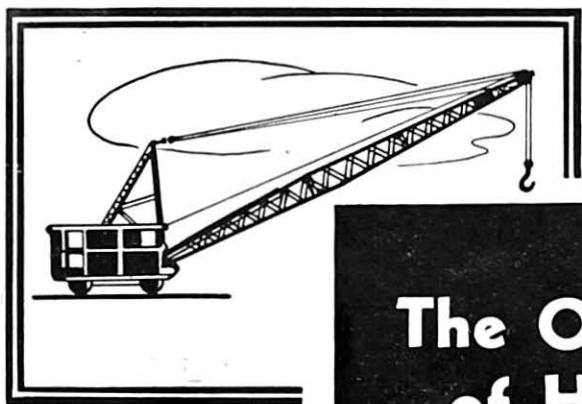


THE OPERATION OF HOISTING  
APPARATUS.



# The Operation of Hoisting Apparatus

OCCUPATIONAL HAZARDS TO YOUNG WORKERS  
REPORT NO. 7

UNITED STATES DEPARTMENT OF LABOR  
Division of Labor Standards  
Child Labor and Youth Employment Branch

CHILD-LABOR SERIES NO.11

## — OCCUPATIONAL HAZARDS TO YOUNG WORKERS

Report No. 1.—The Explosives-Manufacturing Industries. Children's Bureau Publication 273. 1942.

Report No. 2.—Motor-Vehicle Drivers and Helpers. Children's Bureau Publication 274. 1941.

Report No. 3.—The Coal-Mining Industry. Children's Bureau Publication 275. 1942.

Report No. 4.—The Logging and Sawmilling Industries. Children's Bureau Publication 276. 1942.

Report No. 5.—Woodworking Machines. Children's Bureau Publication 277. 1942.

Report No. 6.—Radioactive Substances. Children's Bureau Publication 286. 1942.

Report No. 7.—The Operation of Hoisting Apparatus. Child Labor Series No. 11. 1946.

*Copies of any or all of these reports may be obtained on request from the Child Labor and Youth Employment Branch, Division of Labor Standards, U. S. Department of Labor, Washington 25, D. C.*

## LETTER OF TRANSMISSION

UNITED STATES DEPARTMENT OF LABOR,  
DIVISION OF LABOR STANDARDS,  
October 1, 1946.

HON. L. B. SCHWELLENBACH,  
*Secretary of Labor.*

SIR: The report transmitted herewith, on the occupational hazards to young workers involved in the operation of hoisting apparatus, is the seventh in a series of investigations conducted under the child-labor provisions of the Fair Labor Standards Act of 1938 by the Industrial Division of the Children's Bureau. This report was made available in mimeographed form in May 1946 by the Children's Bureau. It served as the factual basis for Hazardous Occupations Order No. 7, which was proposed by the Chief of the Children's Bureau on May 23, 1946, and on which a public hearing was held on June 25. The order was issued on July 11 by the Chief of the Children's Bureau and became effective September 1, 1946. This order has the effect of raising the minimum age from 16 to 18 years, in establishments covered by the Fair Labor Standards Act of 1938, for employment in occupations involving the operation of power-driven hoisting apparatus, including elevators, cranes, derricks, hoists, and high-lift trucks. It is quoted in full in the appendix of the report.

Acknowledgment is due to employers and safety experts cooperating in the investigation. Especially helpful were studies made by the Air Technical Service Command and the Safety Branch, Office of Industrial Relations, Navy Department, and reports of State labor departments. Special thanks are accorded to the following technical advisers who reviewed a preliminary draft of the report, made valuable suggestions, and aided in the formulation of the order:

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Harry L. Sain, superintendent, Division of Safety and Hygiene, Industrial Commission of Ohio, Columbus, Ohio.

J. C. Wheat, Industrial Brownhoist Corporation, Bay City, Mich., and chairman, Section Committee, American Standard Safety Code for Cranes, Derricks and Hoists.

