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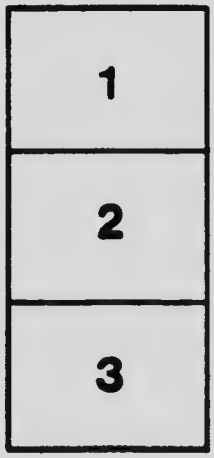

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Canadian National Safety League

Papers Presented At

THREE-DAY SAFETY CONVENTION

KING EDWARD HOTEL

TORONTO

13, 14, and 15 APRIL, 1920

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of

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An Accident
is an
Economic Loss
to the
Whole Community

FIRST ANNUAL MEETING
CANADIAN NATIONAL SAFETY LEAGUE
and
SIXTH ANNUAL MEETING
ONTARIO SAFETY LEAGUE

KING EDWARD HOTEL, TORONTO
13TH, 14TH AND 15TH APRIL, 1920

Following the annual meetings of the two leagues on the 13th April, 1920, the five half-day sessions were devoted to technical papers.

FIRST SESSION, TUESDAY AFTERNOON, 13TH APRIL, 1920.

W. H. Shapley, Toronto, Chairman.

Mr. W. H. Shapley, chairman of this session, in his opening remarks, stated that a number of people who would have been at the meeting were doubtless at the funeral of the late Mr. C. A. B. Brown. He was of the opinion that the citizens of Toronto had been greatly impressed by the death of Mr. Brown, due to an automobile accident. He stated that the remedy for the present state of affairs lay in the hands of the citizens who should assume their responsibility and force the City Council to act. Mr. Shapley stated that every citizen should interest himself or herself in the work of the Safety League and should demand safer streets.

Mr. Shapley stated that the Ontario Safety League was doing a good work and should be encouraged, as the need for conservation was great, owing to the fact that Canada and the United States are the greatest wasters in the world. The chairman stated that "Produce and Conserve" should be the slogan for the day, as wastage is criminal. He then called on Dr. McCullough for his paper on "Industrial Hygiene."

Industrial Hygiene

By Dr. J. W. S. McCullough, Chief Officer of Health, Ontario

I have been invited to speak to you on the subject of Industrial Hygiene, which is a most important branch of preventive medicine, having to do with a large proportion of the population, the workers so-called. Most of us, except the very wealthy, are obliged to work, but while the well-to-do may choose their work, their manner of working, and their environment, the poorer amongst us often have to work to keep body and soul together at anything which will bring the means of livelihood, at trades which are unhealthy, in poor quarters and under conditions which take a toll of life and health greater than the actual work itself. It is in the utilization of the principles of industrial hygiene that work and the conditions of work may be improved and the worker compelled to seek occupation in unhealthy industries may find the conditions so improved that the dangers to his health and life may, in so far as possible, be mitigated or removed.

Workers on this continent have so far failed to reap the benefits of industrial hygiene to the extent these benefits have accrued to the workers of England and the continent. Some assistance has come through the efforts of organized labor which has exerted a good influence in limiting the avarice of the employer in shortening the hours of labor, in increasing wages, and in the improving of sanitary conditions, but much remains to be done.

Modern conditions of labor are very different from those of a century, a half-century or even of a generation ago. Machinery has worked miracles in labor, but with machinery has come increased danger to life. Of all the labor-saving machines invented, however, there is none so vital and indispensable in the production of wealth as the human machine—and at the same time there is none so sensitive and delicate. Both from the standpoint of humanity and the standpoint of economy the human machine deserves greater care and consideration than any other mechanism engaged in the production of wealth. Yet it is a fact that while the ordinary machine is oiled, cleaned and cooled and kept in the most careful repair, the human machine is expected to run day in and day out with no particular care on the part of the employer that this delicate mechanism shall be kept in constant repair. It has been the habit to work the human machine for all it is worth, which when worn out and dies, is forgotten the next day.

Certain industries are particularly dangerous to health, such as lead-poisoning in the manufacture of

white lead in painting, and in typesetting; of the phossy jaw in the use of white phosphorus; of caisson disease in divers and compressed air workers; in railroading, mining and among workers with explosives; there is particular danger to those working in dusty atmospheres, in the fumes of carbon monoxide, hydrogen sulphide or mercury. Certain diseases set up nervous conditions and infectious diseases such as anthrax, glanders, and hookworm, are acquired in certain occupations. Influences such as improper light, poor ventilation, lack of cleanliness, overcrowding, excessive hours, fatigue, and a hundred and one conditions may affect the health and efficiency of the worker.

The losses consequent upon the failure to maintain healthy conditions in places of employment fall upon both the employee and the employer. The former loses his health, the latter loses financially from the want of efficiency of the employee. It is well-known that the number of industrial accidents increase progressively as the day progresses, being fewer in the early morning, increasing towards noon, dropping after the noon period and again increasing towards evening. Thus it is seen that fatigue becomes a factor in accidents. Thus overwork is found to be a danger not only to the worker himself, but also to the public, whose lives may be endangered by the overworked train despatcher, trainman, conductor or engineer.

Minors

Most countries have laws limiting the age at which minors may go to work. This is a valuable measure not only for the protection of the health of children, but also in the interest of their education and development. Certain of the more dangerous trades should not be open to minors, such as lead-working, bronzing and cutlery grinding, naphtha works, textile factories, melting and annealing glass and many others.

Women

Women are not physically capable of doing the same work as men, particularly during the period of maternity and during menstruation. This is important not only in the interest of women alone, but it has an important bearing on the future of the race, it being well-known that the life and strength of the unborn child makes it necessary that women should be exempt from severe labor for several weeks before and after labor, the latter particularly because the baby needs the care and attention of its mother in order to thrive properly. Experience in the Lancashire district of England during the cotton famine and in the seige of Paris showed that in spite of privation the rate of infant mortality fell greatly in Paris 40 per cent below that of normal times, and in industrial centres like Fall River, Lowell and Lawrence, the infant mortality rate is twice as high as in similar towns without factories and no overcrowding.

No woman should be permitted by law to work at a dangerous trade. Saleswomen should be provided with seats and should have one or two day's rest each month. Women's work in the home needs supervision. Their work is "never done" and its results are seen in the anaemic, tired and worn faces of housewives which may be observed in every street of the city and in every country district. The long hours and close confinement of domestic servants, the excessive heat in cooking, the unventilated sleeping quarters, send large numbers of this class to hospitals and out door clinics.

Factory Inspection.

Factory inspection under a proper law and with inspectors who are familiar with the law, the process of manufacture, and having a good knowledge of preventive medicine is of the greatest value to the worker. The factors of ventilation, dust, gases, odors, temperature, moisture, light, cleanliness, overcrowding, drinking water, child workers, washing and toilet facilities to the proper capacity, hours of work and rest, are among the many which should engage the attention of the inspector. Physicians make the best inspectors, because they should know more about health conditions.

Preventable Accidents.

Of the preventable accidents those on railways in mines and factories are the commonest and most striking. On this continent there are something like 30,000 deaths of wage earners and 500,000 or more seriously injured in our industries every year. There are in America over 3,000 deaths annually of those engaged in mining operations. Much of this appalling disaster can be prevented. Fatalities are four times as common on our railroads as upon those in England. Indeed a railway disaster with us is an accident; in England it is a crime. In Belgium the death-rate in mines since 1840 has been cut to one-third of what it was in the previous decade.

Some special injuries incident to work are:

Spinal curvature from faulty posture; flat feet and varicose veins from prolonged standing, as in nurses and shop girls; injuries to the eyes from metal splinters or stone fragments; impairment of eyesight from poor lighting; eye strain in garment workers and miners; rupture of the eardrum in workers; ear disease in boilermakers and gunners; injuries to the skin by violence and in laundries; chilblains in cold storage workers; ulcers from X-ray or radium operators, most of which is preventable.

Lead.

In considering the various factors productive of injury to health of industrial workers, much of which may be readily prevented, that of lead poisoning is one of the most frequent, dangerous and insidious of all the occupations of man. We are apt to be impressed by an accident which has immediate and fatal consequences. For example, a pound of lead dropped from a height upon a man's head may easily prove fatal, but the daily ingestion of minute quantities of lead salts while slower, is equally fatal if means of prevention are neglected. The general population is liable to lead poisoning from various sources, such as drinking water conveyed by lead pipes; in canned goods from the solder; from foods cooked in lead-enameled utensils, or from handling lead or objects containing lead. Painters are very liable to lead poisoning. Young persons and women are very liable to lead poisoning, and as long ago as 1898 English law abolished female labor in the processes of the manufacture of white lead. Persons with hyperacidity of the stomach, those who fail to thoroughly cleanse their hands before eating, and alcoholics have no business dealing with lead. The most dangerous lead industries are the processes involved in the manufacture of red lead, the fumes and dust of which are dangerous in white lead manufacture from the dust raised in stripping the "white bed" and in the manufacture of pottery and earthenware in which the dangers from lead poisoning and lung disease such as "potter's asthma" are very great. The dust raised in file-cutting carries a large proportion of lead, and besides, considerable is carried from unclean hands in the process of this industry.

Besides the dangers from lead poisoning in the industries already mentioned, there are upwards of 100

others in which lead is more or less used and with consequent danger to the worker. Some of these are:

Making and selling wallpaper; polishing brass and nickel; finishing cut-glass; holding lead-covered nails while shingling, working with aluminum foil in lithography; wrapping cigars in tinfoil; enameling bath tubs, stopping holes in wood with white lead, assembling and recharging storage batteries; diamond cutting; painting and printing trades.

Prevention of Lead Poisoning.

The lead reaches the mouth and eventually the digestive tract of the worker through fumes and dust and from hands, particularly about the finger-nails of the careless workman. Consequently the ventilation of the factory must be ample and hoods should be provided with suction fan to carry off the dust and fumes. For the workman himself education is necessary. He should be taught the dangers of unclean hands, particularly at meal times. He should bathe the body frequently and have special clothes in which to work, for there is reason to believe that a certain amount of lead salt is absorbed by the skin.

Much may be done by giving advice to employees and employers along the following lines:

Employees

To prevent lead poisoning obey the following rules:

(1) Personal cleanliness
(2) Clean hands
(3) Rinse mouth before eathing
(4) Take a good breakfast; an empty stomach invites lead poisoning
(5) Never eat, smoke or chew tobacco while at your work
(6) If possible, eat outside the work room
(7) Avoid all excesses, especially alcohol
(8) Wear overalls or a long coat at work, gloves and cap
(9) In white lead or dusty lead work wear a respirator
(10) Consult a physician at first sign of trouble.

Employers

To prevent injury to employees:

(1) Provide washing facilities, lockers and out-of-workstop eating places
(2) Provide respirators for workmen
(3) Clean floors and benches of workshops, first moistening them
(4) Post up both regulations in conspicuous places in workroom.

Phosphorus

The next important poisonous trade is the manufacture of matches, the danger being from the use in the process of phosphorus. There are two kinds of phosphorus, the white or yellow and the red or amorphous. The former is the dangerous one, and is used in the manufacture of the common strike-anywhere-match. The safety match contains no phosphorus. It contains potassium chlorate or chromate and the paste on the side of the box contains antimony sulphide and red phosphorus. Friction of the one against the other produces a light. The common match contains the poisonous white phosphorus in the lead with glue chlorate of potash, powdered glass and some coloring matter. There is another strike-anywhere-match which has the non-poisonous sesquisulphide of phosphorus in the lead. Those matches have been used exclusively in France for the last 12 years.

The disease caused by white or yellow phosphorus is a necrosis of the jaw called the "phossy jaw." It begins as an inflammatory infection which runs a chronic course and causes localized death of the bone. So dangerous is the disease that in Belgium a prize of 50,000 francs was offered by the Government to whoever would invent a strike-anywhere-match free from white phosphorus. The prize was won by two Frenchmen and the match is used entirely in some continental countries.

Prevention

(1) By the prohibition of the use of white or yellow phosphorus in matches. This was done in Great Britain in 1908. In many continental countries its use in the manufacture of matches is prohibited. In 1913 a prohibition tax upon white phosphorus was adopted in the United States.

(2) By medical and dental inspection and treatment of carious teeth.

(3) Personal cleanliness and the use of mouth washes

(4) Proper ventilation of factories, and provision for washing facilities.

Arsenic.

Arsenic is used to a large extent in certain industries. This chemical is an irritant to the skin and mucous membranes setting up inflammation of the eyes, eczema and ulceration of the skin, general poisoning and neuritis.

Some years ago the writer then engaged in medical practice was called to see a man, who with his wife was visiting his wife's relatives. He was ill of vomiting and diarrhoea, his eyes were swollen and his hair was falling. Treatment of the digestive disturbance gave relief for a few days when the symptoms would break out afresh. Careful examination led to the belief that he was suffering from arsenical poisoning and suspicion attached to the wife, but proof was lacking. A nurse was procured who was instructed to allow the sick man nothing but what she gave him. This was much resented by the wife who was quietly told that her husband was being poisoned, and that if she interfered suspicion would probably attach to her. Subsequently, to the engagement of the nurse the sick man improved and it was discovered that the husband had been dosed with an infusion of Wilson's fly pads. The man recovered completely and the wife was warned that any recurrence of his malady would land her in gaol. They lived (so far as I know) happily ever afterwards.

Arsenic is found in wallpaper, painted toys, gloves ribbons, calico, artificial flowers and many colors, confectionery, etc.

Arsenical poisoning is found among workers in the manufacture of Scheele's green, wallpapers, artificial flowers, in the packing of white arsenic and reduction of arsenical ores, in curing furs, paperhangers, millners and handlers of Paris green, the latter of which is in common use for suicidal purposes. Free ventilation and clean hands are the best means of prevention.

Mercury

Workers in mercury acquire anaemia, headache, dizziness, tremor of muscles, fetid breath, swollen gums loose teeth, depression and melancholy. A persistent and apparently causeless diarrhoea is frequently a symptom of mercury poisoning.

Prevention.

Similar to that for lead.

Carbon Monoxide

CO, is colorless, odorless and highly poisonous gas which burns with a pale blue flame. It is the source of

the blue flame seen on the surface of an ordinary coal fire. It is a gas given off in large quantities by coke ovens from blast furnaces in smelting iron, hot water heaters, and is the cause of the deaths from ordinary coal self-feeders that one reads of in the newspapers during the winter months. Likewise, it is a product of the gasoline engine, and is the cause of death in the fatalities in public and private garages.

In the coke ovens of England, where men are obliged to enter to clean them out, two men always go together, one stands by in case of accident.

Time will not permit to describe in detail the many poisonous trades and the means of the prevention of accident and fatal results, but there may be mentioned hydrogen sulphide gas, a very stinking gas noticeable about privies which in the small quantities inhaled usually do no worse than cause nausea or headache, but which in large amounts may, if inhaled, cause death. Others of a more or less dangerous character are benzene, used in a variety of trades, aniline used in the manufacture of rubber goods, etc., as well as dozens of others.

Dusty Trades

Much ill-health is caused by the inhalation of dust in various trades. Some are poisonous, others act as mechanical irritants. The poisonous dusts have already been referred to, such as those of lead, arsenic, mercury, phosphorus, tobacco wood, dyes and chemical works. The mechanical irritants are particles of iron, steel and other metals, granite and marbles, coal chalk and plaster of paris. The significance of the latter will be seen in the fact that while but 2.39 persons per 1,000 die of consumption in occupations without dust production the rate in stoneworkers is 34.9 per 1,000.

Prevention

Much of the dust raised in industrial processes may be limited by proper machinery or preventive devices. Thus moisture or working the process under water may serve to keep down the dust or wet grinding substituted for dry. Inclosed hoods with suction fans may be used to confine and suck away the dust. Good ventilation helps much. Respirator masks are required in some trades.

Textile Work

The danger from the dust and excessive humidity necessary in the work of textile mills may be largely removed by good ventilation, abundant airspace, cleanliness, good light and the use of improved machinery. The moist garments used in textile works should be changed for dry ones before going out in the cold air.

Wood Dust.

Wood dusts, particularly those of boxwood, teak and rosewood, have all an ill effect on the worker, the alkaloids in these woods producing bronchitis and asthma.

Coal Mining.

As we sit beside the coal grate in the stormy winter's night we rarely give much thought to the men who mine the coal in the bowels of the earth. We give more thought to the headlines in the paper indicating the rise of coal to unheard of prices, the exorbitant demands of the miners and how much rise of salary we must have to meet the high cost of coal and other incidentals in the high cost of living. We should not forget that the mining of coal is a most dangerous and unhealthy occupation. The underground work means poor ventilation, exposure to poisonous gases, and risk to life and limb. Sanitary conditions though improved of late years are still bad enough. The disposal of excrete is not well-managed in all of the mines, and this fact predisposes particularly in the south to the development of hookworm infections, particularly where the use of moisture in the mine is favored for the prevention of explosions. The dust of coal is productive of a lung disease called "coal miners' phthisis (consumption)." This is not a tuberculosis like ordinary consumption, and besides backache, troublesome affection of the hands, knees and elbows are the fate of miners. The irritation of the dust is productive of cancer in some cases. Better ventilation, lighting, sanitation, shorter hours and better pay will cure many, but not all of the needs of the coal miner.

Effects of Heat.

In the trades of firemen, stokers, workers in foundries and steel mills the excessive heat is productive of much illness, such as heat stroke and prostration, nervous diseases, anaemia, indigestion and kidney affections. Injury to the eyes occur in many cases as well as respiratory diseases and skin affections.

Infections.

The infections acquired in trades are anthrax or wool-sorter's diseases from hides and hair, hookworm disease from pollution of the soil from fecal matter, glanders from horses and indirectly, tuberculosis. Of these the most important for us to consider in this place is perhaps anthrax, of which there are a few cases in Ontario every year, mostly in large tanneries where hides, imported from South America are treated. This affection may be prevented by the immersion of the hides (using gloves for the purpose) for five minutes in a 5 per cent carbolic acid. Hair of various kinds may be disinfected by steam at 17 lbs. pressure for one hour, or by boiling for quarter of an hour in 2 per cent. solution of potassium permanganate and bleaching in a 3 or 4 per cent. solution of sulphurous acid, or by boiling in water for two hours.

Tuberculosis.

This disease is often spoken of as the most important disease of occupation. It is at any rate the most important single problem in industrial hygiene. There is no doubt that dusty trades, poor ventilation, badly ventilated workrooms, sedentary occupations, fatigue, irritating fumes and long hours predisposes to the disease, but it is generally regarded that tuberculosis is contracted in infancy and childhood manifesting itself later in life. The disease is usually prevalent among grinders, engravers, compositors, stone-cutters, millers, bakers, plasterers, brassworkers, glass-cutters, furriers, weavers and other trades having a large amount of dust.

Physical Examination.

There is no provision for the physical examination of workers and particularly of boys and girls just past the legal working age of 14 years. There is great need for such examination in order that men and women who for reasons of health may be quite unfit for certain kinds of work may be protected, that pre-tuberculous cases in young and old may be detected and proper means of treatment provided, and that cases of disease dangerous to associated workers may be eliminated.

Let me give you one or two examples. A friend of mine a physician employed a lad of 15 years as errand boy. It was noticed during the past winter that

the boy had frequent colds, but seemed otherwise well. By the merest chance it was learned that his mother had been ill for some months, and further enquiry disclosed that she had pulmonary consumption. The boy had a careful examination, and it was discovered that he had a focus of tuberculosis in one of his lungs. He was sent to the Preventorium and has gained 5 lbs. in a couple of weeks. A few months at the Preventorium will put him to rights, when he will be able to return to work. Further delay would probably have meant his early death from consumption. Or again, a man or a woman may have the mucous patches of syphilis in the mouth with or without knowing that he or she has the disease. The common drinking-cup, the use of which is prevalent in many factories, and which should be prohibited by law, is used by such a person. An innocent worker may then use the cup and acquire syphilis. Proper examination of the workers would stop this source of infection, and more, it would give opportunity for the infected person to secure treatment.

Industrial Hygiene Division.

Every country should have an active well-organized division of industrial hygiene in its public health department. Such a division should be ready at all times to make a survey of the plants of manufacturing concerns in order to advise the employers regarding health saving devices, matters of first aid, and general sanitation.

A few years ago it was discovered by our district officer of Health that in the steel mills at Steelton the men were drinking from the hose pipe about the mills the ordinary raw water which was highly polluted and in consequence diarrhoea and typhoid fever were common. Men in a red-hot place like a rolling-mill will drink anything that is cold. The subject was taken up with the management, and water-coolers with pure water were installed and the hose-pipes so arranged that it was impossible readily to drink from them. The results were seen in improved health conditions.

Every industrial concern of any magnitude should provide means for first aid for its employees. The arrangements should be simple and not too expensive. I know of establishments which have provided elaborate operating room equipment. Such is unnecessary. A Division of Industrial Hygiene would be able to give advice in such matters and might even arrange for lectures on general hygiene to the workers at the noon hour or in the evenings.

Proper wash-rooms, lunch and cloak-rooms should be provided for employees. I had my attention called the other day to a women's clothing establishment in this city, where a little pen without any door, and 8 feet walls, was provided for a lunch room, and at the noon hour the shop was swept and the fluff and dust from the shop floated into the lunch-room and over the food. Such conditions should not be allowed.

Women Workers

The most serious matter in connection with industrial work is the increased employment of women. It is serious from the point of view of the normal growth and development of the State. The greatest need of any country is a stable birth-rate and a low rate of mortality among infants. A few countries only show this. New Zealand, Australia, Norway, Sweden and Denmark are notable examples. But women cannot work in factories and raise babies. The mother's undivided attention is the most essential feature in the increasing of the birth-rate and the prevention of infant mortality. Let us consider for a moment the causes of the lowering birth-rate and the increasing infant death-rate. What are the causes? Some say ignorance and poverty. But it can be shown that among the best educated people, and in the midst of prosperity these conditions prevail. There is no country in the world where the system of education is better or the general mass of the people are better educated than in Scotland. Yet the birth-rate of Scotland went lower in the last five years than during any former period of the history of that country. The people were earning more money than they ever did, everyone left at home had plenty of work. In spite of this the infant death-rate reached a deplorable figure in Edinburgh. Bradford in England is a textile centre, literally rolled in wealth during the war, yet the birth-rate sunk to about 17 per 1,000 births, and the death-rate under one year rose to 132 or 31 per 1,000 more than that of Ontario. Let us turn to Connaught in Ireland poor, steeped in ignorance, the people full of nonsense and ready for more; yet despite these conditions, the birth-rate of Connaught rose to 45, and the infant death-rate dropped to 50 and in some places to 35. What was the reason? The mothers stayed at home and nursed the babies and with a little more prosperity and a little less ignorance all might have lived. I tell you in all seriousness, the mother is the greatest factor in saving the baby, and to do this she must be kept out of industrial work, or in spite of education, in spite of prosperity, in spite of everything else, the future of the state will be imperilled.

The City of Edinburgh, with a reputation as the modern Athens and with graduates of her University leading the medical profession in every part of the Empire, with churches as numerous and powerful as can be found anywhere, should have a better record than she has in the matter of slums and baby saving. The record of Edinburgh in respect to the protection of motherhood is unsurpassed only by that of Paris. There Simpson introduced chloroform much to the scandal of the goodly to relieve the pains of childbirth; there Lister proved the value of antiseptic methods in preventing childbed fever; there Ballantyne began the study of ante-natal pathology and therapeutics and founded the first pre-natal bed in any maternity hospital. Yet Edinburgh in a year of unprecedented prosperity had a birth-rate of but 17.9 and during a cool summer an infant mortality of 132.

DISCUSSION.

Mr. Orr, of the T. H. & B. Railway, Hamilton, in discussing Dr. McCullough's paper, brought out the fact that twelve years ago a despatcher on a railroad worked twelve hours each day, under great stress, and that conditions were now improved and a despatcher only worked eight hours. Mr. Orr commented generally on accidents in this country and the Old Country and stated that the G. T. R. had recently issued a statement to the effect that 80 per cent. of all of their accidents in the past two years had been preventable.

The chairman asked Mr. Orr whether accidents on railroads were increasing or decreasing.

Mr. Orr replied that accidents were decreasing. In 1919 their company had gone for one week without an accident, and had a period of three weeks in 1920 in which there was no accident.

In discussing Dr. McCullough's paper, Dr. J. J. R. Macleod said:

"Dr. McCullough's paper has been of great interest to me, and I especially welcome his expression of hope

that the Department of Health would establish a division of industrial hygiene. In this connection I am very glad to have this opportunity of telling you what the Dominion Government has already done in the way of assisting the development of industrial hygiene. The whole matter came very much to the fore during the war, and last summer the Honorary Advisory Council for Scientific and Industrial Research decided that it was the duty of the Government to take steps to facilitate the progress of industrial hygiene in Canada. Accordingly the Committee of Industrial Fatigue, of which I am chairman, was formed. The committee includes Dr. A. B. Macallum of the Honorary Advisory Council whom you know, a representative of the Department of Labor at Ottawa, a representative of industry, and members of the departments of physiology of the various Canadian Universities.

"The functions of the committee are purely advisory and investigatory. Its general purpose is to bring industry and medical science into closer touch, so that the firms may benefit by a proper control of the health conditions of the workers. In order to promote this the committee has adopted three main measures. In the first place, it offers industry the help of scientific laboratories in solving health problems which arise in industry. In the second, it offers industry the use of a bureau where the most up-to-date information on every sort of health danger and on the corresponding preventive or palliative measures is kept. In the third, it is ready to co-operate with any member of industry in conducting surveys or investigations into such questions as sickness incidence, causes of lost time, etc., both in individual plants and in individual industries.

"I can safely say that the Government is concerned in all problems of industrial hygiene and is ready, both in the interests of increased production and in the interests of increased industrial health—the two things are inseparable—to do all in its power to promote healthy conditions in industry. The committee thinks that it can help manufacturers to save money—to put it crudely—by helping them to safeguard the health of their employees.

"Coming to practical details, the procedure would be somewhat on the following lines: A manufacturer in some industry where he recognizes or suspects harmful effects on the health of the workers would apply to us to know if the hazard was due to some avoidable cause, or if not, what the best preventive measures were. We would have to inspect the problem to see if it was a feasible one for us to undertake. Then, if it were, the expenses of any further investigation which might be necessary, and which we would conduct in collaboration with the business management, would be borne in part by the manufacturer and in part by the Government who, as I said, are vitally interested in the solution of such problems. Again, it might be that full knowledge of the solutions proved by the experience of other manufacturers in the same industry would render a special investigation unnecessary. In this case the committee would furnish an account of this reported work which the manufacturer could then apply. It is precisely for this purpose that we have established the bureau of which I spoke, where such information is at hand and will be kept up to date.

"I think I have explained our objects and it only remains to say, both to the firms represented here and through them to others, that if there is any problem in which they think we might be of assistance I hope they will let us know."

Miss Hutton, Secretary to the Committee on Industrial Fatigue, said:

"There is nothing further for me to say except to give the address of the Toronto office of the Committee on Industrial Fatigue and to tell you that as secretary, I shall be very glad to receive any questions or requests for information. The office is in the Medical Building of the University of Toronto and correspondence should be addressed to Miss R. M. Hutton. This office is the bureau of which Dr. Macleod spoke. I think we can say with confidence that we have up-to-date information on all aspects of industrial hygiene and have a great deal of material which should be of use to plant physicians, sanitary engineers, service and safety men and, indeed, to anyone who wants facts bearing on industrial health. For instance, to take one very common hazard, that of lead poisoning, we have information on its incidence, on the measures by which in certain plants it has been completely eliminated, on the best palliative measures in other plants, on the personal precautions in which all workmen should be educated, and on the medical treatment after poisoning has occurred. Or again, many trades have hazards of dust or fume inhalation. In these cases we could supply information as to the most convenient kind of gas mask, the best exhaust system or the most efficient type of hood. I have only instanced two hazards and have selected them at random. My object is simply to show that we aim at being a clearing house for reliable information on practical matters."

Mr. Wanzer, of The Steel Company of Canada, asked for information regarding protectors for coal dust and gases. He stated they were at present using protectors such as rubber mouthpieces, but that the men objected to them, claiming they were unsatisfactory. He stated that men working in the vicinity of tank cars and furnaces often have been taken to the first-aid room as they were suffering from the effects of gas. The present gas mask is cumbersome and heavy, and they are now looking for a simple and practical protector for the men.

Dr. Macleod replied that the gas and general conditions require investigation. He stated that in the case of coal dust the proper masks and ventilators would materially reduce hazards and offered to help his committee in the solution of this problem.

Mr. Falk of The Henry L. Doherty Company, stated that in their natural gas operations they were using a mask known as the Improved Gasco Protector, and found this reasonably satisfactory. He informed the meeting that a new mask was being put on the market by the Draeger Company.

The chairman then called on Mr. Thomas Fraser for his paper on "Accident Prevention in the Steel Industry."

Accident Prevention in the Steel Industry

By Thomas Fraser, Algoma Steel Corporation, Sault Ste. Marie

THE first essential in safety work in an industry is a genuine desire on the part of the management to diminish the number of accidents and promote the safety and health of its employees. This desire, this concern, must be live and vital, and emanating from the management, must radiate throughout the whole organization. A sense should pervade the plant that rare and caution is approved and noted, that carelessness and risk is checked and reproved. All should feel that negligence will not be tolerated and the guilty will be promptly and adequately dealt with. To create this atmosphere, the driving force must come from the head though directed by subordinates specializing in the work. The safety enthusiasm of subordinates is generally proportionate to that of their superiors, which, in turn, will be in a large measure, based on the safety requirements of the management. To achieve a high standard of safety it must be first a vital part of the managerial policy to promote it.

In this we have the management backing us in our plant at Sault Ste. Marie. It is the desire to spare neither time nor expense to render it as safe as possible, and to teach safety and enforce the teaching by a system of discipline proportionate to the seriousness of the offence. We have a long way to go but we are on our way. Equipment, repairs, education, and discipline, day in and day out, without immediately noticeable results, is the road to safety, and we think we are on this road. We will never reach the destination we would like to. Steel industries are especially hazardous, but we hope each month we will have progressed a noticeable distance along the road.

Having secured the mandate from the management, "This plant must be made as safe as possible," we can start our task with hopes of success.

The first problem that confronts us is to know what to do. It divides broadly into:

1. What duties must the company fulfill?
2. What duties must the employee fulfill?

The first, namely, duties of the company, resolve themselves mainly into safety devices, equipment, maintenance, safety rules and their enforcement, and the insistence that proper safety examples be set by senior officials in the plant. These I will leave for later consideration, and touch first on the duties of an employee. This includes an appreciation by him of the necessity for safety and the measures necessary to that end, in other words, safety education the biggest factor in accident prevention.

The employment office is the first place we meet our new employee, and there his safety education should begin. First, however the employment official allotting him work has an important office to perform. He must fit the applicant to a job suitable and safe for his mental and physical condition. This requires that the employment officer should be familiar with all jobs, the grade of danger peculiar to them, and the stamp of men best suited to fill them safely. He should also be a man of keen insight into human nature and quick to read character and notice shortcomings and defects. A man unsuited for a dangerous job is as risky as dangerous machinery. The preliminary responsibility in this matter rests with the employment office thus a deaf man should not be sent to clean up railway tracks. A further step towards safe placing of employees, is the surgeon's examination. Such an examination is sometimes resented, but it makes for safety to the man himself as well as to fellow-workers endangered through him; safety to the man in that the job suits his physical condition, and safety to his fellow-workers by avoiding failure in a hazardous operation where others depend on him. This examination would help to avoid later complaints from the man that he cannot do the work allotted to him, and therefore lessen the grievances that often arise from this cause with consequent enlargement of the labor turnover. In addition to properly placing the new employee, the officials that we have been dealing with, impress upon him that there are certain risks that he will have to guard against, and that he must be alert and careful in order to avoid unnecessary injury. Also in the employment office he has been handed out literature of safety propaganda. In both offices safety bulletins, warnings and advice, confront him.

He is now sent into his new work. Here the foreman takes him in hand, instructs him in his duties warns him of dangers and demonstrates the proper and safe method of his prescribed work. However, the man's safety education has just begun. There are countless little knacks and ways in the numerous jobs of avoiding simple but painful injury, and these the new man is made familiar with. For example, in pushing rails along carloading rolls they should be grasped by the ball about a foot from the end and not by placing the fingers over the end, as the following rail may jam in and crush the fingers; how to open hopper doors without jamming fingers, when the slag is thrown off the ratchet wheel; that piled billets must rest on a solid foundation to avoid falling on workmen. He is also shown what are prohibited practices and warned that indulgence in them will be disciplined. He is now left to the general safety education about the plant and the safety supervision of foreman and senior officials. It is here that example is most important. The superintendent must lead and insist on all subordinates following him.

Safety education requires time and persistence. It is not ended in a day or a week. A man must learn to think safety, to act safety and to make safety an ingrained habit of his working life. Real safety is best advanced by caution and care becoming a habit and not dependent on each occasion to a mental effort to realize and act on safety principles. Often it means to break up old careless habits and to form new ones in their place and this can only be done by a long continued and oft repeated acting along safety lines. Habit grows by repetition, and it is most important for the growth of a habit that there be no relapses while it is being formed. This ideal development to a safety attitude of course is very difficult to attainment. It is, however, the goal to aim at. If safety can become a habit it becomes ingrained second nature and part and parcel of a man's mentality.

Methods of safety education are varied and numerous. Any plan, or action that brings a man into a realization that safety is health, wealth, and happiness

as against injury, pain and distress from accidents, is safety education. We will, for a moment, consider a few ways of carrying on such education.

Bulletins.

(1) Everybody familiar with safety efforts knows of the various bulletins prepared by safety leagues for safety propaganda. I believe these bulletins are most useful and have a very telling effect in this educational campaign if properly distributed, located and very frequently renewed. Their effectiveness, however, is largely lost by a half-hearted use of them. They should confront men from every advantageous position, and be so renewed as to repeatedly and pointedly challenge attention and consideration. Occasional or unchanged displays miss effective mental impression. The mind must be repeatedly and consistently confronted so as to set it in operation along the lines intended. This practice, steadily adhered to, will in time largely assist in directing the mind to anticipate and avoid dangers. These bulletins can be supplemented by locally made signs with safety mottoes or slogans; by local photographs of actual accidents posed for by injured men for this purpose. Another effective plan is a collection of articles, tools, machinery, goggles, etc., which graphically tell the story of an accident or near accident which actually happened among employees who are known among their fellow-workers. This collection can be displayed in cases faced with glass.

(2) Safety rules and regulations are a source of education as well as the basis of discipline. Perhaps they more properly deal with enforcement of safety discipline, but they are also educative in dealing with problems and conduct also directly connected with accident prevention. Their object is lost without unfailing and impartial enforcement. I will touch on these under discipline and its enforcement.

(3) Those industries fortunate enough to have a "Plant Newspaper" have a splendid opportunity to teach safety. The accident record of the various departments can be kept vividly before the employees even in their own homes. It tells how and why the accidents happened and perhaps how they could have been avoided. It can create a healthy rivalry among the departments in the reduction of accidents. It can teach where danger lies and the ways and means to avoid same. It can build up interest in the general safety movement and educate the employees to demand safety measures and precautions as their just right. It can tell of the work of safety committees composed of their fellow workers, the results of accident investigations and recommendations resulting therefrom, and when thought advisable, the fact of discipline having been enforced. It gives favorable opportunity for safety slogans.

(4) Another device that is useful in spreading safety ideas is the motion picture and lantern slide. These pictures can be shown at appropriate intervals in entertainments, meetings and social gatherings as well as in regularly planned exhibitions. If employees do not bother going to such affairs the pictures can be taken to them and shown at lunch hour safety talks. Films or slides can be made showing familiar local conditions with right and wrong methods of doing various kinds of work, how actual accidents have happened or through proper precaution been avoided.

(5) All safety committees are educational, especially to the members composing it. For this reason, as well as freshness of interest, the personnel of these committees should be changed frequently in order that as many as possible may actively engage in safety work and acquire the safety spirit, as well as give the benefit of new ideas for accident prevention. These committees come under consideration when dealing with ways and means of safety organization, but their educational value is also very great.

I have before stated that education also must point out duties to be fulfilled by the management of the plant. To, in any degree, fulfill these important duties, a careful study must be made as to best ways and means, by one specializing in that work. The company must ascertain the best safety appliances and equipment and also the best system of enforcing their use, and the rules and regulations governing accident prevention. A company cannot demand safety from its employees if it is not willing on its part to equip for safety, repair for safety, and enforce safety conduct. The company must give the lead by doing its part in the safety endeavor.

This imposes on the company the first duty of planning and building for safety and of being willing to face the initial expense that this necessarily involves. The safety program should be a live consideration in the drafting room and all plans should be checked and approved for safety before being issued. The checking of these plans should be done by the safety department, and the benefit of their experience utilized at this stage. Work poorly planned for safety means costly alterations and accidents later whereas, well planned with safety devices makes for ultimate economy and safety.

One of the main considerations in laying out plans for a steel industry is to establish good, safe, main thoroughfares in those places where there is much traffic. The twisting, and turning and climbing in, over and about machinery, hot steel, rolls, etc., to get from one place to another should be eliminated as far as possible. Passageways should be well defined, cleaned and guarded wherever necessary. Main passageways up and down and across the mills should be the skeleton from which the minor passageways radiate to all areas to which access is customary. This can be best attained by proper planning before building. If it has not been originally planned it must be worked in afterwards, for clean, guarded, well defined passageways are one of the fundamentals for safety in the steel industry. So to remove the tendency to clutter clean areas in the mills by piles of billets, scrap, etc.

Numerous safety precautions could be mentioned that must be worked into the plans of construction. These are such fundamentals as adequate light and ventilation, both natural and artificial. These are duties in themselves about which much could be written. Suffice it to say that they are important in promotion of safety and health.

Gases and dusts are common hazards about steel industries and they generally present problems in which there is no uniform solution. In Northern areas, we meet with ventilation difficulties, different to those experienced in Southern climates. We must combat excessive heat in summer and excessive cold in winter. Openings must be closed up in winter and cannot be left open in summer. In the cold days of winter when the temperature often requires the closing of many windows and the retention of gases and dusts, artificial ventilation by fans and ventilators become necessary.

The proper guarding of all machinery, elevator openings, cranes and whatever equipment carries possible risk, is a definite obligation placed upon the management before a demand can be made on employees to adopt the safety spirit. All guards in ste

plants require to be made of heavy durable material. We have found that it is poor policy to place even moderately heavy steel walks protecting the gears on live rolls on approach tables to the mills. Only very heavy material of at least ¾-in. thickness has been found to stand up against the heavy wear and tear and abuse. Light installation means perpetual repair and renewal, and initial heavy construction is ultimately economical. Stairways and walks must also be constructed sufficiently heavy for very hard usage.

It is the duty of the company to establish a system of ways and means of perpetually carrying out safety work. This is briefly summed up in organization backed by enforced discipline, without which organization itself can accomplish little.

I will touch on this briefly under the following divisions:—

1. Methods to anticipate and avoid accidents happening;
2. Methods to minimize the seriousness of an accident immediately it happens;
3. Methods to subsequently investigate the cause of accident, place responsibility, and recommend preventive measures.
4. Methods of disciplining negligence.

"Prevention is Better than Cure" is applicable to my first division. We must anticipate where accidents may happen and take immediate steps to remove the danger. This is best accomplished by the co-operation of all minds in seeing where the danger lies, reporting same and, if possible, suggesting a remedy. All employees should be individually concerned in this work. In addition to this general concern, we need bodies and individuals making it a special duty and study; and also a central office to systematize and give effect to effort. This leads us to the safety department and the Safety Inspector. The Safety Inspector's duties vary in the different plants. He should, however, be the pivotal point around which safety works swing. He must inspect all parts of the plant, consider improvements, require repairs, collect all accident particulars, make improvements, make preliminary investigation of all accidents, give direction to, and if possible, avoid repetition. He must keep in close touch with all safety committees, consider their suggestions and have effect given to them.

He must acquaint himself with all Government requirements and see that they are strictly complied with. He has an unlimited field for statistical work demonstrating various aspects of accident results. He must direct publicity work through the various channels. He must keep committees alive; must seek suggestions and collect those placed in suggestion box. He should keep records of all suggestions made, properly acknowledge same, and follow them up to see that they are duly considered. His records should show work that has been approved and is under order for installment; also when such work is completed. A follow-up system is necessary to keep suggestions, orders, decisions, alive and effect prompt action. In short, the safety inspector's system should tell the history of all safety work, detailing its origin, course and completion, also frequency of repairs or renewals. The Safety Inspector must be ever inspecting, and needs a keen eye to detect weakness, defects and danger indications. He must not, however, confuse his work with that of department heads. Once safety appliances are installed maintenance should be a first charge and consideration with department superintendents, and where they do not give it proper attention or fail to realize possible danger, it is the duty of the Safety Inspector to point out necessary safety repairs, and require that same be immediately attended to. Maintenance must be put up to superintendents. They must feel their responsibility to keep appliances in order, to keep guards in place, and any permission to shift such responsibility to the Safety Inspector should not be permitted. It misplaces primary responsibility, invites department slackness, and throws a mass of detailed work upon a department not sufficiently large to handle the countless details that are continually needing safety attention, from one end of a plant to the other.

