Wood Products Section

Officers 1938-1939

eneral Chairman—J. H. LEE, Liberty Mutual Insurance Co., Rockford, Ill.
ice-Chairman—S. T. DIBSDALE, The J. G. Brill Co., Philadelphia, Pa.
ecretary—*M. C. GOODSPEED, General Electric Co., Erie, Pa.
ews Letter Editor—KARL N. SEARLES, American Car & Foundry Co., New York, N. Y.
ngineering Committee Chairman—J. A. CROUSE, Southern Lumber Co., Warren, Ark.
embership Committee Chairman—LOUIS GLAZER, Dierks Lumber & Coal Co., Kansas City, Mo.
oster Committee Chairman—O. M. SWANSON, Joslyn Manufacturing & Supply Co., Chicago, Ill.
rogram Committee Chairman—O. C. BOILEAU, RCA Manufacturing Co., Inc., Camden, N. J.
ublicity Committee Chairman—F. A. POLLOCK, Lumbermens Mutual Casualty Co., Chicago, Ill.
afety Instruction Card Committee Chairman—THOMAS SHERRY, Potlatch Forests, Inc., Lewiston, Idaho.
tatistics Committee Chairman—WILL D. JENKINS, British Columbia Lumber & Shingle Manufacturers Assn., Vancouver, B. C., Canada.
embers at Large—
*R. C. BARR, Lumbermens Mutual Casualty Co., San Francisco, Calif.
*F. W. BRAUN, Employers Mutuals, Wausau, Wis.
R. F. CALDWELL, Moore & Merklein, Inc., Shreveport, La.
*E. ROSS FARRA, Grand Rapids Safety Council, Grand Rapids, Mich.
*HARRY GUILBERT, The Pullman Co., Chicago, Ill.
*ROLAND JONES, The Surty Manufacturing Co., Chicago, Ill.
*[illegible]RY J. KELLEY, American Seating Co., Grand Rapids, Mich.
*WALTER S. PAINE, Aetna Casualty & Surety Co., Hartford, Conn.
*J. A. PURDY, Michigan Mutual Liability Co., Detroit, Mich.
*G. E. SANFORD, General Electric Co., Schenectady, N. Y.
*H. E. SEELY, The Brunswick-Balke-Collender Co., Chicago, Ill.
*Past General Chairman

Officers 1939-1940

eneral Chairman—J. C. WILSON, Lumbermens Mutual Casualty Co., Chicago, Ill.
ecretary—*M. C. GOODSPEED, General Electric Co., Erie, Pa.
ews Letter Editor—CHARLES H. JONES, Bituminous Casualty Corp., Chicago, Ill.
ngineering Committee Chairman—JAMES G. ALDRICH, Berst-Forster-Dixfield Co., Plattsburgh, N. Y.
ealth Committee Chairman—A. D. HUBBARD, Employers Mutuals, Wausau, Wis.
lembership Committee Chairman—LOUIS GLAZER, Dierks Lumber & Coal Co., Kansas City, Mo.
oster Committee Chairman—O. M. SWANSON, Joslyn Manufacturing & Supply Co., Chicago, Ill.
rogram Committee Chairman—O. C. BOILEAU, RCA Manufacturing Co., Inc., Camden, N. J.

Publicity Committee Chairman—F. A. POLLOCK, Lumbermens Mutual Casualty Co., Chicago, Ill.
Safety Instruction Card Committee Chairman—THOMAS SHERRY, Potlatch Forests, Inc., Lewiston, Idaho.
Statistics Committee Chairman—WILL D. JENKINS, British Columbia Lumber & Shingle Manufacturers Assn., Vancouver, B. C., Canada.
Trade Association Cooperation Committee Chairman—D. J. MURRAY, The Huber Manufacturing Co., Marion, Ohio.
Members at Large—
*R. C. BARR, Lumbermens Mutual Casualty Co., San Francisco, Calif.
*F. W. BRAUN, Employers Mutuals, Wausau, Wis.
R. F. CALDWELL, Moore & Merklein, Inc., Shreveport, La.
*E. Ross FARRA, Grand Rapids Safety Council, Grand Rapids, Mich.
*HARRY GUILBERT, The Pullman Co., Chicago, Ill.
*ROLAND JONES, The Surty Manufacturing Co., Chicago, Ill.
*HARRY J. KELLEY, American Seating Co., Grand Rapids, Mich.
*J. H. LEE, Liberty Mutual Insurance Co., Rockford, Ill.
*WALTER S. PAINE, Aetna Casualty & Surety Co., Hartford, Conn.
*J. A. PURDY, Michigan Mutual Liability Co., Detroit, Mich.
*G. E. SANFORD, General Electric Co., Schenectady, N. Y.
*H. E. SEELY, The Brunswick-Balke-Collender Co., Chicago, Ill.
*Past General Chairman

MONDAY AFTERNOON SESSION

October 16, 1939

The first session of the Wood Products Section was called to order by General Chairman J. H. Lee, Safety Engineer, Liberty Mutual Insurance Company, Rockford, Ill., who presided. In his opening remarks, Chairman Lee sketched some of the activities of the Section during the past year, paid tribute to the Sectional Committees for their work, and then introduced the first speaker.

Health Hazards in the Woodworking Industry

By R. R. SAYERS

Senior Surgeon, Division of Industrial Hygiene, National Institute of Health, U. S. Public Health Service, Washington, D. C.

In 1935 there were 579,012 workers in the United States employed in industries in which wood in some form is the principal material. Of this number 283,309 were employed in the basic industries and 133,772 in the furniture and related industries. The remainder were in woodreworking industries, wooden-container industries, and other allied industries.

Only limited data as to absenteeism due to all illness or to occupational diseases are available. However, in a survey of 1,487,224 workers employed in 16 industry groups in 16 states the data given in the accompanying table showing exposures were obtained for the lumber and furniture industry.

The table shows that dusts and the chemicals involved in finishing and preserving wood constitute the major exposures which may cause illness or untoward symptoms.

Dust

Many processes in the wood industry (sawing, planing, boring, drilling, belt-

Pe[illegible]f of Workers in the Lumber and [illegible]niture Industries Exposed to Specified Materials

Materials	Workers Exposed
umber of workers surveyed	93,375
. Organic dust	51.8
. Silica dust	5.7
. Dermatitis producers	5.3
. Petroleum products	5.0
. Lacquer and varnish	3.7
. Organic solvents	3.6
. Other metals	3.2
. Silicate dust	2.8
. Carbon monoxide	2.2
. Paints and enamels	2.1

nding, removal and utilization of waste) ve rise to wood dust.

Smith, in reviewing the literature on the lationship of wood dust to respiratory sease, states that on the whole exposure conditions of work incidental to the ıde of woodworking carries with it an creased risk from respiratory disease.

Although there may be disagreement as whether wood dust *per se* is responsible r an increased incidence of tuberculosis ıong woodworkers there is general reement that organic dust in high ov[illegible] concentrations may produce some it[illegible] of the upper respiratory tract. ıe possibility has also been suggested at this type of dust may act as a carrier the tubercle bacillus into the respira- ry tract. In view of the fact that there no conclusive evidence that pure wood ıst is the cause of the increased inci- nce of tuberculosis and other respira- ry infections among wood workers a ore extensive investigation of the ques- ın than has yet been made would appear be warranted.

The occurrence of asthma due to the halation of fungus spores should also be entioned. Towey, Sweany and Huron rried out a clinical, roentgen and lab- ratory study on a series of 35 patients the Upper Peninsula of Michigan. The mptoms were acute and typically asth- itic. These men were working where ey came into contact with dust from ıple logs cut for more than a year. ıe dust proved to be the spores of a ngus identified as *Coniosporum* cor- ale E. and E. In the authors' opinion, e condition was due to a local toxic effect and foreign body reaction, combined with a delayed effect resembling protein sensitization in its clinical and certain immunologic effects. The authors recommended preventive measures which include the removal of affected patients from the environment of the spores as soon as they are detected, or exhaust ventilation of the saws during the working process.