Samuel Wolchok, president, United Retail, Wholesale and Department Store Employees of America, New York, N. Y.

The powers under which hazardous occupations orders are issued under the child-labor provisions of the Fair Labor Standards Act were transferred from the Chief of the Children's Bureau to the Secretary of Labor by the President's Reorganization Plan No. 2, effective July 16, 1946. The duty of investigating and reporting on occupations particularly hazardous for young workers is among those delegated by the Secretary of Labor to be performed by the Division of Labor Standards through its Child Labor and Youth Employment Branch (formerly the Industrial Division of the Children's Bureau). This report is, therefore, now published as a bulletin of the Child Labor and Youth Employment Branch of the Division of Labor Standards. The Child Labor and Youth Employment Branch is under the direction of Beatrice McConnell, who, as Director of the former Industrial Division, was administratively responsible for the studies on which this and the six previous reports on occupations hazardous for young workers were based.

The investigation was made and the report prepared in the Research Section of which Elizabeth S. Johnson is in charge, by Sheldon W. Homan, safety engineer. The statistical material on industrial injuries was developed by Miriam Noll, specialist in accident statistics.

Respectfully submitted.

VERNE A. ZIMMER, *Director.*

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# THE OPERATION OF HOISTING APPARATUS

## INTRODUCTION

The child-labor provisions of the Fair Labor Standards Act of 1938 establish a minimum age of 16 years for general employment and provide an 18-year minimum for occupations found and declared to be particularly hazardous for minors of 16 and 17 years of age or detrimental to their health or well-being.<sup>1</sup>

This report presents the findings of an investigation of the hazards of operating or assisting in the operation of power-driven hoisting apparatus. This apparatus consists primarily of various types of elevators, cranes, derricks, hoists, and high-lift trucks. The purpose of the investigation was to determine whether occupations involved in the operation of such hoisting apparatus were sufficiently hazardous to warrant application of the 18-year age minimum to them.

Occupations involved in the operation of hoisting apparatus were selected for study because of the generally accepted belief that the operation of hoisting apparatus involves such a high degree of accident risk that such occupations are not suitable for minors under 18 years of age. The hazards to the operator, co-workers and the public are now recognized by various State child-labor laws and regulations which establish a minimum age for the employment of minors in operating many kinds of hoisting apparatus, and by municipal and State safety codes which also set a minimum age for operators. Recommended safety codes, particularly those developed by the American Standards Association, also specifically recognize the hazard by recommending an 18-year minimum age for operating some of the apparatus covered by the investigation.

## METHOD AND SCOPE OF STUDY

In making the investigation, the findings of which are presented in this report, information has been drawn from a variety of sources. Statistical evidence of the hazards of operating or assisting in the operation of the apparatus covered has been compiled from reports of several State labor departments and of the United States Labor, War,

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<sup>1</sup>The administration of the child-labor provisions of the Fair Labor Standards Act of 1938, including the authority to find and declare occupations to be particularly hazardous, was originally vested in the Chief of the Children's Bureau. Under the President's Reorganization Plan, which became effective on July 16, 1946, these powers are now vested in the Secretary of Labor.

and Navy Departments. State child-labor laws and regulations have been analyzed to find out the extent to which the States have established a minimum age specifically for the operation of various kinds of hoisting apparatus. Safety codes for elevators and for cranes and hoists have been consulted to ascertain provisions regarding age of operators, and the experience and opinions of safety engineers, workers, and employers have been drawn upon.

### ***Apparatus with which this report is concerned***

Power-driven hoisting apparatus falls into five major classes of equipment, consisting of (1) elevators, (2) cranes, (3) derricks, (4) hoists and (5) high-lift trucks. All these classes of hoisting apparatus are included in this investigation. Other types of hoisting apparatus not power operated, such as hand-powered elevators or block and tackle which are considered much less hazardous, have not been included within the scope of this report. The investigation is based on the operation of power-driven hoisting apparatus wherever found in any kind of industry. Elevators, both passenger and freight, as well as cranes, derricks, and hoists are used in a great number and variety of establishments and have been so used for a considerable length of time. High-lift trucks, on the other hand, are of comparatively recent development but they have been extensively used, particularly during the war period, for handling and stacking materials in factories and warehouses.