We expect to shortly use the following system of directing repair work. The Safety Inspector decides certain repairs are necessary. He carries a book of forms to be made out in triplicate. This form is directed to department superintendent and requires certain repairs to be made. The original stays in the book, one copy goes to the superintendent of the department affected, and the third goes to the general superintendent. To the form sent the department superintendent is attached a detachable portion which is directed to the general superintendent and he is to report what disposition was made of the work required. In the meantime, the original form has been filed in proper departmental category under "Work to be done." It is retained there until the detachable portion before mentioned has been returned from the general superintendent's office reporting the work completed. The both are then fastened together and under departmental divisions, filed as "Safety repairs completed." The general superintendent is kept directly in touch with safety maintenance by this method.

Safety committees are an important factor in accident prevention. For effective work there should be about three kinds of committees. There should be:

1. Plant Safety Committee
2. Departmental Safety Committee
3. Accident Investigation Committee.

Our Plant Safety Committee is composed of employees entirely elected from a board composed of representatives of each department elected by it. We have no department safety committees. I think, however that the Plant Safety Committee would be greatly assisted by small department safety committees. They are right on the job, familiar with all apparent dangers and within hearing of workmen's comments, suggestions and criticisms. The committee can confer with the Safety Inspector on his rounds; can also point things out to the Plant Safety Committee in its regular monthly inspection, and keep their superintendent advised of danger as they become apparent. This committee should have regular meetings with the department superintendent, say, once a week to consider safety measures, practices and requirements that department.

The Accident Investigation Committee is for what its name implies, and its operation I will deal with under my third division.

When an accident has happened, the first concern is immediate first aid to lessen its seriousness and relieve pain and suffering. There are all grades of accidents, very minor ones and very serious ones, but all should have immediate attention. Any neglected accident, however trivial it may seem at the moment, may develop into one of more serious proportions. It must be considered sufficiently serious to require at once, pro

per care and attention. A fatality growing out of a serious accident, may possibly be avoided by surgical attention being promptly available. These considerations as well as being human, have an important moral and financial aspect. The working morale of employees is affected by the accident reputation of a plant. The Workmen's Compensation Act and many economical factors, such as labor turnover, and reduced production give the question a financial significance.

To give first aid promptly, safely and efficiently, the proper equipment and supplies must be on hand for instant use. In a steel plant, a medical department in charge of a capable surgeon is the foundation on which the first aid system is built, and it is that department I will first consider.

The right man, or men, must be chosen for the medical and surgical work. He must be a man who gains the confidence and respect of the employees and, through his personality and system, creates the feeling that the medical department is desirous and anxious to serve the employees.

The surgeon may be located in his office in an elaborately laid out emergency hospital or more modestly in a combined office and surgical room. These vary greatly according to the different ideas on the matter and the amount willing to be appropriated for the purpose. However small or unpretentious a doctor's office and surgical quarters may be, they should invite a sense of confidence by being adequately equipped, neatly and brightly furnished and immaculately clean. The existence of such an office, easily accessible to injured men, will help to diffuse a feeling of protection and safety throughout the plant.

A first aid dressing station, centrally located in the plant; in charge of a trained nurse or qualified first-aid man, can render great service in immediate and regular treatment and dressing of slight wounds, and the dispensing of simple remedies. The handiness of such a station, invites prompt attention to minor injuries and will help in the reduction of lost time by preventing infection, detecting unseen risks and, where necessary, advising that medical attention should be obtained. This station is also very useful to take injured men to, as an emergency hospital, where the surgeon gives them first care. This station will largely depend for its efficacy on inviting general usage and instilling confidence in the surgical service of the industry.

Each department should also have a few well-trained first aid men with adequate first aid kit. Stretchers, splints, pulmotors, gas helmets, should be located wherever necessary, or wherever they can be used advantageously. Classes in first-aid and also in the use of pulmotors, gas helmets, etc., should be conducted at regular times so that a body of emergency knowledge may be built up in the plant. Prizes can be awarded to those attaining the highest standard of efficiency. These men properly coached and encouraged become quite efficient and are a real strength in the safety work of the plant. Men who pass certain standards we list as first aid men and issue them neat, first-aid button. The services of these first aid men during the year should be appreciated and some tangible evidence given of the appreciation. A letter of commendation and thanks, if nothing else, is worth it.

The Accident Investigation Committee should be composed of such men as mechanical superintendent, electrical superintendent, works engineer, safety inspector and a few representatives from the employees serving on the Plant Safety Committee, the whole presided over by the head of the Industrial Services Department. The duty of this committee is to investigate all accidents which the Safety Inspector decides should be classed as major accidents. The committee inspects the scene of the accident and retires to a quiet room to hold the investigation. Witnesses are summoned before it and closely questioned regarding the accident. The enquiry is made as serious and impressive as possible. After all evidence is in the committee decide where responsibility, if any, rests, and considers preventative measures that might avoid repetition. This committee will report to the general superintendent the results of the investigation and will recommend the degree of discipline to be imposed on those responsible. The penalty, whether it be discharge or censure, is entered on the man's record card with the plant, when the general superintendent gives his written decision. The Safety Inspector, acting as secretary, keeps a file of all proceedings connected with investigation.

DISCUSSION.

Mr. H. H. Champ, Treasurer Steel Company of Canada, in discussing Mr. Fraser's paper, said:

"Mr. Fraser is to be congratulated for his very able paper covering the many phases of accident prevention very thoroughly. The organization he outlines very nearly corresponds with the system adopted by this company.

"Last year's report for our Hamilton works shows that our experience largely bears out his statements, namely, that about 25 per cent. are due to unguarded machinery, and raises the question how best to deal with the other 75 per cent of industrial accidents.

"While mechanical safeguarding is only a question of attention by foremen or those immediately in charge, with thoughtlessness and carelessness we have the human element more directly to deal with, and this requires education, and education requires co-operation.

"To secure co-operation a large percentage of employees must be interested.

"To secure this they must be impressed with the seriousness and whole-hearted intent on the part of the management to join with them and unitedly to bring about this betterment of working conditions.

"To this end a system has been outlined by means of which management and men are brought together on a common level, where all accidents, preventable or otherwise, can be discussed and safety means adopted and executed without undue loss of time.

"Safety organizing really means constructive work for industrial betterment. A bond of union and mutual respect is established between employer and employee and all are brought to realize that the other fellow is not such a bad sort after all."

Mr. Fraser stated that men must be dismissed in cases of flagrant disobedience of rules and regulations. The Algoma Steel Corporation has no general rule on this subject, but is at present preparing a new book of rules.

Mr. Falk stated that the question of disobedience of rules was taken up with the New York Central Railway and others, and that the New York Central does not discharge men, but if a man breaks a rule he is given a ten day suspension which is wiped off his records at the end of the year if the offence is not repeated. In this way men are given another chance.

Mr. Wills Maclachlan, Electrical Employers' Association, pointed out that the committee investigating accidents might find in many cases the machine not the

man who was at fault. He stated that cases of infected wounds needed immediate attention and asked Mr. Champ for the experience of the Steel Company in regard to pulmotors.

Mr. Champ stated that pulmotors had been successfully used in cases of gaspoisoning from the furnaces.

Mr. Maclachlan recommended the use of Prone Pressure Method rather than apparatus, as being simpler and more effective and stated that the Public Utilities throughout the Province were giving up pulmotors in favor of Prone Pressure Method.

The chairman then called on Mr. W. D. Black for his paper on "Elevators."

Elevators

By W. D. Black, Otis-Fensom Elevator Co., Ltd., Toronto

In considering elevator hazards it is well to review briefly the evolution of the elevator and the results sought, or attained, in improving their safety features and to keep this in mind while analyzing statistics dealing with elevator accidents.

Prior to the advent of the steam passenger elevator, nearly six decades ago, buildings were limited in height and, while this type of elevator encouraged the addition of a few storys, its operation in the early days was too slow to make any general increase in buildings, until some twenty years later when the hydraulic elevator was introduced and rapidly improved in methods of construction and operation.

In 1876 there were in the City of Toronto nine passenger elevators of the hydraulic type with copper cylinders, several of which remained in service for twenty-five years. At that time there were also a few hand operated hoists, without cars attached, that lifted the load through openings in the floors provided with hinged doors on which the load was landed. The last of this type, to the best of the writer's knowledge, was removed from a building on Colborne Street a year or so ago.

The belt drive, spur gear reduction, drum type machine was built and installed as late as 1905, but was used only for freight service on account of its slow speed.

In 1882 the first worm gear reduction, motor driven elevators were installed in this city, driven by belts, from a countershaft operated by constant running motors.

In 1892, the first direct connected, motor driven elevator was installed in Toronto, and the development has continued to the present day 1:1 traction elevator, which has put the elevator engineer so far ahead of the construction engineer that he can equip a building with elevators to any height demanded and running at any speed compatible with comfort.

It is estimated that the number of passengers carried daily by elevators in large cities exceeds the number carried by all other means of transportation, and it speaks well for the elevator engineer's attention to safety features that so few of these passengers are injured.

We will outline the things it has been considered by the designers as unsafe in elevator practice and to avoid which various features have been embodied in the design of the modern elevator.

1. To fall unretarded to the bottom of the hatchway.
2. To be overhauled by the counterweight so that the car hits the overhead work.
3. To permit the car or counterweight to over-run their limits of travel at top or bottom.
4. To use safeties so severe in action as to cause a dangerous impact in stopping or engage only on one guide rail.
5. To permit the machine to continue to operate after lifting ropes have slackened for any reason.
6. To lose control of the car to such an extent as to alarm the passengers to a point of attempting to jump off a moving car.
7. To permit operation of the elevator until the hatchway door is closed.

It is not within the scope of this paper to attempt to describe the various devices designed to meet the above contingencies, but it is well to bear in mind that on many of the older elevators some of the most necessary items were not included and on some, where included, the design was so crude as to make them inoperative, and it, therefore, is important for all inspectors to thoroughly satisfy themselves that the elevator under inspection is sufficiently equipped with such safety features as to meet the service for which the elevator is used. It is unfortunate that the inspector rarely has the power to condemn and have removed an elevator which, in his estimation, is improperly equipped with safety features, or, on which these features are defective in design, or, inoperative. As a rule he must bide his time until an accident does occur when the owner is morally, if not legally, forced to renew the equipment.

In the Provincial records of 1909-1916 there are recorded thirty-seven casualties resulting from the dropping of about twenty elevators a large proportion of these injuries being serious. In practically all cases the elevators were of old and obsolete design, not properly equipped with safety catches, and almost invariably designed and installed by concerns who carried elevators as a sale-line and did not have the experience or knowledge to properly build such equipments. Fortunately the elevator business has developed to a point where practically all elevators are built by specialists in that line and such accidents on the modern installations are rare. In one case where an elevator dropped, causing four of the thirty seven casualties above referred to the safety was rendered inoperative by a screen installed by the owner in such a way as to interfere with the safety operating spring.

In all cases the inspector should test the operation of the safeties as they are the ultimate means relied on to save serious injury in the event of weakness developing in the ropes or equipment due to poor design, faulty construction or latent defects which are impossible of detection until the part fails.

There are in service many handpower elevators on which operators run from floor to floor with the loads. This is a practice which should be prohibited because, even with safety catches, there is danger of the weight overhauling the car and causing serious accident. The Toronto Civic Regulations insist that the pull rope of such elevators be placed outside the gates, where the operator cannot ride on the car. This is a good pre-

caution that would be well to be applied more generally as this type of elevator is more susceptible to "hogs" than even many of the old power driven machines.

Out of a total of one hundred and eighty elevator accidents reported by the Provincial Government for the eight years, 1909-1916 inclusive, the above mentioned thirty seven, or approximately 20 per cent, were reported due to the falling of elevators over which the operator presumably had no control, the balance, or approximately 80 per cent, of the total, was due to carelessness or fool hardiness. It is interesting to note that 12 per cent. of these accidents occurred to boys varying in age from seven years to seventeen years. The one hundred and eighty accidents referred to are reported as occurring in approximately the following manner:

1. Dropping of elevator	37
2. Caught between elevator and walls or projecting sills	75
3. Fell down the hatch	37
4. Head caught between car and gate	18
5. Injured in attention to machine	6
6. Caught under car	5
7. Fell off elevator	1
8. Cleaning elevator hatch	1

The first item, viz. Accidents due to dropping of elevators, has already been considered.

The second item crushing by elevator is probably due largely to lack of proper enclosure on the car to protect the sides and rear and to projecting sills in the front of the hatchway. It appears necessary, therefore, to insist on proper car enclosures, and the use of deep bevelled toe plates, making an angle of not less than 60 degrees with the horizontal, which is essential under all thresholds, beams and other fixed construction projecting into the hatchway more than 1-in. Doubtless many of these accidents occurred as a result of playful scuffling of youths in the elevator where they are usually out of sight of the foreman. Another cause of being caught is the habit employees have of jumping on or off moving cars. This practice is dangerous enough with reference to the moving platform only, which is much complicated in most cases by the fact that as the car is leaving the floor the automatic or semi-automatic gate or self closing door is moving, constantly cutting down the clearance, with the result that the person trying to board the car is upset by the car, gate or door, and very serious accidents usually result. Such accidents are only too common on freight elevators, but rarely occur on passenger elevators in charge of regular operators. It is to be hoped that future development of the freight elevator will include interlocking features which will prevent the moving of a car unless all entrances to the hatchway are closed.

The third item falling of men down the hatchway is in many cases not subject to reduction, except by "Safety First" signs which will emphasize the necessity of caution but such accidents are too often due to the careless leaving open of hatchway protection doors and gates, which are frequently found nailed up to avoid the handling, or due to procrastination in calling an repair men.

The fourth item, which lists the accidents due to crushing of head and shoulders between the car and gate, is usually due to the fact that the gate is sufficiently low to permit of a person putting his head over same in his curiosity to locate the elevator. It is curious that he invariably looks down, and it frequently happens that the elevator is descending just in time to pin him between the bottom of the car and the gate. It is necessary that all gates be not less than 4 ft. 4 in. in height. In cases of old installations where it would be a hardship for the owners to install gates of this height, warning loops of sash cord or light chains should be hung from the front edge of the platform. It also frequently happens that a person looks over the gate after the platform has passed down and is caught in this position by the enclosure top of the car. To avoid injury from this cause the front section of the cover to a depth of 9 in. should be made to hinge on freight elevators.

The fifth item covers injuries received by attendants in caring for the equipment. Such injuries are usually minor in character and usually due to carelessness, but would be reduced by making the machine more accessible and by providing more room around the machine than has been the rule in the past.

The sixth item, covering accidents due to men being crushed below the elevator, is usually due to their using hatch doors or space below the elevator as a passage. Such practices should be strictly prohibited and, in fact, the use of hatch doors should be abandoned entirely as they are the direct cause of numerous accidents.

The seventh item covers injury due to falling off the elevator. It is frequently noted that on old elevators, uncnclosed, the back wall has several offsets and in many cases deep-set windows which provide ample space for a person to fall off, and it is surprising to note that such few accidents are reported from this cause.

The eighth item covers an accident due to injury received while cleaning the elevator hatchway. Such are probably unavoidable by any mechanical precautions that could be taken.

It is now interesting to analyze the class of accidents that occur on elevators of the passenger and warehouse type in the City of Toronto over which the City Architect has jurisdiction according to a by-law passed July 14th, 1907. The City Architect, as "Inspector of Elevators" has in this department three inspectors, all practical men with years of experience in elevator construction, who every three months inspect all elevators licensed by the city. During 1919 elevators to the number of 881 were licensed.

Mr. Price, City Architect, has very kindly furnished the writer with data as listed below which shows the number of accidents, fatal and otherwise, which have occurred in connection with the elevators under his jurisdiction, which do not include factory elevators, for the period 1918 to date.

Cause	Fatal.	Injured.
1. Making repairs without first locking car	5	1
2. Open gates	9	9
3. Leaving or boarding moving car	5	4
4. Projection over hoist floor	1	8
5. Open space between stationary and elevator floors	2	11
6. Operating car while standing outside	7	1
7. Starting car without first closing gate	0	2
8. Breaking of mechanism	0	2
Total	29	27

Analyzing this record indicates that practically all may be classed as due to carelessness by the victim negligence by some other party, such as leaving gates

open, or foolhardy practice such as operating the elevator from the landing which is especially dangerous in the case of the hydraulic type elevators.

Mr. Price, in his letter comments: "Although accidents on elevators have not been entirely eliminated, they have been reduced to a minimum by various mechanical innovations, such as automatic gates, locking devices, etc., but it would seem that the day of the fool-proof elevator has not yet arrived when one looks into the lists of accidents and the cause of a large majority of same, viz.: raising and propping up automatic gates, making it possible to board or leave a moving car, which would not be possible were the doors and gates closed; operation of elevators by employees other that the operator; the use of freight elevators for passenger purposes. It would seem that the only way to guard against such accidents would be a campaign to educate the employees against such dangerous practice."

In conclusion, it is the writer's opinion that Section 58 of the Ontario Factory Act, which applies to elevator regulations, is obsolete and entirely inadequate. In several provinces and states elevator ordinances have been drafted by "Boards" composed largely of elevator engineers and this has resulted in improved new installations, and the correction of many glaring faults in existing installations and their enforcement must result in a decided reduction of elevator accidents. I would strongly recommend that the Ontario Safety League use their influence in having the Government appoint such a "Board" with a view to drafting a comprehensive set of rules and regulations, the enforcement of which would result in the reduction of elevator accidents to the lowest possible minimum.

DISCUSSION.

Mr. Hutton, of the Verity Plow Works, stated that regular gates throughout the plant would reduce materially the risk due to elevators, and cited the case of an official of the Y.M.C.A., who stated that he had heard his own head crack when the elevator struck him.

Mr. Falk asked Mr. Black whether engineering revision or safety education was more helpful in preventing accidents.

Mr Black replied that, in his estimation, education was a more important factor, as 80 per cent. of the reported accidents were due to carelessness, but that many important mechanical features might be introduced.

Mr. Machlachlan asked whether this 80 per cent. was due to the carelessness of the victim or some other person, to which Mr. Black replied that the responsibility was divided.

Mr. Burke, Chief Inspector of Factories, congratulated Mr. Black on his paper, but objected to the statement that the Ontario Act is obsolete. He stated that notwithstanding the law there were still accidents, and with the last revision of the Act all concerned decided that the present Act was as far as it could go. Mr Burke referred to the Manitoba charts shown by Mr. Black, and stated that there were more elevators in Toronto than in the whole Province of Manitoba. He pointed out that in the administration of the Act, the Department had gone on the principle that common sense must be used, as elevators of the best equipment often caused accidents which laws could not prevent. He asked for a continuance of education of the whole public against accidents and said that the Factory Inspection Department was open to any suggestions that will prevent accidents.

Mr. Burke said that a commission or committee could not prevent accidents, as accidents do not happen, but are caused. He suggested that it might possibly be advisable to license all elevator companies and thought that all elevator safeguards should receive a practical trial among men who are working with the elevators. In closing his remarks, Mr Burke said that his department was prepared to accept the fool-proof elevator when invented and stated that in the past four years fatal elevator accidents had been reduced from 19 to 6 in Ontario.

The chairman asked Mr. Black whether Manitoba was ahead of the other provinces in the reduction of elevator accidents. Mr. Black said he had not taken this into consideration, but wished, however, to thank Mr. Burke for his remarks and maintained that a more specific law would serve as a guide to owners and elevator builders to raise the standard of equipment.

Mr. Maclachlan said that all of the statistics given should be read very carefully. He suggested that rules might be adopted to serve as text books of information to builders, designers and owners and that everyone concerned should live up to the rules.

Mr. J. H. Shales, Manager, Elevator Specialty Co., Ltd., has submitted the following written discussion on Mr. Black's paper.

"The article written by Mr. W. D. Black on Elevator Hazards is a very good enumeration of same.

"After 28 years' experience as elevator engineer, the writer of the present article, who has been engaged in designing, erecting and maintenance branches of the work, would say that wonderful improvements have been made in the safety appliances used on the various makes of cars or platforms which are being used for different kinds of work. It is very hard to make a fool-proof machine, for, as a rule, the owner, if he is a foreigner, will not spend any more money than absolutely necessary on maintenance if he can get out of it. They evidently value human life very lightly, and think it smart to get ahead of the factory or city inspectors.

"Thanks to the firm stand taken by those officials, for they are gradually bringing before the public the dangers of such practices and that rules and laws are made for the protection of the public and the people as a whole, but I must say that we are a long way from real safety yet, as the number of elevator accidents that have taken place the last two or three years will in itself testify.

"The only remedy for this danger is to keep up the good work with the object in view that Safety First should be taught to the public, and that they should not interfere with the gates, doors or any other appliance that is put on the machine or hatchways for protective purposes.

"The writer would go even farther than that and have the owner's license withdrawn if any of the gates or other appliances on their elevators were not repaired immediately after being notified by the inspector of their unsafe condition. If this were done about 25 per cent. less accidents would not occur and would not have to be recorded against freight elevators."

The chairman thanked the gentlemen who had read papers, and those who had discussed them, and at 5.20 p.m. declared the session adjourned.

WEDNESDAY, 14TH APRIL, MORNING SESSION.

Mr. W. C. Coulter, Chairman, Booth Coulter Copper Co., Ltd., Toronto.

The chairman said that he was glad to be at this session of the convention, both as a representative of the Canadian Manufacturers' Association, and because of the value of the papers to be presented. The gentlemen who were reading papers at this Three-day Safety Convention deserved the thanks not only of the Safety Leagues, but also of the manufacturers throughout the country. The preparation and publication of this material was a valuable contribution to accident prevention, and accident prevention was of more monetary value to employer and employee than compensation. He congratulated the Safety League's Committee on the Papers, and wished the League success.

Mr. Coulter then called on Mr. Rousseau for his paper on "Grinding Wheels."

Grinding Wheels

By A. Rousseou, The Norton Co., Chippawo.

TO insure safety in the use of grinding wheels the same fundamental principles apply as in the case of all other industrial operations the prevention of accidents and protection of operators by mechanical means, and the education of the workmen to observe the proper precautions.

The operation of all high-speed machinery is hazardous and the grinding wheel is no exception to this rule. The structure of a grinding wheel is fragile and under certain conditions can easily be broken. Under ordinary working conditions the periphery travels at a speed of approximately a mile a minute, so that if a breakage does occur the results are likely to be serious. Special precautions, therefore, must be taken; first, to prevent wheel breakages; and second, to guard the operators against injury in case breakage does occur.

Causes of Grinding Wheel Accidents.

When a grinding wheel accident occurs, the cause can always be traced to one of the following sources: the wheel, the machine, the mounting, or the operation.

By making all the conditions of each of these sources ideal, grinding wheel accidents could be prevented. In other words, if a perfect wheel is properly mounted on a satisfactory machine, and is operated under ideal conditions, the chance is very remote that the wheel will break while in operation. I will attempt to describe these ideal conditions by practical suggestions and if all grinding wheel users would follow these suggestions, grinding wheel accidents would be cut down to a minimum.

However, there enter into the practical application so many uncontrollable factors, the most important of which is the human factor; that, even though every effort is made to secure these ideal conditions it is necessary to provide protection devices of some sort. There are three standard forms of protection devices, which will be described later. One of these forms, or its equivalent, is considered absolutely necessary and should be provided except in those cases, such as internal grinding, where the work itself forms ample protection.

General Description

The modern grinding wheel consists essentially of a large number of abrasive or cutting particles held together by the bond, which in vitrified wheels is of about the same structure as porcelain or glass. Therefore, a wheel must be treated with respect and should not be thrown about as if it were a chunk of steel. Many users of wheels do not recognize the fact that grinding wheels are fragile, and as a result many wheels, especially thin ones, are broken by careless handling.

Manufacturer's Duty.

All reputable grinding wheel manufacturers take every possible precaution during the process of manufacture to produce only such wheels as are free from defects. Wheels are inspected between operations and any which are found to to be defective are rejected and broken up.

After the final manufacturing operation, every wheel larger than 5-in. diameter, is subjected to a mechanical test of sufficient severity to rupture a wheel which contains any inherent weakness. In this test the wheel are mounted on a spindle and revolved at a speed much higher than the recommended speed. The testing speed is sufficiently high to provide a factor of safety of at least 2½, in most cases considerably higher.

Each testing machine is equipped with a tachometer connected directly to the spindle, which enables the operator to tell the exact speed at which the wheel are revolved.

A complete record of all wheels tested is kept for reference. Daily affidavits as to the accuracy of these records are sworn to before they are permanently filed. The manufacturing and shipping check must also contain a record of the test, otherwise the Inspection Department will not pass the wheels.

Immediately after testing, the wheels go to the Inspection Department where they are given the final inspection before being packed. Every wheel is given a careful and thorough examination by experienced men with eyes trained to detect imperfections of all kinds. The inspectors also check the size, shape, grade, quantity, and special features. The utmost care is also used in packing.

Beyond this, however, the manufacturer cannot go. It becomes the duty of each user of grinding wheels to determine if wheels have been damaged after leaving the manufacturer, and further to see that they are kept in good condition before and during use.

Customer's Duty.

Immediately upon receipt the wheels should be examined to make sure that they have not been damaged in transit or otherwise. Each wheel should be held free and clear, then tapped lightly with the handle of a screwdriver or some other such implement. If the wheel is in good condition, it will give forth a clear ring. If it does not give a clear ring, it is a fairly sure indication that the wheel is cracked.

(Damp wheels and those in which the spaces

tween the grains are filled with sawdust, also rubber and shellac-bonded wheels do not give a clear ring when tapped in this manner. Such conditions should be taken into consideration when applying the test.)

Care should also be exercised in the storage of wheels. They should be stored in dry places of even temperature. Shellac and rubber-bonded wheels ¼ in. or less in thickness, should be laid flat on a straight surface to prevent warpage. All other wheels should be supported on edge in racks.

Before mounting, all wheels should again be carefully inspected to make sure that they are in good condition and that they have not been damaged by being moved about or roughly treated while in storage. This is very important, inasmuch, as a wheel may sometimes be cracked by merely falling over from an upright position. The same "ring" test should be applied before mounting.

The selection of the proper wheel for the work required of it is sometimes an important factor in considering wheel breakages. A wheel which is too hard or too fine may generate sufficient heat to cause uneven expansion, thereby breaking the wheel.

Moreover, a wheel of weak structure or one of insufficient cross section might be broken by applying heavy work.

The Grinding Machine.

The design and condition of the grinding machine are very important factors in the prevention of grinding wheel accidents. Improperly designed machines, and machines that are in poor condition, have been the cause of many wheel breakages.

Machines should be sufficiently heavy and rigid to prevent vibration and should be securely mounted on substantial floors, benches, foundations, or other structures. Bearing boxes must be of proper length to provide ample bearing surface, thereby preventing heating and rapid wearing. An automatic method of lubrication should also be provided.

The ends of the spindles should be so threaded that the nuts on both ends will tend to tighten as the spindle revolves. A simple rule to determine the direction of the thread is as follows:

To remove the nuts they should both be turned in the direction that the spindle revolves while the wheel is in operation.

If threaded in the wrong direction, the nuts would tend to loosen as the wheels revolve and serious consequence might result. The spindle should be of sufficient length to provide bearing for the entire length of the nut when the wheel and flanges are in place. The spindle end, nut and flanges should be protected. (Properly designed hoods will take care of this requirement.)

Grinding machines should be located in well lighted and ventilated rooms and, in addition to the devices designed especially for grinding wheels, the usual safety rules for belt guarding and fast-moving machinery should be heeded.

Mounting.

Wheels used for grinding on the periphery or on the sides near the periphery, are usually mounted on spindles, arbors, collets, or centres, and are held in place by flanges or collars.

Great care should be taken in mounting wheels. The hole in the wheel should be slightly larger than the diameter of the spindle or arbor on which it is to be mounted, so that it will not be necessary to exert any force to place the wheel in position. Experience has shown that the hole should be approximately 0.005 in. larger than the arbor.

Wheels of this type should never be mounted without flanges. The flanges should be made in accordance with the dimensions given in the Safety Code. The inner flange should always be either keyed, shrunk, or screwed to the spindle. The outer flange should be made to run perfectly true with the spindle. The outer flange should always be of exactly the same diameter as the inner flange. The hole in the outer flange should be made an easy sliding fit on the spindle or arbor. All flanges should be relieved or recessed at the centre to a depth of at least 1-16-in., in order that the flanges may bear at the outer edge only. All flanges must be true and in balance.

Compressible washers of blotting paper, rubber or leather should always be used between the wheels and the flanges. These washers would take care of any slight unevenness in the surface of the wheel, thereby insuring a uniform bearing around the entire periphery of the flange.

Before mounting the wheel, care should be taken to see that the surface of the wheel and the flanges are clean and free from foreign particles.

When tightening the nuts, care should be taken to tighten them only enough to hold the wheel firmly. Excessive tightening may damage the wheel.

Other forms of mounting, such as cementing or sulphuring the wheel to iron backs and centres, or the clamping of segments to a metal ring, are only recommended for special purposes and no definite specifications can be given. Advice on doubtful cases of this kind should be obtained from experts before installing.

Mounting wheels with tapered [illegible]s on tapered arbors demands great care, for a[illegible]ing necessary to get the wheel in position would [illegible]al to crack the wheels.

Operation—Speeds.

In the operation of a grinding wheel, speed is the first factor to be considered. Overspeeding is dangerous, as the higher the speed at which a wheel is running, the less external force is required to break it. In fact, if speeded high enough, the wheel would be broken from centrifugal force alone, without the aid of any outside force. For this reason, it is extremely important to keep the speeds correct.

Although the most efficient working speed for a wheel is usually a safe operating speed, conditions are frequently found where wheels are operated at speeds which are dangerous. An excessively high speed is allowed either because of the ignorance of the danger, or through lack of proper supervision.

As a wheel wears down, the surface speed decreases, if the number of revolutions per minute is not changed. In order to keep the surface speed constant, various methods are used. The most common of these is to provide the grinding machines and countershaft with cone pulleys by means of which the revolutions per minute of the wheel can be changed.

Another method is to have a set of machines, each running at different speeds, and by changing the wheel from the slower to the faster machines, the surface speed can be kept approximately the same.

These methods are both satisfactory, but both require careful supervision to guard against accident. In the case of a machine which is provided with cone pulleys, the belts will usually be set for the highest speed when a wheel is removed. Unless a competent

man is in charge of this work there will be a very good chance of the operator placing a new, full-sized wheel on the machine and starting it up without shifting the belts to the slow speed. Unless some sort of a locking device is provided there is also a chance of an operator increasing the speed before the wheel has been worn down to the proper diameter.

In the case of a set of machines running at various speeds, there is a chance of an operator placing a wheel of large diameter on one of the machines intended for a smaller wheel. This can be guarded against by the installation of some sort of a stop which would limit the size of wheel which could be mounted on each machine. In case machines are provided with protection hoods the opening in this hood can be made just large enough to permit the mounting of a wheel of the proper size. If protection hoods are not used, the same end can be accomplished by fastening a pin to the base of the machine in such a position that it will not permit the mounting of an oversized wheel.

For rough grinding on bench, floor, swing frame, and other machines a speed of 5,000 peripheral feet per minute is recommended as the standard operating speed for vitrified and silicate wheels, except those known as cup and cylinder wheels. For these wheels a speed of 4,500 peripheral feet per minute is recommended. Speeds exceeding these figures should be used only upon the recommendation of the wheel manufacturer.

For some classes of precision grinding an operating speed of 7,000 peripheral feet per minute is sometimes recommended. Precision machines are usually built rigid and the wheels are kept true and in balance. They are also usually provided with good hoods. For these reasons the higher speeds are not considered as dangerous on this type of machine.

The actual speeds at which the machine spindles are run should be frequently tested with a speed indicator, or tachometer. If a spindle is driven by a variable-speed motor, the speed control for the motor should be enclosed in a locked case, or some device should be used, which would prevent anyone but a man assigned to that duty from changing the speeds. The maximum size of a wheel which should be used with certain operating speeds should be indicated in a conspicuous manner on a card posted near each machine.

Work Rest.

The proper adjustment of the work is also extremely important, as many grinding wheel breakages have been caused by work being caught between the wheel and the rest. Although wheels do not always break from this source, many injuries to the workman's hands have been caused in such a manner. The work rest should be kept adjusted close to the wheel at all times, the space between wheel and rest being not more than ⅛ in. They should be of rigid construction and should always be securely clamped after each adjustment. Instructions should be issued, so that the rests will not be adjusted while the wheel is in motion.

Applying Work.

When starting up a wheel it is well for the operator to stand to one side until the wheel has reached full speed, and has been allowed to run at that speed for about a minute. If it stands up satisfactorily for that length of time it is usually safe to apply the work.

Work should never be forced against a cold wheel, but should be applied gradually, giving the wheel an opportunity to warm evenly and thereby eliminating possible breakage. This applies to starting work in the morning in cold grinding rooms, and to the use of new wheels which have been stored in cold places.

On such operations where work is applied continuously to the wheel, care should be taken that the heat generated will not be so great as to break the wheel. If a large amount of heat is generated, the condition can sometimes be overcome by a change in the grade of the wheel, or by applying a steady stream of water at the point of contact.

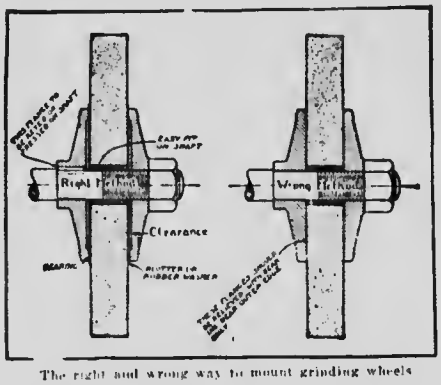
Truth and Balance.

It is important that wheels be kept running true and in balance. The work of keeping wheels true should be assigned to certain men who have been given special instructions. An inexperienced man who attempts to true or dress a wheel frequently makes it worse than it was before. Wheels should be tested for balance occasionally, and if the out-of-balance conditions can not be corrected by truing or dressing, the wheel should be removed from the machine.

Wheels used for wet grinding should not be allowed to stand partly immersed in water. The water absorbed may throw the wheel dangerously out of balance.

Side Grinding.

The question of grinding on the sides of a straight wheel has been much discussed. In some places this is absolutely forbidden. There are some classes of work, however, where it is necessary at times, to use the side of the wheel for grinding. It is difficult to set a fixed rule as to when this practice is permissible, as each case must be considered individually. It should be remembered that thin wheels are not as strong as thicker ones; also, that coarse wheels and those of softer grades can be more easily broken than the finer and harder wheels.



The right and wrong way to mount grinding wheels

If these things are taken into consideration, together with the nature of the work to be done any mechanic of good judgment should be able to tell whether or not a certain operation is dangerous. We recommend, however, that for work where it is necessary to continually use the straight side of a wheel, or where it is necessary to exert considerable pressure on the side, cup wheels be used. The continued practice of grinding, on the sides of a wheel intended for peripheral grinding, will soon wear the wheel out of shape, thereby making it run out of balance, and sometimes weakening it beyond a safe point.

Eye Protection.

In some cases of grinding there is considerable danger of eye injury. Where this danger exists the operators should be provided with goggles which should

preferably be the property of the operator. They should be of such construction that the lens will be firmly held in the frame in case of breakage. In order to give the best protection from fine dust flying around in the air the frame should be made to fit snugly around the eyes, following the contour of the face. The edge of the frame which fits against the face should be provided with a cushion. At the Norton Company plant it has been found that the type which is held in place by means of an elastic head band is more satisfactory than those with the metal temple bows.

A piece of plate-glass held in a metal frame is sometimes fastened to the machine just above the point on the wheel where the work is done. For certain classes of work these shields have proved quite satisfactory. Another device which has been used with more or less success consists of a leather flap or spare brush which is attached to the hood and adjusted so as to interrupt the particles and dust.

Types of Protection Devices.

As the time allowed for the presentation of this paper is limited a detailed description of the various forms of protection devices cannot be given here. We can merely give a brief outline of the principles of each.

There are three approved forms of protection for use in connection with grinding wheels—protection hoods, protection flanges, and protection chucks.

Protection hoods consist mainly of an enclosure for the grinding wheel which retain all of the parts of a wheel which might break in operation.

Protection flanges are designed to be used with tapered wheels or wheels of special shape, the function being to hold together the parts of a broken wheel.

Protection chucks are designed for use with cylinder or ring wheels. The jaws of the chuck, by being clamped around the periphery of the wheel, would prevent the broken pieces from being thrown out by centrifugal force.

These are listed in the order of their relative efficiency and importance. It will be noticed that protection hoods head the list. This arrangement was decided on after very exhaustive tests which proved conclusively that properly designed hoods are more efficient than protection or so-called "safety" flanges. An endeavor should therefore be made to provide all wheels with properly designed hoods.

However, there are some cases where hoods cannot be used and in such cases protection flanges are considered the next best. Of these the tapered flanges used with tapered wheels are the most common and most efficient. Other types, such as hub and ring flanges or dovetail flanges may be used in special cases, but care should be used in their design.

Complete specifications for the construction of those devices will be found in the Safety Code for the Use, Care and Protection of Abrasive Wheels, prepared by the Grinding Wheel Manufacturers of the U.S. and Canada, and approved by the National Machine Tool Builders' Association. Copies of this may be obtained on application to practically any manufacturer of grinding wheels.

Summary.

These remarks can be briefly summarized as follows: "To insure safety in the use of grinding wheels seek first to prevent wheel breakages by the observance of commonsense rules, and secondly provide all grinding machines with one of the standard forms of protection devices to protect operators and others in case something goes wrong."

DISCUSSION.

Mr. H. V. Hutton, Verity Plow Co., Limited, Brantford, said:

Mr. Chairman, Ladies and Gentlemen:

Mr. Rousseau has given us what I believe to be the last word on grinding wheels. As a representative of one of the big industries of our country, large users of grinding wheels, we have met with most of their problems and this paper comes as a fine thing to us. It strikes me that a copy of same would be of untold value if placed in the hands of every foreman responsible for the care and maintenance of said grinding wheels. I personally will see that the Verity Plow foremen are so supplied.

I believe we should have a closer inspection of grinding wheels from both inside our plant and from safety and Government inspectors who visit our plant from time to time. I personally cannot remember that an outside inspector ever checked up the speed of our wheels. To prove the necessity for this—only recently we found the foreman's son in one of our well-managed departments operating a new wheel on the high speed pulley running close up to 7,000 surface ft. per minute. Mr. Rousseau's report teaches us that we must have a higher respect for this grinding wheel. It has perhaps caused more accidents than from any other source in our factory. He warns us that it is fragile and tells us that it must be well cured for before putting into service and well protected and guarded when in service.

To get the most out of this paper we should discuss its different phases. A few questions have been prepared and we hope you have others to put before the meeting. With Mr. Rousseau here to give us expert advice, we should avail ourselves of this opportunity. While the greatest thing in life is eternal life, most of us want to live our allotted time here. Then let us think and plan safety for the other fellow.

I should like to ask Mr. Rousseau whether a properly guarded grinding wheel ever caused a fatal accident.

Mr. Rousseau: No such case have ever been recorded, while many fatalities have been prevented by the use of approved guards and flanges.

I would recommend the hood as being the best means of safeguarding the wheels, as they will keep the pieces in the machine. A certain small portion of the hood is left open for the man to insert his work, and a small portion of the wheel might fly off and hit the man in the hand, but it would not be fatal. I consider that the use of protective flanges is not enough for the large wheels, as a heavy object might swing against it, causing a large piece to fly off and hit the man in a fatal spot. The flange diameter should be one-half that of the wheel.

If the wheels are properly equipped with the protective hood, the flange should be at least one-third the diameter, and if you do not use the hood the flanges should be much larger.

The latter varies with the size of the wheel and is based on the exposure between the flanges. For a 24-in. wheel tthe minimum is an 18-in. flange, on 30-in. wheel minimum 24-in. flange; 12-in. wheel the minimum is a 6-in. flange. The larger the exposure between the flanges the larger the pieces that can be broken off.

Mr. Lennard: Do you have any trouble in getting the men to keep the guards on, as so many of them say it gets in the way of the work.