Poisonous Woods. The fact that contact with certain woods and their dusts may produce an irritation of the skin, mucous membranes or symptoms of general poisoning is well recognized. The majority of cases of dermatitis and toxic symtoms from wood occur in those whose work brings them in contact with the dust and sawdust derived from these woods. However, eruptions have occurred from other types of contact such as proximity to the tree alone or while handling the wood in any way.

Woods of tropical origin are the more common offenders. However, the wood of numerous trees native to temperate climates has also been found to produce irritation. Among them are: birch, California sequoia, chestnut, hemlock spruce, Norway spruce, Japanese Tagayasan, cocobolo, Brazilian walnut, blackwood, satinwood, sabicú, mahogany, teakwood, ebony, boxwood, yew wood, red cedar, oak, and beech.

Few figures are available as to the incidence of dermatitis from contact with woods. Schwartz found dermatitis resulting from the dust of Brazilian walnut in 11 of 100 workers in a cabinet-making plant. He communicated with other firms using the wood, and 9 of 10 reported instances of eruptions apparently attributable to the Brazilian walnut, the number of workers affected in the different factories varying from one or two to a majority. One firm reported that it had discontinued the use of the wood because of the large number of workers affected. It is obvious, however, from the relative frequency of reports dealing with such woods as satinwood, that sensitivity occurs frequently with some, while the infrequent or single mention of other woods indicates that reactions to them are exceptional.

The precise origin of the toxic effect of

woods has not been accurately determined. Some authorities believe that the toxic agents are free unsaturated acids; others, that they are resinous oils and alkaloids. Other types of chemicals are responsible in some cases.

The toxicity frequently varies with the habitat and in many varieties of wood, from one tree to another. Thus, it is reported that cocobolo wood from Panama can produce dermatitis, while that from Nicaragua appears to be harmless. The variation in toxicity from one tree to another is particularly marked in the case of satinwood.

The majority of woods are most toxic when freshly cut but a few become increasingly harmful as they age. Thus cases of dermatitis have been reported in persons who had sat on branches of the rengas which had been cut and dried for months. The use of this wood for the manufacture of furniture has practically ceased because of the production of symptoms by furniture which has been in use for years.

Local or general symptoms of poisoning usually appear within a few hours, days, or weeks following contact with an irritant wood. However, cases have been reported in which workers after years of immunity to a toxic wood have become susceptible to irritation by the material. In the case of some woods, tolerance may be established, but as a rule, sensitivity once established is persistent. In general, the eruptions present the usual picture of dermatitis venenata although a number of variations occur. Perspiration and seborrhea apparently increase the noxious action of practically all woods. The affection is considered by most observers to be allergic.

Patch tests with moist sawdust are usually sufficient to establish the diagnosis in cases of suspected wood dermatitis.

Paints, Lacquers, Varnishes

The paints, lacquers, varnishes and stains employed in the finishing of furniture and other wooden articles constitute a second major health hazard.

Chromates and bichromates which are used for staining and in polishing wooden articles favor the development of ulcers on the hands and feet, of conjunctivitis, and dermatitis. Although perforation of the nasal septum has been reported, it is infrequent.

Prolonged work with stains containing methyl alcohol may cause optic neuritis. "Polishers' itch", an eczematous condition of the hands and arms, is common among wood polishers, the causative agent being either petroleum, shellac dissolved in wood alcohol, or in alcohol denatured with pyridine bases.

The use of the spray gun and dip tank for the application of paints and lacquers has largely replaced the hand brush in industry in painting operations. The adoption of these methods has resulted in a change in working conditions with resultant hazards of two types: those relating to toxicity and those relating to flammability.

The substitution of harmless pigments for toxic pigments has rendered many paints much less poisonous. Turpentine and benzol have been displaced by other solvents in many paints during the past 15 years.

A few years ago lacquers displaced paints in many finishing operations. The ordinary lacquer contains several basic ingredients such as nitrocellulose, solvents and diluents, gums or resins, softeners or plasticisers, and pigments. The volatile ingredients constitute about 75 percent by weight of an average lacquer.

The evaporation of the volatile fraction constitutes the major occupational disease hazard in the use of lacquer, although the vehicle, pigment and resinous compounds cannot be entirely eliminated from consideration as possible offenders inasmuch as the toxic properties of many of them are unknown. Among the pigments which may be toxic are those yellows, greens and oranges which contain lead chromate, the aniline derivatives and possibly those containing cadmium, antimony and barium.

Over 100 solvents are used in the lacquer industry alone. (15). Some of the more important solvents are the esters, such as the acetic acid esters of methyl, ethyl, propyl, butyl and amyl alcohol, and the ethers which include the alkyl ethers of ethylene glycol. The effect of alcohol, ether and massive doses (in excess of 1,000 p.p.m.) of the ester solvents is mainly narcotic in action. Some of them are also irritating to the skin and mucous mem-

ranes. There is need of investigation to et[illegible]ine the effects of prolonged expo-ure and the maximum safe concentra-ion for many of these compounds.

The important diluents (thinners) are the ydrocarbons which include benzol, toluol, ylol, naphtha, and the alcohols (methyl, thyl, propyl, butyl and amyl alcohols and yclohexanol). Air concentrations of reater than 50-75 p.p.m. of benzol and 00 p.p.m. of toluol or xylol may produce erious damage to the blood-forming or-ans of the body. The International abour Office regards a concentration of 00 p.p.m. of methyl alcohol as the hreshhold of toxicity. However, concen-rations of 200 p.p.m. in a New York fac-ory were observed to give rise to com-aratively slight intoxication in the per-onnel. Butyl alcohol in concentrations f 100 p.p.m. is reported to cause dam-ge to the blood, liver and kidneys of ex-erimental animals. The other alcohols re probably not very toxic in ordinary sage.

The most important route of absorption f volatile substances is through the lungs nd consequently it is essential to keep he concentration of vapors in the atmos-here to be breathed at a minimum. Al-hor[illegible]h some of the vapors have but little ox[illegible]ction, any volatile material may roduce narcosis or asphyxia if present 1 sufficiently high concentrations. The ractice of some lacquer workers of in-iscriminately using solvents to cleanse heir hands should be discouraged since bsorption through the skin may produce erious systemic damage and since the racking of the skin which results from ie removal of the fats and oils from the kin of the hands and forearms provides penings through which infection may be stablished.

The volatile materials present in lacquer onstitute the principal fire hazard as well s the major health hazard although itrocellulose adds another inflammable lement.

Wood Preservatives

Persons engaged in the impregnation of ood for the purpose of rendering it eather-proof, water-proof, fire-repellent, nd resistant to fungi may suffer from esicular and other skin eruptions due to the chemicals employed. Eczema of the skin and catarrhal conditions of the mu-cous membranes of the head are fairly common.

Creosote which is used for the preserva-tion of wood to be used for outdoor con-struction purposes is a primary skin irritant and may also result in the develop-ment of occupational coal tar photosen-sitivity.

Although the creosoting process has largely replaced the use of chromated zinc chloride in the preservation of wood to be used outdoors, the latter is still used for wood intended for indoor construction. McCord and Kilker examined 17 workers employed in a wood preserving industry and found that of the four types of skin lesions presented, three were well known as incident to work in tar. Zinc chloride burns were the fourth type of lesion and were present in all patients, occurring on the fingers, hands, forearms, and occasion-ally on the legs and thighs.

In determining the causes of the lesions it was found that the strength of the zinc chloride solution in the treatment fluids was too dilute to produce skin lesions. However, during the period when the ties were left in the open air, following their removal from the treatment cylinder, evaporation of the water from the zinc chloride solution occurred so that the ties when handled in loading were sometimes covered with treating fluid in which the zinc chloride approximated saturation. Additional factors to be considered with respect to zinc chloride burns are: (1) antecedent injury to the skin appears to be necessary; (2) after the initial lesion, re-peated exposure to the zinc chloride solu-tion and irritation from the tar fraction of the treating solution are factors in the severity and progress of the lesion.