The American Standard Safety Code for Elevators, Dumbwaiters, and Escalators defines an elevator as follows:

An elevator is a hoisting and lowering mechanism equipped with a car or platform which moves in guides in a substantially vertical direction. Elevators are divided into two classes based on service: passenger elevators and freight elevators.

The two classes of elevators are further defined as:

*Passenger elevator.* A passenger elevator is an elevator that is used to carry persons other than the operator and persons necessary for loading and unloading.

*Freight elevator.* A freight elevator is an elevator used for carrying freight and on which only the operator and the persons necessary for loading and unloading are permitted to ride.

This report covers both classes of elevators as thus defined. The American Standard Safety Code for Elevators, Dumbwaiters, and Escalators does not include within its scope portable elevators, also known as tiering machines or piling machines. But portable elevators have been included within the scope of this investigation so that all the principal types of hoisting apparatus would be represented. For the purpose of this report, portable elevators are considered as a special type of freight elevator because they more nearly resemble freight elevators than other general classes of hoisting ap-



paratus. For the purpose of this investigation portable elevators are defined as follows:

A portable elevator, also known as a tiering or piling machine, is a power-driven device used for raising or lowering a load on a platform. The platform may or may not operate within guides. It usually serves only one floor of a building and is portable rather than fixed.

All types of cranes, derricks and hoists are included within the scope of this investigation. The principal types of these classes of hoisting apparatus are defined by the American Standard Safety Code for Cranes, Derricks, and Hoists and are given in full in Appendix I. The three broad classes as defined by the code and as considered in this report are as follows:

"A crane is a machine for lifting or lowering a load and moving it horizontally, in which the hoisting mechanism is an integral part of the machine. It may be driven manually or by power and may be a fixed or mobile machine." Various types of cranes are known as cantilever gantry, crawler, gantry, hammerhead, ingot-pouring, jib, locomotive, motor-tractor, motor-truck, overhead traveling, pillar, pillar jib, pintle, portal, semi-gantry, semiportal, storage bridge, tower, tractor, traveling jib, walking jib, and wall cranes.

"A derrick is an apparatus consisting of a mast or equivalent members held at the top by guys or braces, with or without a boom, for use with a hoisting mechanism and operating ropes." Types of derricks include A-frame, breast, Chicago boom, gin-pole, guy, and stiff-leg.

"A hoist is an apparatus for raising or lowering the load by the application of a pulling force, and not including a car or platform running in guides." Types of hoists include base-mounted electric, clevis suspension, hook suspension, monorail, overhead electric, simple drum, and trolley suspension.

High-lift trucks are a comparatively recent development but their use, particularly during the war, has increased tremendously. They are extensively used by both the Army and the Navy in depots and bases for handling materials. They are used for loading railroad cars and ships, the truck operating in the hold to tier materials for shipment. They are also widely used in manufacturing plants and in warehouses. They are often used for purposes other than tiering as well. High-lift platform-type trucks are used in mounting and changing heavy dies in presses. The die is placed on the platform of the truck, the platform raised to the height of the press table, and the die then slid on to the table, thus eliminating some heavy and dangerous lifting. No nationally approved safety codes have been developed for high-lift trucks and, therefore, no standard definition has been adopted. For the purpose of this investigation high-lift trucks are defined as follows:

"A high-lift truck is a power-driven industrial type of truck used for lateral transportation, that is equipped with a power-operated lifting device in the form of a fork or platform capable of tiering loaded pallets or skids one above the other." The lifting device is usually in the form of a platform or square nose or chisel forks, or the lifting device may consist of a ram, scoop, shovel, crane, revolving fork, or other special attachments for handling specific loads. It is usually used in connection with a pallet or skid on which the load is placed. It is known under several names, such as fork lift, fork truck, fork-lift truck, stacking truck, or tiering truck.