Mr. Rousseau: We have very little trouble in getting them to keep the guards in place, the reason is that a

properly designed hood is part of the machine and belongs there. The outside hoods are sometimes left off, but they are more in the way when left off than when in place. I believe that a lot of this trouble is caused by people using the wrong size flanges, and then sometimes use substitutes instead of restoring them when they are worn out. One man using 12-in. wheel had 6-in. flange on one side, and on the other where they were worn out, had put on crooked washers. The foremen do not always think of these things. If you have a 24 in. wheel and 18-in. flange, and the wheel becomes worn down you can use 18-in. wheel and 12-in. flanges. When it is worn down below this point it is time to put on a new wheel. Men will sometimes put on a new 25 in. wheel and use the same flanges that were on the 18 in wheel.

Mr. Hutton: Is the manufacturer ever justified in making a special wheel the use of which is not safe?

Mr Rousseau: We get orders for all sorts of wheels of all shapes and sizes. We have in fact received orders for wheels a diameter of hole larger than the diameter of the whole. It is possible that the man who has ordered does not know this. We take it up with him and try to point out to him the best way to have the wheel designed. We get very good responses from the men in most cases, but if the customer does insist we will make the wheel for him, we being free from every responsibility.

Mr. Leonard: What is the best plan to get the men to wear goggles?

It is hard to get the men to use the goggles when going to the machine shop where the tool grinder is kept, the men will not put on their goggles for a few minutes. In this case we have found that the small glass shield on the machine is of value.

Mr Hutton: One of our men made the suggestion that a movable shield could be used and carried forward as needed and then thrown back if in the way of certain work.

Mr. Maclachlan: As far as grinding wheels are concerned, I think that the greatest trouble is in looking after the grinding wheel that is a utility wheel and used for everything. Guards will sometimes make it useless for certain types of work. Referring to goggles I have found one method very good and that is to make the men realize the strength of glass in the goggles. The men are afraid of getting the glass in their eyes.

Mr Rousseau: We have found that it is very effective to make a test of the strength of the glasses and for this purpose use a hammer. The men are usually very much impressed by this. In regard to the first item you mention about the hood on the general utility wheel. This is one of the things that we run up against quite often. You will find that there are very few things that cannot be ground on the machine with hood standard of operating, and if you cannot think of any other way, a special hood should be designed. Grinding wheel accidents when they do occur are very serious.

Mr Maclachlan: Many manufacturers and employees buy cheap goggles, and these are often broken causing the pieces to fly in the men's eyes. Goggles should only be purchased from a reputable dealer.

Mr. Knechenmeister: In regard to covering emery wheels, glass shields on the machines, we find, do away with the argument for goggles. We provide the men with the best goggles money can buy, and if we find that the lens does not suit the man's eyes he is sent to and optician who will grind a lens to suit his eyes, and these are put in the regular frame. We consider that the goggles are an essential part of the man's tools and we are trying to put them on the same basis.

Mr. Rousseau: I do not claim that glass shields are as good as the goggles, because nothing can take their place, but they are a help.

Mr. Falk: The men do not want to wear the goggles because of the discomfort. If the rim of the goggles is bound they are more comfortable and the men will wear them.

Mr. Albert: We have a large frame outside the office, and all the goggles that are broken are attached to the frame with information as to how they were broken. The men are shown the goggles and shown the records and this persuades them to wear the goggles.

Mr. Wanzer: I have found that the ordinary goggles do hurt my eyes, as I have tried them on. If they are bent to the shape of the head it helps.

Mr. Knechenmeister: The goggles can indeed be made to fit the eyes and to suit the eyes of the men, and this work is done by our first aid man. His eyes are tested if he complains and a special lens is ground.

Mr. Wanzer: Are these the large size goggles?

Mr. Knechenmeister: The regular $1^{1}/_{4}$ inch goggles.

We find that 50 per cent. of the accidents, including all cases in the doctor's hands, are eye cases. We are trying to get the men to wear their goggles all the time, and also to get them to buy them as they own them then.

Mr. Rousseau: In regard to this corrected lens. Is it made of regular lens stock?

Mr. Knechenmeister: These are made of the regular stock and we haven't found a case where the pieces went into the man's eyes.

Mr. Rousseau: We had a case where the man's eye was cut by a piece from his goggles. We have made a sample pair from special lens, which we are going to submit to goggle manufacturers to see whether or not a practical goggle can be made from them.

Mr. Falk: We have made investigations and find that the Julius King Co., of New York, grind a special lens and this is believed to be the best on the market. It is a single lens and the glass will stand a very heavy blow from a hammer and will not shatter.

Mr Maclachlan: As all double lenses are cemented together with gelatine, this cannot be used in hot surroundings or in summer as the gelatine will melt and obstruct the sight. You can get a very strong lens that will not shatter.

The chairman then called on Mr. B. H. Kepner for his paper on "Hazards in Grain Elevators and Cereal Mills."

Hazards in Grain Elevators and Cereal Mills

By E. H. Hepner, Maple Leaf Milling Co., Ltd., Port Colborne

Hazards in grain elevators and cereal mills. Two general classes:

First—Those like unprotected machines which cause injury and even death to the operator, and

Second—Those which result in the total or partial destruction of the building with or without injury and loss of life of the operator. The first-class has been quite fully protected as far as elevators and cereal mills are concerned, and any accidents or loss of life from these causes could, in most cases, be classed as fully accidental. In the second class is included, the fire hazard which may come from an almost endless list of causes.

Cereal mills and grain elevators are usually full of machinery and on this account the greater part of the building is not very conveniently accessible. The contents of the building are of very combustible nature. The floors are connected with spouting and other openings so that fire spreads rapidly throughout the building. For these several reasons it is almost an impossibility to get a fire under control after it gets a fair start.

Almost fifty per cent. of the fires resulting in the total destruction of mills and elevators come from unknown causes, and it is safe to assume that the bulk of these unknown causes are quite preventable.

After the unknown causes are looked over it is well to consider the known causes of fires. The principal ones are overheated pulleys, caused by choking up of an elevator, lightning and power, fires from overheated bearings and fires from machines.

A fire originating from an overheated pulley caused by a choke-up is almost self explanatory it can be prevented by prompt attention to choke up and, on a larger elevator, by having the motor throw-out when overheated. Lightning and power and overheated bearings are self explanatory. Fires caused by machines may be cleaning or separating machines or roll machines and feed mills.

Any of the foregoing hazards are naturally, at the start small hazards and can be controlled. Their occurrence, however, brings up a far greater hazard which when once started immediately gets out of control. All these common hazards are aggravated by the rapid accumulation of dust.

Dust explosions do not originate spontaneously. There must be some spark of flame which has a temperature equal to the ignition temperature of the dust. The source of heat of a flame necessary to originate a dust explosion need not be large an open flame or a torch or even an electric spark is sufficient.

The peculiar fire hazards in mills and elevators deal primarily with dust explosions. To better appreciate this hazard it must be understood that there are an almost endless variety of dusts. For example the dust one gets along a dusty country road is quite different from dust in a mine or factory. The road dust is inorganic in character, and the factory dust is, in most cases, organic. A rough differentiation between the two would be that inorganic dust contains only a very small amount of carbon while organic dust is made up almost wholly of carbonaceous material.

Dust explosions and gas explosions are quite similar. Gasoline and air are mixed in the proper proportions in a motor cylinder and exploded. The force of the explosion supplies the motor power. This is the class of controlled explosions.

Coal dust explosions in mines are quite familiar, and it is a notable fact that in recent years the disasters from this type of explosion have been almost eliminated. In experiments it has been demonstrated that mill and elevator dusts have a higher degree of inflammability than coal dust. The former dusts are hydro carbons and combustion is merely the process of chemical combustion with oxygen forming vapor and carbon-dioxide gas.

Because the air contains less than one-quarter by weight of oxygen the amount of air required for complete combustion is four times the weight of pure oxygen. Ordinary soft coal requires from 30 to 40 pounds of air for each pound of coal burned. The air in a room 10 feet square and 8 feet high would weigh 60 lbs. and this amount of air would require less than 2 lbs. of dust disseminated through it to use all of the oxygen in the air.

Such an explosion is combustion taking place very rapidly. The explosion of gunpowder is a combustion process—it is the process of oxygen locked in the saltpetre uniting with the carbon and sulphur of the gunpowder. Whether it is the explosion of a gas or that of gunpowder or of the particles of dust in the air the results of the sudden combustion are the same, that is: the almost instantaneous liberation of a great quantity of gaseous products many times in volume that of the elements before combustion, and enormously expanded by the heat generated by the chemical combination. It is this great volume of gas which does the mechanical work like lifting concrete walls and roofs and doing almost impossible feats.

Smoking and lighting matches cause many of the greatest fires and explosions. Scattered matches and cigarette stubs are too common causes of them. It is absolutely folly to smoke near or around a mill or elevator, and matches should be barred

An open flame will cause a dust explosion. A lantern carried in a dusty atmosphere is dangerous and the lowering of lantern and unprotected electric light bulbs into dusty bins is apt to ignite the dust.

Dust and dirt should be absolutely eliminated from mills and elevators as far as possible. There are six times as many fires in dirty mills and elevators as in clean ones.

Chopping machines should be so protected that metallic substances cannot gain access to them. The cause of dust explosion is not so great as would be expected on account of the bulk of material going through practically smothering the flame.

Elevator choke ups are frequent causes of fires and explosions. A pulley remains stationary while a belt continues to run causes friction which later causes fire. The explosion of the Government elevator at Port Colborne was caused by a choke-up of a lofter. In this elevator the utmost care was taken to insure cleanliness. This difficulty may be overcome by having auto

matic stops on elevator pulleys which stops them from running when the elevator becomes choked or otherwise stopped.

To sum up the precautions necessary to avoid dust explosions the following points should be carefully observed: (1) Smoking and lighted matches should be forbidden; (2). Avoid open flames of any sort; (3). Attend to elevator choke-ups promptly, and (4) Keep all buildings free from dust and dirt.

DISCUSSION.

Mr. McCann: I was greatly interested in this gentleman's paper and was at Peterborough at the time of the great Quaker Oats fire, in which 25 men were killed. In this case the sprinkler system and the fire brigade were absolutely no good, because of the explosion. The grinders should be put in one building apart from the rest, so that if an explosion did occur, it would affect only the building in which the grinders were placed.

Mr. Maclachlan: It is almost impossible to keep an elevator free from dust, but there should be plenty of equipment in the elevator to keep it down. I should like to ask the speaker whether any provison was made to safeguard the lighting. These switches should all be outside the building proper, to guard against sparking. As a matter of fact the lofter in this case was not over-heated. The insulation on the motor was intact after the explosion. Every mill should have a well-trained force, who thoroughly appreciate the dangers of an explosion, and know best how to guard against them.

Mr. Kepner: The distributing switches were practically all in one room. While the men are loading the barges they become covered with dust, the Port Colborne elevators were using conveyors for carrying this off, previously we were prohibited from doing so, owing to the loss of grain, but the Government has sanctioned their use.

Mr. Maclachlan: The lighting switches were scattered all over the building, and this is a very dangerous condition. None of the lighting in the mill was vapor proof, and all the mills should certainly take this question up.

Mr. Hogarth: Is it customary for all the employees in the mill to use the Humphrey elevators? The foreman in one mill informed me that certain employees in the mill were not allowed to use this elevator. Personally I do not consider this a safe elevator for mills.

Mr. Kepner: We have had the Humphrey elevators in our mills, and had them in operation since 1911 and we have had no accidents since that time. There was one accident to a man going through the mill, jumping off when between floors, but this did not happen to any one of our employees.

Just a small experiment to illustrate the power of dust: Take an ordinary candle, put a little flour or cornstarch in a cloth. Shake gently to and fro above the candle, and the flame will leap nearly twelve feet above the head.

Our Safety Week in the Border Cities and Its Successes

By Capt. Jack Robbins, Border Cities Safety Council, Windsor

Mr. Chairman, Ladies and Gentlemen:

I am very sorry indeed that Capt. Robbins is not able to be here to read his paper on "Our Safety Week in the Border Cities and its Success." Capt Robbins is secretary of the Border Cities Safety Council, and we believe we have the best secretary in the country.

In his absence I shall try to take his place and tell you of our efforts towards promoting safety in our part of the Province.

It is impossible to tell of our Safety Week without first telling of the formation of the local council.

The local council was really the outgrowth of a meeting of the manufacturers with a member of the Compensation Board. At that meeting the problem of the reduction of the cost of accidents in Ontario was discussed and the educational feature of accident prevention was emphasized.

Shortly after that meeting twenty one plants sent representatives to a meeting which was called for the purpose of organizing a Safety and Sanitation Committee of the manufacturers section of the Border Chamber of Commerce. A chairman and secretary were elected at that meeting and it was decided to hold monthly round table meetings of superintendents and foremen.

The first round table meeting was arranged for April 24th, 1919, and Mr. C. W. Price, general manager of the National Safety Council, was the speaker. Mr. Price also spoke at the Chamber of Commerce luncheon that day, and what he told of the paid secretary plan sounded so good that the manufacturers at once took it up and arranged to form a local council instead of merely a committee.

Capt. Robbins was secured as the secretary. He was sent on a tour of the cities of the United States who then had paid secretaries. He was gone two weeks, and when he got back he was so enthusiastic regarding the possibilities of holding a real Safety Week in the Border Cities that plans were at once made for the holding of such a week.

In arranging for the week it was not so much the idea of preventing accidents for that week only as it was to awaken the residents to the possibilities of organizing for safety and carrying out the program for the entire year.

Just as industrial safety must be "sold" to the plant managers superintendents foremen and workmen, so must public safety be "sold" to the community at large.

Our selling plan was to explain our intention to all the organizations in the district. We talked at the Rotary, Kiwanis, Automobile Clubs, at the Chamber of Commerce weekly luncheon, to the teachers the City Councils and Ministers' Associations. They all promised to assist us and when the week arrived they did splendid work.

The program for the week consisted of safety sermons in the churches on Sunday, the Rotary Club allowed us to provide a safety speaker on Monday of the Safety Week, the Kiwanis Club on Tuesday, the Auto-

mobile Club held a special luncheon on Wednesday and the Chamber of Commerce on Thursday was a joint Safety and Boy Scout Day.

Each evening during the week mass meetings were held in the Armory, and were attended by workmen business men and their families. We were a trifle nervous as to the outcome of these mass meetings because we did not know how the people would take to attending meetings for the purpose of listening to talks on how to prevent accidents. After the first meeting we were convinced that we were giving the people something they wanted and the large attendance each night gave us confidence for carrying out the program that had been made for the year.

If we had stopped at the end of the Safety Week our efforts might have been in vain because, even though we did not have a single serious accident or death during the week, safety work does not consist of a one week's effort but must be carried on all the year.

Shortly after our week we started the school of safety instruction. This school met twice a month in the Chamber of Commerce rooms and a man of authority on the subject for the evening gave a lecture on that subject. After the talk the meeting would be open for a general discussion and many valuable points brought out.

That the school was popular is evidenced by the fact that an average of 265 "students" attended. When we consider that these people, men and women, attended regardless of weather or transportation conditions we know that any effort along organized safety is appreciated and well worth while.

The results to plants is direct and the manufacturers in the Border cities are now gaining the benefit. One hundred and sixty-five diplomas will be issued some time in May to the men and women who attended 5 per cent. of the lectures. In our plant we have twelve men who will receive diplomas, and while they are not all in positions of authority yet they are safety men and carry on safety work along with their regular work. For example, the morning after the lecture on Goggles there were twelve men who had a first hand knowledge of why men should wear goggles at work, and they were all busy telling their fellow workmen about it. The demand for goggles was heavy that day and men are wearing them more regularly than before.

For next year we are planning to conduct the same school for beginners, an advanced school for the ones who have received diplomas this year, and also a school for truck drivers and automobilists. Also safety will be taken up as a part of the regular school work and taught to the children.

It can be taught to the children easily and they enjoy the lessons. You know it is as interesting for a child learning to read to have as a lesson a sentence like "When I first cross the street I look to the left, and when I get to the middle of the street I look to the right," as the old one we learned years ago which went something like this, "I see the little red hen the little red hen sees me." It teaches English just the same and also gives the child a lesson in safety that will never be forgotten.

We are firmly convinced that the answer to Accident Prevention in Ontario is educating the people to practise safety. We also believe that the best and quickest way to accomplish that result is to organize Local Safety Councils in each community.

Not necessarily with paid secretaries in each small town but good live organizations conducting schools and in otherwise boosting the work.

With local councils throughout Ontario we can come together at conventions of this kind and exchange ideas and methods and all be benefited.

DISCUSSION.

Mr. B. H. Kepner, Maple Leaf Milling Co., Port Colborne: I would like to know how you financed the organization at the outset?

Mr. Knechenmeister: At the first meeting four manufacturers present guaranteed $6,000 for the first year. We felt that it was not fair that these generous men should bear the entire burden, and a resolution was put through to the effect that the manufacturers would finance the council and if necessary these four men would take the whole thing on themselves. It is up to the manufacturers to start the work and the Executive Committee of the Manufacturers' Association in the Border Cities has assessed the manufacturers of that section for their share.

Mr. Little: What results have been gained from this work in regard to compensation costs?

Mr. Knechenmeister: I cannot at present give you the actual figures, but we know that it has results. Last week one of the best men in the factory came to me and said: "The whole safety idea is a matter of dollars and cents. If you don't think of it in this light you don't look at it in the right light, because it means many dollars and cents no. the employer so much, but to the employees it they would only realize it."

Mr. Little: There are abo four varieties of insurance companies in New York. All of these give reduction for safety work in the plant. The returns to these progressive companies is much more than the cost of the safety work. One large firm in Buffalo put out $60,000 in insurance, and in the first three months of this year they have had only 7 lost time accidents, with nearly 8,000 employees, at a cost of $100 for three months. It is good business and pays.

Mr. Martin: In regard to automobile license numbers, may I suggest that all these licenses should be controlled. If a man offends more than twice, his license should be cancelled for a time; this has a much greater effect than any number of fines.

Mr. Knechenmeister: We are now getting up a Vigilance Committee to consist of the best business men in the Border Cities. Those men will be given a number and provided with postal cards with this number on them. Infractions of the traffic laws which come under their observance, will be written down and sent to the secretary, who in turn will place them in the hands of the Police Department. A copy of the card is then sent to the offender, and he is asked for a reply. many times the man does not know that he has offended as the cars are often stolen ones. In the city of St. Louis 90 per cent. of these cards were replied to. If however two cards have been sent and no reply received the third notice is a summons to the police court.

The chairman asked whether there was any additional discussion and at 12.10 declared the session adjourned.

WEDNESDAY, 14TH APRIL, AFTERNOON SESSION.

Mr. G. C. Martin, T. H. & B. Railway, Hamilton, chairman

Mr. Martin, as a Hamilton member of the Executive Committee of the Ontario Safety League, extended his best wishes, and brought greetings from Hamilton to those present at the convention. He said that his railway experience had brought him closely into touch with the need for accident prevention, both from the point of preventing accidents to the public and preventing accidents to the employees of his company. He said that experience had shown clearly that accidents could be prevented by the exercise of care and caution, and asked that safety education be carried on in a more intensive manner than in the past, in the industries, in the schools, and in the homes.

The chairman then called on Mr. Poole for his paper on "Accident Prevention in the Rubber Industries."

Accident Prevention in the Rubber Industries

By H. S. Poole, Canadian Consolidated Rubber Co., Ltd., Kitchener

The scope of this paper has been limited to the more important phases of safety work which are particular to the rubber industry and considerations of a general character such as apply more or less to all industries, have been only lightly touched on, or entirely omitted. Generally speaking, modern rubber mills are equipped with the latest fire protection and extinguishing equipment, factory hospitals and machinery guards; proper attention is also given to educational work regarding prevention of accidents, and to periodic inspection of cranes, elevators and all specially hazardous machinery. The main causes of accidents in a rubber mill may be broadly classified into the four following groups: Fire, careless use of small tools, hazardous machinery, and vapor poisoning.

Fire.

Approximately 75 per cent. of the fires in rubber factories occur during the dry, cold weather of January and February. This mainly is due to three causes—(a) Many of the processes require the use of naptha and other inflammable solvents, which in a heated dry atmosphere evaporate more quickly than in a humid one; (b) Fabrics and other combustible material are dried and more liable to ignite; (c) Static electricity, which readily leaks to earth over the surface of moist fabrics, and through a moist air, accumulates and builds up a considerable charge and potential in a heated dry atmosphere. The majority of fires occur in the spreading department, where waterproof fabrics are produced by spreading a thin film of rubber dough over the surface of a fabric, and afterwards eliminate the solvents by evaporation over heated iron plates or coils. The condition of rapid evaporation in a dry atmosphere is most conducive to the building up of electrical charge, and it is no unusual thing to see heavy sparks several inches long snap across the surface of such a fabric. In a humid atmosphere the usual provision of an earthed collecting comb of fine wire or tinsel is sufficient to carry off excessive static, but in dry weather this cannot be relied upon. A device known as the Chapman Neutralizer which neutralizes the static charge by means of a high potential reverse charge has been found effective on machines used for one purpose only, where the neutralizing bars can be installed in certain fixed locations, and the operations are not complex. This is not always the case, and the system is not flexible enough to meet the condition more frequently met with where one machine is called upon to do several different operations. Probably the best way of checking fires due to static is to provide grounded plates for the employees working around these machines, ground the frames securely by a heavy copper wire, provide for artificial humidifying of the air in winter (four grains of water per cubic foot being usually sufficient or about 40 degrees of humidity) and furnish a "steam blanket" for extinguishing a fire as soon as possible after it commences.

A satisfactory "steam blanket" can be obtained by running a $\frac{3}{4}$-in. pipe around the spreading machine plates, about two feet above their upper surface with small holes drilled every six inches to direct jets of steam towards the fabric. This device will extinguish a fire very quickly and with a minimum of damage to the material. A hygrometer is sometimes installed in such departments to record the humidity of the air. Similar precautions are also taken in the cement mixing department, and it is customary to conduct these more hazardous processes in isolated buildings to localize the risk, and avoid alarm and confusion in other departments. Watchmen passing through these departments at night are not allowed to use an ordinary lantern. The best practice is to provide a well installed system of electric lights with keyless sockets in vapor proof globes, the switches being outside the building. Exceptionally good ventilation is provided in all departments where inflammable vapors can accumulate, both for protection against fire, and for the health of employees.

A further cause of fires in rubber factories is spontaneous combustion of piles of scrap ground rubber, and it is customary to store all such scrap in galvanized iron bins raised a few inches off the floor. It is considered good practice in rubber factories to have two or more fire squads, under the direction of a local fire chief; these squads are called out at irregular intervals by various signalling devices and competition is stimulated to promote efficiency.

Accidents Due to Careless Use of Small Tools.

In every rubber mill there are a considerable number of operations calling for the use of various forms of cutting knives. Many minor accidents are the result, mainly due to slipping of knives or to carrying knives unprotected in the pocket. Pocketknife shields are provided by some companies, and their use insisted upon. Every encouragement is given to the employees to have cuts or bruises, no matter how small, attended to by the factory hospital, the danger of neglecting such wounds being vividly brought to their attention by striking pamphlets and illustrations displayed on

the departmental bulletin boards. Where new construction or demolition is going on, some companies make a point of posting up in exposed positions pamphlets or blue prints illustrating the special danger of treading upon upturned nails. In some factories proper attention is given to cleanliness, a committee consisting of suitable officials such as the factory nurse, assistant superintendent, and one foreman, the latter being chosen rotatively, making periodical inspections to see that the sanitary and ventilating arrangements are kept in good order.

Hazardous Machinery.

Of the great variety of machinery used in the modern rubber mill, probably the most hazardous from the operating point of view is that in the mill room. Rubber mills are mainly used for compounding the various ingredients which enter into rubber manufacture into a uniform homogeneous mass, also for warming this mass, after a period of rest in which it is allowed to mature, up to a temperature suited to the various operations carried out on the calenders. Such a mill consists of two heavy cast-iron rolls 22 inches diameter, by 60 in. long (being the most popular size to-day) mounted horizontally in massive semi-steel side frames. Usually from three to six mills are driven from a single line shaft, pinions on the latter engaging with drive gears mounted on the end of the rear roll, and driving it at approximately 24 revolutions per minute. The front roll is usually driven from the back roll by connecting gears, its surface speed being from 66 to 90 per cent that of the back roll. Every rubber factory has its record of accidents due to employees getting one or more hands caught between the mill rolls. Before safety devices were employed, these accidents were expensive, both to the company and the employee, the damage usually running into two or more thousands of dollars, and the employee being either killed outright or crippled for life. In the early days the mill room was usually driven by a massively constructed steam engine, with heavy flywheel, and to shut down the mills by closing off the steam was too slow to be of any use in case of an accident. The mill drive pinions were usually provided with a lever operated jaw clutch, but to open this clutch when the mill was under load, even on a small mill was a difficult and slow business requiring the services of another employee.

The earliest known quick-stopping device, which could be tripped by the mill operator was installed during the summer of 1893 at the plant of the New York Belting and Packing Co., Passaic, N.J., and was devised by their engineer, Mr. F. W. Harding, for the purpose of safeguarding an employee who operated a mill at night, no other person being present to assist in case of accident. One week after the device was installed this employee got the left hand caught in the rolls but operating the quick stop with his right was able to withdraw his hand from the mill and phone up the hospital. The man lost most of the fingers of the left hand, but the stop device was considered so satisfactory that similar mechanisms were installed on all the general rubber goods mills of the Rubber Goods Mfg. Co., now a branch of the United States Rubber Company. This safety consisted of a horizontal sliding bar located about 18 in. above the centre line of the front roll, and so arranged that when it was thrust forward or pulled back, it released a weighted lever which fell against a spiral projection cast upon the driving half of the jaw clutch. A wedged action resulted between the driving and driven halves which effectively separated the clutch within two revolutions of the line shaft. This corresponded to about sixteen inches travel of the front roll, and was a great advance over previous practice. Somewhat similar devices were developed by the large manufacturers of rubber machinery, and up to about 1905 this form of quick stop was considered as the best obtainable. It was not ideal however, as the strains on the line shaft and bearings adjacent to the clutch was very heavy during the disengaging period, and it was difficult to get sufficient attention given to the lubrication of the driven half of the clutch when the mill was idle and the clutch disengaged, resulting in the necessity of frequently rebushing and heavy maintenance expense. Mechanically it was preferable to keep the pinions solidly to the line shaft, and allow unused mills to run idle. To do this involved the shutting down of the entire line of mills in case of accident; and as the engine or motor possessed considerable flywheel effect, it became necessary to instal quick releasing cut off couplings between the prime mover and the driven machinery which could be tripped by horizontal rods over each mill. As the line shaft and mills run at very low speed, the inertia effects are relatively small, and even a light load on one mill will cause the line shaft to stop practically instantaneously when the cut-off coupling is released. When the mills are all empty, however, there is appreciable drift due to friction within the coupling sometimes amounting to two revolutions of the front roll of the mills. To remedy this mechanical brakes have sometimes been installed on the mill side of the cut off coupling, arranged to be automatically applied by the tripping of the coupling. Many installations of this general type are to-day in use their chief drawback being that in many cases the rigging required for tripping the cut-off coupling is quite complicated, rather unsightly and not altogether dependable; also the lubrication of the cut-off coupling must receive exceptional care. In a recent installation of this kind, the tripping is effected by the de-energizing of an electro solenoid, installed as part of the coupling mechanism; each mill being provided with a small switch operated by rocking horizontal rods (commonly known as a cradle) located about two feet above the rolls. The use of electric wires between the mills and the cut-off coupling is a distinct advance over the mechanical trip device previously used.

With the advent of the electric motor the possibility of obtaining a quick stop by dynamic braking or by reversing the torque of the motor were early recognized. This method is known as "plugging" the motor, and with suitable automatic control, entirely satisfactory results can be obtained provided the motor has been designed for such service. In most cases some forms of gear reduction is used between the motor and the line shaft, the motor running at from 500 to 600 r.p.m. and the line shaft about 90 r.p.m. The most generally used method of obtaining a quick stop with this form of drive is to interpose a magnetic clutch brake between the motor and the reduction gear, the brake being installed on the mill side thereby checking all tendency to drift. Each mill is provided with a safety switch operated by a horizontal bar trip of the rocking cradle type, arranged to de-energize the clutch and brake through a relay. In order to improve the power factor of the plant load there has been a growing tendency during recent years to operate the large mill lines by means of low speed synchronous motors direct connected to the line shaft through a magnetic clutch. The clutch in this case is necessarily large and expensive but very satisfactory quick stopping is obtained. By the use of the mechanism above described the extent

of the injury resulting from a mill accident has been greatly reduced and rarely extends beyond the loss of the fingers or the hand.

Calenders.

The rubber calender is used for sheeting out rubber, sometimes frictioned into the surface of a fabric, and as a thin plain sheet. It usually consists of three or four heavy horizontal rolls, arranged vertically one above the other, and supported in massive cast-iron side frames. The speed of rotation of the rolls varies for different grades of rubber and for the class of work performed, but generally speaking it is slower than that of the mixing and warming mills. There are two hazardous operations in the use of a calender (a) feeding gum into the machine, (b) threading fabrics between the rolls to receive the coating of gum. The latter is the more dangerous of the two, and it is customary to run the calender at a low speed when performing the threading in operation. Two methods of safeguarding the employees are in use. The first is to provide horizontally swinging rods, just above each danger point, or a safety pull rope, passing entirely around the calender, so arranged as to trip a safety switch which automatically cuts current off the motor and applies dynamic braking or plugging. The other is to install a slotted guard across the entrance to the rolls where the fabric is inserted, the slot being just large enough for the operator to pass his fingers through to the third joint, yet not to reach the actual bite of the rolls.

In some cases, friction clutches or magnetic clutch brakes have been used between the motor and the calender, but the relatively small flywheel effect to be absorbed and the ease with which dynamic braking or plugging can be applied have usually decided in favor of doing away with any disconnecting device on this machine. Calender accidents, however, are relatively rare compared with those on the mill.

The value of these safety trips on mills and calenders would be largely lost if the employees were not trained in their use. It is the foreman's duty in most plants to instruct all new employees in the method of operation, and in some factories the men are required to take turns in shutting down the mill line at closing time, under the foreman's directions.

Tubing Machines.

The tubing machine consists of a steam heated cylinder provided with a feed throat, inside which is rotated a closely fitted screw of long pitch. In principle and design this machine has much in common with the ordinary domestic meat mincer, except that it is larger, power driven, and steam jacketed. The rubber is fed into the throat of the machine and is impelled by the progression of the screw through dies of various forms, heat being applied to maintain the plasticity of the material. Most of the accidents on tubing machines occur on account of the operator putting his fingers too far into the throat opening, and having the fingers gripped by the worm. The remedy is to extend the throat to such length that if the operator keeps his thumb outside the opening when feeding the stock his fingers cannot reach the worm. Many factories have sticks for feeding in the stock, but these seem to be used only when an inspector comes around, except on the large machines.

Power Driven Punch Presses.

These are used in the rubber mill for preliminary cleaning out of stock into the forms of heels and soles. They consist of a top platen of heavy girder construction arranged to descend vertically and drive a cutting die through the sheet of rubber stock. Wood or fibre cutting blocks are placed beneath the stock to absorb the shock and preserve the edge of the dies. The press is operated from any position in front of the cutting block, by depressing a treadle which extends the full length of the machine. Accidents are caused by:—

1. Fingers placed over the top of the cutting die caught by the descending platen.
2. Press starting unexpectedly from shut down.

To guard against the practice of handling dies from the top edge, safety handles or pins are tapped into the sides of the dies about 1-in. from the top. By training the employees to use these handles accidents from this cause may be largely eliminated. Treadle guards are installed, consisting of a board of the same section and somewhat longer than the treadle; this is rigidly fixed five inches vertically above the treadle. The operator is trained to rest his foot on this guard while placing the die in position ready for the next cut, thereby avoiding unexpected restarting due to the weight of the foot on the treadle.

Pressure Vulcanizers.

One of the most important processes in the rubber mill is that of pressure vulcanization. The pressure vulcanizer consists of a containing vessel usually cylindrical in form in which the articles to be vulcanized are placed, the chamber being sealed by a quick-closing steam tight door. Steam is admitted and the temperature brought to 247 degrees F. at which value it is maintained for varying periods of time according to the work in hand. These vulcanizers are equipped with a pop safety valve which is tested about once every six months by allowing the pressure to rise in the vulcanizer until the valve pops. In case the valve sticks or does not pop at the designated pressure or slightly above, it is cleaned, adjusted and tested out again. An air vent consisting of a 1-in. pipe and valve is installed at the highest point in the vulcanizer before opening the vulcanizer doors after a heat, when the steam has been exhausted in the gauge, to make quite sure there is no pressure remaining within the vulcanizer. From an accident prevention point of view, the vessel is considered in the same light as a boiler, and it is insured and periodically inspected in exactly the same thorough manner. Flywheels, cranes and elevators are also considered in this class, periodic examination being made in each case.

Vapor Poisoning.

In the compounding of certain rubber stocks, use is made of aniline oil, and the safe handling of this oil calls for extreme care on the part of the employees. This gas is poisonous in very small quantities when inhaled and as it has a pleasant odor, and is not irritating it does not give warning of its dangerous nature. Somewhat more gradual but very serious is absorption through the skin. The spilling of aniline oil on the clothing, hands or boots may result in severe poisoning by allowing the aniline to come in contact with the skin. It is also virulently poisonous when taken in to the system through the stomach. Mills on which this oil is used are provided with hoods or canopies arranged to fit the mills as snugly as possible. These are connected up to exhausting fans which carry the gases out of the building. It is important that these ventilating provisions be ample, as an insufficiency in this direction may have fatal consequences. A case occurred in one mill where an employee carried a box o

Zymole Trokeys in his pocket for several days, and which absorbed sufficient aniline oil during his working hours to poison him when he ate them.

On another occasion an employee spilled some of this oil upon the floor, and upon attempting to mop it up he became overcome by the fumes and shortly afterward died. The main considerations in safeguarding employees who have the handling of aniline oil are ample ventilation, cleanliness of employees and their abstinence from alcohol. Vinegar is used to mix with the oil when it is spilled or slopped over, acting as a neutralizing agent.

Accident Report Systems.

It is the practice in some rubber mills to have weekly accident reports prepared by the factory doctor or attending nurse. These reports state briefly the nature of the injury and how it happened. Copies are forwarded to the factory manager, superintendent and engineering department. In one factory it is the practice of the factory manager to have a particular man investigate and report on the cause of all accidents, it being his duty to state clearly exactly what occurred, and to recommend means to prevent the recurrence of such an accident if that seems possible. This method of following up every accident no matter how small has much to recommend it. It is also the practice in the larger mills to employ a particular man to take charge of and follow up all safety work. This includes acting on the reports of Government inspectors, insurance reports and the recommendation of the local factory safety committee where such exists. Unless some such method of following up safety and accident recommendations is put into force, they are liable to be relegated to the pigeon hole, in favor of the more vital concerns of production until some fresh accident brings out the necessity for taking action.

DISCUSSION.

Mr. R. Watkins, Gutta Percha & Rubber Ltd., Toronto: "As anything I could say would only duplicate what Mr. Poole has already given you in his paper, I can only congratulate him on the manner in which he has covered the question."

Mr. H. M. Nichol, Goodyear Tire & Rubber Co., Ltd., Toronto: "There is nothing to be added to Mr. Poole's paper, as to the prevention of accidents. The Goodyear Company has gone into the work quite exhaustively and works on the theory that accidents are largely due to ignorance. We have established an educational campaign at the plant, and it takes its regular course with the other problems. Something over 70 per cent. of accidents that occur are inexpensive. For the past two years we have had only two calender and one mill accident. These mill and calender accidents usually are the most serious type of accident. If the foreman and inspectors realize that you give them credit they will come fully into the safety movement. We have a flying squad that reports bad practices. We find that our accidents are largely minor ones, as there are comparatively few accidents in the rubber industry."

The chairman then called on Mr. F. H. Moody for his paper on "Accident Prevention in the Automobile Industry."

Accident Prevention in the Automobile Industry

By Frederick H. Moody, McLaughlin Motor Car Co., Ltd., Oshawa

BEFORE a meeting such as this, it would be a waste of time to enter into any lengthy explanation of the advantages accruing both to the company and to the individual employee, through a proper appreciation of safeguards throughout a plant. Their value, when applied rationally, cannot be overestimated. It is only when the subject is handled by a super-enthusiast if I may use such a term, that the full effectiveness of safety engineering is sometimes injured. By that, I mean the case where the applications of safety measures would possibly encumber the machine, or the movements of the operator, so as to diminish production to such a degree as to more than offset the value of the protection thereby obtained. The subject must be approached rationally, never losing sight of the present day slogan of "Increased Production."

The automobile industry probably does not involve problems that are essentially different from those that prevail in any metal or wood working factories, as the processes that prevail are primarily the same as those found wherever wood and steel are worked. It may safely be said, however, that there are few industries that employ such a wide range of machinery, as nearly every other trade is tributary to it in some degree in the supplying of its myriad wants. But this is considerably narrowed down in factories where the factory is actually built, by the fact that, there being so many parts more or less common to many makes of cars, numerous specialty firms have sprung into existence to supply these wants. This factor also helps the safety movements as I think you will agree, that generally speaking, it is more feasible to manufacture one product under more ideal conditions, than if a wide range of quite dissimilar parts were made with the same equipment. The automobile plant is becoming more and more a group of specialty shops, that is to say as automobile production is increasing, the practicability of having a quite separate department or plant, for each part of the car, is increasing. This, as previously pointed out, all tends towards safer conditions.

In the Oshawa plants of the General Motors Company of Canada, Limited, of which the McLaughlin Motor Car Company, Limited, is a subsidiary, there has been no concerted plan of accident prevention, although the movement has for years received every encouragement from the management. By this I mean that while there is no safety engineer, safety committee, etc., the management, superintendents, foremen etc., have shown so much interest in the matter individually, that the shops and machines are as fully protected as we think a good practice dictates.

A few instances of the protective measures in use will be cited. Every elevator in the plant, of which there are a number for moving cars, chasses and bodies

between floors, has automatic rising gates at each floor, controlled by the movement of the elevator, remaining closed except when the elevator is in the immediate vicinity of each floor. These elevators are of the open type, and to prevent articles falling through the bars of the gates on the occupants a strip of heavy wire mesh is placed over each end of the elevator. The elevator shafts are also protected at night by heavy fire doors, as are also the openings between the various buildings; but this, of course is required by the insurance underwriters.

The yard of the McLaughlin plant is L-shaped, and as there is a lot of traffic, of incoming express, and cars going out and in in the process of being loaded, the gate is made double, with an "in" and "out" opening. As the approach views are somewhat restricted this is a potent factor in preventing accidents.

You are all aware of the difficulty of coping with the tendency of men to hurry out precipitately on the first sound of the quitting whistle. The consequent hustle makes it not overly safe for the peaceable person to be in the path of the departing employees, so the management permit the women employees to leave five minutes before the men, thereby avoiding the mad rush.

Special pains have been taken to thoroughly protect every belt, especially all those that come less than four feet from the ground. No standard types of guards have been adopted, but they all seem quite effective. The more prevalent type is that made up of four wood or posts, with wooden cross slats, rising to about six feet from the ground. Other types are made of heavy wire mesh pipe, etc., more or less along the conventional lines. Also wherever a motor drive belt passes overhead, the lower belt is encased in a trough

Protective Devices in Wood Shop.

The wood shop presents more fields for protective devices than most of our shops, but the big difficulty experienced there is with the employees not appreciating their value. Several devices have been developed, and where used, have proved effective. On the shaper we have a useful guard with both horizontal and vertical adjustments, which has the additional advantage of acting as a guide for flat work. The done guard is used on the jointer. The circular saws and planers both have guards of the overhanging type. The gainers are protected by a pan hanging on the operator's side which prevents the table traveling too far should the operator trip over the machine. The usual hinged wire mesh guard protects the band saw, with the added feature of moveable guards for protecting the saw below the mesh guard. The shapers and gainers are used principally with special formed jigs, as most of the work in the automobile industry is productive. Much in the way of protection can be developed in the proper design of these jigs, and satisfactory results are being secured considering that these two types of machines are deemed the most dangerous in the wood shop. The immediate neighborhood of these two machines is also rendered dangerous by the chips which they cut or tear off. For the larger machines, special moveable wire mesh screens are set on the floor around the machine, and nearby windows covered with mesh on account of possible broken glass. The smaller machines have fixed protection of the same type, as well as the suction system with which all machines are equipped. For certain types of work special adjustable ball jointed pipes are led right to the cutting head.