Experimental studies have shown that approximately one percent mixtures of phenyldichlorarsine in medium or heavy petroleum distillates are efficient wood preservatives. Although these mixtures have not yet received commercial use it should be kept in mind that tests have shown that marked initial vesiculation may occur in certain persons exposed to the action of phenyldichlorarsine.

Pentachlorphenol and tetrachlorphenol are also used as wood-preservatives. In addition to being primary skin irritants

they may also be absorbed through the skin in sufficient amounts to cause systemic poisoning.

Other chemicals which are used for impregnating wood include dinitrophenol, aniline, potassium bichromate, fluorine compounds and mercuric compounds. According to the literature, each of these chemicals possesses toxic properties when absorbed in sufficient quantity into the body. Ultimately, only careful medical examination in conjunction with the study of types and amounts of exposure will establish their importance as health hazards.

Engineering Control. The basic principle in dealing with a dust, gas or fume hazard is control at the point of origin, thus preventing dissemination into the atmosphere. Sometimes a process can be enclosed or isolated completely in a sealed room or compartment, but frequently the exhaust ventilation method is preferable. Water may be used to prevent the dispersal of dust and under certain conditions it may be advisable to combine the use of water with exhaust ventilation. Proper design, installation and maintenance of any mechanical device is essential if protection is to be adequate.

Individual types of respiratory protective devices such as masks or respirators should be used only where exposure is intermittent or brief, or where some unusual condition makes a more adequate control method impracticable.

In the case of materials producing external irritation, auxiliary protective measures may include the use of protective clothing, gloves, goggles and aprons, as well as protective salves, ointments or other compounds to delay or diminish the irritant action. General rules for hygiene and good housekeeping should also be observed.

Safety education and the proper maintenance of equipment and safety devices are the important factors.

Medical Control. Medical control, through preemployment and periodic physical examination, is one of the most important factors in the prevention of industrial injuries and illness.

The preemployment examination serves to determine the employee's physical and mental fitness for work. The purpose of such examinations is not to eliminate or exclude an employee, but rather to direct his placement in work for which he is physically suited. The practice of preemployment examinations should also be extended to include executives and officials.

The purpose of periodic examinations is to secure and maintain physical fitness. Defects and disabilities which were not observed at the time of employment may be discovered on reexamination. In such cases, an occupational adjustment should be made to provide continued employment and remove the risk of permanent injury. Reexamination of employees also serves as a check on the efficacy of the engineering control methods already instituted, or as a measure of the need for new protective devices. The frequency of examinations should be determined by the medical director unless specified by law.

WEDNESDAY AFTERNOON SESSION

October 18, 1939

Use and Abuse of Circular Saws and Their Relation to Safety

By ALBERT L. UHL

Sales Engineer, Henry Disston & Sons, Inc., Tacony, Philadelphia, Pa.

Circular wood-cutting saws are divided into four classes, namely: cross-cut, rip, combination, and grooving. Each of these saws has its own use in the wood-working industry.

Circular cross-cut saws are manufactured in several patterns of teeth and on many spacings of teeth. Each one has certain peculiar work to do, but in all classes the teeth should be bevel filed to best save the

or fibres. Circular rip saws are usually le aight through on both the faces and acks, although in some cases, particularly n the cutting of hardwoods, a slight bevel n the backs of the teeth is recommended. his however, is only done where the teeth f the saw are spring set.

In novelty-tooth combination saws, the utting teeth in each section are bevel filed nd the rakers or cleaners are filed straight rough—no bevel. The function of the aker or cleaner is to remove the core which left by the scoring teeth. Hence, in order at this type of saw be filed to give the est results, the cleaner or raker tooth ould be 1/64 to 3/64 inch shorter than the ctions of the cutting teeth. For cutting ardwood where the feed is necessarily ower than when cutting soft wood, the aker should be 1/64 inch shorter than the ctions of the cutting teeth. But for cutting oft wood, we recommend that the raker be inch shorter than the sections for cutting.

In addition to the raker pattern combination tooth saw there are other types of combination in general use. These are made with arious styles of teeth. The general practice is to have the face-line of the teeth itched about half-way between the face-line f a rip saw and the face-line of a cross-cut w e fact that these saws are used for pp cross cutting and mitering, the teeth ust be filed so that they will work satisactorily when making these cuts. Hence, e recommend that the bevel on the teeth less than ordinarily recommended for oss cutting but more than we recommend r ripping.

Circular saws in the majority of cases are ade flat-ground. In which case, the teeth ust be set for clearance. Such saws, as a le, will not produce a smoothly cut surce. The set teeth, however, place the earance at the rim of the blade where it mostly needed in order to produce fast itting. There are two methods of setting e teeth in circular rip saws: one is the ring type set, the other, the swage set.

Relation to Safety

It is obvious that all safety factors inease with the development of equipment, pable of faster speeds and feeds, and sitive or self-feed features. This type of achinery is usually installed in the reanufacturing or woodworking shop, and in shops manufacturing wood substitutes and other products.

The dangers existing in the lumber planing and industrial plant mills in connection with circular saws are due chiefly to—

1. Saws being out of round.
2. Saws being dull.
3. Setting teeth improperly.
4. Alteration in shape of teeth.
5. Carelessness in sharpening saws.
6. Failure to maintain proper speed. Running saws at a speed faster than that for which they are tensioned.
7. Saws not properly aligned.
8. Center hole in saw not correct size for mandrel.
9. Saw not fitting collars properly.
10. Saw mandrels not level, end play in mandrel, uneven collars, mandrel bearings work, and failure to keep bearings well oiled.
11. Insufficient gullet space.

Saw Out of Round

This condition develops from lack of care when filing the saw to resharpen it. A saw should balance on the mandrel, but if, in filing, more metal is removed from one portion of the saw than from another, a light and a heavy side develop. The teeth in one section of the saw are nearer the exact center than others. The heavy or long side performs all of the work, but does so in a "hammering" style, which may cause several kinds of accidents; the throwing back of stock being cut or a destruction of the saw through breakage, either of which is a hazard.

To prevent accidents through this cause, care must always be taken when "fitting," which means setting and sharpening circular saws, to see that they are made perfectly round: i.e., by "jointing" them.

Jointing is accomplished by placing a piece of emery stone on the saw table. Then press it lightly, bnt firmly, against the points of the teeth, while the saw is revolving, until all teeth show evidence of contact with the stone. (Extreme care should be used in doing this to avoid accidents.)

Saws sharpened with automatic machines will keep saws round.

Dull Saws

Regardless of the particular kind of saw, all must be kept sharp to avoid accidents.

Anything which contributes to the destruction of a saw is a factor inclining toward causing accidents. A saw must be sharpened before it becomes so dull that it drags and pulls.

Dullness of saws is closely related to items three and five in our list of causes of accidents; namely, improper setting of teeth, and carelessness in sharpening saws.

If a saw is improperly fitted (wrongly set, even though correctly sharpened, or wrongly sharpened even though correctly set), it may heat on the rim, and expand, thereby causing rim cracks which may result in total destruction of the saws. It may also cause the saw to spring over the collar, or to spring and bend out of shape, resulting in "lost tension." When this occurs, the saw should be rehammered, retensioned and refitted immediately.

Setting Teeth

Before discussing the proper methods to follow in order to eliminate causes for accidents developing out of these conditions, it will be necessary to designate the various types of circular saws used in the lumber mill. These are—

Edger saws	Swage set teeth
Bolter saws	Swage set teeth
Lath saws	Swage set teeth
Trimmer saws	Spring set teeth
Slasher saws	Spring set teeth
Log Deck saws	Spring set teeth

There is a decided difference in the work which each type of saw performs, but the difference that we wish to consider now is the condition of the teeth when they are swaged properly or improperly, and when they are spring set—properly or improperly.

It is necessary to set the teeth of a saw in order to furnish clearance for the blade while in the cut.

Swaging means spreading the metal at the cutting edge of the tooth.

Spring setting means bending or springing of the teeth alternately right and left.

When a saw is swage set properly, each tooth will *chisel* or cut an equal amount of material from the "path" of the cut. Improperly swaged, it will spring, dodge or bind in the cut. There is danger of its throwing back the material being cut, and running out of the cut, both of which may destroy the blade.

