prevention, fire control, and fire-fighting equipment and organisation, including rescue organisation.

There are 57 illustrations of fans, ventilation arrangements, recording and testing instruments, water spraying and rock dusting equipment, miners' lamps, breathing apparatus, etc.

The course concludes with a substantial bibliography.

Mine Rescue Life-Line Telephone Assemblies. U.S. Bureau of Mines, Report of Investigations 3875. Washington, March 1946. 11 pp.

Describes assemblies used by some metal mines and also an assembly designed by the Bureau for use in explosive atmospheres in coal mines. The Bureau's assembly has no batteries. Chest or throat transmitters are used and these are powered by vibrations originating in the larynx.

There are numerous drawings and photographs.

Flood-Prevention Projects at Pennsylvania Anthracite Mines. U.S. Bureau of Mines, Report of Investigations 3868. Washington, March 1946. 25 pp.

Describes various projects undertaken by the Bureau of Mines in the Pennsylvania anthracite region where flooding is a serious problem. At some mines 30 tons of water had to be pumped for every ton of coal produced. An engineering study of the whole problem is contemplated.

Some Safety Practices for Metal Mines, Non-metal Mines (other than Coal), Mills, Metallurgical Plants, and Quarries. U.S. Bureau of Mines, Information Circular 7387. Washington, September 1946. 56 pp.

In this Information Circular the U.S. Bureau of Mines publishes a very substantial code of safety regulations in three parts relating respectively to surface conditions; mining methods, conditions and equipment; and general safety conditions.

The first part contains 12 sets of regulations on mills and metallurgical plants; open pits, quarries, surface excavations; head frame; hoisting; cages and shafts; steam and compressor plants; storage of equipment and materials; surface fire protection; etc.

The second part has 10 sets of regulations on timbering, explosives and blasting, ventilation, hand loading, surface and underground haulage, electricity, machinery, fire protection and miscellaneous hazards.

General safety conditions are covered by four sets of regulations on supervision, safety organisation, safety rules and standards, and first aid and mine rescue.

Fires, Gases, and Ventilation in Metal Mines. Metal-Mine Accident-Prevention Course. Section 5. Miners' Circular 55, U.S. Bureau of Mines. Washington, 1946. 94 pp.

This Section of the metal-mine course opens with descriptions of some notable mine fires and statistics of accidents due to fires. The principal causes of fires are discussed.

Under the head of "Control and Extinguishment of Metal-Mine Fires", the circular deals with fire-fighting equipment, protective equipment for men, fire-fighting organisation and procedure and fire prevention.

The circular then goes on to discuss the occurrence and detection of gases in metal mines, ventilation and explosion hazards.

There are 42 illustrations and a bibliography.

Electrical and Mechanical Hazards in Metal Mines. Metal-Mine Accident-Prevention Course, Section 6. U.S. Bureau of Mines. Washington, 1946. 82 pp.

This section of the metal-mine course is in three parts: prevention of electrical accidents, prevention of mechanical accidents and falls of persons.

Part I discusses statistics of electrical accidents, electric shock, electrical hazards, guarding trolley and bare power lines, grounding electrical installations, and safety standards for installing and using electrical equipment.

According to the statistics quoted, during the period 1931-1943, 58 persons were killed and 634 injured in electrical accidents underground in metal mines. The fatal accidents represent 2.8 per cent. of all fatal accidents underground and the non-fatal accidents 0.4 per cent. of all non-fatal accidents underground. In open-cut metal-mine operations during the same period 20 persons were killed and 82 injured in electrical accidents. In these operations electricity accounted for 9.9 per cent. of all fatal accidents and 0.9 per cent. of all non-fatal accidents.

The principal electrical hazards considered are shock, burns and fires.

The safety standards are in the form of regulations and comprise 80 sections dealing with general precautions, circuits and conductors, stationary equipment and portable equipment.

Part II, Prevention of Mechanical Accidents, discusses accident statistics, causes of mechanical accidents, and mechanical safety practices. It does not deal with hoisting or haulage equipment, but is confined to machinery, hand tools, drills, power shovels and falls of derricks and cranes. During the period 1934-1944, these causes accounted for 86 fatal and 28,594 non-fatal accidents.