The suction system as a means of purifying the air and carrying off dust may well be counted as one of the best known safety measures and is in use in several places throughout our factories. Every polishing lathe in the plating shop, has a suction pipe for each wheel keeping the air so clear that the electric baths in the same room are not affected by the metal dust. Our numerous spray painting booths are all equipped with a fan, so that each may be controlled individually. These booths are all of the same general cone shape, with the suction outlet at the inner end, the operator standing at the open end, entirely clear of all paint spray, which is effectively removed by the fans. The larger booths for body and chassis spraying, have two larger openings, while the wheel spray are quite small. In the engine block test room, a similar vacuum system draws off all the exhaust gases, each engine having a flexible connection to the overhead trunk line. A vacuum system is also employed for purifying the air of one of our final test rooms. Fumes from the dripping vats are drawn off in the same manner.

The sheet metal shop, machine shop, assembly room, mounting room and other shops are all equipped with a certain number of safety devices, wherever the need for such devices has become apparent. But the big difficulty in the way of protective devices, is not the question of devising such a device, but the convincing of the operators that it is distinctly to their advantage to make use of them. A persistent educational campaign is required to bring this about, and in this direction we are now trying to move ahead.

First Aid Equipment.

First aid forms an important part of the protective work, and in this our company has made good progress. We have a well-equipped first aid room, with other first aid points throughout the plant, all supervised by qualified first aid men.

I have here some of the literature which we are using in this educational campaign. The placards are posted throughout the factories, in conspicuous places where all who run may read, but the circulars are only placed in the hands of the foremen, who are supposed to impart the information to their men. The management are also securing a quantity of enamelled signs to be put up in the factories, carrying such cautions as "Think. If safe, go ahead"; "You can't afford to take a chance"; "Ring bell before starting elevator"; "Report unsafe places at once to your foreman"; and "Do not wear loose or torn clothing."

The safety movement is also aided by our weekly paper "Motor Sparks" in which timely suggestions are offered.

All this literature is valuable in bringing before the men continuously the value of safety measures. But the real impetus to this movement from an educational viewpoint is the proper supervision of the work. It is in this that we believe our greatest progress is being made, our various heads, from the foreman up, interesting themselves in the movement. The men are encouraged by this means, and where great presence of mind is displayed in the prevention of some serious smash up, our president has been known to reward the men very tangibly.

Dangerous conditions often arise from the most unexpected quarters. For instance, oil and paint soaked waste in the paint shop has been the cause of more than one incipient fire, from spontaneous combustion. The education of the men to collect this waste into proper receptacles, at regular intervals, for removal,

part of the safety movement. Dipping articles in the japan vats at too low a temperature has also caused subsequent fires in the ovens. Correct and intelligent supervision is overcoming all this.

Some of the plants in the United States, have had the safety movement with them for a long time. But it was not until November last that definite steps were taken to perfect a plan of central organization for the promotion of safety work throughout the various divisions of The General Motors Corporation. This inaugural meeting was held during the session of the National Safety Congress, in Cleveland. The degree of interest evinced by the G.M.C. may be noted by their having 16 delegates in attendance.

Central Safety Committee.

The educational and publicity work of this centralized movement for the divisions of the General Motors Corporation, is conducted by O. S. McQuistion, Inc., of Detroit, and the recommended plan of organization is as follows:

Appointment of a Central Safety Committee from among the managers and superintendents, the number of this committee depending upon the size of the plant The Safety Engineer will report to this committee.

Direction

(a) Plant supervision by managers and superintendents. (Central Safety Committee.)
(b) Safety Engineer.

Education.

(a) Bulletins.
(b) Pamphlets.
(c) Pictures: Local—Plant; Motion Safety; Entertainment and Instruction, and slides Safety Instruction.
(d) Lectures—Short snappy talks, usually four minutes.
(e) Statistics—Accident; Canadian Labor; Foreign Labor, and other Industries.

Inspection.

(a) Unsafe Conditions—Machinery; Transmission; Building and Property; and Sanitation.
(b) Safe Guarding—Physical Guards; Safe Practices; Improved Method, and Influences.
(c) Good Housekeeping—System; Direction; Co-operation, and Interest.

The above outline covers practically all phases of safety work and accident prevention.

The Central Safety Committee will appoint from among its members a committee on Education, whose duty shall be the supervision of all bulletins, pamphlets, pictures and lectures; a committee on inspection for the purpose of a careful supervision of unsafe conditions, safeguarding and good housekeeping, and a committee on statistical information for the purpose of statistical knowledge of accidents and all other statistical information that has any bearing on accident prevention. All these committees in turn shall report their findings to the Central Safety Committee who will make a final decision. A shop committee made up of the foremen should be selected for the purpose of plant safety supervision. The point is to get all working on accident prevention.

A great deal rests with the Safety Engineer, who must be a safety man through and through; one capable of acting on all phases of the work: a live wire; a good mixer; one who can get to the superintendents; a man capable of promoting clear constructive thinking and a wholesome co-operation in every department of the plant; he must be an all around man.

Some of the duties of a Safety Engineer are as follows:

Each morning go over the accident report of the previous day and find a remedy to eliminate a repetition of preventable accidents, and make, if possible, a sketch of the machine, or place where the accident happened. Supervise the inspection of every machine in the shop each day and see that all safeguards are placed in good condition. Supervise the inspection of tools and equipment and report immediately on any defect found. See that the material on the floor is placed in safe order and not piled in a dangerous way. See that the floor is clean and in good condition—central passage clear. Make a daily inspection of drinking fountains, cuspidors and water closets, and see that they are kept clean and in good condition. See that the factory is well ventilated and all smoke and gases carried off. Give every injured man a pass for treatment. Note all near accidents. Supervision and direction of all monthly accident reports and all such other duties as pertain to the plant.

Four Accident Prevention Essentials.

There are considered four essentials in accident prevention:

First—The manager, who must be won over to the necessity of accident prevention. The big essential is to have the manager back of all safety movements.

Second—The foreman, the next man, must also line up. As you know our first activities along accident prevention were devoted to safeguarding—the covering up of exposed gears and fly wheels; guarding of dangerous places, etc. All of this has only cut our accidents one-third so that now it remains a process of education, and the biggest man looming up in this education propaganda that must be put forth is the foreman. Care for the new man, and protect all.

Third—The employee who comes next, is the fellow we must get our message to. This must come through education. Have him see the necessity of wearing leggings in the foundry; goggles when grinding; the use of lifebelts, etc.

Fourth—The family, is another avenue we may use to get our messages across. We can do this through the school and safety drives. Children learn safety easier than grown-ups. This is one of our best opportunities to teach accident prevention. Safety drives get people talking and thinking about safety and it must do some good. Accident prevention is worth while; it ranks with any movement ever started for the benefit of mankind.

Accident prevention is still in its infancy and our reward in the future shall be the number of lives we may save; the number of limbs kept on the bodies; the number of eyes that will continue to see, and the real happiness that the home may show where carelessness has not entered.

The foregoing resume shows what our parent, the General Motors Corporation, plans to do in the safety field, and this work will reach out to every division.

DISCUSSION.

In discussing Mr. Moody's paper, Mr. H. E. Brasier, Willys Overland, Limited, said:

We are all, I am sure, very grateful to Mr. Moody for his splendid and comprehensive paper on "Accident Prevention." Even a casual reading of this pa-

per will convince as to the valuable matter contained therein, and no member of the League can afford to pass over the opportunity for safety organization that could be developed from the outline presented.

The automobile industry is, as you know, included in Class 10 under the Workmen's Compensation Act, under the heading of "Metal Articles."

Such manufacture, of course, requires a very wide use of machinery, and statistics indicate that injuries under Class 10 amount to about 25 per cent. of the total accidents reported. According to 1917 figures, the total number of accidents was 25,265, with 6,099 of these listed under Class 10. Further statistics indicate that 30 per cent. of the accidents reported involve a disability lasting less than two weeks; another 30 per cent. involved a lay off of from two to four weeks, demonstrating that a majority of the accidents are of a minor nature, and where minor accidents are concerned, there is a relatively greater room for the exercise of preventive measures.

Until the great war made us so familiar with the thought and sight of personal injury, there was a greater reluctance to take chances, but nowadays we can look calmly upon the result of serious mishap, whereas not long ago such a sight would have nauseated us. We have all become hardened, placing too little importance upon the necessity of safeguarding our persons.

On the other hand, there has never been a time when the employer has realized as fully as he does to-day that each man in his employ is a productive asset and that an hour or a day lost cannot be picked up.

In 1917 75,000 days were lost through temporary disability from accident in Class 10 nearly 20 per cent. of the entire loss of time reported in all other classes.

The League is concentrating upon preventive measures, and prevention necessarily brings with it the thought of education. Mr. Moody has shown you what his company is doing in the way of prevention posters and has outlined their further anticipated activity. There is nothing intricate in the plans already adopted and contemplated, and it is our duty to promote and further this propaganda. We may sometimes feel that educative endeavor along accident prevention lines is falling on stony ground, but there is no room for discouragement.

Mr Moody has outlined the organization that is contemplated for the establishment of a central safety committee in the McLaughlin establishment, an organization which will result in commanding the interest of every official and foreman towards the end of preventing accidents.

It will pay every institution with which the League is in touch to carefully study the line-up Mr. Moody has given us, for it can safely be worked upon and will give a basis for a start from which development along individual lines can be perfected.

In the Willys-Overland plant much the same precautions have been taken as outlined. Particularly in our own institution has considerable thought been given to the intelligent placing of machines so that the operator is safely located in relation to his work; also that he is intelligently located as regards the operation that he is performing in relation to the next operation on that particular part.

All of this has its effect in reducing the hazard to the operator.

It is the wish of the chairman that this meeting be opened for discussion so that some concrete line-up may be decided upon and the League in that way assisted, strengthened and encouraged in carrying on its wonderful work.

The chairman called on Mr. Leitch for his paper on "Industrial Dust"

Industrial Dust

By A. S. Leitch, Sheldons, Limited, Toronto

The presence of dust in the atmosphere is practically universal. Its effects are far reaching and extend into the upper regions of the world's atmospheric envelope. Light and humidity are affected by its presence, as well as the comfort, convenience and cost of human existence. Every day "Dust" collects a heavy toll from humanity in the form of money and life. It has been stated by eminent surgeons that the lungs of people who live in the congested sections of our large cities, are a dull grey color, whereas the lungs of those who live in open sections, such as the country or in the mountains are a brilliant red, and that this difference in color can only be accounted for by the greater amount of dust present in the air of our cities. Undoubtedly this high dust content is a serious menace to the lives of our citizens, but it is the workers employed in industries where the process of manufacture produces harmful dusts, vapors, fumes or gases, who are the greatest sufferers and, therefore, from a "Safety First" standpoint the subject "Industrial Dust" offers a very fertile field for investigation. The object, therefore, of this paper is to call to your attention:

1st The various harmful gases, fumes, vapors and dusts produced by industrial processes.

2nd The physiological effect which these dusts have on the human organism.

3rd. Present day methods by which they can be eliminated and healthy conditions maintained in the workrooms.

The various dusts to which industrial workers are exposed may be classified under the following headings:

1. Mineral
2. Metallic
3. Vegetalde
4. Animal
5. Combination of two or more of the above.

In describing the physiological effects of these industrial dusts we will disregard the above classification and consider the different forms of these dusts according to their effects as follows:

1. Irritating dusts which have only a mechanical action and act directly upon the part most exposed.
2. Poisonous dusts which, when entering the system cause a general poisoning, or have an affinity for certain parts of the body, such as the blood, bones and the nervous system.
3. Infected dust which carries with it disease ge

The action of irritating dusts found in metal grinding industries such as iron, steel, brass, copper and in stone-cutting, granite surfacing, emery grinding, etc., is chiefly local, affecting those parts of the body directly exposed such as the eyes, nose, throat and skin. The sharp particles may enter the unprotected eye of the workman and cause an injury, the extent of which depends upon the amount of material entering the eye and the force with which it enters. The thin, transparent membrane covering the eye and lining the lid becomes red and inflamed, there will be pain, great sensitiveness to light, and an increased amount of tears. If neglected, infection may occur by dust entering the eye or from attempts to remove the particle of dust with unclean rag or tooth pick. The eyelids will be swollen and stick together and the eye may be permanently injured.

Should the sharp metal particles be inhaled, the lining membrane of the nose may become affected and show redness and swelling, followed by an inflamed condition of the skin around the nostrils. Later chronic nasal catarrh often develops also causing the loss of the sense of smell. Not only is the lining membrane of the nose affected, but also that lining the tube which extends to the ear. This inflammation affects the middle ear and causes an unpleasant sensation of ringing in the ears, followed by a considerable loss of hearing. This irritating dust may pass beyond the nose, throat and bronchial tubes and enter the lungs, thereby causing a chronic inflammation and rendering the worker more susceptible to tuberculosis.

Other irritating dusts such as hemp, flax, cotton, jute tobacco, may cause keen inflammation of the eyes, nose, throat, lungs or skin. That of furs, feathers and hair may likewise have an irritating effect and in addition, carry diseased germs with which the worker may become affected.

Corrosive dust such as soda and potash, used in the manufacture of soaps and bleaching powders, cause inflammation and ulceration of the skin and other parts exposed. Poisonous dust, such as lead, arsenic, salts of mercury, the most common of which is lead dust, to which the worker is exposed in numerous trades, usually enters the system by being inhaled or through the stomach by eating food contaminated by lead laden hands. When entering the stomach, the lead, after undergoing changes, becomes absorbed and enters the blood, thus being carried to all parts of the system. The tissues chiefly affected are the arteries, nerves, brain, muscle and also the blood.

Dangerous fumes, vapors and gases usually show their effects immediately, on account of the rapidity with which they enter the blood and are carried to all parts of the body. The symptoms vary according to the amount inhaled. These fumes may be classified as follows:

1. Irritating fumes and vapors which act locally upon the eye, mucous membrane of the nose, throat, larynx, bronchial tubes and the lungs, such as ammonia, chlorine, nitric and sulphuric acid.

2. Poisonous, intoxicating fumes such as carbon monoxide, benzol, wood alcohol, carbon di-sulphide, benzine, aniline, and lead, which affect the heart, blood and circulation, the nervous system and digestive organs.

3. Others such as wood alcohol, affecting the optic nerve and causing blindness, chromic acid which causes ulceration and perforation of the partition separating the nostrils, phosphorus which affects the jaw bones, and mercury which particularly affects the teeth and lower jaw.

Irritating fumes such as ammonia cause inflammation of the transparent membrane covering the eye. The fumes of nitric acid have been known to cause intense inflammation of the mucous membrane of the bronchial tubes and later, when the worker has apparently recovered from the effects, inflammation of the lungs appears, causing death in a few hours.

Intoxicating fumes such as carbon di-sulphide, benzol and benzine, causes headache, dizziness, nausea and weakness in the legs.

Poison fumes, such as aniline may cause attacks varying in severity with the amount inhaled. Those unaccustomed to the fumes are particularly susceptible. In mild attacks, there will be headaches, dizziness, pain in the eyes, a feeling of fulness in the head and great weakness in the knees. The speech is slow and uncertain which, with the staggering walk, gives the appearance of drunkenness. The worker's face is pale at first, later blue, and he breathes with difficulty. If treated at this time by inhaling fresh air and heart stimulants, he recovers in a couple of days, but should the worker be so unfortunate as to fall and be unnoticed in some secluded part of the plant, he will continue to absorb the aniline fumes and death will occur very shortly. Very frequently, the worker apparently recovers, returns home, and during the night or the following day, the symptoms recur, the pulse becomes feeble, breathing is slow and difficult, and unconsciousness will occur followed by death.

Lead fumes arising from improperly hooded pots in the composing room of the printing industry frequently cause anaemia and lead poisoning among the printers.

Wood alcohol is used frequently in the preparation of varnish and shellac and in the manufacture of hats, artificial flowers and dyes. In poisoning from the fumes, the worker suffers from cramps, nausea, headache and dizziness. His flesh is tender to the touch, his temperature is low and he complains of great weakness. The symptoms very much resemble those of ptomaine poisoning. In addition, the sight is affected, varying in degree from dimness of vision to complete blindness. In fatal cases, death occurs from paralysis of the heart. Wood alcohol produces a particularly harmful effect upon the optic nerve, causing blindness even in mild cases of poison.

Mercurial vapors are met with in the manufacture of several scientific instruments and mercurial salts. While mercury is one of the heaviest of metals, it is known to volatilize or evaporate at ordinary temperatures. For this reason, all operations should be performed under hoods, as these fumes when inhaled, affect the blood and nervous system, particularly the teeth, gums and jaw bone.

In order to protect the workman from the harmful effects of these various forms of industrial dust, it is first necessary to collect them in such a manner as to prevent their escape into the general atmosphere of the workroom, and second, to deliver into the room a continuous supply of pure, fresh air at the proper temperature and in volume equal to that extracted.

Air is the common medium employed to collect and carry off this dust and both natural and mechanical circulation is in general use.

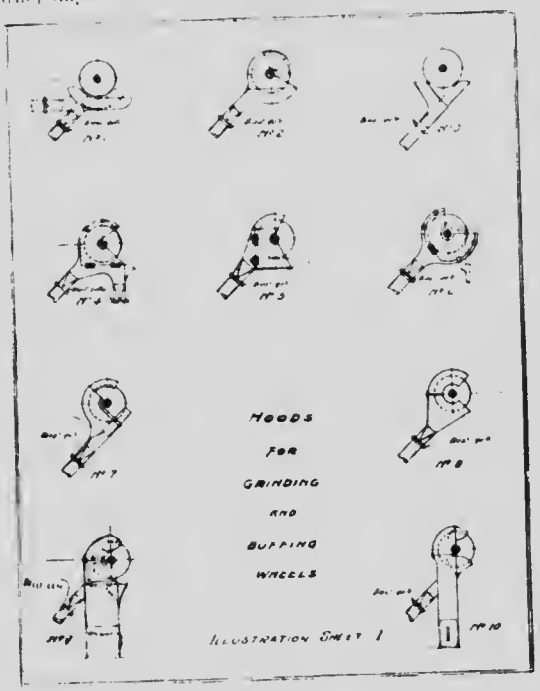
There are a few instances where gases can be carried off by natural circulation, such as in the case of a vat, tank or melting pot, where the temperature of the vapors and fumes is much higher than that of the out-

side air, due to the difference in temperature between the warm air in the pipe and the air surrounding it.

The natural gravity system has the following objections:

1st. Little or no circulation is established when the heat is first turned on. Take, for instance, the case of a blacksmith's forge, it will be found that when starting in the morning and while the fire is burning up, the heavy smoke will refuse to rise up the cold chimney and will spread out under the hood into the room, in fact, completely fill the room, before the cold air in the flue has been sufficiently heated to start a circulation which will carry up these dense fumes.

2nd. The action of a gravity system is seriously affected by the direction and force of the wind. We are familiar with instances where a natural draft flue will give particularly good results on certain days and on other days will be worse than useless.



3rd. In buildings where exhaust fans are in operation, a gravity flue is of little use, as the action of the exhaust fan tends to create a down draft into the building.

The removal of waste material from machines in industrial plants by means of fans or blowers has been in general use for about eighty five years. It is the most efficient and satisfactory method known. There are three general methods in practice by means of which the suction by the exhaust fan is applied to remove the objectionable dust. These are the downward lateral, and upward movement of air currents.

With the downward system, the hoods are located at a point lower than where the dust is produced. This, of course, is only applicable to the removal of heavy dusts, gases, etc., such as shavings, sawdust, chromate of lead, barium sulphate, paris green, silica., hydrated carbon of lead, and most pigments and salts. This method is also very successfully used in connection with the filling of boxes, barrels or kegs.

Lateral systems are those with which the hoods are placed at the sides or at the front or back of the machines producing the objectionable dust, and have been used successfully in the carrying off of nitric acid fumes,and in places where hoods cannot be placed above the vat. This method is also frequently used in connection with vats for pickling before galvanizing and plating.

By the upward system, which is the most common in use, is meant one where the hood or extraction member is located above the machine, vat or tank to be ventilated. This system is preferable where the dust, fumes or gases are lighter than the air and, therefore, have a tendency to rise. It should be used for the removal of coal gas, ammonia, hydrocyanic acid, carbon monoxide, steam, fumes of methyl alcohol, nitric oxides, hydrochloric acid, and the vapors which readily rise from vessels containing lead, arsenic, antimony or zinc when the same are heated to a certain degree.

When fumes or vapors of inflammable liquids such as methyl, alcohol, benzine, or ether, are to be removed by exhaust system, belt driven fans with copper or brass blades must be used and under no circumstance should a motor driven fan be installed where the motor or wiring system is in direct path of the material to be removed.

The design, construction and installation of a proper exhaust system can only be successfully handled by men who have specialized in this class of work. In the past this work has been left too much in the hands of tinsmiths, who probably have had no experience along this line but whose usual occupation is putting on tin roofs or making eavetroughs.

To make a thoroughly good and efficient hood is an art in itself. It requires the best skill of an experienced blow pipe man. Of course almost anything can be made work after a fashion, but to construct a hood that does clean work and does not require an excessive velocity or volume of air, is something known to but few mechanics, very few of whom are outside the employ of those making a specialty of blow pipe work.

Hoods are never carried in stock by anyone, there being such a variety of shapes and sizes that it is always advisable to build the hood on the job.

A governing principle for the design of hoods used for collecting refuse from machines, is to so shape the hood that the knives, saws or beaters will throw the refuse directly to a point where it will be caught by the high velocity air.

A hood is really nothing more nor less than a trap, its object being to prevent the escape of the dust or waste material and direct it to a point where the highest velocity of the branch pipe can reach it. If the hood fails to do this, it is not properly designed for the particular work required of it and in order to make up for this faulty design it will be necessary for the fan to handle a greater volume at a higher velocity and, of course, with an increased power consumption.

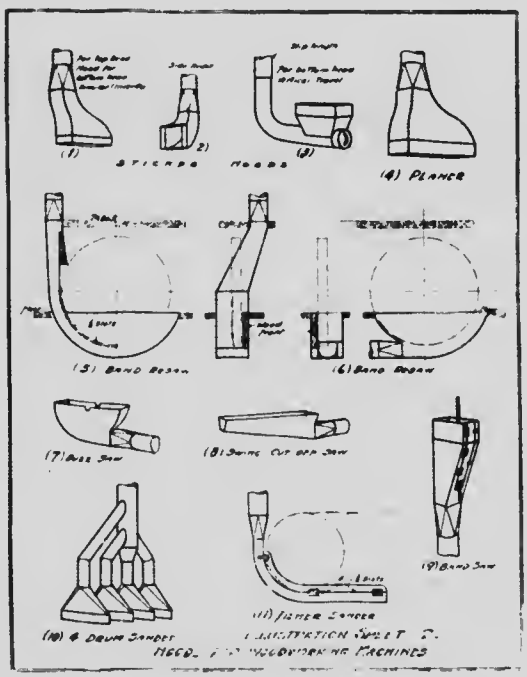
Hoods for grinding, polishing and buffing lathes have to be specially designed to suit the character of the work for which the wheels are used. A hood suited to one class of work on a good type of lathe would be wholly unsuited to some other class of work on exactly the same lathe. For instance, the grinding of some things can be done on the top of the wheel while others are more easily ground at the centre of the wheel or on the underside.

On illustration sheet No. 1 is shown different design

of this type of hood, each having its special application according to the class of work for which the wheel is used.

Speaking generally, the more a grinding wheel can be enclosed, the less dust will escape from the operation, but with certain classes of work, the wheel is so completely used us to make it almost impossible to do much more than run an exhaust pipe to it, something similar to hood shown in Fig. No. 3, in which case, the exhaust action is utilized to carry away as much dust as possible from the immediate vicinity of the worker. Cases of this kind are generally the result of an insufficient number of grinders and by installing a few extra machines it will be found that all the wheels can be properly hooded.

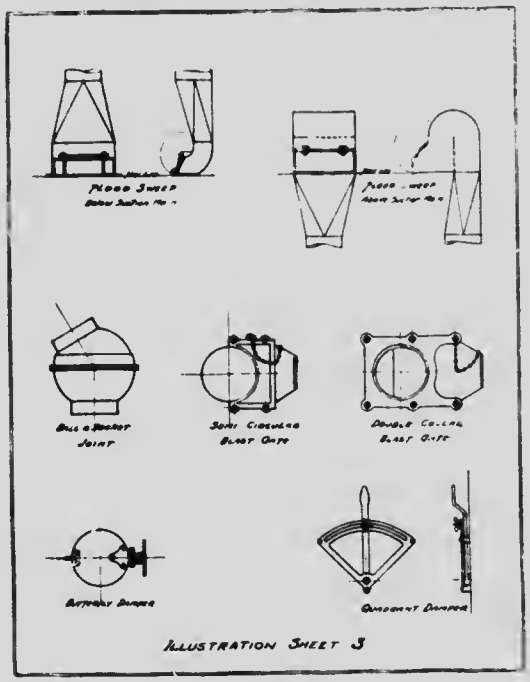
On Illustration Sheet No. 2 are shown some hoods designed for use with woodworking machines. The hood over the upper knives has a mouth at the bottom several times the area of the pipe, consequently it has very little lifting power at the mouth. Immediately above the apron around the knives, the mouth is drawn in on all four sides so as to reduce the area to about equal the pipe area. It is also drawn back at a considerable angle in the direction the shavings fall from the knives. See Hood No. 4. The shavings are thrown at once into the contracted area where the velocity is the highest and being once set in motion, it is a simple matter to keep them moving.



The hood to the bottom knives of a planer is little more than a shallow hopper with a rectangular opening in the bottom connecting with the exhaust pipe. The end of the pipe is usually left open to prevent clogging up, as otherwise, if the refuse should bridge over the opening in the bottom of the hopper, it would shut off all circulation and the pipe would then become dead until cleaned out.

The hoods to the side head of a planer are similar to the side head sticker hood in Fig. 2. These should be fitted with ball and socket joints.

The variety of hoods used in connection with woodworking machines is so great as to make it possible to mention only a few of the most important in this paper. The proper form, proportion and construction of these hoods is a subject very difficult to deal with on paper,

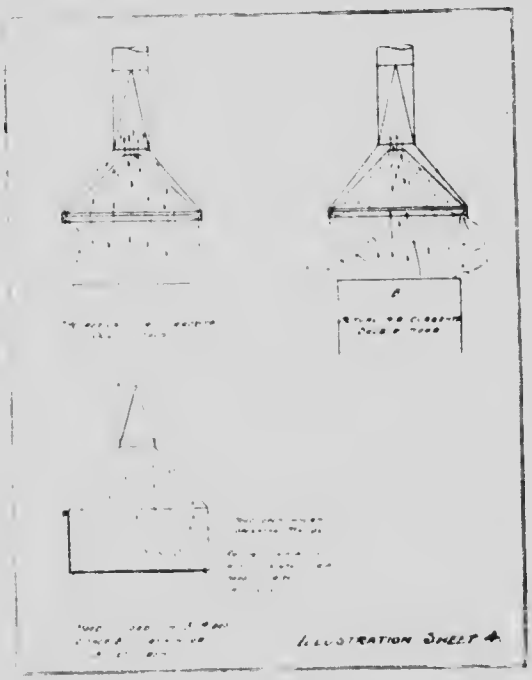


as each particular machine differs from machines made for the same purpose by other manufacturers.

On Illustration Sheet No. 3 is shown the regular form of sweep-up, as used for collecting the sweepings from the floor of a woodworking factory. The first illustration shows the type of sweep-up used when a branch pipe is overhead. The second illustration shows the type of sweep-up used when the exhaust pipe rises from the floor below. On this sheet is also shown an illustration of ball and socket joint, blast gate, butterfly dampers and quadrant dampers.

There has been considerable discussion in the past as to the merits of what is known as double hoods, which consist of really one hood inside of another, as shown at "A" and "B," illustration sheet No. 4. The object of the double hood is to concentrate a suction at the edges of the hood, the theory being that, by creating a high suction at the four edges of the hood, a strain of high velocity air would surround the vat or tank and prevent the escape of objectionable dust or steam. The direction in which the air is supposed to flow with a hood of this kind is shown at "A." The direction which the air actually takes is shown at "B." Experience has taught that with this type of hood, the thin strata of high velocity air which is supposed to extend from the hood to the edge of the tank is usually lost within a few inches from the edge of the hood. In other words, following the line of least resistance, the air enters the hood in a horizontal as well as a vertical di-

rection and within a foot of the edge of the hood it is impossible to detect any movement of air. The result is that in the event of steam rising from a kettle, it will rise directly from the centre of the boiling liquid and owing to the restricted opening at the top of the double hood, it will be crowded in the hood and much of it will escape into the room as shown at "B." The most satisfactory arrangement for carrying off fumes of this



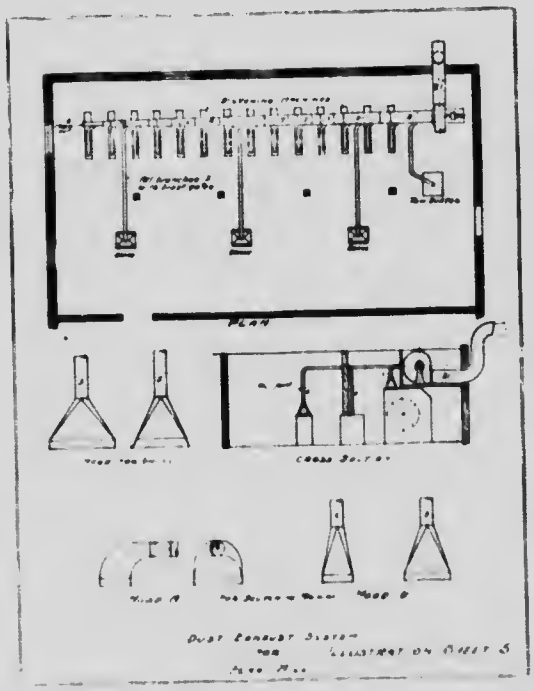
kind is shown at "D" where a single hood is used, the sides being brought down to the sides of the tank and one side only left open for the entrance of air. The open side should be the one where the operator stands, so that fresh air entering the hood will flow over him on its way past the hood. In some cases, where it is impossible to close the rear of the hood off with sheet metal, a curtain can be used similar to an ordinary window blind but made on a stronger roller so that it can be pulled down to enclose the space or run up out of the way when it is necessary to work from that side of the tank.

On Illustration Sheet No. 5 is shown a general arrangement of a system for exhausting the dust from the scutching machines, tow chasers and breakers in a flax mill. The flax industry is comparatively new in Canada and as the process is a very dusty one it is necessary that the machines be connected with a proper exhaust system. This illustration sheet also shows the form of hoods and size of branch pipes required with these machines.

On Illustration Sheet No. 6 is shown a typical arrangement of a ventilating system for a linotype room. When an installation of this kind the metal pot on each machine should be connected with a hood 16 in. in diameter at the base, 12 in. in height, and connecting with a 5 in. pipe. The vertical pipe should be fitted with a slip joint, not counter weight so that the hood can be raised up out of the way or taken down entirely when it is necessary to adjust the machine.

It is also important in the case of a linotype room to see that the supply fan and exhaust fan are started when the gas jets under the metal pots are first lit in the morning. It frequently occurs that the engineer or janitor at the building lights the gas under the metal pots an hour or two before the workmen arrive in the morning, but does not start the fans until the workmen enter. The result is that, during the time between the lighting of the gas jets and the starting of the fans, the room has been filled with the products of combustion and oxides of antimony and lead, and by the time the men enter the atmosphere is in a very poisonous condition, as the process of keeping the metal in a molten state gives off large quantities of heated carbon di-oxide, carbon monoxide and water vapors which are disengaged by the burning of the gas beneath the metal pots and the movement of the plunger in the metal which disturbs its surface and scatters the dross into the air.

On Sheet No. 6, is also shown a supply system for delivering into the room a volume of air slightly in excess of that carried off by the exhaust fan. One of the most common mistakes made in connection with the ventilation of industrial plants is the general impression that an exhaust system is all that is required to produce an ideal condition, whereas when we consider that in the first place, an exhaust system to do its work properly, must extract from the building a certain



definite volume of air every minute it naturally follows that if the fan actually does what it is required to do, that it would only be a very few minutes before all the air in the building was exhausted, which case, any one of three things would happen, viz.:

1st. A supply of air at the outside temperature enter the building from out of doors in a volume to the full capacity of the exhaust fan, or

2nd.—The capacity of the exhaust fan will be reduced in proportion to the volume of outside air which is permitted to enter, or,

3rd.—If no air from the outside is permitted to enter the building, the fan wheel will simply rotate in its case without handling any air.

In summer this condition is not a serious one, but in this country where the winter occupies the greater part of the year, it is very important to see that an adequate supply of air at a comfortable temperature be delivered into any room from which air in a large volume is being extracted, otherwise, in the winter months, cold air will enter the building and often times create a condition more objectionable than before the exhaust system was installed, due to the chilling effect of the cold outside air which will condense the moisture in the inside air and produce a condition of fog.

There is one exception to this statement and that occurs where a small department is so situated that it is in communication with a large building. Under these conditions, the leakage around windows and doors into the main building may be sufficient to supply the requirements of the exhaust system in the small building without any objectionable reduction in the temperature of the room.

Many exhaust systems have proven absolute failures due to the fan being starved for the necessary amount of air to do the work for which it was installed.

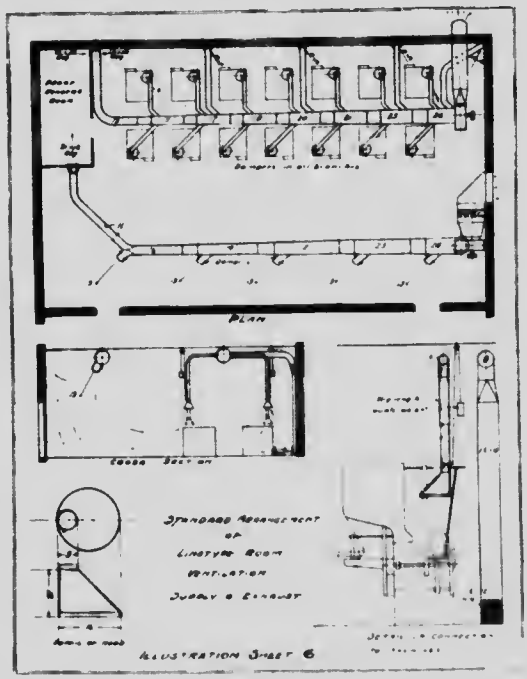
Illustration Sheet No. 7 shows a typical system as used in connection with granite polishing, stone grinding, chipping, etc. On this drawing the necessary dimensions of fans, separators, mains and branch pipes for use with any number of machines from one to ten are shown, and the elevation shows on a larger scale the arrangement of the branch pipes with ball and socket joints, counter weights, flexible rubber hose and hoods required.

Hand sandpapering, scraping, certain classes of painting, dusting with powders and small sand blasting can generally be satisfactorily handled by placing in the tables or benches a grating, under which is located a hopper or inverted hood which is connected with the exhaust system. For this class of work the fan should operate at a speed which will develop a velocity of not less than 3000 ft. per minute over the area of the grating.

For large sandblasting operations it is necessary to remove the sand which is thrown off from the sandblasting hose. This work can be most satisfactorily handled by locating a grating in the floor and placing the article to be cleaned on the grating. The operator should, of course, be protected by a helmet and a suction equivalent to 3000 ft. per minute should be maintained over the surface of the grating, and proper provision should be made for an adequate supply of air to enter the room.

Care should be taken that the hopper is so designed that the sand dust entering it will not cut off the suction. This can be most readily accomplished by dividing the pit or hooper into several compartments, each arranged with a separate branch pipe, each branch pipe being connected with the main exhaust pipe line. Portable wooden deflectors suspended from the ceiling are of great advantage in deflecting the grains of sand away from the operator.

During the past few years painting, enameling and lacquering by means of spray brushes or atomizers has replaced hand brush work. This operation throws a fine spray or mist into the air and if the solid pigments or the liquid medium which are used are poisonous, it provides a distinct hazard to the health of the workman. Such work should be performed only under an enclosed hood, constructed to suit the size of the work being done, and at the same time to provide ample room for the movement of the operator's arms through hand holes in the side of the hood. As with all other hoods, the conical portion should be located so that the spray from the brush will be directed towards it.



For this class of work a disc or propellor type exhaust fan with direct connected motor is not at all suitable and it will be found that an enclosed type of exhust fan, located some distance from the spray chamber and connected to it by means of branch pipes, will give much better results.

In general, a properly designed exhaust system should fill the following specifications:

The arrangement of piping connecting with the hoods should be so designed as to offer as little resistance as possible. The area of any main duct into which any branch pipes enter, should not be less than the combined area of the branches entering it plus 20 per cent. Branch pipes should enter the main at an angle of not more than forty-five degrees and thirty degrees or less is desirable. No branch pipes should be attached to the main at right angles. Two branch pipes should not enter the main directly opposite each other and "Y" branches should be avoided, as the two currents in conflict would retard the flow, sometimes causing the pipe to clog. Laps in mains and branches should be made in the direction of the flow of air. Elbows should have a radius in the throat twice the diameter of the pipe. Hand holes with tight fitting, sliding covers should be located in the main not more than 10 ft. apart. Each branch pipe should be fitted with a sliding blast gate. Top hoods should be arranged with slip joints and counter weighted. Care should be taken that lint from cotton polishing wheels is not carried in

the same main with dust from steel grinding wheels, as a spark from the steel grinders will frequently ignite the cotton dust causing explosion. In the same way care should be taken that fumes or gases from different hoods do not enter a common main where they might chemically re-act on each other and form explosive mixtures.

Acid vapors such as sulphuric, hydrochloric, hydrofluoric, etc., readily attack iron or galvanized iron ducts and should be conveyed in ducts heavily coated with asphaltum or in lead lined or wooden pipes pitched and joined together with wooden pegs

A very dependable rough rule for determining the diameter of exhaust pipes connecting with conical hoods, is to make the bellmouth one foot larger in diameter than the apparatus it is to cover and to increase this diameter one foot for every two feet elevation above two feet then to make the pipe one-quarter the final diameter of the mouth as thus determined. For instance a kettle two and one half feet in diameter, having the bottom of the hood two feet above it, would have a hood 4.5 feet or 42 inches in diameter and the exhaust pipe for this hood would be one-quarter of this, or approximately nine inches in diameter.

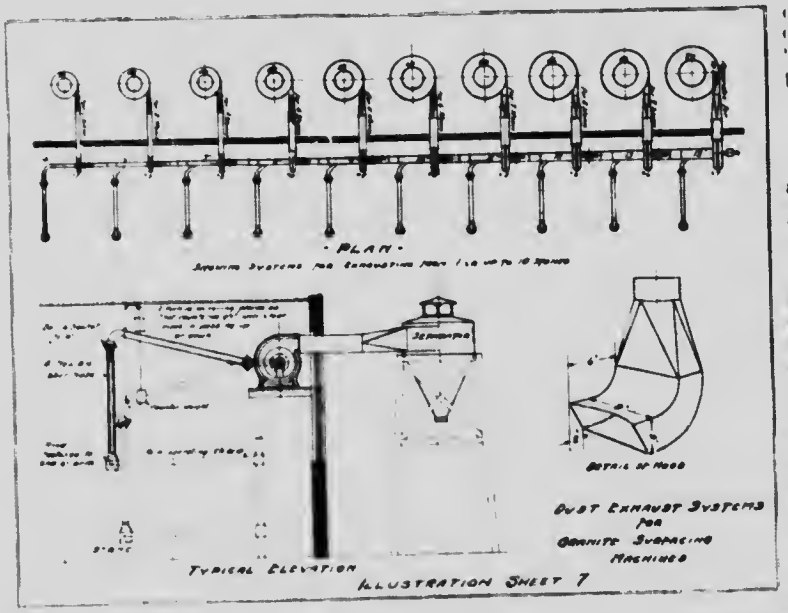
Practically the same results can be arrived at by making the pipe leading from the hood not less than one sixteenth of the area of the hood at the bellmouth, and this bellmouth should extend six inches in each direction beyond the sides of the vat or apparatus which it is to cover

Rectangular pipes can be compared with round pipes by multiplying the area of the square pipe by four and dividing by the perimeter of the square pipe The result is the corresponding diameter of a round pipe for the same velocity

The friction for varying diameters of round pipes is inversely proportional to their diameter at a given velocity The friction of rectangular pipes at this velocity varies inversely as the square root of their respective areas The friction of any pipe is directly proportional to its length

The velocity of air entering a bellmouth hood over a tank, vat or kettle should not be less than 250 feet per minute over its entire area when located within thirty inches of the top of the tank and this velocity should be increased by 100 feet per minute for every foot above thirty inches at which the hood is located.