An improperly swaged saw may have teeth spread on one side more than on the other, or the point of the tooth may be turned down instead of straight. If the set is uneven, it will cause the saw to lead in or out of the cut, which may result in the bending to one side, coming in contact with parts of the machinery or saw bench. If the points of the teeth turn down, this destroys the back clearance, causing rim heat and destruction of tension, with its associated dangers.

To eliminate all hazards created by this cause, a saw can be properly swaged by using a hand swage, spreading the metal with the convexed side of the swage and straightening it with the square side of the swage. The proper angle to hold the swage is determined by the tongue or center piece, which should rest on the top of the tooth. When a roller or die swage is used, it is necessary to see that the spreading dies are not worn. If dies are always kept in good condition, the swage set will be made correctly. After using a roller or die swage, it is necessary, in order to complete a correct swage set, to shape the spread metal with a swage shaper.

After this operation has been completed, with a hand swage, the saws should be side dressed, with a side file, which brings the swage equal on both sides, eliminating the causes contributing to dangers.

The same hazards of binding, leading and heating, are created by an improperly spring set saw. The teeth ordinarily are sprung with a spring saw set or "knocked over" with a hammer as the tooth lies on an anvil. Here again, as in swaging, if the teeth are sprung or set more on one side than on the other, the saw will lead in one direction.

Teeth which are spring set in the correct way should not be set more than one-quarter the depth down the tooth. Uneven setting of the teeth places greater strain on some teeth than on others, and may cause them to break.

Too much set not only places unnecessary strain on the rim of the saw, resulting in cracked gullets or broken teeth, but also makes the saw vibrate in the cut, which may cause a deflection of the stock.

If there is not enough set, the saw will bind or jam in the cut. This heats the

m d gullet cracks develop, or possible ta truction of the saw.

Shape of Teeth

Teeth in saws have been designed for the ghest efficiency and maximum safety in e multiplicity of cutting problems. The tting angles, top relief, gullet line, all have en scientifically determined and laid out.

For example, the hook of a tooth, which is e angle of the face of the tooth in relation a line drawn directly through the center the saw, depends entirely on the type of tting to be done. For general ripping the ont line of the tooth will run approxiately one-half the distance between the nter of the saw and the rim, in back of e center in relation to the running direcn of the tooth.

For cross-cutting, the hook of the tooth ill run along the line directly through the nter of the saw, or for special cross-cutng the line may run in front of the central e or slightly back of the central line.

This "cutting angle" of the tooth deterines the front line of the style or design.

The line of the back of the tooth is degned to give proper back clearance, suffient strength to the tooth, and a proper ll for the storage of dust when in the t.

It is obvious that maximum strength is sired, but ample gullet room must be furshed together with proper back clearance.

The proper lines for saw teeth have been termined on the basis of the cutting quirements.

Grinding or filing of the front and back e of the tooth forms the gullet. This llet line, regardless of size, is never rmed by a sharp angle. It is always on a rve.

Cross-cut saws have the teeth beveled both the face and on the back.

Rip saws are filed square across the face ith no bevel, but may have a slight bevel the back.

All of these factors must be considered as rt of the "style of tooth" necessary for fety. To alter any one or all is to create nditions contributory to failure and accints.

Changing the front line of the tooth will er its cutting behavior. Anything that creates or develops friction or strains develops hazards.

Changing of the back line either will weaken the tooth or reduce the back clearance. Weakening of the tooth may cause breakage. Reducing the back clearance will cause friction.

Changing the gullet line will either weaken the tooth, if it is deepened, or may result in a sharp corner or nick in the gullets. This is the cause for most cracks and breakage.

Sharpening Saws

It is during the reconditioning process that the original shape of the tooth is altered. After a saw has been "spring set" the inside corner of the tooth may be high.

It is by correct filing that this is eliminated. Beveling of the face and back of teeth which have been spring set will bring this high inside corner down.

Extremely wide bevels on the face of teeth in cross-cut saws produce severe lateral (cross) strains and this may cause gullet cracks and teeth break out.

Cross-cut saw teeth are designed to shear the fibre. A long sharp bevel is necessary.

Rip saw teeth are designed to chisel in the cut. A straight across filing is necessary to retain the chisel cutting edge.

It is during sharpening that sharp corners or nicks are created which will result in cracking or breaking the saw.

After the saw has been properly jointed and set, filing below the blunt point left by the jointing will shorten the tooth, thereby preventing it from doing its full share of cutting, throwing undue strain on the other teeth; such strains are causes of failures in saws.

Proper Speed

All saws are tensioned to operate at definite speeds. Unless ordered to operate at a certain speed, most saws are tensioned to run 10,000 feet rim travel per minute.

Tensioning is a process by which the metal or body of the saw is adjusted when idle to compensate for strains developed when rotating. Centrifugal force causes an expansion of the rim of a circular saw. The faster the speed the greater the expansion. The standard speed being 10,000 feet rim travel per minute, if the mandrel speed and diameter of the saw result in a rim feet

travel greater than 10,000 feet, then it is necessary to contract the rim by forcing the metal in toward the center of the saw, to a degree capable of compensating for the additional speed of travel and added rim expansion.

Saws Improperly Aligned

This applies particularly to mill rip saws. The amount of lead required for circular saws should be the least possible that will keep the saw in the cut and prevent it heating at the center. If the lead into the cut is too much, the saw will heat on the rim; if out of the cut too much, the saw will heat at the center.

Heat will cause expansion and the expansion of any portion of the saw will distort the tension and may cause costly damage.

Ordinarily ⅛ of an inch lead in 20 feet will be correct, although operating conditions and conditions of equipment will at times alter this and set up new requirements.

Center Hole in Saw

It is obvious that center holes smaller than mandrels will not go on, so we are confined in this consideration to holes which are larger than mandrel shafts.

When a saw is operated in this condition, the same hazards develop as those for a saw which is "out of round." The saw hangs on the mandrel unbalanced, and will hammer through the cut, with the attending dangers.

Saws Not Fitting Collars

Mandrels not level, end play in mandrel, uneven collars, mandrel bearings worn, and failure to keep bearings well oiled—all these defects are so closely related that they are mentioned as associated causes of accidents.

If the collars are allowed to be loose or if the face of the collars becomes worn irregularly, or if a foreign substance is permitted to come between the collar and saw, the blade is distorted by conforming to the collars or by bending over the foreign substance.

Failure to tighten the collar against the saw is extremely dangerous.

An attempt to operate a circular saw with a collar of too small diameter may result in the saw bending over the collar, due to lack of support.

A saw mandrel having worn boxes not level or with end play will cause the saw to wobble, run unevenly, chatter and heat in the cut, causing cracks and breakage, which always are dangerous to the operator.

The same conditions exist in the manufacturing or woodworking shops and have the same relation to safety with circular saws, as those in the lumber mill. In addition, woodworking shops utilize other types of saws which in some respects present different problems of safety.

The groover saw, dado head, smooth cutting combination saws, and high-speed machinery with positive feeds as previously mentioned have added to the necessities for "perfect conditions" of saws in order to avoid accidents.

Grooving Saws

These usually are buried in the cut and special care must be exercised in the feeding of the material into the saw, in order to avoid its being thrown back at the operator. It is vital that these saws be kept in perfect condition. They must always have sufficient set to furnish clearance; must be kept sharp and in absolute roundness. The fact that they are buried in the cut demands special attention to these conditions.

Dado Heads

This is an assembly of saws and cutters, used to perform the same function as a groover, but suitable to make a variety of grooves of different widths, by the addition or removal of inside cutters as the need demands.

Special attention must be given to having a dado head in "perfect joint" (which means absolute roundness), snug fitting on mandrel, properly assembled, always sharp, and securely tightened between collars.

Usually dado heads are "buried in the cut," a severe operating condition.

It is important that the inside cutters be set for clearance. If swage set, they must be uniform. If spring set, care must be exercised so that the inside corners will overlap and not leave a sliver in the cut, which will cause friction, burning of the head, and probable jamming in the cut.