Low-lift trucks, also known as low-lift platform trucks, which are used for lifting and transporting but which are not used for tiering are not within the scope of this investigation. Low-lift trucks are usually used with skids, the platform rising only high enough to lift the skid from the floor.

### ***Occupations with which this report is concerned***

This report deals with the various occupations involved in the operation or use of the various types of power-driven hoisting apparatus. It includes the work of the elevator operator and of the operator of the crane, derrick, or hoist, who controls not only the raising and lowering of the load, but also the horizontal movement and the placing of the load at a designated place. He may be located in the cab of certain types of apparatus, or may operate the control equipment from the ground or floor of the building. In addition to the work of the persons operating such apparatus, the investigation has been extended also to the work of others who assist in the operation and, in the case of elevators, to those whose work involves riding on a freight elevator. Assisting occupations include the work of the crane hooker who places the slings about the load to be lifted and signals the crane operator when to lift, to travel, and to lower the load, and the work of the person who loads the derrick or hoist and signals the operator when he is ready to have the load lifted. In addition to crane hookers, other workers known as crane chasers, hookers-on, riggers, chasers, or others of like designation perform similar duties and are covered by this investigation. This report does not cover the operation of an unattended automatic-operation passenger elevator, that is, an elevator which is entirely automatic in operation and which is operated by the passenger. The reason for not covering the operation of this particular type of elevator is that its operation is incidental to riding as a passenger.

### **EMPLOYMENT OF MINORS ON HOISTING APPARATUS**

Complete information is not available as to the number of elevators, cranes, derricks, hoists, and high-lift trucks now in use nor on the extent of employment of 16- and 17-year-old persons in operating or assisting in the operation of such equipment. What information is available does, however, indicate that the employment of minors is extensive enough to warrant concern for their safety. Furthermore the number of accidents involving minors on hoisting apparatus indicates that the actual number of minors employed on such equipment is considerably greater than available employment figures show.

#### ***On elevators***

The 1940 census gives some idea of the number of persons in the labor force who were classified as elevator operators. These census data,

however, seriously understate the number working as elevator operators, as many who operate elevators are known by some other occupational title. The 1940 census reported a total of 83,876 persons employed as elevator operators. Of these, 567 were reported as 14 through 17 years of age.<sup>2</sup>

With increased demand for workers, there is little doubt that many times this number of boys and girls under 18 years of age were regularly working as elevator operators during the war years. To this unknown number should be added the much larger, although equally unknown, number of youngsters who are either expected or permitted to operate elevators along with or in the course of their other duties. Numerous elevator accidents have occurred to young workers who are in this category. One example is that of a 17-year-old boy employed as a messenger, who was killed while operating a freight elevator in order to carry some goods from one floor to another.

### *On cranes, derricks, and hoists*

For cranes, derricks, and hoists, even less data are available than for elevators as to the number of young operators and of helpers who assist in their operation. The 1940 census contains little information on the total number of persons in these occupations, especially as far as minors under 18 years of age are concerned. A total of 308,422 workers of all ages are grouped under the single heading, "stationary engineers, cranemen, and hoistmen." Of these, 112, all of them males, were 14 through 17 years of age.<sup>3</sup> Since the classification "stationary engineers, cranemen, and hoistmen" ordinarily includes only the more skilled workers, it is not surprising that so few young workers are shown in it. Other young persons, as well as adults, working on cranes, derricks, and hoists are probably included with other types of workers under such classifications as "operatives and kindred workers" within various industry groups, and no information on their number is available.

That a considerable number of boys under 18 years of age are nevertheless employed in operating or assisting in operating cranes, derricks, and hoists is indicated by such industrial-injury statistics as are available. In Illinois alone, for example, 20 boys under 18 years of age were reported in 1943 as having been injured in accidents caused by hoisting apparatus other than elevators.<sup>4</sup> No information is given as to whether they were operating hoisting apparatus, assisting in the operation, or engaged in some other occupation.