Details are given in the table below.

Kind of mechanical accident	Underground mines				Open-cut mines				Total			
	Killed	Per cent. of total	Injured	Per cent. of total	Killed	Per cent. of total	Injured	Per cent. of total	Killed	Per cent. of total	Injured	Per cent. of total
Machinery . . .	42	2.4	6,011	4.8	14	7.3	749	8.9	56	2.9	6,760	5.0
Hand tools . . .	6	0.3	10,273	8.1	0	0	954	11.3	6	0.3	11,227	8.3
Drilling	13	0.8	10,202	8.1	—	—	—	—	13	0.7	10,202	7.6
Power shovels . .	—	—	—	—	8	4.1	338	4.0	8	0.4	338	0.25
Falls of derricks, etc.	—	—	—	—	3	1.6	67	0.8	3	0.1	67	0.05
Total .	61	3.5	26,486	21.0	25	13.0	2,108	25.0	86	4.4	28,594	21.2
Total, all causes	1,745		126,339		192		8,416		1,937		134,755	

At underground metal-mine operations during the period 1931-1943, machinery accounted for 52 fatal and 6,633 non-fatal accidents, respectively 2.5 per cent. of the fatal accident total and 4.6 per cent of the non-fatal accident total. At open-cut metal-mine operations during the same period, machinery accounted for 14 fatal accidents (6.9 per cent. of the total), and 817 non-fatal accidents (8.4 per cent. of the total).

The mechanical safety practices deal with general precautions, guarding machinery, air compressors, air receivers, air lines, machine drilling, slusher hoists (scrapers) and shovel loaders and hand tools.

Part III, Falls of Persons, discusses aceident statistics and protection from falling (manways and ladderways, shaft openings, etc., slipping and stumbling, work on high places).

At underground metal-mine operations during the period 1931-1943, falls of persons accounted for 355 fatal accidents (16.9 per cent. of the total) and 9.769 non-fatal accidents (6.7 per cent. of the total). At open-cut operations the fatal accidents numbered 14 (6.9 per cent. of the total) and the non-fatal 1,205 (12.6 per cent. of the total).

There are 44 illustrations and a bibliography.

Safe Storage, Handling, and Use of Commercial Explosives in Metal Mines, Nonmetallic Mines, and Quarries. U.S. Bureau of Mines, Information Circular 7380. Washington, 1946. 30 pp.

Brief introductory sections are followed by descriptions of mining explosives (including dynamites, liquid explosives and black powder), detonators and igniters, fuses and blasting machines, together with safety hints on their use. Next the paper deals with the storage, transport and use of explosives (shotfiring). It concludes with descriptions of typical blasting accidents.

Report on the Investigation of the Fire at the Liquefaction, Storage and Regasification Plant of the East Ohio Gas Co. Cleveland, Ohio, October 20, 1944. U.S. Bureau of Mines, Report of Investigations 3867. Washington, February 1946. 44 pp.

This fire, which was caused by the failure of an insulated cylindrical tank holding liquefied natural gas at a temperature of -250° F. and a pressure below 5 lb. per square inch, resulted in the loss of 128 lives, between 200 and 400 non-fatal injuries and property damage estimated at $6,800,000.

The report describes with numerous illustrations the plant, the liquefaction and regasification process used at the plant, the storage tanks, the conditions at the time of the fire, the fire itself and the results of laboratory tests on gases and steel.

The causes of the fire could not be definitely ascertained and various possibilities are discussed.

The report concludes with the following recommendations:

1. Plants in which large quantities of flammable gases are liquefied and stored should be isolated and activities not directly related to the operation of the liquefaction and storage plant should be prohibited within the plant area. The distance between the boundary of such plant and the nearest inhabited building should be greater than half a mile.