Cuts are made with the grain, across the

air and diagonally across the grain. The eth of the outside cutters and inside utters, are designed to perform this work, , as with other saws, the shape of the oth as originally made should not be tered. Sharp nicks in the gullets of any eth must be eliminated.

Combination Saws

These saws have the clearance ground in e sides of the blade, in order to produce smooth cut. They require "no set."

As their name indicates, they rip, cross- t and mitre. Hence the term "combina- on" saws.

The tooth has been designed for that spe- al purpose and consists of sections of teeth, hich are made up of special cutting teeth d a cleaner.

The cutting teeth score the way through e cut, leaving a center core which is re- oved by the cleaner tooth which follows in e cut.

The scoring performed by the cutting eth furnishes clearance for the cleaner in dition to the clearance ground in the sides the blade.

When "fitted" properly, the saw will erate freely and without burning.

"Proper Fitting"

The teeth should be so filed that the cleaner will be slightly lower than the cutting teeth. If the cleaner teeth are permitted to remain longer than the cutting teeth, then the cutting teeth never function. The cleaner tooth forces its way through the cut, generating friction with its resultant hazards.

Correct fit of center hole, the correct tension, saws out of round, dull saws, carelessness in sharpening, failure to maintain speed and operating at excessive speeds, are as important factors in these saws as in the circular saws operated in the lumber mills.

Maintaining shape and size of gullets in saws operating on self-feed rip saw machine is very important.

An important consideration, although foreign to the topic of "condition of saws and their relation to safety," is the proper selection of a saw. For example—

Combination saws will not rip in a satisfactory manner on a *self-feed, high-speed rip machine.* An incorrect choice may develop hazards just as destructive as improper condition of a saw.

Wood Shapers

By GEORGE H. GIBSON

Wood Mill Foreman, Calumet Shops, The Pullman Company, Chicago

I started in the Wood Mill in 1895, and ve held a supervisory position for the st twenty years. So you see, I have ssed through the old CARELESS era to the new SAFETY era. I mention this cause safety is a vital part of the proper eration of tools and shapers.

The Calumet Shop of The Pullman mpany where I am employed has al- ys lent its wholehearted support to any ggestion that would aid in the promo- n of better and safer working condi- ns: purchasing guards, making altera- ns in shop set-up, and devising systems make employees "safety conscious."

A most encouraging policy in effect in e Pullman Company is the rewarding employees for improving old guards or vising new ones. I have been the recipient of several such bonuses. Equally as important is the effort exerted by our management to keep working conditions SAFE. Pullman employees are educated to the fact that Safety is an integral part of their work, and in our wood machine department, we are now past the nine-year mark without a lost time accident.

Before a job is started, I constantly endeavor to make certain that each worker has the proper tools and set-up. Should I detect anything amiss, I call the man's attention to it and assist him in correcting it. Occasionally the operators have better ideas than I do, and I never hesitate to adopt them. I am of the opinion that the leader, foreman, or whoever is responsible for overseeing the job should understand that he is the "key" safety man, respon-

sible for the safe operation of the work under his supervision.

In selecting a man to operate a machine, it is wise to choose one who is not afraid of the machine but who has a wholesome respect for its dangers. See that the area surrounding the machine is kept clear so that the operator has plenty of room to swing his work. Provide a piece of old carpet for the worker to stand on in order to minimize slipping hazards. Make sure that the machine is in perfect working order.

If the machine is belt driven, countershaft pulleys and belts must be properly guarded. It might be well to write to the National Safety Council for their pamphlet No. 7 on "Safe Practices on Belts and Belt Guards." Knives must be properly balanced, making sure the cutting edge has the proper cutting bevel and that they are sharp. It is important that the bevels on the edge of the cutters upon which the collars rest are the same because many times the knife will throw itself when the bevel does not correspond with its mate.

After the cutters have been set, it is your duty to see that the operator has the correct starting approach to the point of operation and that the proper safeguards are in place. Of course the type of guard is determined by the operation to be performed.

Safety in the Use of Edge Tools

By RAY A. FINCH

U. S. Fidelity & Guaranty Co., Baltimore, Maryland

In addition to Safe Practice pamphlets, issued by the National Safety Council, information appearing from time to time in the *National Safety News* and other safety publications, literature prepared and distributed by manufacturers of planer and jointer equipment, and information prepared by manufacturers of guards and protective equipment, this subject was ably treated during the twentieth annual Safety Congress before the Advanced Safety Engineering on Friday, October 16, 1931. Again, this subject was discussed at the Safety Congress held in Washington, D. C., in 1932. The Congress Transactions show that here in Atlantic City during the Safety Congress held in 1936, the subject was again discussed by two capable speakers before this section, and last year at the Congress held in Chicago on October 12, all the newest and latest developments in the care, adjustment, and safe operation of this equipment was discussed by members of this section.

As I have just mentioned, these talks and discussions will be found in your copies of the printed Transactions of the Safety Congresses, and you can find them in the proceedings of this Congress when they have been printed and distributed.

During the first eleven years of my safety engineering training, I was with a company which was and is self-insured. Our insurance department handled all matters under their jurisdiction. If accidents occurred, our claims department went into action, but immediately insurance coverage was extended. The work of the safety department, of which I was a part, was to extend such safety service and to plan and put into operation organized safety efforts which would protect the risk.

Briefly, our safety plans included inspections of the physical property, tools, and equipment; observations of working methods and practices; conferences with the management to determine that proper attention was given to the selection, training, and supervision of workmen, to determine or to provide for proper safety and working rules, to provide for the proper distribution of safety posters and safety literature, and to agree upon and make effective a safety organization designed to meet the particular needs of the operating company.

Following our inspections of the physical property and equipment, naturally such recommendations were immediately offered as were needed to correct obvious hazards, but our inspections were carried on and our recommendations submitted in such manner as to cause supervisors

d kmen to detect and correct haz- do conditions or unsafe working actices as a day by day proposition, as a atter of course, in carrying on their rou- e work, rather than await inspection a central office safety engineer, or the currence of an accident to point out at hazardous conditions or unsafe work- g practices had developed.

In giving attention to proper selection d training of employees, we pointed to- ard the objective that on every job, ether the individual was assigned as orer or skilled mechanic, the workmen uld be thoroughly trained. That the mpany would in fact have on every job expert in his particular field.

Safety organizations provided for, first, afety executive committee composed of partment heads, local managers, and mbers of the general management, with chief operating executive acting as airman. Second, safety committees com- ed of supervisors and foremen usually th the plant superintendent or the local nager presiding; and, third, a sufficient mber of employee group safety meet- s, so organized by departments or lo- ions, as to include all employees or rkmen.

Th xecutive Safety Committee had upr e jurisdiction over the safety plans l safety program of the operations and l authority to act upon any suggestions erred to the committee either by super- ory meetings or employee meetings. etings of this committee provided a dium for executives to formulate com- y safety policies, to analyze accidents ich occurred for the purpose of adopt- remedial measures, and gave the man- ment opportunity to give to safety tters of the company the same attention given by the board of directors to other ortant company affairs.

upervisor safety meetings gave super- ors the opportunity to analyze and ly accidents which occurred to deter- e accident causes, not primarily for purpose of placing blame, but to de- upon remedial measures which should adopted to prevent their recurrence. se meetings of supervisors also pro- d opportunity for studying improved ervisory methods and all other phases the accident prevention problem. Su- visors and foremen were made to def- initely understand that safe and efficient operation was one of their major respon- sibilities. But rather than dump that re- sponsibility on the shoulders of the fore- men or supervisors and then withdraw, as is so often done, then return at a later date and point out to supervisors that they had failed in their responsibility, we went further through the employee group safe- ty meetings and assisted the foremen in gaining the co-operation of workmen.

This was accomplished in the employee group safety meetings by creating a prop- er understanding first of safety funda- mentals. Employees were made to under- stand that their suggestions and recommendations intended to eliminate unsafe conditions or unsafe practices were wanted by the management. They were made to understand that accidents were analyzed primarily for the purpose of de- termining causes and remedial measures to prevent their recurrence, rather than to place blame upon the injured employee or others involved in the accident. By the manner in which the meetings were con- ducted, employees over a period of time were caused to analyze jobs before they were started to give assurance that proper protective equipment would be on hand, and that accident producing hazards would be anticipated and guarded against.