In conclusion, it is to be regretted that so little attention has been paid to this problem by our universities and professional experimentatists. For generations our leading technical institutions have been experimenting on centrifugal pumps, steam turbines, steam boilers, heating plants and other various lines of useful and economical apparatus for industrial and domestic use and are still doing it, yet it is safe to say that none of them play a more important part in the development of our industries, the safety of human life and the economical production of manufactured goods than the application of fans and blowers to the removal of fumes, vapors, gases and dusts, all of which have been discussed under the heading of "Industrial Dust" in this paper.



DISCUSSION.

Mr. Charles R. Watson, Canada Cycle and Motor Co., Ltd., Weston, submitted the following written discussion on Mr. Leitch's paper.

The paper on Industrial Dust so ably read by Mr. Leitch has given us something to think about, he has covered every subject fully, and has left very little for me to say.

Dust is something which we meet everywhere, even in my experience as a sailor for 14 years we had dust to contend with in mid-waters. As Mr. Leitch has already informed you the flight of dust in the air carries with it all sorts of germs and diseases, and to guard against this we must have a continuous supply of fresh air in our factories.

In some plants it is difficult to get the necessary supply of air, such as grinding rooms, etc., but with proper piping and blower fan of sufficient size a constant supply of fresh air can be maintained.

Formerly it was considered sufficient to use the exhaust fan alone, but now it is generally considered more important to force the air in and trust to its finding an exit than to reverse the process. The air supply may be taken from a source, the surroundings and condition of which are known, thus insuring its purity. When necessary this air may be drawn through cheese cloth screens. With the exhaust method alone, the air which takes the place of the air drawn from the rooms comes from no one knows where. Under certain conditions it may be drawn from toilet rooms or other objectionable places. Too much care cannot be given to the installation of a proper ventilating system to keep the workers in our factories healthy, and where healthy, generally happy.

Thanking Mr. Leitch for the knowledge he has imparted to me through the reading of his paper on Indus-

trial Dust. I shall look forward to our next meeting, as I always go away wiser than when I came.

Mr. W. J. Orr: I don't think you can emphasize too much the importance of men going to a competent person to have bits removed from their eyes. We have considerable trouble of this kind. Some of the men are very careful and can do the thing properly but more often they pick the nearest thing and this unskilled probing often makes it worse. One of our men lost an eye a short time ago owing to this thing.

Mr. McCann: I have listened with a very great deal of pleasure to this paper. Most of these papers have been on the subject of guarding the machines, but it is to my mind, far more important to guard the man, and plenty of fresh air is doing this thing.

Mr. Leitch: Every factory is equipped with a dust exhaust system. It is not always the fault of the employees, however, that these systems do not work. Some of the worst factories have these systems, but in many cases the men cannot be brought to see the necessity of the hoods.

Mr. Moody: I cannot emphasize the fact too strongly that there should be expert men to look at the installation of these systems. It cannot be done by an ordinary tinsmith, he must be especially skilled in this work, and there are few such men.

Mr. Wanzer: A great deal of dust arises from the coal. The men become covered and have to breathe this dust. Guards do not protect the men from this.

THURSDAY, 15TH APRIL, MORNING SESSION.

Hon. W. R. Rollo, Minister of Labor, Toronto, chairman.

In opening this session Mr. Rollo said:

I have great pleasure in acting as chairman of this meeting to-day. Prior to this year I have not been actively connected with the work of the Ontario Safety League, but as a member of the Hamilton School Board I have always endeavored to assist them wherever possible. I count it a great honor indeed to be included among the honorary vice-presidents of the League.

I never become connected with any organization for that purpose only, or for the advantages that might come from so doing, but do so that I may assist as far as possible in the work being done by that organization. I realize that this League has made rapid progress in the short time in which it has been formed, and no organization could be engaged in a more worthy cause. I believe also, that this organization is one that will continue to make rapid progress as it is one that appeals to all classes of people. The fact that one manufacturer may accept its help and suggestions and use them, is proof that it is sure to spread to other factories.

I am perhaps now in a better position to render assistance to the League. The Department of which I am minister—the Trades and Labor Branch—has to deal with the safety of life and limb of the workmen, and is therefore working along much the same lines as the League, and I see no reason why we should not co-operate. The League, of course, is engaged in the work on a much larger scale. My duties keep me very busy and do not allow of much time for outside interests, but I assure you I shall be pleased to assist as far as possible in the work you are carrying on.

I have much pleasure in calling on Mr. McIntyre for his paper on "Shop Lighting."

Shop Lighting*

By Kenneth A. McIntyre, Electrical Engineer, Toronto

MANY attempts have been made to determine the percentage of industrial accidents attributed to improper illumination. The estimates range from 23 per cent upwards, and cannot be taken unqualifiedly, inasmuch as it seems impossible to secure an accurate classification of this kind. Poor illumination is certainly directly responsible for a considerable percentage of such accidents and indirectly responsible to an even greater extent. This general statement is borne out by the results of the study of an insurance company's accident statistics for one year. The number of fatal accidents in the months of December and January proved to be 40 per cent. more than might reasonably be expected, were there the same number of daylight hours in winter, as in summer.

Under poor and improper lighting, an obstacle in the workman's path means tripping or falling with possibility of becoming caught in machinery. Ever since stairs have been invented, human beings have been prone to fall up or down, and poor illumination favors the habit even though a broken limb or a broken neck be the penalty. Presence of shadows is also blameworthy.

Accidents are caused indirectly by injurious effect of improper illumination on the eyes, resulting in impaired visual powers.

Further, for humanitarian reasons, the eyesight of employees should be conserved.

The Postal Life Insurance Co., in its Health Bulletin No. 22 in 1918 states "The visual faculty in life's most precious boon; yet from infancy to old age its wealth is squandered in ignorant and excessive use. Among the agencies that work injury to the eyes, it is probable that our system of artificial lighting is the most destructive. The illumination in our homes, offices, stores, and factories is nearly always direct, concentrated and intense, whereas the most elementary science and knowledge of the laws of refraction teach that it should be indirect, diffused and at least as mild as daylight. But a vastly greater number of victims of defective lighting systems are those whose vision has become gradually impaired through an unconscious effort to accommodate the eye to the glare of an elec-

*References—Transactions of the Illuminating Engineering Society (I.E.S.), works of C. E. Llewell, Industrial Commission of Wisconsin, Publications of National Lamp Works of General Electric Co. and Electrical World.

tric bulb in its immediate vicinity. This growing weakness in the seeing power means reduced efficiency in every way."

Eye-strain is productive not only of headaches, but of specific disorders of the system, as well as resulting in actual diseases of the eye, with blindness frequently the consequence.

The real test of illumination is the ability of the eye not only to discern details distinctly, but to continue the visual effort for a great length of time without eye strain and fatigue.

Good Lighting Stimulates Production.

Factory output or production is stimulated and improved by good illumination in various ways:

1. Increase production for same cost.
2. Greater accuracy in workmanship with consequent reduction of spoilage.
3. Reduced accident hazard.
4. Avoidance or at least reduction in eye strain.
5. Surroundings made more cheerful.
6. Work performed with less fatigue.
7. Order neatness and sanitation promoted.
8. Superintendence rendered more effective.

Such advantages are obvious and can be obtained through an annual expenditure of less than 1 per cent. of the pay roll. It is not difficult to realize many times over on the investment.

During the past few years perfectly good machinery has been scrapped without hesitation to make way for more efficient machinery in the endeavor to increase production and reduce its unit cost. We should not overlook the need of the man in charge of the machinery and to provide him with the very best working conditions. He is the vital factor.

Lighting is of two kinds, natural and artificial. The requirements for good lighting under both classes are much the same.

1. Sufficiency under all conditions.
2. Diffusion, i.e. the avoidance of glare and of extreme contrasts of light and shadow.
3. Maintenance to ensure the conditions contemplated in the proper designs.

As the architect or engineer, who is abreast of times gives, during the design of industrial structures, very careful consideration to the matter of natural lighting, before passing to the subject of artificial lighting, the following points on natural lighting are worthy of mention.

1. Where no overtime operation is in effect 65 to 75 per cent. of the work is done by natural light.
2. Lighting codes require double intensity of natural lighting over artificial lighting because light coming to the eye in daylight from all the surroundings, is much brighter than at night. Thus a more intense light is required on the work.
3. Light should be adequate for each employee.
4. Windows should be so spaced and located that daylight conditions are fairly uniform over the working area.
5. Intensities of daylight should be such that artificial light will be required only during those portions of the day when it would naturally be considered necessary.
6. Quality of light should avoid glare due to sun's rays or light from the sky shining directly into the eye. Window shades or awnings should be provided where necessary to this end.
7. Ceilings and upper portions of walls should be maintained a light color to increase effectiveness of lighting.
8. Among the special means of improving natural lighting may be mentioned saw-tooth roof construction, skylights, and the use of prismatic glass to redirect light into the working space.
9. Wire glass should be used as safeguard where there is danger of glass falling if broken.
10. Some factory laws require the use of clear glass in lower sections of windows to enable employees to exercise long range vision to retain that power.
11. Windows should be cleaned regularly at proper intervals.

We now come to the subject of artificial illumination. Its importance has kept pace with the growth of modern industry, but its proper consideration is only too generally neglected, yet 25 per cent. to 35 per cent. of work is performed under artificial light. Production often demands more than one working shift and even where this is not the case, adequate illumination must be continuous regardless of length or brightness of days. Because of limited time, electric lighting only will be discussed.

At the outset it is well to realize that the incandescent lamp in its present stage of development is many times more efficient than the lamps of ten or fifteen years ago, it is available in larger units and at reasonable prices. Its brilliancy has also greatly increased, which introduces a serious problem.

Artificial lighting must comply with the requirements for good illumination set forth earlier in this paper. Complete satisfaction cannot be obtained if one of them is neglected.

In considering illumination, measurements are made in units of intensity of illumination such as distances in feet or weight by pounds. The unit of intensity is known as the foot-candle and is the intensity of illumination produced on a surface one foot distant from a lamp of one candle power.

Measurements are made by means of an instrument called a photometer. A simplified form known as the "Foot-candle meter" is in general use and is sufficiently accurate for practical purposes.

The first requirement is sufficiency. Intensity will be determined largely by the color and fineness of the materials in process of manufacture. Since an object is seen only by the light it reflects, dark objects will require higher intensities as does also work requiring more accuracy.

The intensities must be sufficient whether working surfaces are in horizontal, oblique or vertical planes.

For an average value, intensities in a vertical plane will be approximately one-half those in a horizontal plane of the same installation.

Diffusion, the second requirement, avoids glare which is defined as "Brightness within the field of view of such excessive character as to cause discomfort, annoyance or interference with vision." An exaggerated and familiar example of glare and its effects is met at night in attempting to drive on a highway under the spell of unprotected headlights approaching.

In problems of illumination the degree of glare depends upon six principal factors:

1. Total candlepower emitted by the source in the direction of the eye.
2. Distance from the source to the eye.
3. Intrinsic brilliancy of the source.
4. Contrast in brightness between the light source and the working surfaces and surroundings.
5. Proximity of the light source to the line of vision.
6. Length of time during which the source of glare is present within the field of vision.

Another form of glare is so-called specular reflection, in which case the image of a bright light source is reflected from a highly polished surface. This is especially trying because it is necessary to keep the eyes directed towards such surfaces when working on them and the eyes by nature are much more sensitive to light rays entering from below.

The avoidance of extreme contrasts require the illumination of surrounding surfaces as well. Thus the eye is not called upon constantly to change its adjustment from one extreme to the other. Aisles and passages for this reason must be well lighted.

The foregoing considerations lead to one conclusion—general lighting from overhead. It is thus possible to keep the light source somewhat above the line of vision and to secure uniform distribution by choice of proper reflectors correctly located as to mounting heights and spacing.

The use of drop lights should be avoided except when absolutely necessary because of very fine character of work or shadows cast by parts of machinery. The lamps should be covered from view by suitable reflectors.

Incandescent lamps are available in sizes 10 watt to 60 watt in vacuum type and 50 watt to 1000 watt in gas filled type for choice to meet any conditions. Their average life is 1,000 hours of burning and at the end of that period their efficiency is within 6 per cent of initial value.

Voltage fluctuations, if frequent and considerable, have a bad effect. Low voltage decreases candle power, over-voltage shortens lamp life. The lamp should be selected for the average voltage of the circuit. Light and power circuits should be kept separate if possible to minimize fluctuations of voltage. Copper sizes in wiring should be sufficient to keep voltage drop within 2 per cent.

Light emitted from incandescent lamps contains the colors of daylight and is not unpleasing to the eye. A type is available which approaches the color value of daylight.

The effect of frequency in the use of alternating current for lighting has been a matter of investigation in order to determine the critical frequency below which it is unsafe to go, but it is difficult to define what constitutes objectionable flicker. Incandescent lamps are least sensitive to low frequencies so far as flicker is concerned. For physical reasons the smaller sizes up to 25 watts show a perceptible flicker on 25 cycle circuits, though in larger units the flicker is not evident. Much of the annoyance displayed by some people must be due to suggestion and imagination. The case is cited of the man who worked for months under 25 cycle lighting without knowing it. Upon having the flicker called to his attention, he suddenly developed headaches and eye-strain. Flicker can seldom be observed by looking directly at the light source or at the plane of illumination. Due to the fact that the periphery of the retina is more sensitive to flicker than the centre, flicker can be detected out of the corner of the eye by looking directly at an object to one side of the light source. In general, it may be stated that for factory lighting no difficulty will be encountered except for very fine work under small size lamps for local lighting.

Three methods of general lighting are available, direct, semi-indirect and total indirect. The two latter are more suitable for illumination of offices, stores and buildings other than factories. Being inverted, they accumulate dust under average factory conditions unless cleaned very frequently.

Since an unshaded lamp sends no more than half its light below the horizontal, it is necessary to make use of reflectors.

In considering reflectors for a direct lighting system, the size of lamps must be first decided according to intensity required, spacing and mounting heights, which factors are determined by dimensions and structure of the building.

Reflectors may be divided into the broad classes

Extensive
Intensive
Focusing.

The former being used for moderate heights of mounting and the latter for greater mounting heights. In a brief article, time does not suffice for sufficient detail of illumination design and the statements are therefore more or less in the form of an outline.

Reflectors may be obtained in these three styles, but made of various materials, a list of which with comments follows:

Porcelain Enamelled Steel are strong, durable, reasonably efficient, reflecting surface does not deteriorate and can be easily cleaned, restoring to original condition.

Paint Enamelled Steel should only be used for temporary work, since they are usually of light gauge metal and surface deteriorates rapidly. Cleaning cannot altogether restore the surface to original condition.

Aluminized Steel has almost gone out of use in favor of porcelain enamelled steel. Strong, but the surface when dirty can only be restored by refinishing.

Mirrored Glass are breakable and require careful handling. Makes are available which show maximum efficiency over all other types of reflectors, the reflecting surfaces of which do not depreciate. Are opaque.

Prismatic Glass are breakable and require careful handling. Designs are available which give excellent results and have the added advantage of permitting light to pleasantly illuminate the ceiling and other upper surfaces. The makers claim low depreciation due to dust accumulating because the refracting and reflecting prismatic surfaces are not affected.

Opal Glass reflectors are not so efficient as prismatic glass, but the same remarks apply. They give excellent diffusion.

An interesting development is a combination steel and glass reflector recently designed which permits a portion of the light to escape to the upper parts of a room.

It is important in using low mounting heights to either use bowl frosted lamps, or to supply diffusing or reflecting caps over the tip of the lamps to hide the bright filament from view.

Lighting systems should be conveniently controlled by switches either local or in sectional cabinets. Circuits should run longitudinally so that central spaces can be lighted first as twilight approaches.

It is important to provide emergency from a separate source if possible so that in case of failure of the main lighting and power system, employees in emergency are able to find exit.

Watchman's circuits should be provided giving just sufficient light for safe vision in walking and to detect intruders.

Yard lighting should not be overlooked in the interest of safety. The need for stair and passageway lighting has already been mentioned.

Last, but not least, is the requirement of maintenance

ance to ensure good lighting. According to a recent and comprehensive article the best practical method involves:

1. The use of a depreciation factor, or factor of safety in the original design of the system to ensure adequate illumination when the system has depreciated a normal amount.
2. The cleaning of lighting units at frequent, regular intervals.
3. The replacement of lamps which have become blackened in service by abnormally long life.
4. The use of lamps at correct voltage rating for all replacements.
5. The refinishing of ceilings and walls at reasonable intervals.

This method should not stop with a knowledge of and a desire for it, but it should be organized as a regular part of the shop routine. Tests show that after a period of neglect, illumination can be increased anywhere from 25 per cent. to 100 per cent. by merely washing the units.

Lamps in use below rated voltage will show for each five volts below rated voltage a decrease in candlepower as follows

5 volts 15 per cent. loss.
10 volts 29 per cent. loss
15 volts 41 per cent. loss.

so this point is one we can ill afford to pass by.

The great need for education on the subject of factory illumination is forcibly illustrated by data recently gathered in 446 industrial plants by trained observers. 85 per cent. of the manufacturers interviewed were more or less satisfied with their present lighting conditions and yet only 40 per cent. of the plants visited were adequately lighted. Better illumination was needed in 60 per cent. of them.

The intelligence of men interviewed on the subject was rated as:

Intelligently informed 44.5 per cent.
Vaguely informed 35.4 per cent.
Not informed 20.1 per cent.

A further astonishing disclosure shows that there were more plants burning bare lamps than there were plants with lamps entirely equipped with reflectors. Here is the call to safety organizations for an educational campaign for the benefit of employees' welfare and safety.

The educational efforts of the Illuminating Engineering Society and of safety organizations have already resulted in legislation in several states in the United States.

The lighting codes thus made law are a logical step to follow in the path of industrial legislation. The requirements set forth in them are designed to protect the operators who must work for long hours under the conditions day after day. They are the very minimum consistent with consideration of the workers' health. They do not, however, ensure the most economical production, for which result much higher intensities are necessary.

These codes are in force in California, Pennsylvania, New Jersey, New York, Ohio and Wisconsin. A partial table of the Wisconsin requirements for intensities is given herewith:

Extracts from Wisconsin Lighting Code.

Order 2112—Artificial Light

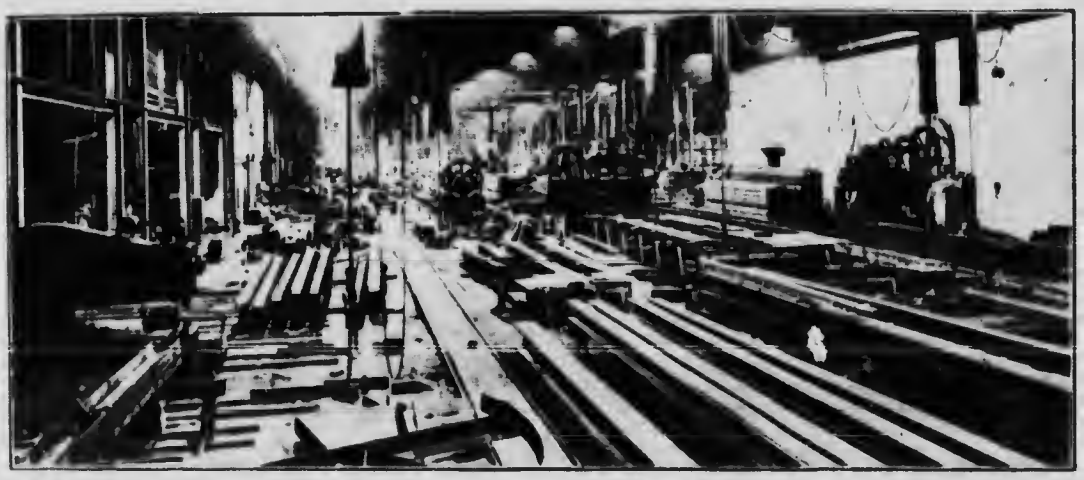
When the natural light is less than twice the minimum permissible intensities of illumination set forth in the following table, artificial light shall be supplied and maintained in accordance with the table. The intensities of recommended practice indicate the desirable illumination for best working conditions.

Illumination Intensity at the Work in Foot Candles.

	Minimum Permissible Intensity.	Ordinary Practice
(a) Roadways and yard thoroughfares	0.02	0.05—0.25
(b) Storage spaces	0.25	0.5 —1.0
(c) Stairway, passageways, aisles	0.25	0.75—2.0
(d) Toilets and washrooms	0.5	1.5 —3.0
(e) Rough manufacturing, such as rough machining, rough assembling, rough bench work, foundry floor work	1.25	2.0 —4.0
(f) Rough manufacturing, involving closer discrimination of detail	2.0	3.0 — 6.0
(g) Fine manufacturing, such as fine lathe work, pattern and tool-making, light colored textiles	3.0	4.0 —8.0
(h) Special cases of fine work, such as watchmaking, engraving, drafting mark colored textiles	5.0	10.0 —15.0
(i) Office work, such as accounting, typewriting, etc.	3.0	4.0 —8.0

Note—The measurements of illumination are to be made at the work with a properly standardized portable photometer.

The minimum foot-candles specify the lowest illumination intensity with which the employees can be ex



A good example of incandescent lighting, in a steel fabricating shop in Toronto.

peeted to work with safety when artificial light is used. It is to the advantage of the employer to provide the intensities of the ordinary practice, as this results in less eye strain, greater accuracy of workmanship, increased production for the same labor costs and less spoilage. When part daylight and part artificial illumination is used, it is desirable to use even higher intensities than those of ordinary practice, in the table above. (See note accompanying Order 2111.)

In order that the illumination intensities shall never fall below the minimum during the interval between inspections, installations should be designed to produce initial values at least 25 per cent. higher.

Note that measurements are taken at the work regardless of its position whether in a horizontal, oblique or vertical plane.

In conclusion it should be realized that the science of illumination has made tremendous strides in the past few years. The installation of more than five years which has not been properly revamped during that period is now obsolete. The design of a modern efficient and satisfactory system of lighting is no hit and miss proposition but requires the services and best thought of an expert.

Surely in all the provinces of Canada to-day there is the most glaring need for education and legislation to abolish the evils of harmful illumination and to bring to the aid of Canadian industry in its forward march the powerful ally of good shop lighting.

DISCUSSION.

In discussing Mr. McIntyre's paper Mr. H. L. Sheen, Canadian General Electric Co., Limited, Toronto, said:

Mr. McIntyre's very excellent paper on "Shop Lighting" is in accord with the latest recommendations of the Illuminating Engineering Society embodied in the lighting codes now in force in seven states in the United States.

The whole problem in a nut shell is summarized by the words "Sufficient light properly diffused" and the advantages as far as health and safety are concerned:

Reduction of Accidents,
Better working and living conditions,
Greater contentment of employees,
Order, cleanliness and neatness in the plant,
Easier supervision.

Advantages with regard to production include greater accuracy in workmanship, decreased spoilage of production and increased production for the same labor cost.

Considerable assistance can be given to factory managers who have not the time to go into technicalities on lighting by making up recommendations on a watts per square foot basis. A very useful table for connecting foot candle illumination with watts per square foot for certain standard equipments is now available.

So thoroughly convinced are all who have made a study of lighting that adequate illumination is an important factor in accident prevention that the codes above referred to are now published. I understand that no attempt has been made to enforce the law until now, but the inspectors will begin right away a systematized inspection of industrial plants, following this inspection with proper recommendations for illumination. I am sure that Mr. McIntyre will agree with me that such legislative action would be most advisable in Ontario, and in fact in all of the provinces of Canada.

Mr. Martin: How is a man to judge the correct voltage to use at home. He may be using a stronger voltage on some circuits than on others and an electric stove will affect the other parts of the house.

Mr. McIntyre: As the voltage is different for the different centres in Ontario you should ask the city department what the voltage is and then use accordingly.

Mr. Wanzer: Why do the factories use beaded or frosted glass for the lower section of the windows. Is it because the men may become distracted from their work, or is it because of the light?

Mr. McIntyre: This point was covered in my paper. In the United States the lower part of the window must be of clear glass so that the workmen may exercise their powers of long vision, as they may become very short sighted from close application to work.

Mr. Hawkins: Is it possible in case of an emergency to influence the rival firm to give you service? They would be able to carry a load large enough to make it worth. Would the Ontario Safety League have any influence in this connection?

Mr. Martin: Perhaps you could install a small storage system to take care of this.

Mr. Hawkins: This would run up into several thousands.

Mr. Little: It comes to my mind while on the subject of installation, a demonstration of a double reflector for fine machine work, where the operator wants a strong light on his work. Usually while there is a bright light on the tool or lathe the worker who apart from that is in a very dark situation. This new reflector is a double one, the outer shade is green and the inner one is painted white, thus assuring a soft lateral light on the eyes. From these a strong light is thrown on the work and soft one on the eyes.

This reflector unfortunately is rather high in price, being $4.00.

Mr. McIntyre: This is a very good point.

The chairmen then called on Mr. Wills Maclachlan for his paper on and demonstration of "Resuscitation."

Resuscitation

The Prone Pressure Method for Resuscitation from drowning, gas poisoning or electric shock.

By Wills Maclachlan, Electrical Engineer, Toronto

"The best manner in which I can describe resuscitation from electric shock, drowning or gas poisoning, is to quote from the rules on the Prone Pressure Method, issued by the National Electric Light Association, and now in use by public utilities throughout Ontario. This will be followed by a demonstration by two crews, one from the Toronto and Niagara Power Company and one

FIGURE 1

from the Toronto Hydro-Electric System. These crews will show you just how this work is carried on.

1. Instantly attend to the victim's breathing. As soon as the victim is clear of the water, rapidly feel with your fingers in his mouth and throat and remove any foreign body, such as tobacco, false teeth, etc.. If mouth is tight shut, pay no more attention to it until later. Do not stop to loosen the patient's clothing, but immediately begin actual resuscitation. Every moment of delay is serious. Proceed as follows:

a) Lay the patient on his stomach, one arm directly extended overhead, the other bent at elbow and with face to one side, resting on the hand or forearm, so that nose and mouth are free for breathing (see figure 1).

b) Kneel straddling the patient's hips with knees just below the patient's hip bones or pants pockets; place the palms of your hands on the small of the back, with fingers spread over the lowest ribs, the little finger just touching the lowest rib, the thumb alongside of your fingers, tips of fingers just out of sight as in figure 1.

c) Count one, two, with arms held straight, swing forward slowly, so that the weight of your body is gradually but not violently brought to bear upon the patient (see figure 2). This act should take from one to two seconds.

d) Count three, then immediately swing backward so as to remove the pressure, thus returning to the position shown in figure 3.

e) Count four, five, rest.

f) Repeat deliberately twelve to fifteen times a minute and swinging forward and backward a complete respiration in four or five seconds. Time with your breathing.

g) As soon as this artificial respiration has been started and while it is being continued, an assistant should loosen any tight clothing about the patient's neck, chest or waist. Keep patient warm.

2. Continue resuscitation (if necessary four hours or longer) without interruption, until natural breathing is restored, or until a physician declares rigor mortis (stiffening of the body) has set in. If natural breathing stops after being restored, use resuscitation again.

3. Do not give any liquid by mouth until the patient is fully conscious. Place ammonia near the nose, determining safe distance by first trying how near it may be held to your own. Assistant should hit patient's shoe heels about twenty (20) times with a stick and repeat this operation every five minutes until breathing commences.

4. Give the patient fresh air, but keep him warm. When patient revives keep him lying down and do not raise him. If doctor has not arrived, give patient one teaspoonful of aromatic spirits of ammonia in a small glass of water if he can swallow.

5 Carry on resuscitation at closest possible point to the accident. Do not move patient until he is breathing normally without assistance. If absolutely necessary to move, he should be placed on a hard surface, such as a door or floor of conveyance. Do not stop or interrupt resuscitation for an instant.

Send for nearest doctor as soon as accident is discovered.

FIGURE 2

The prone pressure method of artificial respiration described in the above rules is equally applicable to the resuscitation from electrical shock as well as of the apparently drowned, and also to cases of suspended respiration due to inhalation of gas, smoke or fumes, or to other causes.

Do not stop or interrupt resuscitation until patient breathes, or rigor mortis (stiffening of the body) sets in.

The two crews from the Toronto Hydro-Electric System and Toronto and Niagara Power Company then gave a most convincing demonstration of this method of resuscitation.

DISCUSSION

In discussing Mr. Maclachlan's paper, Dr. R. E. Gaby said:

We have seen an excellent demonstration of resuscitation by the method which is recognized throughout Europe and America as the best. Artificial respiration is resorted to in cases of threatened or apparent death from apnoea consequent upon (1) drowning, (2) anaesthetics, (3) electric shock, (4) inhalation of poisonous or noxious gases, or (5) any interference with the function of breathing.

Development along electrical, chemical, mining and other industrial lines make it imperative that a knowledge of the method of resuscitation should be available to all. In fact it is a moral obligation and the duty of every citizen to be acquainted with an efficient method. A knowledge of artificial respiration is as necessary on the street as in the factory—in our everyday life as in the industry. Artificial respiration is no longer exclusively the role of the physician, but should be efficiently practised by all.

From time immemorial man has tried to resuscitate the apparent dead. A resume of the methods might be of interest, and be useful to judge of the relative value of the methods of artificial respiration.

In 1767 a society was formed in Amsterdam to develop methods of resuscitation. In 1773 the method as practised in Amsterdam was translated from Dutch into English, resulting in the formation of the Royal Humane Society. The methods then employed were: Warmth, artificial respiration by mouth to mouth method, fumigation of large bowel by tobacco smoke friction, rubbing of the skin, bleeding.

In 1776 John Hunter devised a method by using bellows. This method was recommended by the Royal Humane Society in 1782. This was shown to be dangerous and was discarded 40 years later. From 1830 to 1855 resuscitation was carried on chiefly by warmth and artificial respiration regarded as a secondary measure.

In 1856 we have the first real organized efforts to systematize the methods of artificial respiration. In this year Marshall Hall introduced his postural method. In this method the subject was placed in prone position pressed upon back (active expiration) then turned on side and shoulder raised (active inspiration). Soon after Sylvester introduced his method which was recommended by Royal Humane Society in 1861. The subject was placed in supine position, and the arms were brought slowly above the head and then slowly brought down to the sides against the chest wall exerting a pressure on the sides.

In 1871 Howard demonstrated his method before the American life-saving organizations. This method did not find favor however.

In 1903 we have the most important contribution ever made to the literature of resuscitation namely the Schafer or prone pressure method. In principle it is somewhat similar to that of Howard. This method has

FIGURE 3

supplanted the Sylvester method and has been recommended by commissions in Great Britain and the United States as being the best.

About 10 to 15 years ago mechanical methods came on the market, not through medical means but largely exploited through the press. These mechanical apparatus work on the principle of the bellows. Inspiration being an active inflation and expiration by suction. The inspiration is usually automatic and dependent on oxygen pressure. The first machines did not differ materially from the bellows devised, Courtois in 1779. The use of oxygen is not new, as it was recommended by John Hunter in 1776.

The mechanical methods are open to many objections both from a physiological standpoint and their availability. These objections are: They are usually not available, and if artificial respiration is to be of any use it must be started immediately, and frequently their use causes a neglect of the manual methods. They are usually too complicated and are liable to get out of order. Their use is also likely to be dangerous in the hands of a novice. Respiration is dependent on the automatic activity of the mechanism of the apparatus. The Commission National Electric Light Association in 1913 showed that in animals respiration could not be kept up if left to the automatic activity of the apparatus. This automatic activity also does not give good ventilation as the insufficiency is easily turned into expiration if any back pressure is met. The machine by inflation impairs the resiliency of the alveolar walls and diminishes the amount of blood and lymph in the alveolar vessels instead of increasing as normally. The expiration by suction causes a collapse of the alveoli and respiration carried on in the bronchi and consequently inefficient.

We have in the prone pressure method a method always available, one which can be started immediately, is efficient and more efficient than any mechanical apparatus at present on the market. I don't think we can impress on the public too strongly the importance of learning this method of artificial respiration.

Mr. Little: What is the value of striking the man on the heels?

Mr. Maclachlan: It re-shocks him

Dr. Gaby: This striking on the heels stimulates the nervous system.

Mr. Little: Strickland recommends the method of dropping a man from a height of 5 feet to resuscitate him.

Mr. Machlachlan: This is a part of the resuscitation, but we have hesitated to drop a man from such a height in case he may not be caught before he dropped on his face.

Mr. Seddon: 16 years ago I received a shock of 2,500 volts, and I do not remember the time between the shock and the fall, and I fell on my face on the pavement. I had a fractured skull, but the fall brought me back to consciousness and I got up and began to walk.

Mr. Martin: Can you use this method if a man's ribs are broken?

Mr. Machlachlan: We try to train the men in one method only, and then cover it thoroughly. These cases of broken ribs are very rare, and even if the man's ribs are broken, use this method, as the more you hurt the man the more likely he is to come round.

Mr. Costigane: This method is principally used in putting oxygen in the lungs and expelling liquids. I understand that the lungs are paralyzed. Does this method bring them back to normal?

Dr. Gaby: What usually happens is a paralysis of the respiratory centre, by the action on the central nervous system. We must get the blood supplied with oxygen, and if the paralysis is not too serious the patient recovers, if it is he dies, and death is probably due to asphyxia.

Mr. Maclachlan: A resuscitation gang can start work in 8 seconds, and should be kept up for four hours, until the patient breathes or is dead.

A great number of the drowning accidents this summer could be avoided if the newspapers could be induced to give space to this manual, and in this way every man, woman and child could become familiar with this method and apply it.

The chairman then called upon Mr. A. P. Costigane for his paper on "Accident Prevention in the Pulp and Paper Industry."

Accident Prevention in the Pulp and Paper Industry

By A. P. Costigane, Ontario Pulp and Paper Makers' Ass'n, Toronto

I have been asked to read a paper on Accident Prevention in the Pulp and Paper Industry. This is rather a large order as accident prevention has so many angles that to cover the whole ground would not be possible in the time at my disposal. Furthermore, my first hand knowledge refers only to the pulp and paper mills in Ontario and I think it would be desirable under the circumstances to confine my remarks to what is being done in these mills.

We have heard a lot about accident prevention during the past few years, and I hope we will hear a lot more very soon. What has led to this interest? Some people think it is an outgrowth of the European war, but this is hardly correct. Long before the war started an uneasy feeling arose in industry and all was not well, internally. Strikes and limitation of output were the order of the day. Strikes are often times justified. The uneasy feeling was not confined to employers, the same feeling was beginning to cause thinking employees to ask the question "Why all this distrust and disagreement?" This questioning attitude creditable to both sides was fostered by leading articles in the newspapers pointing out the loss to the country as a whole caused by internal strife and emphasizing the benefit to be obtained from mutual trust and a give and take policy. About this time workmen's compensation came within the realm of practical politics, and the feeling already awakened helped the passage of the Workmen's Compensation Act through the legislature. The passing of this Act was the first real step taken to clear up at least some of the misunderstanding between employer and employee and marked the dawn of a better day in industry. The Act may not be perfect as it stands to-day, but it is an honest effort to deal justly with both employer and employee. Previous to the passing of this Act all claims for compensation for accidents were made under common law and in serious cases the claims were opposed by insurance companies who had insured employers risk. In the event of the insurance company being able to prove contributary negligence, little or no compensation was awarded the injured party. Besides this being an expensive and uncertain method of procedure the ability to appeal on the part of the insurance companies who had funds at their disposal, against the inability of the injured or his dependents to procure funds to cover legal expenses, resulted in many cases of gross injustice. Many just claims for compensation for accidents, sometimes caused by unprotected machinery, never received compensation of any kind on the ground that such hazards were accepted by the employee on entering the services of the company. On the other hand many cases of malingering received compensation through the agency of shyster lawyers whose importunities often forced a payment from employers who would rather pay a species of blackmail than go to court. The Workmen's Compensation Act has done away with all injustices of this nature, and as the Government handles the business itself, insurance companies are eliminated. Under this Act no matter how, when or where an employee is injured while executing the duties of his employment, he is entitled to compensation. You are probably all familiar with the Workmen's Compensation Act, so I will not dwell on it, further than to say that one provision at least appeals strongly to and was early taken advantage of by the pulp and paper industry. I refer to the provision whereby the employers in any industry have the right to form themselves into an association and appoint an expert to carry on active accident prevention campaigns. Taking a broad view of the situation and after exhaustive study of the experience of other countries the pulp and paper industry decided that something more than the guarding of machinery was required if the best results were to be obtained. A study of accident statistics showed that not more than 20 to 25 per cent. of the accidents were due to unguarded machinery, and the question arose as to how to deal with the

other 80 per cent. It was realized that while the employer could take care of accidents due to exposed gears, etc., little or no progress could be made along other lines without the whole-hearted co-operation of the men in the mill. An organization has now been in operation for four years working educationally and has secured the co-operation of a large percentage of employees. The progress made has justified the early conception of the directors of the association and proved that the efforts of the association were along the right lines.

The first year was devoted to missionary work among the employers and with few exceptions the employers proved readily accessible and not difficult to convince when the full scope of the plan was explained. Missionary work among the men in the mill was also taken up and converts were made almost from the start, in spite of the fact that some of the younger element treated the whole idea as a huge joke. A few serious accidents made use of as object lessons soon dispelled the joke idea, but some still hung back. By judicious enquiries and conversations with men whose confidence has been secured it became evident that the hanging back was caused by a feeling of distrust. This feeling of distrust, one might call it the residue of former strife, was the most difficult to overcome. One could feel when talking to the men that while they admitted a desire to co-operate they hesitated because they were all the time looking for ulterior motives and wondering what new scheme was being put over them for the benefit of the management. The idea of co-operation between the management and the men was new and it took a long time before the men were really convinced there was nothing in the background which would later be used to their disadvantage.

The question naturally presents itself—what is to be gained by an educational campaign? I will try to answer this question. 1. Reduction in accidents; 2. reduction in lost time due to injury; 3, reduction in labor turnover; 4, and most important of all, the establishment of a bond of union and mutual respect between employer and employee.

1. Statistics covering a period of years has conclusively proved that accidents can be reduced by organized efforts. Our experience in the pulp and paper industry of Ontario bears this out, and I think similar results have been shown in mills located in other provinces. I have here a chart classifying all accidents that have taken place in the pulp and paper mills in Ontario during the years 1917, 1918 and 1919. The records for 1917, however, are not quite accurate, as many accidents were not reported, so that for comparison purposes we can only deal with 1918 and 1919. This chart includes all accidents involving lost time of one-half day or more, whether such accidents were compensatable or not. During 1918 each full year worker in the industry lost 2.65 days owing to disability resulting from accident. Last year this figure was reduced to 1.99 days or a reduction of 24.3 per cent. (Mr. Costigane will explain in detail these percentages).

2. Reduction in Lost Time Due to Injury.

Anyone who has been responsible for the practical management of a mill or factory will admit from personal experience, that the lost time due to accidents is a factor to be studied and reduced. Where machinery is used, a minor accident means that the machine in question stands idle while the operator goes to the first-aid room to report and have the injury dressed. This may seem a small item but at the end of the year the time lost makes quite a big figure. In the case of a major accident, where a man is incapacitated for some weeks there is the loss due to training of a temporary man to fill his place. But the greatest loss of all is when an employee is fatally injured. In such a case there is bound to be almost a complete cessation of work by fellow employees in the immediate vicinity of the victim. A certain number will drop their work to give aid and will remain with the injured man until he is removed to the hospital (sometimes accompanied by one or two of his friends. After removal of the victim, there will be further interruption to the work owing to the witnesses of the accident discussing among themselves and with others the details of the occurrence. Following this, much time and energy is expended officially in investigation, interviewing witnesses, examining conditions, etc., and in the event of an inquest, the attendance of all officials directly or even remotely responsible for the occurrence. A value can be put on all these interruptions and when such figures are compiled the total will be astonishingly high even when the reduction of output is not taken into consideration.

Speaking of losses due to accidents, let me tell you of an incident that came under my own observation. Not long ago, I met the superintendent of a plant in which a fatal accident took place. In the course of conversation I put the question: "What do you consider this accident cost you, irrespective of compensation?" (expecting him to name a sum of a few hundred dollars at the outside.) Imagine my astonishment, when he said "About $1,000." Asked to explain, he said the accident happened at 9 o'clock in the morning, and owing to the unsettling of the other employees, the output of the plant fell to practically nothing for that day. Two days later the plant shut down for the funeral, all wages being paid by the company as usual. Thus the services of 200 men for practically two whole days was the price this company paid for that one accident. The superintendent did not over-estimate when he placed the figure around $1,000.