2. Storage containers for liquefied gases should be isolated from other parts of the plant and should be provided with dikes large enough to confine the entire contents of the tank in the event of a failure. The construction of dikes and the distances between tanks should conform with the "Suggested Flammable-Liquids Ordinance" given in the National Fire Codes of the National Fire Protection Association.

3. Additional studies on the properties of metals at low temperatures should be made, and industry should be encouraged to publish existing data on the subject.

4. The construction of a storage tank for liquids at low temperatures similar in design to No. 4 storage tank using low-carbon, 3½ per cent. nickel steel, should not be undertaken unless the cause of the failure of No. 4 tank is definitely established and unless it can be proved beyond doubt that the properties of the steel were suitable for the particular design in question.

5. All pipe lines carrying cold liquid or cold gas should be furnished with suitable bolted flanged joints. Expansion loops capable of taking care of pipe movement due to changes in temperature should be provided.

6. Storage tanks for liquefied gases should be provided with independent inlet and outlet lines for the liquefied gas. The inlet line should discharge at a point near the maximum liquid level in the tank.

7. Extreme precaution should be taken to prevent spilled liquefied gas from entering storm sewers or other underground conduits.

8. The appearance of frost spots on the outer shell of storage containers for liquefied natural gas should be regarded with suspicion, and the tank should be drained and thoroughly inspected, unless the reason for the appearance of the frost spot can be definitely established.

9. Efforts should be made to prevent wide variations of temperature in the inner shell of storage containers when they are filled for the first time with liquefied gas.

10. Although closely coupled equipment is desirable in low-temperature refrigeration processes, nevertheless some dispersion is indicated when such hazardous material as highly inflammable gases in the liquid state is handled.

11. In future designs of storage containers for liquefied natural gas, provisions should be made for remote closing of the foot valve from a point at ground level.

12. Positive and fool-proof liquid-level indicators should be provided for each storage container. These indicators should be equipped with automatic high and low-level alarms.

13. When possible, the tops of the vent gas lines of all storage tanks for liquefied gas connected to the same manifold should be at the same level, so that accidental leakage of liquid from one tank to another would never result in the overflowing of liquid into the vent gas system. When this is not possible, extreme precautions should be taken to prevent leakage of liquid from one storage container to another in which the level of the liquid is lower. Containers for storage of liquefied gases should not contain liquid in excess of their rated capacity. The liquid level in any tank connected to a common liquid manifold should always be at least 1 foot below the top of the lowest overflow in the group of tanks.

14. All outer portions of storage containers for liquefied natural gas should be readily accessible to inspection and should be in the open to permit proper ventilation.

15. The gas purged through the annular space of storage containers for liquefied natural gas should be metered both into and out of these containers.

16. All sources of electrical ignition should be eliminated in and around gas-liquefaction plants. This hazard should be safeguarded to the extent considered necessary in modern explosive plants. Precautionary measures in such plants include protection against lightning, elimination of static charge on machinery, equipment and persons, and the use of explosion-proof electrical equipment and wiring throughout hazardous areas.

17. Means should be provided for rapid egress of personnel from the plant area in case of emergency. Escape drills should be held frequently and damage-control drills should be held after types of damage that might possibly be repaired with safety have been established.

Memorandum on Arc Welding. Factory Department, Ministry of Labour and National Service, Form 329, Fourth Edition. London, 1945. 14 pp.

The memorandum deals with protection against electrical risks; protection against other risks such as radiations, fumes, hot metal and ignition of flammable materials; and protective shields, screens and clothing.

In connection with electrical risks the memorandum discusses circuit voltage, earthing and return conductors, protection of circuits, electrode holders, cables and cable couplings, etc.

Memorandum on Safety Measures Required in the Use of Acetylene Gas and in Oxy-acetylene Processes in Factories. Revised Edition. Factory Department. Ministry of Labour and National Service, Form 1704. Published by H.M. Stationery Office. London, 1946. 10 pp.

This is a slightly revised version of the edition of 1944 which was reviewed in *Industrial Safety Survey*, Vol. XXI, No. 3, July-September 1945. On that occasion the safety precautions relating to generators were reproduced in full. The precautions also include general provisions and provisions relating to calcium-carbide stores, gas cylinders and other apparatus.