By making the meetings interesting and by developing the feeling or spirit of friendly co-operation, employees were caused to voluntarily comply with safety rules even without constant supervision; also, employees were caused to co-operate with and participate in the safety activities of the company, not because of the cost of accidents should they occur, but as a mat- ter of good operation. The mystery was taken out of accident prevention work and employees caused to realize that accidents are usually the result of mistakes, that doing work safely was largely a matter of doing the job the way they knew the job should be done.

In short, the aim of the employees' safety program was through proper selec- tion and training to place an expert on every job and then in every manner pos- sible to help that expert remember to do his job the way he knew it should be done.

That method of conducting safety ac- tivities has been successful since 1914.

In April of 1935, I joined one of the

Government agencies as safety engineer. The operation to which I was assigned was heavy dam construction. With very little change the safety plans effected in that operation were identical with those which I have just described. Although it has been contended that such accident prevention plans will not work on construction jobs, because of the large labor turnover, and even though in the operations to which I refer we were confronted with the problems presented by an abundance of green labor, in the face of all that, the plans were successful.

Perhaps it will be sufficient to point out that as a result of our efforts, we were awarded the safety trophy given by the National Safety Council for our type operations at the National Safety Congress in 1936.

I know you agree that just as the successful industrial supervisor today must be a leader rather than a driver, the successful safety engineer must be capable of creating safe attitudes, and capable of maintaining safety understanding and interest. Even today "the woods are full" of individuals who call themselves safety engineers but who are in reality merely safety "inspectors," and who apparently believe and give the impression that theirs is the responsibility for preventing all accidents. Men who create the impression that only through their personal inspection of property or equipment can hazardous conditions or unsafe working practices be detected and corrected. Who expect to bend down all the upturned nails, to erect all needed handrails or barriers, and who usurp the authority delegated to supervisors by giving orders to workmen or take the worker's place by personally making adjustments of equipment.

We sometimes wonder just what procedure would be followed if those individuals were given a crew of men and instructed to build a fence line. It is not unreasonable to assume that they might attempt to dig all the post holes themselves while the members of the crew stood around with the wire, the posts, and other material until he had completed the excavation. Naturally, some other member of the crew likely would take over the job of directing the work. Surely, in the light of recent developments, accident prevention activities today are sufficiently important to tax the ability of capable and practical men with vision and imagination—men capable of leading workmen, capable of causing men to put forth their best efforts, capable of causing workmen to understand that preventing accidents is merely a matter of doing work properly.

Definitely, inspections do have a place in the safety program, but it is my belief that they should be so conducted that supervisors or workmen will be led or so directed that they will detect the unsafe conditions or the unsafe working practice and will immediately make or cause to be made, the necessary corrections as a part of their day by day work. Only in that manner can effective accident prevention be accomplished. Also, we must make proper use of safety posters and other safety literature to give better assurance that all types of individuals will be reached.

Safety meetings with supervisors must be held in order that, by proper exchange and discussion of experiences and methods, all supervisors will be kept abreast with latest developments. Proper attention should be given to physical examinations, proper attention must be given to selection and placement of individuals, workmen must be properly trained in order that inexperienced men will be properly instructed or to give assurance that experienced men do understand their work. Cooperation, a spirit of friendliness, job interest, and job pride must be created and maintained through group safety meetings. Through employee group safety meetings, the safety engineer must give the supervisor or foreman the benefit of his safety engineering experience by helping the supervisor and foreman to gain the cooperation of employees under that supervisor's supervision. The management must sincerely attempt to provide a safe place in which to work. Safety guards, barriers, and protective equipment must be furnished.

However, I believe you will agree that even after safety equipment and protective equipment, guards, and appliances have been provided, that is, even after the job has been wrapped up, men who do not possess the correct safety attitude will fail to use protective equipment, will crawl

in behind barriers, or will fail to use g[illegible]s, and will be hurt. On the other ha[illegible], men who have the correct understanding of the purposes of accident prevention, who have the proper safety attitude and understanding can work even around hazardous conditions without being injured.

Wood Stickers, Molders and Matchers

By ROBERT WILLIAMS

Safety Engineer, Thomasville Chair Co., Thomasville, N. C.

In this era of high speed machinery and speeded up production, the importance of molder knife and cutter head specifications cannot be emphasized too much.

Try as I may to discuss other phases of molders, I cannot ignore the many conversations with molder users and operators which indicate that *feeds and speeds* are matters of primary interest and importance.

After all, what everybody wants to know about a molder is — "How much *good work* will it do in a given time?"

One doesn't have to be an expert to realize that the answer to this one is equally difficult, unless one has an endless lot of information about conditions under which a molder is to operate.

The importance of molder knife and cutter head specifications has been emphasized by the use of high frequency molder operation because the centrifugal forces of rotation increase as the square of the speed (assuming a constant cutter head diameter).

For example, consider the centrifugal force exerted on a knife at various speeds. The load or "pull" on a 3/8x3½x4 inch knife weighing one pound, attached to a cutter head with a 6¼ cutting circle increases as follows:

At 3600 R.P.M. the pull is 976
At 6000 R.P.M. the pull is 2711
At 7200 R.P.M. the pull is 3904

In other words, when you double the spindle speed you multiply the centrifugal load on the cutter knife by four, because of the law that "centrifugal force increases as the square of the speed" — and not merely in direct proportion to the speed.

Nevertheless, the higher knife speeds are desirable because the higher the knife speed, the cleaner the cut—less roughing and tearing.

But all the foregoing statements are merely in the nature of a background for the more important fact that these knife forces are transmitted to the heads and everything pertaining to knives and cutter heads must be made accordingly.

In the following paragraphs I shall mention some of the fundamentals in connection with high frequency molder operation.

1. All types of cutter heads should be made of properly treated alloy steel, of such formulae that they have reasonably hard surfaces to maintain clean edges and tensile strength to prevent distortion, but drawn to a point to prevent brittle texture of steel.

2. Square heads should be supplied with knife bolts of similar characteristics. Maximum tensile strength should be reduced to a point which included toughness so that there will be reasonable and gradual elongation before ultimate breaking load is reached.

3. Tipped high speed steel inlays on carbon backed knives are dangerous, and solid high speed steel knives should be used.

However, none of these fundamentals is of much use without reasonable care in operation and supervision. Some of the important points are:

1. A well balanced knife setup is the first essential. This calls for better balancing scales than are commonly provided.

2. More cleanliness is required of all parts pertaining to cutter heads than is commonly practiced.

Smoothly and accurately ground cutter head and surfaces assist in holding the knives in place, but this advantage is lost if the surfaces are not carefully cleaned.

Similarly, internal bore of heads, all sur-

faces of colletts and spindles are accurately ground, partly to help hold against slippage, and partly for balance, and both requirements are lost if all parts of these surfaces are not properly cleaned at all times.

Insistence on maximum accuracy of balance and cleanliness contribute to developing other essential operating precautions.

3. Management must insist that knife, bolts, nuts, and screws be tightened with the standard wrenches supplied for these nuts and screws, to prevent pulling of threads and distortion of heads. The use of pipes and other wrench handle extensions must be prohibited.

Management has to teach machine men that the science of metallurgy has not yet succeeded in developing a 5/8 inch diameter bolt which cannot be stretched, or whose thread cannot be distorted, when subjected to sufficient weight at the end of a two or three foot lever. Damaged threads, and distorted heads are naturally dangerous.

I recently saw a 24 inch round slotted head of a planermatcher with a split running from the bottom of one slot into the bore. It required a pipe extension on the wrench handle to LOOSEN the 3/8 inch set screws holding the knives, but the set screws could not be removed completely from the head because their ends had been "mushroomed" by excessive pressure. No wonder the head had cracked!