3. Reduction in Labor Turnover.

Safety organizing really means constructive work for industrial betterment, with the main purpose of promoting a sound body, a clear eye and brain, and a clean standard of living. Such a movement aims at preventing men from being injured, it precludes poverty, suffering and destitution in the families, it helps to prevent injury of one employee by another, by carelessness, or thoughtlessness, it emphasizes the necessity of guarding physical hazards, so that employees do not feel that their lives may be snuffed out if they are not constantly on guard to keep away from moving belts, flywheels or open gearing. Employees are intensely human and will seek employment, will remain with and speak well of the companies offering the best employment conditions and showing the greatest interest in their welfare.

4. Establishing a Bond of Union and Mutual Respect Between Employer and Employee.

There has never been a movement in the history of industry that has done so much to bring employer and employee together on a common platform as has the Safety movement. The formation of popular elected committees has been one of the chief influences to bring this about. When representatives of the employees sit in committee with representatives of the management, each learns the viewpoint of the other. The feeling of

restraint passes away and questions are discussed freely and openly. Meetings such as these quickly bring each side to realize that the other fellow is not such a bad sort after all.

The means adopted by the association must of necessity vary, as the men employed are not all of the same class. The grades run from technically trained men to day laborers and sometimes the latter are not even familiar with the language. The following are some of the principal means used to stimulate interest among employees:

1. Safeguarding physical hazards.
2. Teaching English to foreigners.
3. Improving lighting in building and yard.
4. Advocating pure drinking water in mills (individual cups or bubblers.
5. Issuing books containing safety instruction.
6. Placing of bulletin boards in each department, on which are posted regularly bulletins depicting the causes and results of accidents.
7. Exhibiting at meetings of employees specially prepared safety films, giving short lectures on safety topics.
8. Arranging matinees for school children to see safety films and encouraging essay competitions for prizes among the children on what the pictures taught them.
9. Designing and distributing safety calendars.
10. Education encouraging attendance at night schools (Text Books).
11. Formation of safety committees.
12. Visits to all mills and by personal contact arousing interest of the management as well as the men.

As well as above, means are taken to stimulate interest among employers. I may say that in some cases the employers need the stimulant mixed just as hot and strong as the law allows.

1. Comparative monthly statistics showing the position of each mill in comparison with other mills in the province.
2. Charts issued annually classifying all accidents during the year.
3. Letters commenting on accidents which might have been avoided.

I do not intend to elaborate all the methods I have mentioned, but merely to touch on some of the principal ones.

Safeguarding physical hazards, for instance, is important, as this must be the first step taken. There would be no use in asking men to be careful, if glaring cases of unguarded belts or gears were left to trap the unwary. Safeguarding of hazards must be done if for no other reason than to show sincerity on the part of the employer.

What has brought the best results so far has been the exhibiting of safety films to the employees. The usual procedure is to secure the use of a picture theatre in a mill town, issue tickets to employees a week in advance from the evening show, and inviting the school children to a matinee. Men on the night shift often attend the matinee with the children. Meetings such as these are always well attended and safety films such as "The House that Jack Built," "The Man he Might Have Been," "The Price of Carelessness" etc. are followed intently. An interval is arranged for during which a short talk on How to Prevent Accidents is given. Last year ten meetings were held at different points and invariably the accommodation was taxed to the limit. In some cases repeat shows had to be ... n to take care of those anxious to see the pictur... who had not, owing to the crowd, been able to secu... admittance. After viewing pictures such as I have ... ferred to, the audience is usually in a receptive fra... of mind during the interval and listen attentively ... anything said from the platform. These intervals ... great opportunities for a speaker to push home for... fully the lessons depicted on the screen.

As a result of some such meetings an intensive eff... was made in three mills, employing on an avera... 2250 people to reduce accidents. A date was set fo... "No accident week" during which every effort wo... be made to create a record of no accidents in each ... the mills. The week selected was from August 4th ... 9th, the same date being set for all three mills in or... to create friendly rivalry between men. During the f... weeks to elapse before the opening day of the fate... week arrived, various means were taken to secure p... licity throughout the mills. The date was announc... in every issue of the mill periodical, interesting artic... were written bearing on the subject and putting it ... to everyone in the mills to see that the mill, with wh... they were connected passed through the week with ... an accident of any kind. Inside the mills, signs w... placed in every department urging the men to be p... ticularly careful for that week. Red colored triang... were given to the employees to wear on their overa... as reminders of the "No accident week." Large ca... were placed in each department, with space left for ... names of those injured during the week. There w... also a large sign printed on cotton placed above ... entrance gate referring to the Safety Week, and a... ing the co-operation of everyone to make it a succes...

The results were magnifi...nt. At the close of ... week two of the mills had a clean record, not hav... had an accident of any kind, but one employee in ... third mill spoiled an otherwise perfect record. ... of the employees playing ball in the machine room... defiance of all rules and regulations, reached his ha... into the winders to recover the ball which had lod... there. His fingers were caught and rather ba... crushed, and he lost ten days as the result. That s... an accident, caused by misbehavior, should have b... pened was very regrettable, but much more to be ... plored was the callous indifference of this youth ... wards the success of the campaign in which his fel... employees showed so much interest. The remarka... success of the experiment in the mills referred to sh... what can be accomplished in preventing accid... when all pull together.

In this serious business of accident prevention, ... occasionally meets with an incident combining h... humor and tragedy. After an exhibition of safety ... tures at a Safety Rally held in one of the mill town... Ontario, I was standing at the door watching the a... ence disperse and overheard a couple talking of ... meeting. The wife remarked to the husband, "Jo... you will need to be more careful now of the way ... throw matches around, you might set the house on... some day." "Yes," replied John, "I will be more c... ful, and you will need to stop lighting the fire w... coal oil." "Indeed I won't," replied the lady, ... have been starting the fire with coal oil for two... years and never had an accident yet." This wom... was a convert to safety as it affected the action ... other people, but as far as she was concerned, it w... probably take the setting of her clothes on fire to c... vince her.

As a means of keeping alive the interest in acci... prevention all the year around, a good word should

said of the excellent service of bulletins issued by the Ontario Safety League. In nearly every mill in Ontario a bulletin board in every department is looked on as essential, and when these boards are taken care of and the bulletins changed regularly, they are a constant source of interest. It is a very difficult matter to secure new material every week for such bulletins, and the members of the Ontario Safety League could with very little trouble to themselves be of great assistance to the league and other members thereof if they would send particulars or procure photographs of accidents that may have occurred in their plants. Photos, such as these when prepared in bulletin form, may be the means of preventing similar accidents in other plants.

The distribution of safety calendars at New Year time we have found to appeal strongly to both the men and the families, especially if the illustrations are of a practical nature and treated humorously. Calendars, such as I have described are taken home and studied, create an interest in safety among the whole family. At the end of each month when a page is turned over a new lesson in safety is exposed to the gaze of members of the family, and so on from month to month. In all the mills when the calendar idea was taken up, the demand far exceeded the supply. The calendar issued for 1920 brought in more letters of congratulation than anything we have produced in the past.

I would like to say a few words on education, and what is being done along this line by the Canadian Pulp and Paper Association. The Pulp and Paper Association came to the conclusion some years ago that the better educated employees are, as a whole, the more efficient they will be, and the more efficient employees are the less liability to accidents. Working along these lines a Committee on Education was appointed; this committee on investigation found there was not a text book in existence covering the pulp and paper industry as a whole. Realizing that little or nothing could be done without up-to-date text books, the committee recommended that a fund be started to cover the cost of the compiling of such text books. The Association backed up the proposition and the money was immediately forthcoming. About this time, as a committee of the Technical Association in the United States was busy along the same lines, it was thought advisable that the two committees work together so that the method of education in the industry in Canada and the United States would be the same, and as the field covered would be so much larger, the cost would be proportionately reduced. A fund of thirty thousand dollars has been raised from the mills in Canada and the United States to be used in the production of a set of text books. These books, when they are finished, will be suitable for class or correspondence instruction.

The last point I wish to touch on, as I feel I have already taxed your patience, is Plant Safety Organizing.

I am a great believer in the maxim: "If you want anyone to take an interest in a movement, give him something to do." Therefore, I believe that the formation of plant committees, popularly elected will do much to reduce the annual toll of accidents. In the large mills I advocate a committee in each department responsible for the conditions in their own department. Also a central committee composed of representatives of the management and the chairmen of the departmental committees. The chairmen of the departmental committees being members of the central committee, binds all the committees together. Inspections are made periodically of the whole plant, and the report considered by the central committee, who have power, subject to the approval of the management, to order hazards to be safeguarded. All suggestions are passed on by the central committee, and adopted or discarded. In the event of a suggestion not being adopted a good and sufficient reason must be given, and a letter stating the objections sent to the employee making the suggestion. When a suggestion is adopted, a letter of commendation and thanks is sent to the employee responsible for the suggestion. This is merely the skeleton of a plan which we have found to work extremely well in the mills. Committeemen take real interest in the work and are sincere in their efforts to spread the gospel.

The whole success of safety work is bound up in the successful study of the personnel. The study of the personnel in any mill is most interesting and for the safety engineer absolutely essential.

Talking of studying men, I am put in mind of a story I heard recently at a dinner in Toronto. A well-known senator at Washington appeared in the Senate one day, with a beautiful orchid in his buttonhole. The flower raised the curiosity of a friend who enquired where he got it. The Senator explained that it had been presented to him by the head gardener of the Government conservatories who was a Scotchman and a great admirer of the national poet. By simulating an admiration and interest in the poet, he had got around the old man and secured the trophy. His friend determined to try the same game, so next morning he called at the conservatory and made a point of meeting the head gardener and entering into conversation with him. "I hear, Sandy, you are a great admirer of your national poet and I would like to tell you how I have studied his works, and what a great man he was," began the visitor. The Scot beamed, and the Senator feeling encouraged, proceeded to greater flights. "Yes, Sandy," said he, "the people of Scotland owe much to their poet and are rightly proud of having had such a great countryman as Willie Burns." The Scotchman turned a withering look on him and expressed his contempt by repeating "Willie Burns, Willie Burns, huh, Johnny Washington, get out." One can imagine the great indignation of the Scotch gardener on hearing the national idol referred to as Willie Burns. Study men as an aid to arousing their loyalty, but be careful to humor their prejudices.

DISCUSSION.

G. Meerbergen, Belgo Canadian Pulp & Paper Co., Ltd., Shawenegan Falls, Quebec.

Mr. Chairman and Ladies and Gentlemen. Mr. Costigane has covered the subject fully in his paper, but I will give you the benefit of what was done in our plant in regard to safety and accident prevention.

In June, 1918, at the regular monthly department heads meeting a Safety Committee was formed and this safety committee immediately started to "put the house in order." Guards were provided on all machines and the mill rendered as safe as possible.

In 1919, one year after, a new Safety Committee was elected to have the following broad powers:

1. Have general charge of all safety work in the plant (this to include sanitation till such moment that a man is appointed to take care of this work).
2. Make periodical inspections.
3. Gather information and statistics.
4. Adopt rules for government of mill employees.

5. Outline and supervise educational work.
6. Call meetings of their own accord.
7. Have the privilege of correcting employees when they seem to be careless in carrying work, or carry it out in an unsafe manner.
8. Granting of monthly money prizes for suggestions accepted by the committee.
9. Direction of Safety Bulletin, and other points which may arise of the discussion of previous reports.

In November last, after considering that more impetus was needed, a Safety Bulletin was started to convey to the men ideas on safety, comments on accidents and mill topics. This paper, which is issued every pay day, has generally 12 to 14 pages, and is distributed free to our 1,100 employees. Through this Bulletin we have asked the men to assist us in making suggestions, and in three months we have received over 125 of these. Monthly money prizes have been given to the best suggestions, and a minimum prize of $2.00 given for all the accepted suggestions. In this Bulletin we carry on a continual education campaign covering safety in the plant, in the home, the streets, and in the schools.

The following figures will show the utility of the safety committee and its Bulletin:

Lost time accidents in	1916	276	
	1917	243	900 men
	1918	204	
	1919	145	1100 men

From May to Oct. 1918 — 114 accidents, 1347 lost days
From May to Oct., 1919 — 66 accidents, 676 lost days

Last December in reading the report of the Laurentide Co. of Grand Mere, and which plant is located 9 miles from ours, we induced our men through our Bulletin, to try and beat the Laurentide record.

Accidents from May 1st to November 31st, 1919:—
Belgo, 1100 men, 75. Laurentide, 1450 men, 23.

In January 1920,	Laurentide had	5 accidents,	Belgo 4
February	Laurentide had	6 accidents,	Belgo 9
March 24	Laurentide had	14 accidents,	Belgo 8
		25	22

An influenza epidemic affected both mills to some extent during the last two months, but yet we have reduced our accidents to come down to the Laurentide level.

Seeing that safety had good results in our plant, the other companies combined their efforts and we are all together now, and are inaugurating the Safety League of Shawenegan Falls, Que., in staging a Safety Week on April 26th.

That is as far as the past and present is concerned.

The future. The Belgo-Canadian Pulp and Paper Co. is spending on the building and equipment of a first-aid room around $6,000; we expect to have a plant doctor and later on a trained nurse.

The Belgo Co. has offered for competition a cup that will go to the Shawenegan Falls plant showing the best record for 1920. With the combined action of the companies and the help of the employees and education through house organ, we expect to make Shawenegan the safest town of the St. Maurice Valley district.

Mr. Wanzer: "The paper has been of intense interest, and it might help a little to give some of our present experience.

"Regarding men reporting places where accidents are liable to happen:—

"We have suggestion boxes, and the men are invited to give us suggestions for the safety and betterment of the plant. These are collected periodically, and for those of good value, a prize is awarded. An original suggestion is awarded $25. In a plant such as ours—The Steel Company of Canada—accidents are very liable to occur, and great care must be taken. A great many stretchers are supplied and these are placed in cases, at different points, and as all the men know where they are, are quickly reached at the time of accident."

Mr. Costigane: "In a paper such as this one can touch only on the high spots, but it is well to emphasize the points that these safety committees not only promote good fellowship among the men in the plant, but increase the good feeling and spirit of co-operation between the employees and the management."

After thanking those who took part in the papers and discussions Mr. Rollo declared the meeting adjourned.

THURSDAY, 15TH APRIL. AFTERNOON SESSION.

Controller Joseph Gibbons, Toronto, chairman.

The chairman, in opening this, the final session of the three day Safety Conventions of the Safety Leagues spoke of the value of accident prevention to both employer and employee, pointing out that each had much to gain from the work of the safety leagues, although the man who saves his life or limb is a greater debtor to safety work. Controller Gibbons spoke of the work done in safeguarding the conductors on the street cars in Toronto, and told how the Toronto Railway Company had finally stopped the use of open cars, due to the hazard to conductors. The chairman went on to say that there were three important papers to be presented at this session and that he looked for a lively discussion on each of the subjects. He then called on Mr F. J. Gernandt for his paper on "Shop Safety Committees and Industrial Relations."

Shop Safety Committees and Industrial Relations

By F. J. Gernandt, International Harvester Co., Hamilton

IN order that I can place before you the relation of Shop Safety Committees and Industrial Relations, I am going to carry you back to February 1912, and note there an address by Mr. A. E. McKinstry, who was at that time superintendent of the Hamilton Harvester plant and who is now the vice-president of the International Harvester Company, in charge of sales and collections.

In Mr. McKinstry's address to us eight years ago he said:

"I have been particularly interested in this question of accidents, especially since returning from my last

trip to Chicago. Necessarily, in speaking of it, we are obliged to use dollars and cents as the measure of comparison. I am sorry this is true; I am sorry we have not got a pyrometer or a thermometer or some other instrument that might measure in human suffering what is involved, and I sometimes think, after it was measured out that if each one of us could receive an injection of a dose in proportion as each is responsible, it might do us some good.

Now, when I tell you that the owners of this business are deeply interested in this question, I want you to distinguish in your minds the difference between owners and managers. I do not say the managers of this business are alone interested in this question. I say to you that the owners of this business are interested in it. I want to say to you that the president, Cyrus H. McCormick, is responsible for the inauguration of the struggle to reduce industrial accidents in the Harvester Company, and he is willing to pay the bill.

Inauguration of Industrial Accident Department.

Mr. McCormick caused to be inaugurated the Industrial Accident Dept., by which the International Harvester Co. recognize the principle of Employers Liability as fully and completely as it is recognized by the Statutes of any State in the United States, or by any civilized government anywhere in the world. After doing this, he set in motion, through the proper channels, a strong campaign to guard the machinery in the different plants of the I. H. Co., for the purpose of preventing these accidents. He gave us a free hand; he said wherever there is a spot of danger and wherever the expenditure of a dollar will remove that feature of danger, I want you to spend the dollar.

Now, through the assistance of the general foremen through the assistance of the Mechanical Department; through the assistance of the Welfare Department at Chicago, we of the Hamilton plant have tried faithfully and honestly to carry out that idea and that principle. We have guarded our machines, we have removed every source of danger that has been called to our attention, and we have not spared the expenditure of money when by spending money we could make a guard or provide a device that was calculated to prevent accidents and despite the spending of money our accidents still continue, and they still continue in heavier ratio than they are continuing at other plants of the I. H. Co.

I have gone to the scenes of accidents a good many times and have gone over the circumstances with the foreman and I have said and I have heard the foremen say, that you would think anybody would know better than to do such a thing as that. That is true, but it is not good enough to say that any more, that won't do. We have got to try to educate the men that are working for us, so that they won't do these foolish things. As I see the situation, the Company has done its part to the last farthing, or if it has not done its part, it is willing to do its part to the last farthing by the expenditure of money. Now, if we are going to reduce accidents, we have got to enlist the support of the men. We have got to enlist the co-operation of the workmen, and that is the cause of my being here to plead with you gentlemen that we enlist the help of the workman. He is the man we must interest. The Company has done its part, now the men must do their part and we must help them, we must try to educate them and bring them up to that point. Very well, you say, a man never has any business to criticise anything, unless he has got some suggestion to make to improve the thing he is criticising, and I have one to make that I would like to carry out.

In the first place, I think there are a good many dangers that are self-evident to us, and we think, and you think, that everybody ought to know that; it is a perfectly plain proposition to you, it is so simple that it never occurs to you to refer to it and to caution a man against doing a certain thing. It seems so foolish to think that a man would do some of these things, that it never occurs to you to caution him about it. We all know that the general foremen are extremely busy men, that it is quite impossible for them to go down through their departments and stop with each of the several hundred men and instruct them minutely as to what they are to do, but we have got assistant foremen that come in contact with all of these men; you assistant foremen start these men on their jobs, you put them to work, you change them from one job to another, from an old job where the man is familiar with the work, to a new job where he is not familiar with the work and I want to enlist the support and help of the assistant foremen to begin a campaign of education, so that he will know himself that every man working in his particular gang has been instructed and has had pointed out the elements of danger on the job the man is doing. We want to reach the men; we want to find a way to interest the men. I have had prepared a safety button to wear on the lapels of the coats to boost for safety. I am going to wear one, and I hope and desire all you gentlemen will wear one. I want to have every man in the shop wear one of these buttons. We are going to put a bulletin on the bulletin boards in reference to that. We want to put a little life into the organization on that subject, so that the men will think occasionally of the element of danger, and the elements of safety. We want to have it in his mind, we do not want to refer to it as a by-product in a slighting way, it is a vital issue; it is a vital thing in the Harvester business, and we want to interest all our men.

Recommends Departmental Safety Committees

In addition to that, I propose that we appoint, on the recommendation of the general foremen safety committees in each department to consist of three workmen in the big departments, perhaps a smaller number in the departments with fewer men. Let these committees serve say, for three months. Give them an hour each week on full pay at their average piece work rates to go over the departments, give them a free hand for an hour every week, let them go over the departments, and let them make recommendations, let them talk to their fellow workmen, let them tell us where they think the points of danger are and then let us get busy. I think this will produce results. I believe it will interest the men, they know how each one of the jobs is done, they have been at the work, they know the points to look out for, they will talk to their fellow workmen and they will caution them and if there is anything we should do, that the Company should do, let them tell us fairly and fearlessly and without favor of any kind what it is. Let us consider their suggestions fairly and squarely, and if they are right, let us remove whatever element of danger there may be. This seems perfectly natural that we should be able to do a thing of this kind. It seems unnatural to me to suppose that men will not [illegible] their attention. They are all busy, they are all in a hurry, they are all trying to get out a day's production, which is proper, but with just a little instruction as to the elements of danger I am satisfied we can reduce the number of accidents very greatly in the Hamilton plant.

I want to appoint these safety committees of workmen to serve three months; I want these men to be made to understand just as clearly and forcibly as we can possibly make them understand just what we want them to do. Give them an hour at full pay each week to look around the departments, see if they can see points of danger that we cannot see, and when they come to us with their recommendations, above all things let us be fair, let us be square, and if danger exists, let us try to the greatest extent of our ability to correct it.

Accident Statistics for First Quarter of Years 1912 and 1920.

	No. of Accidents.	No Lost Time.	Lost Time cases.	T'l cost. quarter.	Average No employees for quarter.
From January 1st to April 1st, 1912	246	72	174	$1,923.12	2350
From January 1st to April 1st 1920	39	5	34	617.53	2054

Industrial Relations

In common with all other forward-looking employers of labor, the Harvester Company had felt for many years the necessity of some change in the industrial relation that would meet the changed conditions that would take the place of the old-time personal contacts between employer and employee, which characterized the operation of business in the days of small shops under individual ownership and management.

Sketching the Harvester Industrial Council plan as briefly as possible, the heart and core of it is the Works Council the establishment of an intimate practical, and continuing means of bringing the workers and the management of the plant together on a fair and square fifty fifty basis for the consideration and shaping of the plant's policies with relation to all matters of mutual interest which are continually arising between and among them.

This plan is equally frank in its declaration and provision whereby the principle is clearly established that the function of the fifty-fifty Works Council is to discuss industrial questions and shape industrial policies, but that the function of executing and enforcing them remains with the management

The Works Council at each plant is composed equally of employee representatives, freely and secretly nominated and elected by the employees, with voting divisions so arranged as to give due representation to all crafts and shop areas, and of representatives appointed by the management. The management representatives need not be equal in number to the employee representatives but may not exceed them By the unit plan of voting in each group, strict equality of voting power is secured between the employee and management representatives None but British citizens, 21 years of age or over, and having at least a year of company service are eligible as employee representatives

Experience that may be classified as hopeful began early The company believes that it has reason to be gratified from the very outset by the attitude of the employees The extent of their participation in the voting upon the plan and in the first balloting for nomination and election of employee representatives was greater we think, than could have been expected At the Hamilton plants it was 90 per cent.

One hundred and forty eight employee representatives have been elected from all the works, of whom 125 are married and 102 are native born citizens. The average age of the representatives is 39 years, their average length of service with the company is 7½ years and many of them are stockholders of the company and owners of their homes

It is significant to thus observe that, in an untrammeled selection by secret ballot, the employees elected as their representatives mature, conservative workers of long employment with the company.

One of the first results under the plan was, naturally enough, a demand at several of the plants for shorter hours and increased wages. As one old-timer said, it looked very much as if the company was giving a sort of Christmas party when it passed around these booklets saying that the Works Council would determine wages and hours.

With a single exception these requests were withdrawn voluntarily by the employee representatives upon representation of the management's side of the case, which was to the effect that this was not an opportune time for such action. We were able to show that our wages and our rates were as high or higher than in similar industries in our vicinity, and that only through constructive work in the council, through greater efficiency and reduction of costs, would we be enabled to pay higher wages and still remain in a competitive market; and if they were willing to do their part we would do our part and exchange figures with them and show exactly what conditions were at any time, and when they felt that the time had come when we should consider it again, we would do so.

When all is said and done, the main thing, the one big accomplishment of the Harvester Industrial Council plan, is the fact that it has been the means for frank, friendly conferences, participated in on an exact equality, between the management and the freely chosen representatives of the employees. In this manner each has been brought to realize the problems, the prejudices, the ambitions and hopes of the other. Happily, we have come to believe that they may all be encompassed in the same program when squared by the group judgment of the fair-minded, forward-looking responsible men and women who constitute our councils.

Industrial Relations Department.

Reasons why the Joint Conference plan of Industrial Employees' Representation is better adapted to American industrial conditions than the so called Whitley or National Industrial Council plan of England.

1. The English plan is built upon the principle of two opposing interests, "Capital and Labor," organized separately, but the Joint Conference plan assures unity of interest and co operation on the part of all directly concerned

2. The English plan presupposes unionized conditions which prevail in England, but which do not prevail in America, where only a minority of the workers are unionized. It would be distinctly un American to force here such unionization as the English plan requires. The plan for America must suit American conditions.

3. In England, which is a compact country, with a homogeneous population, with similar industrial conditions existing, it may be possible to attempt standardization as proposed; but in America, a large country with a diversified population and widely differing industrial conditions, the working conditions can far better be settled in a joint conference with reference to the situation in each locality and plant.

4. The English plan introduces into labor discussions representations of outside organizations who cannot have as their primary interest the good of the particular company concerned, since they are not associated with it either as managers or employees; the Joint Confer-

ence plan brings into discussion with the management representatives who are employees themselves, and hence are vitally interested in the company's success.

5. The English plan sets up an elaborate and expensive piece of machinery for the adjustment of industrial problems under Government supervision, while the Joint Conference plan affords a quick, satisfactory and economical method of settling such problems by direct contact between employer and employee.

6. The English plan may be adapted to English conditions where the status of the workingman is comparatively fixed; but the Joint Conference plan is far better adapted to America where the status of the workingman is not fixed and where unlimited advancement is open to him in accordance with his ability.

7. The English plan would be a radical departure for American industry, while the Joint Conference plan has afforded a satisfactory basis for many recent settlements of industrial disputes in this country. It has also been adopted in a large number of American companies and is proving satisfactory to both management and employees.

DISCUSSION.

In discussing "Shop Safety Committees and Industrial Relations" Miss Mono McLaughlin, Imperial Cotton Co., Ltd., Hamilton, said:

In discussing the paper Mr. Gernandt has given, I may say that I came from Hamilton, and to us, the International Harvester Company is just another word for safety. There is no safety idea that has not been carried out.

In the first place our firm wished to get in closer touch with their employees, and I came to bring this about. I was told that the safest way to start in work of this kind, was with the safety movement. I did so, and we have had a great response from the employees.

We are organized very much along the lines Mr. Gernandt speaks of in his paper. We have, however, a little different arrangement in the General Safety Committee. Overseers and department heads' recommendations are discussed and acted upon by the department committee. In addition a committee made up of the department committees was formed, and they often catch lots of material dropped by the department committees.

Safety pays not only in the large plants, but in the little places as well, and is worth while in the smallest kind of shop.

Our industry (cotton) is not very hazardous, and we have to deal mostly with the prevention of blood poisoning, yet we feel that the safety work is a very important item, as it is a medium of self-expression for the workmen, and goes to promote closer relations between the workmen and employers.

Mr. Maclachlan: We have been using the Whitley plan in Toronto for the past year in the building trades. It has done good work last year and will continue to do good work this year.

Mr. Gernandt: We do not consider the building trades to be in the same class as industrial workers. We are going to give this plan a fair trial. If it is all right the employees will want it and it will spread to other plants. If it is so we will not have to compel anyone to use it, they will want it themselves.

The chairman next called upon Mr. G. C. Martin to present a paper on "Steam Railroad Hazards."

Steam Railroad Hazards

By. G. C. Martin, T. H. & B. Ry., Hamilton

Your chairman on papers asked me to address you on the subject of Steam Railway Hazards. I do not feel qualified for such work but like the missionary who started out for the South Sea Islands in the days of the cannibals, will endeavor to fill the vacancy as best I can.

Having started railroading as a boy I have a vivid recollection of some of the conditions of those days, and think I could not do better than tell you of them. As we consider the conditions of those days and of to-day, it should not be difficult to find that great changes have taken place and the hazards of steam railroading largely eliminated notwithstanding the great growth of the transportation business. I shall not attempt anything technical but will stick to cold facts.

In the early days a switch was simply square rail ends, so arranged as to connect up with whichever track was to be used. There was a target which moved horizontally from side to side, on the switch connections to indicate which track the switch was set for but at first there were no night indications. Later on a lamp was attached to the switch stand, and was operated by a lever to indicate blue or red. These lamps were attached with a set screw and many accidents were caused by desperadoes loosening the screw and turning the lamp, thereby giving a false indication. Now, as you know, split switches are of a very much improved type and all main track switches are locked in position in order to overcome the danger of meddling by unauthorized persons, and this has, to a very large extent, eliminated the open switch accidents which were so common and disastrous.

The rails were formerly of wrought iron, which soon became badly worn and splintered, soft spots developed and made rough track and there was the consequent danger of derailment. The rail splinters resulted in many injuries to sectionmen's hands and feet. The rails were set in what were known as "chairs" at each joint. These were hard to keep in place, and were very noisy when trains were passing over them.

The rails and joints now in use are of the highest order and represent one of the greatest advances in railroad safety.

Then there were the dangers of the old wooden trestles. Timber was cheap and during construction when a ravine was reached instead of filling in the gap and building the roadbed on the fill, as is now done, a wooden trestle was erected. Many of such bridges collapsed through deterioration while others were de-

stroyed by fires and floods, resulting in serious train accidents. That hazard has been practically eliminated by fills and the use of steel or concrete trestles.

Signals in the old days were very crude. Common hand lamps and flags largely constituted the equipment. When an agent had orders to stop a train, he hung a red flag or lantern on the corner of the station or alongside the track. Sometimes cars standing on adjoining tracks or other obstructions would obscure the flag or lantern, and this was found to be entirely unsatisfactory. This brought about the use of the train-order boards, which were placed high above the buildings, so as to be within the clear vision of approaching trains. The order-boards were operated with a chain which when pulled or released changed the position of the board and the lamp indication. The earlier installations of this kind were affected by snow and ice, particularly at points where the operator was not keen enough to go outside and see that the signal gave the proper indication. The lights frequently went out. Improved types of signals and lamps have largely overcome these difficulties. Signals were considered of minor importance at one time, but more recently they have taken a very important place in the equipment of a railway, and in addition to trainmen, enginemen, and trackmen, who were at one time considered as the "railway employees" we have now large forces doing nothing but signal work. Signals and their proper operation and maintenance constitute a very important part of the present day equipment of a railway.

The uses of electric block signal systems has accomplished wonders in safeguarding operation where the traffic is heavy. These indicate whether the track ahead is occupied. They also provide protection against opposing movements on single track and where the safety of trains previously depended entirely upon the flagman going out the regulation distance and properly performing his work, the automatic signals, where in use, provide additional protection. Broken rails have always been a railroad hazard, but the automatic block signals have overcome the danger resulting therefrom, inasmuch as when a rail breaks the electric current operating the signal is broken and the danger indication is given.

Railway crossings or intersections in the early days were in many cases inadequately protected, sometimes by a flagman and sometimes not at all, the movements over the crossings being left to the discretion of the train crews. Many chances were taken and serious accidents resulted. Mechanically and electrically operated interlocking plants are now provided at practically all railway crossings and the equipment is so arranged as to give a clear route for one line at a time and when a route is set for one line derails stand open against the other. Signalling generally is a very expensive part of railway construction and operation but the requirements of safe operation have brought about these expensive but effective appliances.

Another of the old hazards has been eliminated by the modern codes of train rules. Sometimes employees think some of the rules are unnecessary, and that there are too many of them, but the rules have been made because conditions developed which made them necessary. Trains orders at one time were issued in what we would now consider a very crude way. It was not an uncommon thing for a train to receive an order such as this: Run wild to so and so." The meaning of this was to run extra or special from one point to another. To save time the orders were frequently signed by the operator or agent and handed to the crews while on the fly, and because of their being badly written or not understood, chances were taken and trouble was the consequence. The present train order system is of the highest order. Orders issued are given at the same time and in the same words to all concerned, and the general handling is such as to make the present day operation safe.

One of the most difficult and dangerous features railways have had to deal with was the condition of private sidings and industrial tracks, due to materials of all kind being unloaded and left too close to the rails. This condition created many hazards and accidents to the railway employees engaged in switching and shunting in these plants. This danger was recognized, and in order to overcome it there is now a provision in the Railway Act which requires that a clearance of six feet must be given from the nearest rail.

I might say, however, that notwithstanding the requirements of the Act, we still find in many cases that materials are unloaded and piled too close to the rails, but plant managements have recently become interested, and it is now only necessary to call attention to these conditions to have them corrected.

Trespassing on railway property is a very dangerous practice, and has resulted in the loss of many valuable lives. The general impression seems to be that trespassing applies to hobos. While there are a few of that class injured and killed, the bulk of these accidents result to workmen going to and from work and children playing on railway property.

There should be definite co-operation between municipalities, industrial concerns and railways with a view to overcoming this dangerous practice. Factory employees should be educated along this line. In fact, the educational process should be started in public schools, where safety education can be most effectively carried on. For instance, why not include problems such as this in mathematics: "If persons are killed in Canada in one year, what percentage would this be of the total population of 8,000,000?" Many problems of this kind could be worked into the curriculum with good results.

Another very difficult situation to handle is the automobile at grade crossings, and until some drastic measures have been taken through legislation and with more help from the magistrates, careless and foolhardy drivers of automobiles will continue to not only endanger their own lives, but the lives of innocent people in their cars. Furthermore, it is a great hazard to railway operation through the derailment of trains and probable great loss of life. In order to stop this, the onus must be placed entirely upon the automobile owner or driver. An automobile can stop within a reasonable distance, but a railway train cannot dodge an automobile, nor can it as a rule be stopped in time to avoid accidents.

Now let us consider the rolling stock of the railways, and see what has been done to eliminate the hazards.

The connections between cars and engines, as many of you will remember, were of the link and pin character. A short stick was provided for making the couplings, but these sticks were seldom used, and the connections were made by hand. It was a dangerous proposition, and many a finger, many a hand and many an arm were lost in the operation to say nothing of the lives sacrificed. Many serious accidents in the link and pin days were due to long loads shifting when

cars were being coupled, and also when due to a low coupling or other cause the buffers were allowed to come together. This condition is now changed; the couplings are made automatically and the adjustments of the couplers are handled by levers which extend to the outside edge of the car, making it unnecessary for men to go between the cars while the coupling is being done. In fact, that is one of the things employees are forbidden to do.

The railwaymen of the old days were of necessity alert. They had to think and act quickly to avoid injury not only of themselves but to their co-workers. They avoided injury by their alertness just as the street arabs of to-day do. Real street arabs are seldom injured or killed. A tenderly reared child, with someone to look out for his safety, will often walk into danger when alone, and with the modern appliances of to-day there is the danger of railway men becoming indifferent by placing sole reliance in mechanical contrivances.

The trains used to be stopped by means of hand brakes, and many a man has lost his life in the performance of his duty as a brakeman. In wet and stormy weather with cars covered with snow and ice, you will readily realize that the process of climbing over the cars and setting hand brakes was a hazardous occupation. In many cases the cars would be loaded with long materials extending beyond the ends of the cars and the hand brakes covered, and thereby made useless.

The invention of the air brake has practically eliminated this hazard. To-day hand brakes are practically only used when the air brakes for some reason are inoperative or when a car is being placed at a definite location for loading or some such purpose.

When wood burning engines were used, it was necessary to have piles of wood located about every ten miles, and when these piles were reached it was a case of everybody "wood up." Frequently the wood was piled too high on the tenders and was freely distributed along the right-of-way, endangering the lives of men working on the track. The danger of fire was also great. In modern engines a netting is placed in the ash pans and smoke-stacks so as to prevent sparks from being emitted.

There was also a very dangerous practice carried on before engines were equipped with automatic or force feed oiling equipment. It was frequently necessary while a train was running for one of the crew to go out through the cab window, pass along the running board and get down to oil the cylinders with a hand oil can. As a boy I have frequently performed this feat when getting a free ride after helping to wood up the engine. I can assure you it was an exciting experience, especially when the train was running 40 to 50 miles an hour. The necessity for such performance is, of course, now eliminated because of the use of improved lubricating devices.

The up-to-date powerful electric headlight is also a hazard reducer. These lights not only are a great advantage to the engineman but the light is so powerful that it attracts the attention of motorists and other users of the highways.

I could go on indefinitely pointing out these things which have been accomplished to make the railroads safe for the traveling public and the handling of the country's traffic, and also to make the working conditions safe for the employees. Notwithstanding all that has been done, however, we still have the human element to deal with.

When a man enters railroad service he has many things to learn. If he enters the operating department he is instructed as to the rules and the necessity for their observation is impressed upon him. He must pass an examination on the rules before being allowed to go to work. He must satisfactorily pass a doctor's examination as to vision, hearing and physical fitness. He is required to go before a safety officer for instructions in safety matters.

If he enters the Maintenance of Way Department, he is instructed among many other things, to do track jacking in the safe way by placing the jack outside the rails instead of between them, handle material safely and keep out of the way of moving trains.

If he enters the service in the Car Department, he is given to understand that the important thing is to see that cars are not allowed to go forward in an unsafe condition. Before going between or under cars to do work he must provide for his protection by placing blue flags or lanterns so as to indicate to those operating the yard that he is working around the car, and that no move can be made until these protection signals are taken down by the man who put them up. He is impressed with the fact that in a train of one hundred cars there are eight hundred wheels; one defective wheel missed by him is likely to result in a wreck and the consequent destruction of many cars and much property, and possibly the loss of life. Couplers, brake connections and all vital parts must be carefully examined and passed before cars are permitted to go forward. He must also detect overloads, improper loading—see that loads are not too high or wide to pass clear of bridges, tunnels, etc.

The wrecking crews necessarily meet with hazards in their work. In addition to the dangers of the actual wrecking operations, there are to be met the dangers of handling explosive shipments, cars containing acids, etc. Extreme care is required in handling such shipments as gasoline. Open light must not be used when inflammables are leaking, etc.

When it is necessary to jack cars and engines to repair them it must be carefully done the jacks and blocking so placed as to prevent accidents. Shopmen work among high power pneumatic revolving and striking tools, saws, planers and machinery of too many kinds to mention, and just here I want to say that we have great difficulty in educating the men to wear goggles to protect their eyes, but I am glad to say they are coming strong. This lesson is best taught by photographs of actual happenings.

Locomotive repair men are frequently called upon to do work on hot engines. Burns are the frequent consequence. Due to the quantity of smoke and steam in roundhouses, there is danger of the men falling into the repair pits, which extend nearly the entire length of the house.

In order to obtain the best results in avoiding personal injuries among the employees and the patrons of the road, and damage to property, extensive safety organizations have been developed. These organizations have done much to eliminate the hazard of railroading by having corrected the conditions that are recorded as unsafe. Thousands of dollars have been, and are being spent in order to correct unsafe conditions and to educate employees in the principles of safety.

The safety movement was first started by the United States Steel Corporation in their shops and on their privately owned railways. It was then taken up by the International Harvester Co., and the first railroad to inaugurate the system was the Chicago and Northwestern f— which it soon spread to many other railways, and in — all of 1912 a Safety Rally was held in the City of Buffalo, at which all lines terminal at that point were represented by some 2,000 officials and employees. The T. H. & B. Railway was invited to be represented and a special train was run from Hamilton, taking between 400 and 500 employees. As a result of this meeting we started our organization. A general committee composed of heads of departments and standing committees composed of the foremen or key men among trainmen, enginemen, maintenance and way men, shopmen, shedmen etc., were appointed. These standing committees in turn appointed sub-committees in each shop or department from the employees therein. The general and standing committees are permanent but the sub-committees are changed every three months, and it is their duty to make periodical inspections on the company's time, reporting unsafe conditions or practices on a form provided for that purpose. This form first goes to the standing committee of the department, and if the unsafe conditions reported can be corrected at the time, they are immediately attended to. If the conditions are of such a nature, as cannot be corrected in this manner, the report is referred to the general committee, which decides the action to be taken. If, for some reason, the report is of such a nature, in the opinion of the general committee, as to not require action in the nature proposed, he or they are so advised and the reasons given. Although we considered we had one of the safest railroads in America, the first year the Safety First Organization was in operation some 220 reports of what were considered unsafe conditions and practices were made. Ninety five per cent of these were readily adjusted. Many of the conditions reported were of a minor nature, but the results obtained were such that the men soon became enthusiastic "Safety" advocates, and are heartily co-operating in the work.

Notwithstanding the varied conditions which are found in conducting steam railway operations the safety work has been carried on to an extent which has made railway operations as safe if not safer than many other employments which are not generally considered to be as hazardous as railroading.