These provisions now read as follows:

Carbide Stores and Acetylene Generating Plant

1. At premises licensed for the storage of carbide, a notice must be posted in compliance with the law setting forth the conditions attached to the Licence which have to be observed by employees.

2. Where carbide is stored in a generator house or shed, it is important that the carbide should be kept on a raised platform in order to keep it dry. Drums containing carbide should be opened in a dry place; a special cutting tool, similar to the domestic tin-opener, should be used for opening and not a hammer and chisel; care should be taken to avoid the production of sparks.

Where drums of carbide are stored, the store should be provided with a suitable rainproof vent to atmosphere so as to prevent the accumulation of acetylene.

It is dangerous to leave carbide drums exposed to rain. Drums which have been left in the rain or rolled through or over surface pools of water in works yards are liable to explode when opened.

. . . . . .

Cylinders

18. Cylinders of oxygen and dissolved acetylene should not be subjected to rough usage, excessive shocks, or local stresses, or exposed to high temperature. Cylinders should not be stacked too high in dumps or under heavy weights.

It is desirable:

(*a*) that the store or shelter for reserve stocks of cylinders containing compressed gases should be of fire-resisting construction;

(*b*) that no inflammable material should be stored in the building or in the immediate vicinity of the cylinders;

(*c*) that the shelter should be so placed that in the event of fire in the works the cylinders may be readily removed.

19. Cylinders should never be allowed to fall from a height. Slings should not be used for removing several cylinders in one load; a proper platform or carrier should be used instead, whether the cylinders are full or empty.

20. Cylinders should never be stored in positions where grease or oil, which are spontaneously combustible in the presence of oxygen, are likely to come in contact with the valves or gas connections. For the same reason grease or oil should not be used in connection with valve fittings, etc.

Explosions occasionally occur in the regulators on oxygen cylinders as a result of grit, grease or oil getting into the socket of the cylinder valve and being projected on to the regulator valve seating when the cylinder valve is opened. It is important to see that the sockets of cylinder valves are clean before the reducing valves are attached, and also that the cylinder connecting piece on the regulator is free from dirt or oil. The outlet sockets of cylinder valves can usually be cleaned by turning on the valve momentarily and closing soundly.

21. Properly designed automatic pressure regulators and pressure gauges should be fitted to both oxygen and acetylene cylinders when in use. Special care should always be taken to open cylinder valves very slowly and cautiously: any leakage of oxygen or acetylene should be stopped at once, or the cylinder should be removed to a safe place.

Before putting a regulator on to a full cylinder, always release the adjusting screw for regulating the pressure of output — otherwise there is a risk of damage to the regulator.

Other Apparatus

22. A blowpipe of the injector type intended for use with low pressure should not be used in connection with high pressure acetylene unless a suitable control valve is fitted. A blowpipe of the non-injector type intended for use with high pressure should not, on any account, be used with low pressure acetylene.

23. (*a*) Blowpipes should be connected to the oxygen and acetylene supply pipes by stout canvas reinforced-rubber hose; to avoid confusion in making the connections, the acetylene hose should be coloured red and the oxygen hose black.

(*b*) Hose should be firmly attached to the blowpipe and other connections by clips or other suitable means. Frequent accidents occur due to leakage or to the supply tubes becoming loose or being blown off; the connections should be frequently examined.

(*c*) The supply of both gases should be cut off when changing either the blowpipe or the oxygen or acetylene cylinder.

24. (*a*) All blowpipes and other apparatus should be dismantled and cleaned internally at regular periods, preferably by the makers. Maintenance of the apparatus in proper working order

will tend to avoid back-firing and stoppage of work.

(*b*) Accumulation of slag on the blowpipe-tip should be frequently removed. No attempt should be made to alter or clean the blowpipe-tip by a hard metal reamer; only hard wood sticks or soft brass wire should be used for this purpose.

25. Cylinders should not be used to support the work, nor should the blowpipe flame be allowed to come in contact with the cylinders. The blowpipe when alight should not be hung on the cylinder or on the regulators.