4. Not only is it management's responsibility to guard against such abuses, but these orders must be supplemented with frequent inspections. No matter how hard their surfaces, threads of nuts and screws will wear, and worn bolts, nuts, and set screws *must be replaced* from time to time.

5. Similarly with old cutter heads.

You'd be surprised how frequently management plans to use old heads (made of ordinary machine steel and originally purchased for slow speed belt driven molders) with the idea that it is good business to "save" a $500 or $600 investment, when considering the purchase of a $5,000 or $6,000 electric molder for high frequency operation.

Here is another example along this line: When the management learned what it would cost to replace the 24 inch round planer head mentioned above, there was serious consideration of running the risk of having it repaired in a local welding job shop.

6. The use of narrow knives on square heads held with a single bolt—especially if the cut is more or less to one side of the knife like a bevel cut, instead of straight in—should be discouraged. Such knife setups tend to slip, and should be steadied with an adjacent non-cutting knife blank.

7. Replacing an overload relay with a "jumper" to prevent tripping of overloaded machine motors ought to be a "just cause" for discharging any man.

Knives seldom fly out of machine heads like a bullet out of gun. Such accidents generally begin with a slight sluffing or slipping of the knife with resultant miss-machining, and a motor overload, so that accidents are frequently avoided by the automatic tripping of relays.

8. However, all machine men should be taught to duck to the floor and reach for the "stop" push-button whenever a machine "doesn't sound right" before they investigate the reason for the unusual sound.

9. Finger ends are frequently clipped by front side heads of molder spindles because operators attempt to remove dust-hood before spindle has come to a stand still. It sometimes takes four to five minutes for vertical ball bearing spindles to come to complete rest after power is disconnected. Operators should, therefore, be taught to always use the mechanical spindle brakes or stop each head with its individual reversible drum control — if machines are so equipped except in emergencies, or when quitting at the end of a day.

10. Operators must be taught to shut down their molders when making any other than operating adjustments.

We have a report of an operator dropping his wrench when reaching to make a blow pipe turnbuckle adjustment over top head while it was revolving, and another of an operator's jacket being caught by front side head while reaching to make similar adjustments or repairs.

11. Special precaution must be instituted to guard against accidents resulting from the impression or assumption that a

molder setup has been completed by an operator of the preceding shift when machines are operated more than one shift per day.

Although we have no authentic records, we are under the impression that more molder accidents occur because one operator ASSUMES that another operator has left the machine in proper operating condition.

12. Thin knives are safer than thick slotted knives because a standard type 5/32 inch thin knife weighs less than one-fourth as much as a 3/8 inch slotted knife of equal length. Therefore, they exert less than a fourth as much centrifugal force. Moreover, they are more likely to shatter themselves against a chip-breaker or dust hood than the thick knives, and in such cases they frequently have disappeared into exhaust systems without doing much damage.

Incidentally, thin knives also cost less and require much less grinding time.

Thin knives may be held under knife caps on square heads or they may be used in round heads for detail work in the same manner as thin knives are generally used for surfacing with round heads.

Summarizing all these details, we believe that nearly all molder accidents develop from carelessness. Without further explanation, this broad statement would seem to be an indictment of the machine men, but individual carelessness can be corrected under proper supervision, and in the final analysis, it is management's fault for not dictating more operating rules, and for not being more watchful to prevent violation of those rules.

If woodworking machines are kept in proper condition by experienced workmen, the number of machine injuries will be greatly reduced. If the cutting tool is in good condition, first class work can be performed more rapidly, with less consumption of power and with far greater safety to the operator. Dull and improperly set tools are the direct cause of many of the accidents mistakenly attributed to careless operation or lack of proper guards. Frequent and thorough inspection of all machines should be made to insure that the bearings are not loose or dry and that the belts are in good order and under proper tension.

Safety Chips

By J. C. WILSON

Vice-President, Lumbermens Mutual Casualty Co., Chicago

Accidents in the lumber and woodworking industry continue to be a serious problem although mechanical safeguards and safety education have done much toward preventing injuries in this dangerous occupation.

Through the cooperation of all State authorities having regulatory power over mechanical guarding, safety engineers have succeeded in securing codes and rules and regulations which, if vigorously enforced, would require satisfactory guarding for every dangerous machine—every saw and exposed moving part.

Unfortunately, laws are ignored, rules are broken or not enforced, and saws and machines, gears and belts remain the same serious menace to the workers in hundreds of plants that they were 25 years ago.

Mechanical safeguarding, even though strictly enforced, is not enough to stop accidents in any industry. Why? Beause we still have "the human element" to contend with. I still am firm in my belief that the best safety device known is a careful workman.

The investigation of an accident of any kind seems to start with the assumption that someone was careless; however, the study of thousands of accidents in the woodworking industry has convinced us that a large percentage of injured workmen are not necessarily careless. Even though the employee is injured on a properly guarded saw or machine, in many cases there are other factors involved beside pure carelessness.

Fatigue is a word we hear in all our discussions on accident prevention and apparently fatigue covers a multitude of errors and enters as a big factor into a large per cent of injuries. Nervous strain results from many

causes other than physical impairment. Poor eyesight carries its share of responsibility as does mental worry and we believe that worry causes more fatigue and more accidents than any other one cause.

What can a safety engineer do about worry on the part of a machine hand? Very few woodworking plants have a sufficient number of employees to require the services of a so-called personnel man whose duties would include a continuous knowledge of the employees and the conditions surrounding their home lives. Generally speaking though, worry and mental disturbances and their correction are beyond the ability of even the first-class personnel man. Therefore, these accident causes, being too much for others especially trained, have also proved to be too much for the safety engineer. However, he will continue to work toward his goal of loss prevention through the selection and education or training of workers, safeguarding of machines and constant supervision.

Let us consider a representative list which analyzes by cause 1000 actual accidents reported to our company by various woodworking plants.

These are grouped under seven major causes with "Handling of Objects" the largest with 327 reports or almost one-third of the total. You will note that 148 of these are splinter cases. Many of them, I regret to say, were neglected with serious results as infection rapidly follows a high percentage of such injuries when the workman ignores or refuses proper first aid.

"Machinery" is next with 283, and although no breakdown is used to contrast guarded with unguarded I assume that at least 30 per cent of those machines were properly guarded and the guard being used. This group also covers our most expensive compensation cases for many machine accidents result in permanent loss through amputation or loss of use, and some have proved fatal.

The third class under "Particles in Eye" certainly could be eliminated to a large degree by the employer strictly enforcing the use of properly fitted goggles by all employees grinding tools, while suitable exhaust systems will remove at least 75 per cent of the hazard of sawdust blown into workers' eyes. There are 128 losses in this group.

Under "Hand Tools" are 87 reports and we wonder why so many. Perhaps dull tools were responsible or inexperience or maybe old man "fatigue" enters the picture. Carelessness certainly was a factor.

"Falling Objects" caused 61; "Falls of Persons" 49; and "Stepping on or Striking Objects" 57. Too many of these instances were aged employees who fell from elevations to which they should never have been permitted to climb.

Any safety engineer would argue that this group shows lack of supervision, poor housekeeping and in many cases, pure carelessness. All should lend themselves to proper safety education.

Permit me to cite just a few claims which will illustrate my previous statement that the fundamentals of safety in woodworking are selection of workmen, education in the use of tools and machines, safeguarding all points of operation—gears, saws and belts, and constant supervision.

Obviously, all men are not temperamentally fitted to work high speed, dangerous machines and many are not physically fitted for such work. A simple physical examination will determine the applicant's condition and enable the employer to place him on the type of work he can safely perform.

Education or employee training is costly of course but it is necessary and very much worthwhile. Guarding must be mandatory, apparently, required by laws strictly enforced. Lastly, but certainly not least, comes constant supervision.

Down in Indiana, an aged employee had operated a completely guarded and exhausted trim saw. One day the dust collector choked up and without stopping the saw, this man removed the lower guard, reached in to clear out the choke and lost his right hand. Where was the foreman?