You have probably heard the story of the lad who, while at home working on the farm had a desire to be a railroad man. His parents and friends tried to discourage him pointing out the possibilities of accidents upon a railway compared with the farm life. Notwithstanding their counsel he left the farm and obtained employment on a railway. Shortly afterwards he received word from home that the hired man employed to help on the farm had lost three fingers in the cutting machine. Time passed on and another letter came telling him that his younger brother Tom, had been kicked by a colt and was laid up with a broken leg. The next letter brought the sad news that his father had fallen from a hay mow breaking his arm and dislocating his shoulder. The frequency of these accidents began to alarm him and he wrote home suggesting that the farm be sold and that the family move to town in order that his father and brother might secure employment with the railway which, in the case of their family, had demonstrated a much safer vocation.

Notwithstanding all the modern appliances and the effective work carried on by safety organizations of the railways, there are still many hazards in steam railway operations. According to statistics of the Interstate Commerce Commission for the month of January, 1919, there were on the railways in the United States 1,924 train accidents resulting in 71 deaths, 688 injuries and a loss of $1,618,350. 1,367 of these accidents were due to defects in equipment, defects in or improper maintenance of way and structures and miscellaneous causes and 557 due to negligence of employees. The accidents due to negligence of employees are computed in the following manner:

	Number of Train Accidents.	Damages to Railway Property.	Total non-trespassers Killed.	Injured.
Train orders	10	$36,170	1	19
Fixed signals	19	51,580	37	182
Hand signals	40	20,230		9
Train flagging	32	37,610		31
Air brakes	18	29,780	1	6
Hand brakes	75	27,170		14
Switches	81	52,900	2	12
Other forms of negligence of employees	282	212,230	18	187
	557	471,570	59	460

DISCUSSION.

Mr. Angus MacMurchy, solicitor, Canadian Pacific Railway, said:

I appreciate the honor of being asked to open this discussion. Having read the paper prepared by Mr. Martin, I will say a few words about two of the subjects he has discussed.

1. Trespassing on the Railway.

In considering this matter of trespassing on railway tracks a subject which can never be very far from a railway solicitor, one is inevitably driven to the conclusion that we are dealing not with a temporary or fleeting condition but with the ingrained and inveterate habit of Canadians known as "taking the short cut."

I suppose, if we had been born in the British Isles, or if Canada had been, like England, a civilized and populous country for centuries before the advent of railways the habits of our people would have been different in this respect.

In England, as any of you who have traveled there know, grown up people and children are compelled to keep off the railway, and the railways afford crossing facilities at stations and elsewhere.

We are now dealing with the consequences of the habits and training of the people of Canada since railways came to this country for the most part fifty or sixty years ago.

There has always been on the Statute Book, a prohibition against trespassing on the railway but this prohibition is often entirely disregarded.

A rather striking illustration occurred not long ago in Nova Scotia where a physician in the round of his daily calls took the usual short cut and walked on the railway track and was killed. His widow not unnaturally brought an action for damages against the company, and the courts were much divided in opinion as to her right to recover. Some of the judges thought, because everyone was allowed to walk on the track, that the prohibition in the Statute should not preclude the widow from recovering damages for the death of

her husband. By a majority the Supreme Court of Canada decided against the widow's claim. (Herdman v. Maritime Coal Co. 6th May, 1919, 59 S.C.R. 127 49 D.L.R. 90.).

I have watched the growth of railways in Toronto and its vicinity for many years. On the north where the Ontario & Quebec Railway was built in 1882-4, at least two generations have grown up who have been in the habit of walking or playing on the tracks. Trespassing is not confined to tramps. There is as much trespassing to contend with in Rosedale, where tramps are not usually found, as in any other part of the city. From Yonge Street easterly to Leaside there are only two level crossings, but this does not prevent the flower of our youth, or more elderly persons, from taking a quiet walk along or across the tracks, particularly on Sunday. At certain seasons of the year the Legal Department are implored by trespassers who have been summoned to appear before magistrates to intercede for them and avoid the unpleasant consequences of their being served with summonses. These experiences point to the necessity for education and I agree with Mr. Martin that you should begin with the children.

One of the latest accidents to children trespassing on the railway was that of a child about two years of age, who left the house, where his mother was getting dinner ready. He walked about one hundred yards from the house to the railway fence at a place where two planks had been placed over the wires, one on each side, used by the section men when going over the fence to procure drinking water. The child got on to the railway by walking up one plank and down the other, where he was run over by an engine and lost a leg.

There are many similar and distressing accidents to children who seem to have a perverse instinct for straying on the railway.

The civic and school authorities of Toronto may well have their attention most earnestly called to this matter, which involves so often the loss of life.

Note. Since the meeting on 15th April, another deplorable accident has happened. A child one year and ten months old walked on to the track at a public crossing, and having sat down between the rails as a train was approaching, was struck and killed by an express train, a mile and a half west of Mystic.

2. Accidents at Level Crossings.

Since the advent of automobiles twenty years ago you now have an agency of destruction not infrequently under the control of the most reckless class in the community.

Railway employees in charge of trains have a new and deadly peril to contend with at level crossings. One of our most experienced locomotive engineers said to me lately "I never approach a level crossing and see an automobile coming up but I think who is going to make the crossing first. I cannot tell whether he intends to go over the crossing or stop."

As Mr. Martin says in his paper, the engineer of the train on the railway track cannot dodge the automobile. He cannot get his engine away from the rails. He must stay there and run the risk of a collision which he is powerless to avert, with perhaps awful consequences not only to the occupants of the automobile, but to himself, the fireman, the train crew and the passengers on the train in case of derailment.

There have been at least two fatal accidents of this nature at level crossings within the last month, and in the streets of Toronto we have had, during the last few days two terrible and fatal accidents. The words of John Bright, spoken at the time of the Crimean War, are still true. "The Angel of Death is abroad in the land. You can almost hear the beating of his wings."

In 1909 the Parliament of Canada amended the Railway Act to provide that all railways constructed after April 1, 1909, must at their own cost and expense provide protection at all such public crossings as may be required by the Board of Railway Commissioners, and appropriated out of the consolidated fund the sum of $200,000 per annum for ten years to be used in paying the expense of eliminating railway grade crossings. A similar provision was made in 1919 for a further period of ten years, but only $300,000 has been spent in separating grades at level crossings in ten years out of $2,000,000 provided by Parliament for the purpose, known as the Grade Crossing Fund. Originally not more than 15 per cent. of the cost of protecting any crossing could be spent in any one year and on not more than three crossings in any municipality. This has been amended by increasing the percentage to 25 and the number of crossings to six.

The total amount expended between 1909 and 1919 for the protection of level crossings by separating grades or by establishing gates and watchmen is said by the Board of Railway Commissioners to be $3,899,000. Besides the contributions from the Railway Grade Crossing Fund the municipalities interested have contributed $1,432,000 and the railways $2,467,000.

The Dominion Board of Railway Commissioners administers the fund and usually apportions the cost of protecting level crossings between the railway company and the municipality in proportion of 60 per cent. to the former and 40 per cent to the latter.

Compulsory protection of level crossings of highways by railways, under statutory authority, practically began in Canada on the 8th of January, 1891 when the Railway Committee of the Privy Council of Canada (Sir John A. Macdonald, chairman) upon the application of the City of Toronto, made an order for the protection by gates and watchmen of the crossings at Bathurst, Dufferin and Bloor Streets and other streets, apportioning the cost of protection as follows:

"Where two railway companies use the same crossing, each railway company to contribute one-third and the municipality or municipalities interested the other third of the said cost.

"Where one railway company only uses the crossing, the railway company to contribute one-half and the municipality or municipalities interested the other half, of the said cost."

Long litigation ensued caused by municipalities seeking to escape from paying any part of protecting level crossings. This dispute was not finally decided until 1908 by the Judicial Committee of the Privy Council, which upheld the order of the Railway Committee.

In 1908 the Supreme Court of Canada had given a similar decision in the case of the City of Toronto v. Grand Trunk Railway Co., arising out of the protection at other street crossings under the same order of the Railway Committee.

Pending this litigation, application by municipalities for the protection of level crossings became less frequent and largely ceased because the municipalities objected to bearing any portion of the cost of such protection.

The principle is now firmly established, however, that where protection becomes necessary at a level crossing of a railway the expense is to be divided between the

railway company and the municipality interested in protecting the crossing. The only exceptions are in the case of railways built after April, 1909, or where in the west the railway company has brought about an intolerable situation by laying out a town and not providing proper access from one part to the other. Hon. Mr. Killam in giving judgment in the case of City of Regina v. Canadian Pacific Ry. Co. 11 Can. Ry. Cas. 165 at p. 180, said:

"But the truth is, municipalities have been asked to contribute because if the cost were placed entirely upon the railway company, the necessary work of grade separation could not be carried out to the extent necessary in the public interest."

The only way to protect people crossing railways from the consequences of their own folly is by protecting these crossings or separating grades. The resources of the railway companies will not permit of this being done without aid from the public funds.

The greatest amount of protection has been afforded in the two largest cities of Canada, Montreal and Toronto. In Toronto there are at the present time 121 protected crossings, in Montreal there are 53. There are 67 bridges and subways in Toronto and 22 in Montreal. Sixty four level crossings are protected by watchmen, gates or bell in Toronto and 31 in Montreal.

The automobile menace at level crossings ought, if anything can, quicken the desire for protection at level crossings, but in the vast majority of cases we must rely on the prudence and care of those who use the automobiles. It has been suggested that there should be a hard and fast rule laid down to "stop look and listen" before crossing a railway track but I am inclined to agree with the Western editor of The Railway Age, who says

"I do not believe legislation requiring automobiles to come to a dead stop before reaching a level crossing could be enforced universally. Rather it seems to me, we must accept conditions as they are and human nature as it is and endeavor to install warnings to protect people from their own, but natural carelessness."

The greatest safety lies in separating grades, although in some cases gates and watchmen may be sufficient. But even then sometimes automobiles disregard gates, watchmen or electric bells, in their anxiety not to slacken speed or stop. Cases are not infrequent where automobiles are run against the gates at level crossings by motorists who neither stop, look nor listen, and disregard gongs, gates or other warnings.

You have my best wishes for success in the great beneficient work in which you are engaged.

Mr. E. E. Stevens, Canadian National Railways, Moncton, N.B., said:

The gentlemen who have preceded me have so completely covered the subject that there seems little left for me to say. Accident prevention is a most important factor in railway operation, not only because of the loss of life and limb, but also because of the economic waste, reduced efficiency of the organization and the public criticism which follow in their wake. Every operating problem of a railroad involves necessarily the question of safety, and as you know, there has grown up a great body of splendid rules and regulations governing the transportation business. Public sentiment has demanded and received from the railroads throughout the country the safest and most improved equipment and methods of operation. Mr. Martin has shown how the improved equipment and safety appliances in use to-day have brought about a decrease in accidents which they were designed to prevent, but while we have improved our equipment, improved our roadbed, and given great attention to every machine and appliance that could be devised to guard against accidents, the statistics of the casualties of the railroads show that we have not altogether solved the problem.

While there are some accidents which occur with more or less regularity and frequency which may be properly called unavoidable, such as landslides, washouts, tampering with railroad equipment etc., there are, however, a large majority of injuries or accidents that are preventable. In order to overcome this needless sacrifice many of our railways have started a safety educational movement. We have on the Canadian National Railways a safety organization in charge of the Safety Engineer, which is conducted on somewhat the same lines as that mentioned by Mr. Martin on the T. H. & B. The results obtained have been most gratifying, and notwithstanding the large number of new employees and changes that have taken place in recent years we have been able to maintain a splendid accident record. The securing of results in safety work is due to publicity in the most part, education of men to the fact that it is better to take no chances is the primary feature and as soon as the employee can be brought to realize that non-chance taking is better for themselves and for their families then there will be a decrease in accidents.

Mr. Martin has referred to the value of motion pictures and bulletins in safety work. In this connection I might say we have found bulletins to be of considerable value but more especially have we found the value of motion pictures, they have proven a most effective way of impressing employees with their responsibility in accident prevention.

This regard for human safety is, of course, no new thing, yet the safety idea as we know it and as we are trying to develop it is really one of the finest products of our natural civilization. Apart from a selfish regard for one's personal safety it is now coming to a thing which the railways are looking out for all people especially for those whose employment involves hazards which are constantly to be guarded against. Conservation is ever growing, and in this present day men are coming more clearly to realize that an individual life is an indispensable economic feature in human affairs. The safety movement is one of the greatest ideas we must foster and develop, for it concerns not only human life, but human happiness, human welfare, human society, and creates a special goodwill between employer and employee.

In securing the highest standard of safety in railway operation the co-operation of the public is essential, such co-operation must not stop at simply wishing the railways good luck in their task. The people as a whole must be trained along safety lines, and the laws and the courts in administering the laws must embody and enforce safety standards which will be the enlightened conviction of the people. There must be the same painstaking effort in the education of the public as has been set forth by the various employers in the education of their employees. The fact is, that many people as a whole have lagged far behind this, in safety propaganda, and it is my belief that a great safety movement is under way in this country, and that the day is not far distant when the railways and all employers of labor will unite with the

people and public officials in reducing perils to life and limb which lurk about us on every hand, and in bringing about this movement for the prevention of avoidable accidents, I think that the Ontario Safety League and similar organizations will be the big factor.

Mr. McKellar: There is extreme laxity among the educational authorities in introducing education in the schools to assist in the prevention of the loss of so many young lives in our country. While the teachers are sympathetic nothing is done. There could be one-half hour set aside for safety education in the classroom that is general safety in the streets, homes etc. This type of education for the kindergarten classes would be productive of great results.

During the cold weather when the hoods of most cars are up, a great many accidents are the result, as the sight is obscured. People having defective hearing or sight should never drive a car. The Ontario Safety League might have pamphlets distributed with each license to impress the dangers that occur when approaching railroad crossings. We have had many accidents lately that have occurred owing to carelessness and lack of caution on the part of the driver.

Mr. Martin: A license or permit to drive should be required for every automobile driver. This license could be cancelled if the motorist showed himself incapable of careful driving.

Mr. Jackson, Dom. Express Co.: Some time ago Mr. Macdonald general manager of the company, issued an order that all the messengers should be familiar with the signals, brakes, etc. The modern cars of the Canadian Pacific Railway, are supplied with air brakes in the centre of the car so that the messenger can stop the train without running to the valve, and there is also one at either end of the car, and as these cars are 175 feet long it saves several precious seconds. The messengers are being encouraged in this way, so that when an instruction car comes down the line they are invited to go into the car with the others and learn, and in this way we are getting the men educated. The messengers now, as well as the crew, are on the alert for anything that may go wrong on the trains.

Mr. A. B. Ingram: Every railway is required to erect signs at crossings, and there is no doubt that these prevent many accidents, but they cannot prevent all accidents. The railways throughout the Dominion incur a large expense by erecting these signs, and this should be remedied, and could be remedied by the municipalities taking a share of the expense.

Mr. Martin: I would suggest a sign on white planks 3 or 4 feet out on the road, and only 3 or 4 feet above the road, so that they may be read easily by a motorist who may have the hood of his car down, but the railways cannot afford to do this themselves, and some legislation should be made to cover this.

Mr. Meadows: It has struck me that something might be done in the way of common rules for both the United States and Canada. In Toronto, street cars stop before they cross the corner and how is a stranger to know this? There should be some convenient method by which the stranger would know.

Mr. Ingram: Wherever you see the white pole the car will stop. As these have the words on them to indicate this.

Mr. Martin: All licenses should be controlled, and if a man should offend again and again his license should be cancelled, and this will have a very good effect, and he will not often be found guilty afterwards.

Mr. Kuechenmeister: We are now getting up a Vigilance Committee to consist of the best business men in the Border Cities. These men will be given a number and provided with postal cards with these numbers on them. Infraction of the traffic laws will be put down on the card and sent to the secretary, who in turn will place them in the hands of the police department. A copy of the cards is then sent to the offender. In St. Louis 99 per cent. of the cards were answered by the offenders. After two cards have been answered comes a summons to the police court.

The chairman then asked Mr. Mylrea for his paper on "Fire Prevention."

Fire Prevention

By A. J. Mylrea, Reed, Shaw & McNaught, Toronto

It is somewhat of a pleasant surprise to the speaker to note that the Ontario Safety League has included, as a topic for deliberation at this convention, the subject of "Fire Prevention." From the name of the League, the average person might assume that its function consists primarily in protecting persons from injury or death by such means as the enclosure of gear wheels, the installation of proper elevator gates and locks, and enclosing electric switches, etc., in factories. If he stopped to think about the subject he might include the protection of life in traffic or the correct method of erecting scaffolds. He might even assume that as far as safety from fire is concerned, the object of the League would be fulfilled in the installation of proper fire escapes and exits, but the fact that the League recognizes the deplorable loss of life, maiming and nerve shock that occurs each year through fire, not to mention the tremendous waste, and that it realizes that the proper way to prevent this loss is to combat it at its source by eliminating the fires themselves, and are taking up a campaign in this manner to prevent such calamities, is an excellent indication of their breadth of vision.

The subject of "Fire Prevention" is an exceedingly broad one and one about which a great deal has been written. In the short time at our disposal it will be possible barely to touch upon these phases of the subject which are of particular interest from a Safety League standpoint.

Let us first consider what is the extent of the annual loss as a result of fire. For the United States and Canada, the annual loss for the years 1917-1919, inclusive is as follows:

1917	$267,273,140
1918	317,014,385
1919	269,000,775
Average	$284,422,050

For Canada alone, we have the following record:

1917	$20,068,085	
1918	31,815,844	
1919	23,207,647	
Average		$25,036,519

and for the Province of Ontario, the losses have been:

1917	$10,365,539	
1918	15,673,240	
1919	9,490,478	
Average		$11,843,096

In other words, for the past three years we have been destroying property in the United States and Canada at the rate of $782,000 per day; in Canada at the rate of $68,600 per day, and in Ontario at the rate of $32,450 per day; and the records for Canada for the first three months of this year show that we are jogging merrily on our way at the same gait.

Tremendous as is this monetary loss, the deplorable feature of our fire record is the trail of death and suffering it leaves behind. Statistics as to the loss of life are very difficult to obtain with any degree of accuracy, but all one has to do is to take up the nearest newspaper to find some new records of human sacrifice to the God of Fire, or to see pictures entitled "Searching for the dead among the ruins" or the like. Let me read a few examples; here is one:

"New York, January 24, 1920. An old five-story building burst into flames, trapping employees of a jewelery manufacturing firm on the upper floors. Three men were burned to death and one dropped from a fourth floor window with clothes ablaze and was killed instantly. The fire is believed to have reached celluloid materials used for manufacturing toilet articles. . . . and the entire upper part of the building flared like a furnace, sending out clouds of suffocating smoke that greatly hindered the work of rescue and hampered the handling of fire apparatus. There were good fire escapes on the building, but the fire mushroomed out of the windows and prevented the descent of employees from the upper floors. The fire started in a closet under the stairway in which waste paper sweepings and burlap bags for scraps were stored. The lesson of careful housekeeping is one which many holocausts have presented to the public with very little general effect. Fatalities by fire were frequent this week. Six deaths occurred on Tuesday in a factory fire at Philadelphia."

"March 20, 1920. Last Saturday, March 13, 1920 Sturgeon Falls received a very serious shock when two tenements, consisting of six homes, were destroyed by fire. Six lives were lost in the fire . . . other tenants escaped . . . first before the roof crushed in."

"Newark, N.J. A loss of eleven lives and the mourning of a number of employees resulting from the first fire that destroyed the factory of the American Button Company."

"March 20, 1920. Ten firemen were painfully burned in New York by a tongue of flame which shot sixty feet across the street into their fire house, following an explosion in a button factory."

"Montreal, February 1, 1920. Fire destroyed the paint shop of the Blain Carriage Works. Two lives lost. Caused by the accidental ignition of linoil veneer."

"Halifax, N.S. February 6, 1920. Child burned to death by fire which destroyed two houses on Westmount Street."

"New Toronto, February 7, 1920. Home of Herbert Buckland destroyed. Child of four burned to death."

"Seattle, Wash. April 7, 1920. Hotel Lincoln destroyed. Loss $400,000. Fred R. Hamilton and daughter, Grace Hamilton, of Berkeley, Cal., killed by jumping from fifth floor, and five persons injured."

"Four missing, four seriously injured in Wright Hotel blaze. This disaster was one of the worst ever known in Saginaw, Mich. Fifty-five hotels were burned in Michigan in 1917."

"March 13, 1920.—Four poor old ladies were burned to death in the Aged Women's Home at Lynn, Mass. The old frame building burned like a match box and only heroic efforts by the Fire Department saved a score of inmates from a similar fate."

"On April 24, 1919, the St. Mary's Industrial School of Baltimore was practically destroyed by fire . . . . A falling roof buried thirty-eight firemen, as they were heroically fighting the flames. Thirty-six of them were injured and two of them were killed."

The following is part of a clipping from the Chicago Herald Examiner, concerning a fire in Pontine, Ill.: "Fifteen patients, some of whom had undergone operations a few hours before, were carried scantily-clad through a heavy downpour of rain at four o'clock this morning when fire swept through the St. James Hospital in Pontiac. It is feared the shock and exposure will prove fatal to some."

"On the afternoon of Friday, Jan. 15, 1920, a fire broke out in the basement of the Chamber of Commerce Building, on Church Street, New Haven, Conn., resulting in the death of two occupants, smoke prostration of ten more, and fourteen firemen, and serious damage to about one hundred others."

"Wilson Hotel Fire, Atlanta, Georgia . . . Five lives lost . . . . This fire would have been a veritable holocaust if it had not been for the timely arrival of the firemen."

"Ville Platte, La.—On the evening of Nov. 22, 1919, twenty-five persons lost their lives by a fire which destroyed a two-story building, the upper story of which was used for a dance hall."

In the foregoing list we have intentionally omitted citing any instances of loss of life in school fires.

In the case of school fires, the loss of life is particularly deplorable because the innocent are the ones who suffer for the penuriousness and carelessness of the guilty. Some of the important fires in educational institutions in which there was loss of life, are as follows:

University Building, Nashville, Tenn., Dec. 18, 1903. Fifteen girls perished.

Hochelaga School, Montreal, Que., February 26, 1907. Kindergarten on second floor. One teacher and nine children lost their lives.

Lakeview Grammar School, Collingwood, Ohio, March 4, 1908. One hundred and seventy three children and two teachers burned to death.

Private School, Central City, Ky., May 22, 1909. Five children burned to death during commencement exercises.

St. John's Parochial School, Peabody, Mass., October 28, 1915. Twenty-one girls burned to death.

Christian Brothers' College, St. Louis, Mo., October 5, 1916. Nine persons killed and eight firemen injured.

Feb. 1, 1918. Grey Nunnery, Montreal, Que. About one hundred little babies burned to death from a fire which started on the top floor. Below were many wounded soldiers.

July 22, 1918. The Juvenile Detention House at Lansing, Mich. Five children burned to death.

Toronto itself has not escaped from school fires, but it is largely due to the intervention of a merciful Provi

dence that no deaths have occurred. For example in the winter of 1918, a small fire occurred in the Frankland School, which was readily put out, the children being led from the school by a fire drill. On February 2, 1920, a small fire occurred in the Brock Avenue School; there was no loss of life, however. You may also recall the fire which occurred in the Lansdowne School on Spadina Crescent, a few years ago. It might be interesting to note that in this school, which is the only one in Toronto equipped with automatic sprinklers in the basement the sprinklers were shut off some time prior to the fire, for reasons best known to the persons who ordered them to be shut off, and have not yet been restored.

Many of the more prominent institutions of higher learning have had their fires, but owing to the fact that these fires occurred at night, or due to the calmer dispositions of the older students, the loss of life has been comparatively small. Among these institutions may be mentioned the University of Toronto, McGill University, Laval University, Montreal; King's College, Windsor, N.S., Agricultural College, Guelph; Alteri College, Belleville; University of Florida, Gainsville, Fla.; Valparaiso University, Valparaso, Ind.; De Pauw, Greencastle, Ind.; Notre Dame University, South Bend Ind.; Purdue University, Lafayette, Ind.; University of Iowa, Iowa City; Northwestern University, Evanston, Ill.; Harvard University, Cambridge, Mass.; Wellesley College, Wellesley, Mass.; Michigan Agricultural College, Lansing, Mich; Dartmouth College, Hanover, N. H.; Vassar College, Poughkeepsie, N.Y.; Columbia University New York, N.Y.; Cornell University, Ithica, N.Y., University of Pittsburgh, Pittsburgh, Pa., University of Pennsylvania, Philadelphia, Pa.; University of Vermont, Burlington, Vt.; University of Virginia, Charlottesville, Va. University of Wisconsin, Madison, Wis.

Fire Protection for Schools:—

The Actuarial Bureau of the National Board of Fire Underwriters reporting only on fires where insurance was in effect, advised that for the two years regarding which complete information is now available the facts are as follows:

1916 No. of fires 2,498 Property destroyed $4,333,025
1917 No. of fires 2,417 Property destroyed 4,051,680

Because of the great extent to which schools carry their own insurance, it is certain that the total number of fires and the amount of losses have been greatly in excess of these figures.

No accurate records have been kept of the lives lost in school fires, or any other type of fires for that matter, and consequently exact data are not available. The most notable cases are shown in the tabulation above.

The reasonable life loss in relation to the exceedingly large number of fires is due to a great extent to the fact that a very high percentage of fires in school houses occur outside of school hours and is not due to the safety of the buildings themselves.

H. W. Forster, chairman of the Committee on Safety to Life of the National Fire Protection Association, says:

"At the present time there are in the United States approximately 300,000 buildings used for educational purposes, valued at more than $3,000,000,000. A very considerable number are erected each year, and it has been estimated that for every two new schools erected each year, one is destroyed by fire."

To put the situation in a slightly different form, we may state that according to a report made by the Russel Sage Foundation, ten notable schools, two colleges, two hospitals, three public halls two jails and twenty six hotels burn on the average each week in the year. The most authentic reports available for 1917 show that in that year there were over 2,500 school fires, doing a damage of more than $4,000,000.

For instance, Philadelphia has burned up nearly one-half a million dollars worth of schools in the last nine months.

To quote from the January 1920, quarterly of the National Fire Protection Association, "The suffocations and deaths that have already been recorded in fires in hotels, apartment houses and tenements during the cold winter, forecast the usual unhappy statistics of loss of life by fire during the present year. It is unfortunate that some Government agency does not gather and tabulate some accurate record of lives lost in burning buildings. Such a record might prove astounding far surpassing in extent the usual guess of 15,000 lives per year."

Confirming the statement in the N.F.P.W., that the usual guess of 15,000 lives lost per year is far too low, Mr. Linn of the Actuarial Bureau of the National Board of Fire Underwriters, states that "The Fire Marshals of America now estimate this annual life loss in unsprinklered buildings at 30,000.

We may summarize the situation thus: In addition to the tremendous monetary loss mentioned above, between 75 and 100 lives per day are lost through fire. With such a record as this, it can easily be seen why a campaign for fire prevention is most timely.

Fire prevention may be resolved into three specific phases: 1st. The prevention of the start of a fire; 2nd. Holding a fire, once started, in check and not allowing it to assume serious proportions; 3rd. Confining a fire which has once gained headway, to the building in which it originated, thus preventing a local fire from becoming a conflagration.

From statistics prepared by the National Board of Fire Underwriters, we learn that 62 per cent. of all fires started from preventable causes, and they assume that those fires whose origin is unknown, probably started from preventable causes, but the fire destroyed conclusive evidence. Taking such fires into consideration, 89 per cent. are the result of preventable causes.

The one thing that will do more to prevent fires starting than anything else, is good care and cleanliness or in other words, good housekeeping. As one manager of a large firm said: "It is yesterday's dirt that always starts the fire." This is an excellent rule, and if followed, would remove the rubbish hazard which is a source of considerable evil. Proper receptacles should be provided in all workrooms or wherever dirt is liable to accumulate, for all rubbish and sweepings and these should be removed at least each evening, and the contents disposed of without being allowed to accumulate in the boiler room. Unless such receptacles are provided piles of rubbish are found to collect under benches in closets, in dark corners, or anywhere that the workmen may think "is out of the road," thus forming a potential breeder or spreader of fire. The same remarks also apply to oily waste and similar materials subject to spontaneous combustion, only that in the case of these materials, standard waste cases raised from the floor and provided with spring covers should be used. For workmen's overalls or other clothing liable to become oil soaked metal lockers with complete provision for circulation of air, should be provided, thus removing the temptation to roll such clothing into a bundle and throw in a corner, or hang over radiators to dry. Pots of paint cans of oil, varnish, etc., should

never be allowed to be scattered about but should be placed in proper metal cupboards. If no such place is provided, they will merely become part of an accumulation of rubbish which is so conducive to untidy conditions and spontaneous combustion.

Another hazard common to all buildings is that of heating. Furnace or boiler flues, wherever passing through wooden partitions, should be provided with suitable metal collars. Steam pipes should be bushed clear of all woodwork, and in the operation of any plant, so heated, great care should be taken to see that no stock is in close proximity to either steam pipes or radiators. It need hardly be emphasized that all woodwork should be kept clear of all chimneys and that all small chimneys should be either properly lined with tile crock, or well parged with mortar.

The scarcity of coal during the last few years has resulted in numerous fuel oil heating equipments being installed. While this form of firing is much cleaner than the use of coal, eliminates the danger of hot ashes coming in contact with combustible materials in the boiler room, and possesses other advantageous features, it still has dangers peculiar to itself. For example, the main supply of oil should be located below the pump and spraying nozzle in the fire box. Less than a month ago, in one installation in the down-town district of the city, an equipment was found being installed, without the knowledge of either the City Architect or Fire Chief where the main supply tank was located at a higher elevation than either the pump or the spraying nozzle. To make matters worse, an auxiliary tank of about one barrel capacity was located inside the building above the basement floor. These devices are operated by electric current and an automatic cut out is provided to shut off the oil pump when the current fails, so that when the current returns the pump may not start again and spray oil around when there is no fire to consume it. After an interruption of this nature, the temptation is for the operator to tie the circuit breaker up in its closed position, thus circumventing its object although he should know that when the switch is tied in this fashion, the return of the current will spray oil around without setting it alight. Such an occurrence took place in a prominent down-town garage in Toronto on January 6th, of this year, resulting in a small fire.

While the Toronto Building By-law provides for the proper construction of chimneys and warm air heating flues, it does not provide for low pressure steam heating apparatus or fuel oil installations. Regulations governing such installations with adequate provision for inspection are urgently needed.

Lighting presents its own hazards. In the case of gas lighting, swing brackets should be prohibited, and in case there is any possibility of combustible material coming in contact with the naked flame wire cages should be provided. In the case of electric lighting the most common forms of carelessness are winding up frog cords or extension lights about nails or metal fixtures, thus inviting a short current circuit as the insulation deteriorates in contact with the metal. It is an all too common practice particularly in the case of nitrogen gas filled bulbs where the light is very intense for persons to attempt to relieve the strain on the eyes by fastening paper shades around the bulbs. The heat given off by the light is sure to set the paper on fire. As the number of electric pressing irons in use increase, the danger from fire becomes greater in the same proportion. These devices are rapidly superseding other means of pressing in tailor and clothing shops, as well as in the home. Unless a tell-tale pilot light is provided in the circuit controlling the iron or group of irons fires are bound to occur due to the operator forgetting that the current is on. As an instance of this, the speaker recalls that in a certain tailoring establishment in Toronto, such a thing occurred. This resulted in the iron setting fire to the ironing board which caused a sprinkler overhead to open and turn in an alarm of fire. The sprinkler extinguished the blaze and while the fire inspector was going through the stories below to reduce to a minimum the possibilities of water damage, he discovered another electric iron with the power on. In this case, however, the iron was on a stand which had thus far prevented it from setting fire to anything.

In the matter of preventing small fires becoming large ones, it has long been recognized that the first five minutes are all-important. During this period and before the arrival of the Municipal Fire Brigade, many fires can be extinguished if the persons in the buildings have been instructed as to what to do. The use of fire pails, soda and acid chemical extinguishers, or those of the carbon tetra chloride type, and standpipe and hose, constitute an effective first-aid in fire fighting. No building intended for human occupancy, should be without at least one of these forms of equipment. In the case of large plants or institutions, a private fire brigade should be organized and regular fire drills held. An efficient watchman's service is highly desirable when the plant is not in operation. In the case of the watchman, some approved method of recording the fact that he has visited all portions of the plant at regular intervals should be used.

The construction of the buildings itself plays an important part in preventing the spread of fire. All stair and elevator openings should be enclosed in a manner which will prevent fire traveling from one floor to another. These enclosures should preferably be of incombustible material, and if of wood, should be the equivalent of the floor in thickness up to 4-in. The speaker cannot concur in the opinion that splined plank partitions are as good as fire stop, as ordinarily assumed, for in the process of seasoning after erection, the shrinkage of the lumber is often sufficient to cause wide cracks to appear. As a preferable alternative to this construction, he would suggest the use of layers of matched boards with the joints staggered; while this does not prevent shrinkage the cracks so formed will not extend through the partition. The doors to those shafts should be preferably of the automatic sliding type. Swing doors offer too much temptation to employees to block them open, particularly when, on account of not being hung in a truly vertical position, they have a tendency to swing shut. Unevenness in the surface of the floor is also liable to prevent this type of door from closing properly, and the operating chains seem to be continually getting out of order. If circumstances make it necessary to instal the double-leaf type of swing door, provision should be made by the installation of a mechanism at the top which will ensure that the proper leaf closes first. We might instance the case of the fire which occurred in a mill constructed paper box factory in Toronto a few years ago, in which swinging doors did not close properly owing to unevenness of the floors and a fire which started in one end of the basement traveled back and forth the full length of the building from floor to floor. Walls or floors should not be cut for shaft, belt or chute openings, but where unavoidable, such openings should be protected adequately. In this manner fire may be confined to the

floor in which it originates. Too great a floor area without division walls, however, is liable to permit a fire to reach such proportions as to get beyond control, and large floor areas should be sub-divided by fire walls equipped with approved fire doors at any communicating openings. As one typical example, let us refer to a fire which occurred recently at the plant of the Moline Plow Company, at Rock Island, Ill. Owing to the persistence of an insurance agent, this plant which consisted of one great area over 1,200 feet long, was subdivided into three sections by two fire walls equipped with automatic fire doors. The fire was held to the section in which it occurred, with a loss of less than $1,000,000, whereas, had not the walls been erected, the entire plant would have been wiped out, with a loss of over $4,000,000. In other words, one fire wall saved this company over $3,000,000.

Hollow spaces should be reduced to a minimum. Prospective builders or owners should be made thoroughly acquainted with the advantages which mill construction has when compared with joisted construction, or which so-called "fire-proof" has over any form of timber construction.

Special hazards peculiar to their particular industries, should be isolated in such a manner that the possibility of communicating fires from them to the remainder of the plant is reduced to a minimum. Cereal mills, flour mills and elevators with their dust hazards, cotton mills with their picker room hazards, mills with their pulp-wood pile hazard, rubber works with their cement and impregnating hazards, pyroxyline plastic works with their explosive hazards, and other industries with other attendant hazards, must be passed over for lack of time. There are, however, several industries with exceptionally severe hazards which are still permitted in our congested down-town districts, should be given special attention.

With the rapid growth of the moving picture industry, film exchanges have become a necessity. It was realized that owing to the combustible nature of the material from which films are made that they represent a serious fire and life hazard, and numerous lists were made by the Eastman Kodak Company and the National Fire Protection Association, to devise ways and means of safeguarding this hazard.

"The results of the various tests, together with a study of the evidence deduced from the fires of the past indicate:

First—Automatic sprinkler protection is imperative in preventing loss of life and serious property damage wherever film is handled or stored, and even a substandard system is beneficial.

Second—To reduce loss of film to a reasonable figure, and the decomposition to a point where the gas cloud does not introduce a severe exposure hazard, and there is little liability of an explosion, automatic sprinkler protection must consist of an adequate number of sprinkler heads, at least twelve to a standard vault of 750 cubic feet, and an abundant water supply, capable of supplying water for at least twenty minutes to the full number of heads in a vault, and at least one-half the heads in any other section between fire partitions.

Third—That for effective control of film fires by automatic sprinkler, it is necessary to insulate masses of film from one another by partitions, and that these partitions are of great value in vault storage.

Fourth—That without adequate ventilation to the outside air, any considerable amount of film will generate conditions introducing a severe life hazard, and a probable heavy property damage from explosion.

Fifth—That arrangement of work rooms and other places where film is handled, must be kept practically free of film; all reels to be placed and kept in properly constructed and protected cabinets and vaults when not in actual process of being handled.

Sixth—That the highest order of housekeeping must be exercised; the rooms be kept clean, and fire equipment in good order.

Seventh—That because [illegible] nature of the gases, danger of spread of fire a[illegible] rapidity of the burning of film, protection to life requires superior construction in buildings used for storage and handling of film. Of particular need is the protection of all openings, stairways, passage ways, between floors, and the sub-dividing of fire partitions of the various parts of the film exchange.

Eighth—That ample enclosed stair exits are necessary to prevent loss of life and injury.

Ninth—That in vault construction, it is of primary importance to have door of easy operation, and that it be kept normally closed. As a further provision for safety, to prevent discharge of gases into the room, an automatically closing door should also be provided.

Tenth—That film may be stored in a vault properly ventilated and protected by automatic sprinklers, the entire installation conforming to the National Board regulations, and if fire occur it seems reasonably certain that the fire will be controlled by the automatic sprinklers and considerable film will remain uninjured except for water, and that the explosion hazard to surrounding property will be slight.

Eleventh—That full compliance with storage requirements is necessary and responsibility for these conditions must be placed on a competent employee.

Twelfth—That the above features can be obtained only through enactment of suitable laws and ordinances, and their enforcement by the Fire Department through frequent inspections, preferably each day.

It will be seen from the above recommendation that the exceptionally great hazard connected with film exchanges is recognized by the manufacturers of the films and the National Board of Fire Underwriters, and adequate protection can only be secured by heavily-sprinklered vaults, provided with adequate vents in buildings the escapes from which is easy. In the city of Toronto there are several film exchanges, but not one of them is located in a sprinklered building, and all are located in buildings of inferior construction in the very heart of the city. What is the answer going to be?

Another hazard which possesses exceptional possibilities, but which, because of its familiarity, seems to be breeding a great deal of contempt, is the gasoline hazard, as exemplified in garages, and dry-cleaning establishments. The gasoline driven automobile has become so common and the fluid has become such a familiar article of commerce, that its destructive power is not fully appreciated. To quote from a bulletin of the Ontario Fire Prevention League: "One gallon of gasoline will give off 180 times its bulk in vapor; and when vaporized will convert 1,550 times its volume of air into an explosive mixture, which will ignite from a flame or spark. Five gallons of gasoline will generate 8,000 cubic feet of gas—enough to fill a room 20x40 feet and 10 feet high. When ignited, it immediately expands to fou[illegible]-sand times that space.

It does not require a very concentrated mixture of gasoline, vapor, and air in order to be explosive, and consequently the danger in a public garage should be more thoroughly appreciated. To be sure we see signs

posted "No smoking allowed" but how many smoking motorists extinguish their cigars or cigarettes when driving into a garage for a new supply of gasoline? If they stopped to consider that for every five gallons of gasoline they buy, they procure in explosive power the equivalent to nearly a quarter of a ton of dynamite, they might be more cautious. The workmen in the garages themselves are none too careful, often using blow torches in making repairs, and using extension lamps which are not provided with vapor-proof globes, and almost without exception the boiler or furnace room may be entered directly from the garage floor. Numbers of these garages are located in the more congested portions of our large cities but fortunately are under the protection of automatic sprinklers.

Of late years dry cleaning establishments have been coming under Legislative enactments on account of the hazardous nature of their processes. For example, the State of Ohio has recently passed an Act to regulate the use of dry cleaning and to provide for the proper construction and inspection of such establishments. This Act is patterned after a suggested Ordinance issued by the National Board of Fire Underwriters. Some of the outstanding features of this Ordinance are that buildings used for dry cleaning purposes shall not be more than one story or 16 feet high without a basement or other open space below the floor, shall not be used for other occupancy, and shall be at least ten feet from other buildings or public thoroughfares. The building shall be entirely constructed of non-combustible material and no direct openings shall be permitted between the wash rooms and dry rooms. Raised door sills are insisted upon and all rooms are required to have a steam extinguishing system, or where such fire extinguishing agent is not available, an approved system using a fire deterrent chemical or gas. The details of heating and ventilating systems, location of motors or dynamos and drainage systems are gone into at considerable length, and the construction of cleaning, rinsing, extracting, distilling and drying machines [illegible]. The location and construction of all [illegible] storage tanks and settling tanks are dealt [illegible]. In Toronto some of our large dry cleaning establishments are located in the down town district and [illegible] thickly populated residential portions. In [illegible] knowledge are any of these establishments located in a fire resistive building.