26. Leather gloves or gauntlets should be used when necessary. Goggles fitted with tinted glass eye-pieces, which can be removed for replacement as required, should be provided for all oxy-acetylene workers, and properly worn by them whilst at work. An operator should not wear articles such as goggles, collars, etc., made of celluloid or similar inflammable material.

General

27. Ample means of a thorough ventilation should be constantly maintained in welding shops, and special provision should be made for ventilating confined spaces in which acetylene is used.

The contact of an acetylene flame with a large mass of cold metal for a long period may lead to the formation of nitrous fumes from the atmosphere; these fumes may be dangerous and even fatal if breathed for a period. Where, under these conditions, proper and adequate ventilation is not available, workers in confined spaces should be provided with suitable breathing apparatus. Ventilation should be obtained by changing the air in the confined space by means of suction fans and not by blowing fresh air into the confined space.

28. The equipment should be so arranged that the main control valves on cylinders or generators are readily accessible in case of emergency.

29. Oxygen should not be used for the purpose of clearing fumes in a confined space. Such use has caused fatal accidents through the worker's clothing becoming ignited.

30. Where acetylene has to be used in confined spaces special precautions should be taken to prevent leakages which may lead to serious accumulations of gas during intervals in the work such as meal times, etc. The gas supply should be turned off and *the blowpipe should be removed from the confined space until work is resumed.*

31. Portable fire extinguishers or buckets of sand should be provided in readily accessible positions where oxy-acetylene work is carried on.

32. Accidents have occurred where acetylene has been generated by placing carbide and water in a pipe line, the gas so evolved being used for testing instead of using the usual smoke testing apparatus. Testing drains, pipe lines or engineering plant by acetylene or other inflammable gas is a dangerous practice and should not be permitted.

33. Before repairs are started in connection with any tank, etc., which has contained inflammable liquids, precautions must be taken to ensure that all traces of inflammable vapour have been removed Rinsing with cold water is not sufficient.

34. Young persons under the age of 16 should not be allowed to recharge or use acetylene plants except under proper supervision. No person should be allowed to do work of this kind unless he has been carefully instructed.

Safety of Machine Tools and other Plant. No. 1, Fencing of Drilling Machine Spindles, Chucks and Tools. Factory Department, Ministry of Labour and National Service, Form 291, Published by H.M. Stationery Office. London, 1946. 16 pp.

The latest edition of this pamphlet contains 16 drawings of telescopic and other guards.

Safe Use and Storage of Gasoline and Kerosene on the Farm. U.S. Department of Agriculture. Published by the U.S. Government Printing Office, 1945. 14 pp.

A brief description is given, in this pamphlet, of hazards in the use and storage of petroleum and petroleum products. Apart from the general recommendations the pamphlet describes the methods of extinguishing gasoline and kerosene fires with appliances recommended for fighting such fires.

The pamphlet, issued originally in 1932, was revised in May 1945.

Inspection Standards for Strip Mines (Coal and Lignite). Revised October 1945. U.S. Bureau of Mines, Information Circular 7350. Washington, March 1946. 32 pp.

The standards were prepared for use in the Federal inspection of strip mines. They relate to surface structures and operations; stripping and drilling overburden; explosives, detonators and blasting; haulage; electricity, mechanical equipment; lighting; protective clothing; and general safety organisation, including first aid.