In a Chicago planing mill, one of the workmen decided the tool grinder was not running fast enough, so he changed pulleys on the jack shaft and so speeded up the emery wheel that it burst and killed him. A section cut off a truss rod supporting the roof with the result it collapsed and injured four others. Where was his foreman?

Every claim man and safety engineer knows the sad results from changing saws and leaving the guard off—then using a dull unguarded rip saw just to saw off one piece —result a kick back—perhaps fatal.

Splinters seem to hold no horror for the workman handling lumber. He simply will not use pads or gloves and generally speaking, refuses either first aid or medical care. I recall my most distressing splinter claim vividly, though it happened about 25 years ago. The workman was ripping when a splinter as large as a pencil was kicked back, entering his right hand between the first and second fingers. Without notifying anyone, he ran out of the shop to his home and for four days attempted to draw the splinter out of the hand with home-made poultices. We finally found him but it was too late.

It hardly seems possible that any woodworking plant would have a poor ladder but we find as many in this industry as in any other, and we have many bad accidents because of their use.

Slippery floors are dangerous anywhere but certainly should not be tolerated around machines, yet they continue to cause many serious losses. A little glue and sawdust will correct that condition.

Many of those accidents reported under falls are a direct result of stumbling over short stock, edgings, blocks and scrap from saws. One man lost a hand when he stumbled while passing a band saw. Many others have been injured in the same manner.

As you are all familiar with the Safe Practice Pamphlets published by the National Safety Council, I am sure you will agree that the following outline on woodworking machine accidents and means of preventing them may be cited as standard for this industry. These are just off the press, and may be secured from the Council's Chicago headquarters.

It is the opinion of some authorities that the principal means of preventing injuries on machines used in wood furniture plants are:

(a) Thoroughly trained workers.
(b) Correctly conditioned machine tools.
(c) Suitable and properly maintained machines.
(d) Adequate and properly maintained guards.
(e) Proper flooring about the machines.
(f) Good lighting.
(g) Properly conditioned stock.
(h) Use of suitable clothing.

Thoroughly Trained Workers

Injuries sometimes occur to men who are put to work on jobs with which they are not familiar. It is the duty of the foreman to be sure that every man he assigns to a certain job knows the safe methods to be employed on that job.

Injuries often occur when men from one department attempt to do jobs on a machine in another department. Such men sometimes do work for themselves after hours or do not wait for the regular operator to do the work required. They often work without guards or with improperly adjusted ones. It should be a strictly enforced rule that a man from one department is not to use a machine in another unless he is given special permission to do so.

Correctly Conditioned Tools

The condition of the tools used in the machines has a much more important relation to the number and severity of injuries than most persons realize. No matter how well a machine may be guarded, if the tools in the machine are not suitable for the work, the operator is not afforded maximum protection. A tool that is not in proper condition requires greater power to drive it, it does not cut cleanly, and it requires greater effort to push the material through the machine, thereby increasing the danger of the operator being injured by slipping and falling or in some other manner. It is important that all tools used in the machines be examined at regular intervals by someone competent to judge their condition and that all faults found be corrected immediately.

Suitable Machinery

The machines should be suitable for the work to be done. A suitable machine properly installed makes it possible to provide adequate safeguards and decreases the cost of making the product. A poorly maintained machine is not only a potential source of injury but it is also an important factor in decreased output. Loose bearings, poor lubrication, use of worn or defective parts are too important to be overlooked or neglected.

The inspection and repair of machines should be done only by qualified persons. Usually the millwright or a similarly qualified person performs this work. When it is

necessary to make repairs to a machine or remove or replace cutting tools, the belt shifter or electric switch should be locked in the "off" position. Otherwise the machine may be started accidentally or too soon and cause injury to the man at work on that machine.

Safeguards

All gears, spoke-type wheels and other dangerous revolving, oscillating or reciprocating parts of machines, including the tools should be enclosed as completely as possible with guards of substantial construction.

All machines equipped with automatic feeding devices which are likely to catch the operator's arms or clothing, should be safeguarded by means of safety switches which will shut off the power and operate automatic braking devices when light pressure is applied to the guards that are placed over the tool arbors or spindles.

All machines, the tools of which remain in motion due to kinetic energy for some time after the power has failed or been shut off, should be equipped with automatically operated braking devices.

It is a good policy when purchasing new machinery to include a clause in the purchase specifications that the maker is to supply all safeguards required by local, state, or other authorities having jurisdiction. By so doing, uniform and satisfactory safeguards can usually be obtained at less cost to the machine purchaser than if he attempted to have them made himself.

Flooring

Floors should be kept in good condition, with a smooth surface, to prevent tripping, and free from accumulation of waste material, small sticks, blocks, shavings and sawdust.

The standing space at each machine should be covered with anti-slip material to prevent the operator from slipping and possibly falling against moving machinery or losing hold of stock being fed through the machines. Mats, if used, should be cemented or otherwise secured to the floor, and should be renewed when badly worn or torn. Rubber mats are probably most commonly used. Some Council members advise that a coat of thick paint or glue sprinkled over with sand while wet and allowed to dry gives good results.

In places where the mats are subjected to excessive wear or are likely to be run over by trucks, metal plate with an abrasive grit embedded in the wearing surface is probably the most satisfactory material to use. (See Safe Practices Pamphlet No. 11, "Floors and Flooring" and Industrial Data Sheet D-Gen. 1, "Slippery Floors.")

Good Lighting

Proper lighting is of vital importance. There is a wide belief among men experienced in accident prevention work that 25 per cent of all avoidable accidents are due to improper lighting.

It is important that proper attention be given to the maintenance of all lighting equipment, i. e., cleaning and adjustment of reflectors. Dust accumulating on the lamp bulbs and reflectors quickly cuts down the intensity of the light. Tests show that where lighting equipment is not kept clean there may be loss of 25 per cent or more in the efficiency of the lights. Makeshift or improperly adjusted reflectors spoil the efficiency of any carefully worked out lighting system.

Washing of windows, keeping material off of window sills, and keeping stock away from in front of windows will aid greatly in admitting sufficient light in the daytime. When daylight is not sufficient, artificial light of the proper intensity should be provided. Much information of value on proper shop lighting will be found in the National Code of Lighting for Factories, Mills and Other Work Places and in Safe Practices Pamphlet No. 22, "Industrial Shop Lighting."

When wood stock is not in proper condition it sometimes warps against the saw because of strains in the lumber, or loose knots and slivers may be jarred against the saw by the vibration of the machine. To prevent injury under such conditions it is particularly necessary that the operator pay strict attention to his work, that the machine and its tools be in proper working order, and that the necessary machine safeguards be provided and used.

Clothing and Eye Protection

Men working about wood furniture plant machinery should wear close fitting garments. Torn or ragged clothing is dangerous. The ragged edges of coats and jumpers often catch in the machinery and cause

injury to the wearer. Loose or flowing ties and finger rings are equally dangerous. Frayed, torn and ragged gloves or mittens frequently catch in the work and result in hands or fingers being drawn against or into the rapidly revolving parts of machines. (See also Safe Practices Pamphlet No. 16, "Protective Clothing.")

Men operating machines sometimes suffer severe eye injuries because of the dust, slivers, and chips thrown off by the revolving knives. Suitable goggles worn by the operators or in some instances chip screens attached to the machine table will prevent such injuries. (See also Safe Practices Pamphlet No. 14, "Goggles," and Health Practices Pamphlet No. 6, "Industrial Eye Hazards.")

The final conclusions of this study remain the same as our first observance—

We must select our men.
We must properly train them.
We must guard the machines.
We must keep our tools sharp.
We must exact constant supervision.

ADJOURNMENT

Alp

Acme Pr
Gas M
American
Schoo
American
Manu
American
Fire I
American
Head

Bausch &
Safet
Bear Ma
Vehic
Bendix P
Autor
Brown Sl
Men a
Stewart I
Safet
R. H. Bu
Safet
Burrougl
First

Carbisul
Foille
H. Child
Indus
The Clev
Safe
Coffing H
Coffi
Columbu
Alloy
H. S. Co
Respi
Craddocl
Indus

Davis Ei
First
C. H. Do
Head
Dugas E
Fire