Another industry in which there are several special [illegible] of exceptional importance, is the manufacture [illegible] and they are of particular interest to [illegible] second largest manufacturer of [illegible] vehicles in the world. Two of these hazards, [illegible] of dip tanks and bake ovens demand at[illegible] portions of automobile bodies are [illegible] by dipping in tanks. With the growth of [illegible] automatic dipping has been introduced [illegible] in the size and capacity of [illegible]. Numerous fires have occurred in dipping [illegible] the inflammable nature of the mater[illegible] and the introduction of automatic dipping [illegible] rendered ineffective the older method of ex[illegible] dip tank fire by means of automatic clos[illegible]. A splendid example of the more recent [illegible] controlling these fires may be found in one [illegible] automobile manufacturing plants. The dip tanks [illegible] provided with overflow pipes connected to underground tanks outside the building so that the level of [illegible] in them may not become too high. A large [illegible] is provided in the bottom of each tank in which is a quick-opening valve controlled by a thermostat located at the ceiling above the tank. A rise of ten degrees in temperature in a period of ten seconds or less will cause this thermostat to actuate the mechanism which opens the drain valve and the contents of the tank are quickly drained through a trap to the large underground tank outside the building. Over each tank is located a "Dumbo" or sprinkler head of large capacity. Since water would only float the burning enamel out of the tank and spread it about the building, a frothy, incombustible mixture, lighter than the enamel and known under the trade name of "Foamite," is substituted. The opening of the sprinkler would distribute this frothy mixture over the surface of the japan in the tank, thus smothering the fire. It is to be hoped that such installations will become more common, not only in the automobile factory, but wherever dip tanks are used.

The second hazard to which we referred, namely the bake oven hazard, has been responsible for a considerable number of explosions with resultant fires and loss of life. Only recently such an explosion occurred in a Toronto automobile factory, resulting in a considerable fire damage and the loss of one life. The japan drying ovens are usually heated by gas, electricity or steam. The evaporation of the volatile thinners of the enamel may produce an explosive mixture if adequate ventilation is not provided, and in the cases where gas or electricity is used for heating, the naked gas flame or highly heated electric element may easily ignite such a mixture. It is essential that in all enamel baking ovens ample ventilation be provided and that the heating element be so protected that no drippings can come in contact with them.

In the great majority of cases the most effective means of nipping a fire in the bud is the "automatic sprinkler," but we will reserve discussion of the merits of the automatic sprinkler till later.

The third phase of "Fire Prevention" is confining a fire which has once gained headway to the building in which the fire originated.

The shingle roof probably spreads a fire on a windy day about as well as any contrivance which the ingenuity of man is capable of inventing. Once the shingle roof catches fire, every one of its shingles becomes a brand to carry the fire to other roofs. This is particularly true following a long, dry spell when such roofs become so much tinder. Frame buildings especially in congested areas are another prolific cause of the spread of fires. The most efficient Fire Department in the country is powerless when once a fire gets under considerable headway where bad construction prevails.

In our down town sections, where we have buildings several stories in height usually containing large stocks of combustible material, approved fire shutters for windows, open sprinklers, or best of all wired glass in metal sash form most effective barriers to the entrance of fire from adjacent exposure. In the case of fire shutters their chief fault is they are so often inoperative and are so frequently left open at night. To close the shutters in a large number of windows is quite a task, and a watchman who is inclined to be lazy will often leave them open. In those buildings where watchman's services is not maintained, the management should assign the task of closing of the shutters to some definite person or persons and should insist on the orders being strictly carried out. But managements like watchmen, are apt to grow careless. Open sprinklers are never controlled by an automatic valve, and in consequence fire may gain access to a building through win-

dows thus protected before the valve is opened. Unfortunately the efficiency of wired glass windows, is often nullified by the fact that ventilators are held open by push rods instead of by the approved method of fusible links and chains.

The necessity for an efficient fire-fighting brigade with ample equipment and abundant water supply, is so apparent as to need no discussion at this meeting.

Last, but not least, as a conflagration stop, is the automatic sprinkler. In the consideration of the means to prevent the growth and spread of fire, we have so far given the automatic sprinkler but passing mention. Gorham Dana says: "The automatic sprinkler is without question the most important fire protection device ever invented. This is due to the fact that it is constantly on duty in every part of the property equipped, and is automatic in its action. Practically every fire is small at the start and can be put out at that time, without the intervention of any human agency. The device itself has been so perfected that it practically never fails to operate when needed, provided only that it is properly installed and maintained."

To show the efficiency of the automatic sprinkler records compiled by the National Fire Protection Association, indicate that in the period from 1897 to 1919 inclusive, 21,192 fires occurred in sprinklered buildings, and of this number 20,439 were practically or entirely extinguished or held in check—an efficiency of 9554 per cent. Of these fires, 70.4 per cent. by five or less heads, and 90.7 per cent. by twenty or less heads. In a previous portion of the paper, the speaker dwelt at considerable length upon the loss of life and property in schools, hotels and institutional buildings. In the August, 1919, issue of "Fire Protection," a tabulation was printed, showing that whereas during the five year period, 1914-1918, the average loss per fire in unsprinklered hotels and lodging houses, was $21,391.081, attended by casualties of 85 persons killed and 75 persons injured, the average loss per fire under sprinklers was $547.03, with no attendant casualties.

As more specific instance, let us compare the results of two recent fires (garages) in Toronto. A fire occurred on January —, 1920, in the unsprinklered garage operated by the Wilder Cartage Company, resulting in a loss of approximately $68,000. In a sprinklered garage, on January 14th, 1920, a fire occurred at about 5 a.m. and was discovered by a passing policeman who noticed water pouring and immediately notified the manager. It was found that the heads located in the front section of the third had "let go" as a result of a fire which started in an automobile stored there. The sprinklers, in operating, had almost put the fire out, and by the aid of two chemicals it was entirely extinguished. The loss will not be heavy as the only damage sustained was by the private car in which the fire started and slight water damage to decorations and woodwork in the office below. In a certain Toronto manufacturing establishment a fire occurred at about 2 p.m. on January 20th, 1920, in a cut off steel tempering room at the east of the second floor of a four story building; a forty gallon tank of whale oil is located here, in which the hot steel pieces to be tempered are immersed. During this process air is blown up through the oil causing a circulation which prevents ignition. On this day, however, the oil was so congealed by the low temperature of the room that no circulation was established and the flash point of the oil was reached. One employee attempted to smother the flame by putting on the lid, but this fell edgewise into the blazing tank. Other employees used four extinguishers in fighting the flames. One sprinkler head then operated and completely extinguished the fire. Similar instances might be multiplied without end.

If three-tenths of 1 per cent. of all fires, which are responsible for approximately 5th per cent. of the fire loss, occur in unsprinklered properties, think of the possible reduction of Canada's vast fire toll in view of the 95.54 per cent efficiency displayed by sprinkler equipments during the past twenty-two years.

In sprinklered buildings whose exterior walls are composed of incombustible material and with adequate protection for windows and other openings, it has been repeatedly demonstrated that they can withstand even the most severe conflagrations. In the Toronto conflagration in 1904, the W. R. Brock Co. building withstood the fire from 8 p.m. till 3 a.m. the next morning, while buildings all around it were completely destroyed hours before. By this time the water pressure had become so reduced owing to broken service connections and the heavy draughts made upon it by the fire fighting apparatus, that water from the city mains did not reach the sprinklers in the upper storys of the buildings, and after the tank supply was exhausted, the fire gained access through the upper stories. In the same fire, the paper bag and box factory owned by Kilgour Brothers, on Wellington Street West, not only withstood the fire due to its larger tank supply and good division walls, but prevented the further eastward spread of the fire along Wellington Street. In the San Francisco conflagration, the warehouse of the Western Electric Company, although built with ordinary brick walls and plank and timber floors and roof, resisted an attack of the conflagration first on one and later on the other, and, practically uninjured, was ready for business the next morning, while everything around it was burned flat. The concrete stone house of the Nanmkeag Cotton Mills, which stood fairly on the hottest path of the Salem fire of 1914, came through without injury, thanks to the concrete, inside automatic fire shutters and the sprinkler system. During the forest fire of 1916, a large number of lives were saved by the people congregating in the sprinklered buildings belonging to the Mattila Pulp and Paper Company.

The conditions along Wellington Street, Toronto, are much better than at the time of the last conflagration. On the south side of Wellington Street, between Bay and York Streets, all but fifty-five feet of the built up property is of fire-resistive construction or under sprinkler protection. This forms an effective barrier between the property to the south and the fire trap construction to the north, and north west. In the area bounded by Simcoe Street, Dundas Street, George Street, and the water front, there are one hundred and forty one sprinklered properties each of which may be relied upon to resist the spread of fire.

During these days of industrial unrest, the automatic sprinkler assumes an entirely new role. From the newspapers we learn that the Fire Department of St. Louis armies that went on strike recently. The Waterworks employees in Montreal were on strike for over a month. Two thirds of the 820 firemen of St. Louis have voted to strike unless they are granted a wage increase by May 1st. Upon the resignations of more than 1,100 firemen (approximately one-half of Chicago's fire fighting force) have been handed to Chief O'Connor in one batch. But the automatic sprinkler is always on the job, for even in the event of a waterworks strike the independent tank and pump supplies, usually provided, are available.

Unfortunately the automatic sprinkler has usually

been installed to safeguard property, protect profits or to act as a lucrative investment to the purchaser, a result of saving in insurance premiums, and not for the protection of human lives. Its record in this respect makes it doubly valuable. The records of the Factory Mutual Insurance Companies covering risks employing 1,500,000 people, show only twelve deaths in sprinklered buildings in thirty-eight years. Of these, three were due to persons going back into the burning building to save property and four were firemen engaged in fighting the fire. To quote W. H. Forster, chairman of the National Fire Prevention Association Committee, of "Safety to Life." "Long experience and continually repeated demonstrations prove that the automatic sprinkler, where properly installed and in operating conditions, is always ready, operates quickly and either extinguishes the fire or else holds it in check, and is the most reliable means of safeguarding lives in the majority of existing manufacturing buildings. Enclosing stairs, building fire towers, properly constructing fire escapes, etc., are all means intended to permit of escape after the fire gets under way. The automatic sprinkler almost invariably prevents the fire from assuming serious proportions." One particular instance of the automatic sprinkler acting as a life preserver occurred one night in a Toronto tailoring establishment. A watchman was heating some wax on a small gas heater when the wax boiled over, took fire and part of the burning material set fire to his clothes. In endeavoring to extinguish the fire in his clothing, he was rolling on the floor when two automatic sprinklers operated. They extinguished the fire in his clothes at the same time putting out the blaze that was started by the burning wax coming in contact with some furniture. The sprinkler probably saved the man's life.

Merely to recount a list of ills without attempting to point out their remedy, is not constructive criticism. It might therefore be well for us to consider some of the remedial measures proposed. It has long been recognized that it is almost impossible "to teach an old dog new tricks." There are any number of property owners who can never be convinced that their particular plant will ever catch fire and amongst the others are those who, although they might be convinced of their danger, are too set in their careless habits to change them. The place where any educational campaign will do the most good is amongst the school children whose minds are capable of receiving impressions and retaining them. Such a course might be patterned after the one outlined by the National Board of Fire Underwriters entitled "Safeguarding the Home against Fire." In the case of the "older dogs" compulsory measures are the only ones likely to be effective. Certificates of occupation should be required in order to prevent hazardous risks being located in buildings which are literally unsuited for such occupancy.

Systematic inspection should be made of all plants by members of the local Fire Brigades, and where extra hazardous conditions by reason of occupancy, area, height or quick burning construction, are found to exist, they should be immediately reported to the Fire Marshal's Department who should issue an order for the compulsory installation of automatic sprinklers within a specified time. The criminal code respecting prevention of fire was amended in 1919, giving any Dominion, Provincial or Municipal Fire Officer power to insist upon the installation of such apparatus. To the best of the speaker's knowledge only the Dominion officials have attempted to make use of this power, and their efforts have been largely confined to trying to convince the owners of what would ordinarily be termed good risks by means of the one-legged argument of the money they would save in insurance premiums, that it would be to their advantage to instal sprinklers and apparently they have disregarded entirely the fire-traps which abound. To the speaker's knowledge, not one system has been installed as a result of the Dominion Fire Commissioner's efforts.

The question of personal liability has often been receiving attention from those interested in the matter of fire prevention; even as far back as the Book of Exodus we find the following law regarding the personal liabilities for fires: "If a fire breaks out, and catch in thorns, so that stacks of corn or the standing corn, or the field be consumed therewith, he that kindleth the fire shall surely make restitution." Such laws have already been adopted in several of the States of the United States, and the Section 515 of the Criminal Code of Canada has been amended to contain a similar clause. The justice of this principle need hardly be emphasized as it is to be hoped that the law which we now have on our Statute Books will be productive of much good.

DISCUSSION.

The chairman asked Mr. George F. Lewis, Deputy Fire Marshal for Ontario, to lead the discussion on Mr. Mylrea's paper. Mr. Lewis said:

We have listened with a great deal of interest to an admirable paper on "Fire Prevention," and I sincerely hope that material benefit to the safety and welfare of our homes, factories and municipalities generally, will result after we have carefully digested the indictment against the wilful waste and careless indifference of our people which has been so forcefully brought to our attention.

Mr. Mylrea is well qualified to advise us professionally on many phases of Fire Prevention and Protection especially regarding automatic sprinklers. As a fire prevention engineer he has for many years made a close study of installation and maintenance of sprinkler systems and can speak authoritatively on their efficiency.

Mr. Mylrea has informed us of the enormous waste of our national wealth and resources, and terrible loss of life resulting from fires caused by carelessness, bad housekeeping, disorder and accumulations of rubbish. The astonishing fact is, however, that fully 80 per cent. of all these fires, this unnecessary waste, this unnecessary sacrifice of human lives, is preventable.

What Are You Going To Do About It?

This is not a one man's job.

Everyone is interested. We need the enthusiastic support and co-operation of all to fight the demon fire.

There are more than four times as many people burned to death every year in Canada as are killed on steam and electric railways. The estimated death toll, caused by fire, on the North American continent is 30,000 yearly.

Another phase of the fire prevention problem is the housing question.

Out of nine to ten thousand fires that occur in Ontario each year 61 to 67 per cent. or two out of every three fires occur in the homes of the people.

Caused by carelessness.

Defective chimneys and stove pipes.

Children playing with matches.

Careless smokers.

Carelessness with electric irons.

Accumulation of rubbish in the attic or cellar.

Putting hot ashes in wooden boxes, &c.

"It is yesterday's dirt that always starts the fire."

This all helps to increase the high cost of living. It gives the landlord the power to ply his nefarious trade on a helpless public. It puts on us a financial burden of cumulative character that is becoming harder every day to bear.

I am glad to say that there is a slight rift in the dark clouds of smoke that have been covering our fair land. Last year the fire waste of the Province was reduced by six million dollars, but the amount is still far too high and leaves a fire tax of more than $3.50 per capita on every man, woman and child in the Province.

The fire loss for the North American Continent was reduced last year to the extent of 15 per cent. In Canada, the reduction amounted to 27 per cent and in the Province of Ontario the reduction was 40 per cent. There is some satisfaction in knowing that our efforts have not been in vain.

Now while the large number of fires have been in dwellings; the big losses occur in the industrial plants of the province.

In the year 1918 our statistics show that 486 fires or about 5 per cent. of the entire number, caused losses amounting to over seven and a half million dollars. More than 48 per cent of the total loss.

Further analysis shows that 20 fires or 1.5 or 1 per cent. of the entire number in the Province were responsible for almost six millions of dollars losses; which is 37 per cent. of the total loss for the year.

This direct loss of millions and an indirect loss of additional millions of dollars more can be prevented and the money used to build up the resources and wealth of the country if our captains of industry would but stop and think what precautionary measures should be taken in their individual cases.

Let me illustrate by incontrovertible facts what fire protection and fire prevention means.

During the year 1919 there were 1,082 fires caused by lightning in Ontario, entailing an unnecessary waste of approximately half a million dollars. I say unnecessary waste, for it has been proved beyond peradventure that lightning rods properly installed are more than 90 per cent efficient.

Eighty of these fires occurred in the four large cities of the Province, and the average loss per fire was $92.50. These fires starting in congested areas were in each case potential conflagrations. The loss however owing to first class protection from well organized fire departments was held down to a minimum.

In the smaller cities, towns and villages of Ontario, where there was good or partial protection from fire, I find that there were 609 fires caused by lightning with an average loss per fire of $160.50.

While only 56 per cent of the total number of lightning fires occurred on the farms of the Province they are responsible for over 78 per cent of the total loss.

To make it clearer the average loss on the farm for each fire caused by lightning last year amounted to $988.00. More than ten times the loss per fire compared with the large cities and more than six times the loss as shown by the statistics for the smaller cities towns and villages.

All the fires started from lightning more or less on the same basis because the buildings were not properly protected by lightning rods although it may be claimed, and rightly too, that barns filled with hay are more easily fired than ordinary warehouses or dwellings.

Only two properly rodded buildings were struck and the total loss amounted to $22.00 for the year.

These figures demonstrate two things; the necessity for taking preventive measures and the need for adequate protection.

If these buildings had been properly protected with standard lightning rods the Province would have been approximately half a million dollars better off.

You can apply this lesson to your individual business condition and exposures. Study out your requirements; diagnose the case and adopt the best and most practical methods of preventing fire.

Towns should have properly organized fire brigades, efficient, not obsolete fire fighting apparatus and equipment.

Adequate water flow and pressure

Fire Prevention By laws

Inspectors who understand their duties and empowered to enforce the law under the power and authority provided by the Municipal Act.

Mr. Stockwell, Stockwell-Henderson Co., Toronto. In Mr. Mylrea's paper he has told what the construction of the dry cleaning plant should be, and says there is no such plant in the city of Toronto. Now what must the people think who send their clothes to these places? We have been in the cleaning business for 25 years, and have done everything possible to make our building safe; we have put up a fire wall and installed a special machine to control the static electricity, and think we have succeeded to a considerable extent. In ten years we have had only one fire and one explosion, neither of them serious; the explosion cost $60 and the fire $240. If the insurance companies still carry our risk and they do, they must consider it a pretty good one.

The trouble is that we, who do try to make our buildings safe are discredited in the eyes of the public by the hundreds of people who mis apply the use of gasoline. All plants in the course of erection should be properly supervised, and a by law should be passed to have these buildings properly constructed. We feel that if this is done the loss of life from the careless use of gasoline will be greatly decreased.

Mr Langley Langley The Cleaner, Toronto. There are perhaps thirteen "D" cleaning plants in Toronto in which there is invested approximately $625,000. During ten years there have been only two inspectors to our plant. If they had come more frequently they would have saved us many dollars in the beginning, as we are liable to make mistakes, and if not shown the best way must learn through experience.

Mr Lewis. I have been in close touch with the City Architect for some time regarding this matter, and there is no by law, as yet, to take care of the dry cleaning plants. It is proposed to include in the building code now being drawn up specifications for their construction and maintenance.

Controller Gibbons. Most men who come before the Board of Control come to complain that the restrictions are too strict, not that they are too lax, and if you will come before the Board we shall be very glad to hear you.

As soon as this discussion was over Mr. Parker moved seconded by Mr Marlow. "That a vote of sincere thanks be tendered to those gentlemen who have presented papers at this convention and to all who have taken part in the discussions thereon." Carried unanimously.

At 6.10 p.m. the chairman declared the meeting adjourned.

OFFICERS OF ONTARIO SAFETY LEAGUE.

Officers of the Ontario Safety League for the ensuing year were elected as follows

Honorary President, His Honor L. H. Clarke, Lieutenant-Governor of Ontario.

Hon. Vice-Presidents: Charles G. Booker, Mayor of Hamilton; T. L. Church, K.C., Mayor of Toronto; H. Hartley Dewart, M.P.P., Toronto; Hon. E. C. Drury, Prime Minister of Ontario; Hon. G. Howard Ferguson, Toronto; Harold Fisher, Mayor of Ottawa; E. S. Little, Mayor of London; Tom Moore, President Trades and Labor Congress of Canada; Sir Edmund Osler, Toronto; Hon. W. R. Rollo, Minister of Labor, Ontario.

President, Sir John Eaton, The T. Eaton Co., Limited

Vice-presidents: A. B. Ingram, Ontario Railway and Municipal Board; S. Price, Workmen's Compensation Board, Ontario; H. C. Cox, Canada Life Insurance Co.; P. E. Doolittle, M.D., Toronto.

J. F. H. Wyse, Organizer and Engineer, and R. B. Morley, General Manager, were re-appointed.

An executive committee of 37 members was also elected.

Executive Committee.

A. H. Abbott, Ph.D., Organization of Resources Committee; J. F. Burke, Chief Inspector of Factories, Ontario; Major F. D. Burpee, Ottawa Electric Railway Co.; J. A. Campbell, Metropolitan Motors, Ltd.; C. E. Chambers, Commissioner of Parks; H. H. Champ, Steel Co. of Canada, Ltd., Hamilton; A. P. Costigane, Ontario Pulp & Paper Makers' Safety Association; W. C. Coulter, Booth-Coulter Copper and Brass Co., Ltd.; H. H. Couzens, Toronto Hydro-Electric System; S. J. Dickson, Deputy Chief Constable, Toronto; Thomas Findley, Massey-Harris Co., Ltd.; J. H. Forrest, Toronto Railway Co.; G. H. Gooderham, Toronto-Hamilton Highway Commission; H. Hayman, Board of Education, London; E. P. Heaton, Fire Marshal, Ontario; E. F. Henderson, Separate School Board, Toronto; Arthur Hewitt, Consumers Gas Company; G. A. Hodgson, Ontario Motor League; F. L. Hubbard, Toronto Railway Company; C. B. King, London Street Railway; A. W. Mance, Toronto District Labor Council; R. B. Morley, general manager; G. C. Martin, T. H. & B. Railway, Hamilton; H. Macdonald, Canadian Manufacturers Association; Wills Maclachlan, Electrical Engineer; J. W. McCullough, M.D., Chief Officer of Health; W. A. McLean, Deputy Minister of Highways; W. R. McRae, Toronto Railway Co.; John Noble, M.D., Board of Education, Toronto; Walder Parke, Board of Education, Hamilton; W. A. Riddell, M.A., Ph.D., Deputy Minister of Labor; A. M. Ross, Chief Constable, Ottawa; W. Russell, Chief Fire Department; T. A. Stevenson, Ottawa; W. R. Whatley, Chief Constable, Hamilton; W. T. T. Williams, Chief Constable, London; J. F. H. Wyse, Organizer and Engineer.

Annual Luncheon

Mr. Arthur Hewitt—*Chairman* **Mr. R. M. Little—*Speaker***

The annual luncheon of the Leagues was held in the Pompeian Room, King Edward Hotel, Toronto, on Wednesday, 14th April, 1920. Mr. Arthur Hewitt, Toronto, was in the chair, and the guests at the head table were: Hon. L. H. Clarke, Lieutenant-Governor of Ontario, Hon. W. R. Rollo, Hon. F. C. Biggs, Mr. James White (Ottawa), Controller Ramsden, Dr. John Nolde, Dr. W. A. Riddell, Mr. C. A. C. Jennings, Mr. W. A. McLean, Mr. J. E. Walsh, Mr. F. G. Morley, Captain Sines, Mr. James Simpson, Commissioner Richards, Col. McMillen, Mr. G. A. Hodgson, Mr. W. G. Robertson, Dr. P. E. Doolittle, Mr. A. W. Mance, Mr. James Somers, Mr. Wm. Kerr, Mr. Kuechenmeister (Windsor), Mr. G. C. Martin (Hamilton).

After the toast to the King had been honored, the chairman called to the attention of those present the excellent work done in the past six years by the League, and said that there was no form of investment which returned dividends equal to those coming from accident prevention work. He thanked His Honor, the Lieut.-Governor for his presence and then called upon Mr. R. M. Little, Director, Safety Institute of America, New York, to address the meeting on "The Safety Movement."

R. M. LITTLE, Director Safety Institute of America, New York.

Mr. Little said:

Your Honor, Mr. Chairman and Ladies and Gentlemen: It is a pleasure to be with you and to bring to your conference the greetings of the Safety Institute of America and of the National Safety Council, the two organizations in the United States which are forwarding the safety movement. We meet therefore in the interests of a great cause and while I speak from the point of view of the work in the States perhaps what I may say may be informing and suggestive as to the development of the Ontario and Canadian Safety Leagues. One of the most interesting and effective movements of our time is the safety movement. It aims to make work places safe, sanitary and attractive for the people who work in them and for those who own and manage them. This safety movement, in the United States is led by two organizations the National Safety Council and the Safety Institute of America. The Safety Institute was formerly called "The American Museum of Safety," which was the original safety organization in our country, established in New York about twelve years ago and which aimed through visualization and education to promote industrial safety. The National Safety Council was organized seven years ago and is a co-operative movement of about 3,800 industries. The object of the two organizations being practically the same, we have recently effected a joint agreement between them in the Metropolitan territory of New York City to work together to eliminate accidents from industries and also the public accidents from our streets, highways, homes and schools.

I feel that I speak for a movement which is not a fad, but a real necessity for the economic and industrial welfare of every person in the United States and Canada. I am not here to expound a theory nor explain some slight affair or method which may interest a select group of a city or a certain class of business men but a very important and timely movement. Important in the sense that it is making better industrial relations, and better unity and a better spirit between the employer and employee throughout both our countries.

The movement is rapidly spreading throughout the country and in many industrial centres in the United States local councils of the National Safety Council are being organized. In many of the States annual conventions are held, attended by hundreds and thousands of people interested in the improvement of industry, and the promotion of public and school safety. This conference in Toronto is similar to these conventions. Much has been accomplished in the reduction of accidents in industrial plants, but a great deal more remains to be achieved. Our countries need the safety movement. Industries are being benefited by it, as it is co-operative in its nature and makes a vital contribution to the spirit of industry and the spirit of a community.

Size of Safety Problem.

Perhaps you will be interested in hearing briefly of the size of our problem in industry. Conservatively speaking there are more than 2,000,000 lost time accidents in the industries of the United States each year. By the term "lost time" we mean the loss of the day or more than the day in which the injury occurs. Of these 2,000,000 lost time accidents, 750,000 workers lose four weeks or more from their jobs, and of these 750,000 at least 22,500 of them never return to work. The accidents result in death. Again, about 15,000 injured workmen each year suffer permanent impairment, as the loss of the hand, the arm, or the foot, the leg or the eye, or they receive such an injury to the head, as to reduce the worker's efficiency fifty per cent. The annual cost of these accidents to industry is at least $200,000,000, and this does not include loss from labor turnover and wage loss to the workers.

The major portion of these accidents can be prevented. This fact has been demonstrated by the safety movement. It is not upon a theory, therefore, that I speak to you, but rather upon a successful movement, which has grown up and is shared in by more than 5,000 industries on this continent. Accidents are being prevented in an encouraging degree. There are large industries which have reduced their accident frequency 25, 40, 50, 60, 75 and even 90 per cent.

It must be obvious that at such results can be accomplished through organized safety work that a Provincial conference has an important mission. Here we assemble together to discuss the principles and methods of work by which these good results are achieved. It is a pleasure to address you, therefore, in order to awaken your interest in the movement and secure your heartiest co-operation, that you may share this movement in your business, in your homes and in your city. We have discovered that this work must be co-operative. Therefore by getting together we exchange practical ideas, compare our methods, check up our results and by applying ourselves very seriously to the task we shall achieve even greater results.

Factory Management Must Believe in Safety.

Now first of all accident prevention in an industry depends upon the endorsement of the idea by the management of the industry. Unless the management and those who are in control believe in safety and set themselves to accomplish it, nothing particularly valuable can be achieved. On the other hand, when the management sincerely approves the idea, endorses a practical program, and is willing to spend money and employ talent, an accident prevention program in their plants gets results. Results are achieved, too, that surprise managers. They begin by aiming at a few definite, concrete things. The program and activity to accomplish these definite things bring about results which they may not have thought of at the time. The corollaries of safety are quite as valuable as safety itself.

Accident prevention is just like every other fundamental interest in life. You can approach life from any angle you please and lay out a program for its conservation and enrichment, and you will find that such a program not only helps to accomplish that fundamental aim, but also stimulates and helps other interests of life. This is true because life is one. Only for convenience do we divide it into compartments. Economics are related to sociology; sociology is related to government; religion is related to character. Character makes up the values of life. Every agency and activity, therefore, which seeks to promote the well-being of men, harmonizes with other activities which seek to do the same thing. The effort, therefore, to preserve the life and limb, the health and activity of workers and citizens fits in with other fundamental programs of society.

The co-operative nature of the safety movement needs to be well understood. A single plant may do effective safety work without contact with other plants, but it will do better work if the men in charge of safety come in contact with the safety supervisors of other plants and they discuss together the best principles and methods of work. The work must be essentially co-operative in a single plant.

How Accidents Were Eliminated in One Factory.

Permit me to give a concrete illustration of how safety functions under wise direction. I attended a safety rally in an industrial plant in New Haven, Conn., on the evening of December 15th. It is comparatively a small plant employing 650 workers, 125 of whom work at night. The Safety Rally was arranged by the Safety Committee, the head of which was the assistant manager of the plant. Of a possible 475 employees more than 400 were present at the rally. The meeting was held in a public hall near the homes of most of the workers. The thermometer was two degrees below zero. The workers came to the meeting on their own time. In 1916 the plant had 117 lost time accidents, in 1917 the number was 92, and in 1918 it was 37. To the 15th of December of 1919 they had 17 lost time accidents of which 8 were hernias, not properly accidents, but so classified under the law. Of the other nine, five were due to carelessness of workmen, and four were caused by unforeseen circumstances. The year closed without another accident in the plant and none occurred for three months after that Rally.

So much for the record of accomplishment. What brought it about? Here 650 workmen were engaged in a ware mill which ten or fifteen years ago was considered an extremely hazardous industry, but for the past twelve months it was practically free from injury to

the workmen. Indeed, the accident frequency was not greater than might be expected from that measure of exposure in public life. Certainly safety has made great headway in that plant. How was it accomplished? Let me tell you. First of all, the management of that industry believes in safety—from the president of the company down through all the subdivisions of the company. The management has sincerely and actively backed up the safety movement with money and an effective organization. They have made the physical conditions of the plant safe and attractive. They engaged good safety supervisors. They have an active and intelligent Safety Committee. They enlist the interest and co-operation of the workers. They carry a membership in the Safety Institute and the National Safety Council. They know the best that other industries are doing. They receive the magazine "Safety," the weekly bulletins, safe leaf practices, and all other safety literature. They are everlastingly on the job to eliminate accidents from the plant and they are succeeding. At the Annual Safety Rally, with the thermometer two degrees below zero, of a possible 475 men 400 were present, a large number of whom were foreign born, and many of them could scarcely speak English. The assistant general manager of the district was present; the superintendent of the plant was present; the safety supervisor of the district was present; the assistant superintendent of the plant was present and presided. All these officers made short, practical persuasive addresses. There was a spirit of good fellowship. The men were greatly interested in the fine record which had been made. The plant band furnished inspiring music. A quartette and soloist gave several songs. Everybody was enthusiastic for safety and to drive King Carelessness out of the plant and keep him out. The meeting was just as full of good cheer, song and fellowship as a meeting of the Rotary Club or the Kiwanis Club, but the meeting was possible because good work had been accomplished. They had striven together to accomplish a definite concrete result of mutual importance to both the management and the men. This was a typical Safety Rally, hundreds of which are being held throughout the country to celebrate achievements and to plan for greater results.

Four Central Ideas of Safety Movement.

Permit me to call your attention to four central ideas in the movement. First, it promotes a spirit of unity between the management and men. Safety is a common denominator of the mutual interests of both. In promoting it the management and men must work together. They become acquainted in the safety meetings. They think together, they plan together, they work together upon a non-controversial subject. By this unity of effort they promote a unity of spirit which affects the entire plant and all its interests. The result is to bring about unity, through effort, and unity in our industrial life is of fundamental importance if we are to have a sound economic order that will be the advantage of all our citizenship.

Second: Safety brings about harmony. Industrial safety means good housekeeping, order, system, forethought. Safety eliminates the jar and the discord from the physical conditions of industry. It likewise eliminates the jar and discord which often exist among the workers. It brings about a feeling of harmony between the employer and the employees. When workers discover that their boss cares for them they learn to care for and believe in the boss. The safety movement has more values therefore, than merely reducing the accident frequency. It is not merely a negative program, but a positive one. Its influence is constructive. Accident prevention is the immediate aim. The principles and methods employed to eliminate accidents contribute to unity and harmony throughout the entire works and organization. This discovery of unity and harmony may be considered a by-product of safety, but as often occurs, the by-product is as valuable as the product. Unity in industry is as important as unity in one's own life. Without unity of mind, ambition and effort, a man can accomplish nothing. Without unity in industry there is loss, friction and sometimes disaster. Without harmony in one's own life there is no happiness or joy. Without harmony in the industry there is friction and waste. The lack of harmony is today one of the worst things in industrial life. It slows down production and limits economic happiness. We need happiness in industry, and any movement which will drive fear from the minds of men while at work and bring about unity, harmony and good will is of fundamental value.

Third: Co-operation is another fundamental value coming into industry from safety. Co-operation grows out of unity and harmony. Co-operation means working together for a common end. When management and men in industry find themselves working together to accomplish an object which is of mutual benefit and that accomplishes results, their relationships are made more congenial and effective in every respect. The safety movement does contribute to this desirable end. The movement is helping to fill a long felt want.

It grew up out of the experience of various industries. The Safety Institute and the Safety Council have been established as clearing-house centre of ideas, methods and plans. Through these centres 4,000 industries are exchanging their experience. Thus the movement itself is essentially co-operative on a broad scale. It is one of the best movements in our business life today and is promoting confidence and good will among the industries as well as in individual plants. After all, co-operation in life is much more important than competition. In one sense competition is helpful and will never be eliminated, but it should be competition of the nature of emulation and stimulation and not fierce warfare and destruction. Competition of the other sort is akin to the idea of the survival of the fittest, that idea of life which rests upon the Neo Darwinian theory namely, survival of the fittest through the destruction of the weak and built the rule of the strong. The prevalence of this idea of life in Germany caused the downfall of that great Empire. The ruling mind of Germany embraced the view of life that the strong should rule over and control the weak. They believe that being strong, they should rule over and control weaker nations. Gradually there was eliminated from the State policy of Germany the idea of mercy, kindness, and goodwill towards their neighbors and other countries. That this principle is false and vicious is

now evident to the whole world. The inner meaning of the great war and its results is that this world is not to be controlled by force, but by justice, truth fair dealing, consideration for others, love and goodwill. We come to our best not by subjugating others but by working with and helping others. The larger meaning of life is brought out by co-operation, not by competition. Men should strive to find points of contact, not principles of separation. The nations on this globe must learn to respect each other and help each other. All classes of men must learn to appreciate each other and work together in various groups for the common welfare. Not exploitation but service is the sound philosophy of life. The safety movement exemplifies this principle and spirit. It is bringing about co-operation among industries. It is promoting co-operation within industries. It rests upon a sound, economic and humane basis. It is constructive in its aim and method. What Kipling said about the wolf and the pack is also true of men:

> "The strength of the pack is the wolf
> And the strength of the wolf is the pack."

We are members one of another. If one member of society suffers, all other members of society suffer. If a workman is hurt, the industry is hurt; and if the industry is hurt, the workmen are hurt. Safety, sanitation, health, contentment and goodwill are fundamental to industrial prosperity and success.

Fourth: These principles being true and practical methods, having been discovered for working them out as to safety, the movement results in increased production. I do not say that safety solves all the questions of production, or that every safety device results in increased production, but I do aver that upon the whole the safety movement increases production. No industry which has gone into the safety movement sincerely and wholeheartedly and which has spent a large amount of money and considerable time to eliminate accidents but has made money thereby. The U.S. Steel Corporation, after seven years' experience, published the statement that it had saved more than a million dollars above all costs for safety and they had also saved more than 24,000 workers from serious injury and death. Recently I visited the Commonwealth Steel Plant at Granite City, Ill., near St. Louis and went through the plant with the general manager.

This industry has been keen for safety for a number of years. The president, the general manager and all the officers are forward on the subject. The manager pointed out to me illustrations, again and again, of where they had devised methods to protect their workmen, and prevent accidents, and the result had contributed to production. Further, the general manager of that plant holds to the underlying belief that whatever is right and just will pay in dollars and cents in industry. They demonstrated the principle to their own satisfaction. In fact, their savings by organized safety work more than pay for the entire service department of their industry. The first aid and hospital equipment, the commissary, the restaurant, wash rooms and lockers and recreation centres have been paid for out of their savings from compensation costs. Accident prevention has produced satisfactory results. They have a better satisfied working force. They have an increased output. They have a saving of material; a reduction of labor turnover; fewer absentees from the jobs, and this story can be repeated a hundred times from the practical experience of other industries.

The safety movement, therefore, is contributing these four fundamental things to industry: Unity, harmony, co-operation and increased production. Safety pays in dollars and cents, and it pays in human values as well. It is making a positive contribution to the industrial order which should challenge the attention of every employer, every manager, and every one who in any way has control over industrial processes.

Safety Appeals to Workmen in Several Ways.

Let me call your attention to some other values that arise out of good safety work. Professor Irving Fisher of Yale has called attention to the seven primary instincts of men which must be measurably satisfied in industry if workers are to be content and we are to have a sound and enduring economic order. The first of these instincts is that of self-preservation—the first law of nature and of life. It is obvious that safety is an appeal to this instinct. Second, it appeals to the instinct of self-respect, which is in every normal person. When a working man discovers that his employer is concerned for his safety and welfare, it appeals to his spirit of self-respect, and he is justified in thinking with Robert Burns that his employer also believes that though he may earn his bread by the sweat of his brow "a man's a man for a' that." Third, the safety movement helps to satisfy the instinct of self-expression, which is a part of a workman's life as truly as it belongs to the spirit of a poet or a painter. Workmen have creative impulses as well as other people, and when they observe order, system, light, ventilation, comfort and attractiveness all about them as they work, it appeals to their better nature. Fourth, the safety movement meets the requirement of justice, which is a deep instinct in the hearts of all men. Workmen have an inherent right to demand that places of employment shall be safe and healthy. As these conditions are accorded to them this primary instinct is in part satisfied. Fifth, the safety movement also appeals to the instinct of loyalty, one of the finest qualities of human life. What employer does not want a loyal group of workers, loyal to him, loyal to the enterprise, loyal to the product, loyal to each other? When the spirit and methods of safety are functioning effectively in an industry, it has a better chance to appeal to the loyalty of the workers. Sixth, the safety movement appeals to the instinct of love, that great elemental force which Henry Drummond declared to be "The Greatest Thing in the World." The workman loves his wife and children and home, and he will care a great deal more for a job where his life and limbs are protected than he will for a plant where he is subjected to unnecessary hazards. Seventh, safety meets the instinct for recreation. Work that is safe, well ordered, systematized is not nearly so wearing and exhausting as work that is full of fear and hazard. With safety there usually goes an enlightened policy which provides educational and recreational opportunities for the workers. When their work is over at the bench or machine they can go out and quickly find a change and

give the springs of life an opportunity to fill up again from the bottom. Through wholesome recreation, the great forces of nature within a man commence to re-create new energies of health and happiness, which permit him to come back to his job restored and stronger for the next day's work. The safety movement helps to safeguard the instinct for recreation, thereby giving to people the opportunity to live out their normal life. The workman on the job needs to love his work and have his manager's interests at heart if he would work at his best through all his years until his strength begins to wane. Workers have the right to ask that the places and conditions of their employment shall be safe; that the relationships shall be pleasant and harmonious; that the product of their labors shall be careful and bring comfort to them and welfare to the world. Work is the major interest of life and when the hum and rhythm of machinery begins, there should be something of song in the hearts of the workers. They should not be subjected to conditions and relations which send a considerable proportion of them out from our plants, mines and factories bruised, broken and maimed. Industry must be constructive and helpful in all of its influences if it meets the needs of human life, and what is it all for, gentlemen, if not to make life sweeter and better for us all?

There is a great future before Canada. You are now laying her foundations. Let me suggest that the foundations will be more secure if you incorporate in your national life the idea of human conservation and make your shops, mines, railways, farms, homes, and public life safe, healthy and attractive for all the people. I thank you. (Prolonged applause.)

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