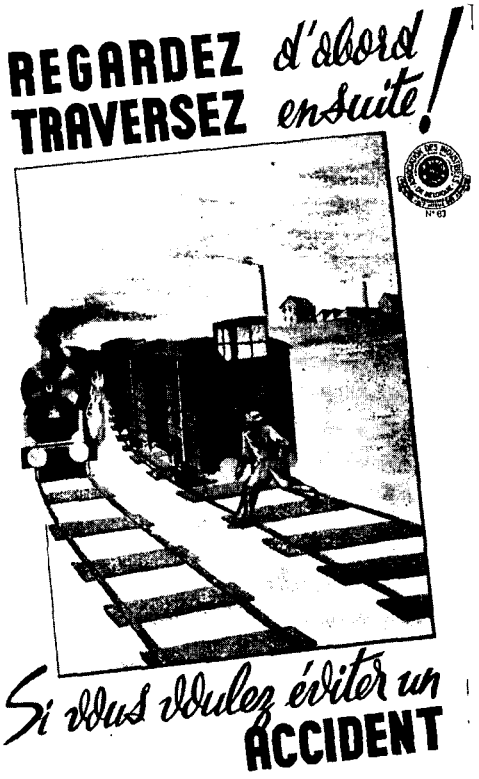
Works Accident Statistics. The Royal Society for the Prevention of Accidents, Safety Organisation Pamphlet No. 4. London, 1946. 7 pp.

As part of its new industrial service the Society is revising and extending its series of Works Safety Pamphlets. In future it is planned to have two series of pamphlets—safety organisation and technical. The present pamphlet is a revised version of Works Safety Pamphlet No. 2, originally published some years before the war.

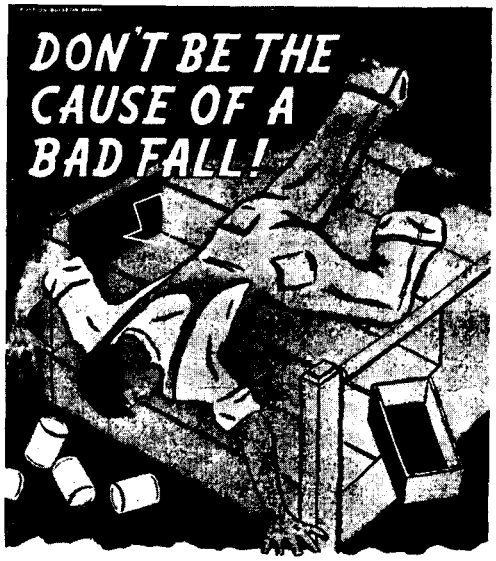
The pamphlet now consists of four parts: I An introduction to the subject of works accident statistics; II An explanation of the system recommended; III Notes on useful additions to the basic system; and IV Advice on the collection and use of data.

All undertakings are recommended to compile frequency and severity rates, the frequency rate being the number of lost-time accidents per 100,000 man-hours worked, and the severity rate being the number of man-hours lost per 100,000 man-hours worked. Suggested additional measures are the compilation of statistics of accident causes and of the nature and location of injuries.

NEW POSTERS



Look first, then cross if you wish to avoid an accident.
(Belgian Manufacturers' Association, Brussels.)

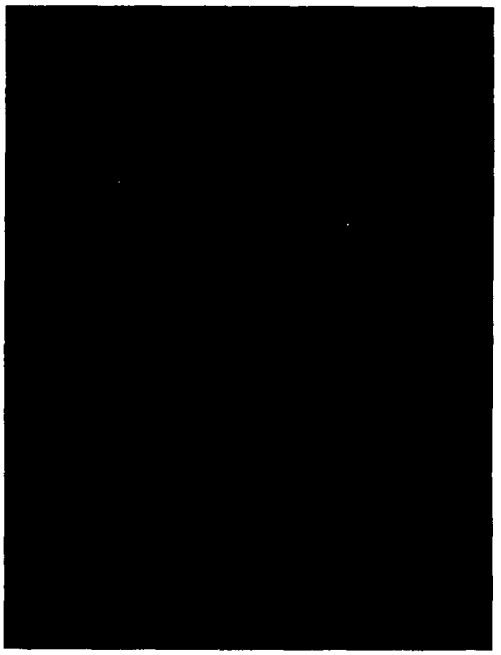


KEEP AISLES AND STAIRWAYS CLEAR!

(Employers' Mutual Liability Insurance Company of Wisconsin, Wausau.)

WHAT *You* SEE . . .

WHAT A *Blind Man* SEES



WEAR YOUR SAFETY GOGGLES

(Willson Products Incorporated, Reading, Pa.)