<sup>2</sup> Bureau of the Census: Sixteenth Census of the United States, 1940. Population, Vol. III, The Labor Force, Part 1, United States Summary, Table 65. Washington, 1943. Pp. 99, 100, 102, 103.

<sup>3</sup> *Ibid.*, Table 65. Pp. 98, 100, 101.

<sup>4</sup> Illinois Department of Labor: Annual Report on Industrial Accidents in Illinois for 1943, Part I, Table 33. Chicago. P. 35.

### *On high-lift trucks*

Since high-lift trucks are comparatively new, little information is available on the number in use or on the extent to which they are operated by young persons. It is known that a large number of high-lift trucks are being used and that their contribution to war production was important. The use of high-lift trucks will undoubtedly continue and expand; in many ways they have revolutionized the bulk handling of materials and their possibilities have not yet been fully utilized. Reports of injuries to minors under 18 years of age, along with observations in plants using high-lift trucks, indicate that they are often operated by young persons.

Some idea of the importance of high-lift trucks may be gained from the following excerpt from an article "Fork Trucks Can Hurt," published by the Navy Department in *Safety Review* for March 1945:

The fork truck has become as necessary for the transporting and storing of materials as the automobile is for our present everyday needs. With the current gasoline and tire shortage, many of us who have been deprived of our pleasure driving begin to realize faintly some of the problems in transportation which confronted our forefathers. But few of us can even begin to realize what problems in handling materials would arise if our modern naval shore establishments were suddenly deprived of the use of the fork lift truck and had to return to the handling and storing methods of even the last generation.

Without the fork truck, vast quantities of the materials of war would still be stacked in this country, clogging and throttling the production which has made our progress in this war possible. Yes, the fork truck has become just as much a modern weapon of war as the truck, the tank, or the ship. Each is a link in a chain; each is strengthened by the strength of the others. After this war, each will again become an instrument of peace, providing for our needs and increasing our luxuries. For some people, however, they will continue to be weapons, for they will still have the power to hurt, to maim, to kill.

## THE HAZARDS OF HOISTING APPARATUS

Hoisting apparatus is inherently dangerous because it involves complicated mechanical equipment and because of the ever-present danger of falling or of being struck by falling materials should the suspended load be dropped. The fact that hoisting apparatus is dangerous has been recognized and efforts have been made to improve on the design and construction of elevators, cranes, and other lifting and lowering devices by means of comprehensive safety codes. Hoisting apparatus is dangerous in that it causes many injuries and the injuries are likely to be severe. The problem of preventing accidents due to hoisting apparatus is extremely wide in its scope because of the universal use of such equipment under such widely varying conditions.

Elevator hazards are numerous and varied. Probably the most publicized type of elevator accident is one where the loaded elevator plunges to the bottom of the shaft killing or injuring some or all of its occupants. Spectacular as they are, accidents from this cause account for but a small proportion of the total number of elevator

injuries. It is the less spectacular types of accidents that make elevators dangerous.

One of the types of accident most likely to cause death or serious injury is falling into the shaftway. This may occur because of inadequate shaftway enclosure, lack of shaftway gates, inadequate or inoperative shaftway gates, or gates without interlocks to prevent opening the car when it is not at the landing. Being caught between the car platform and the landing or between the car and gate are hazards that each year take their toll of injured. Accidents of this type may be caused by faulty gates or by improper operation of the elevator. Many accidents which cause injury to operators are due to the load catching between the car and the shaft. Accidents are also caused by attempting to get on or off moving elevators, or by looking into the shaft to see if the elevator is coming.

Accidents due to portable elevators follow a somewhat different pattern. Injuries are caused by being caught between the platform and the base of the machine or between the platform or the load and fixed object such as racks or portions of the building. Accidents are also caused by material falling from the platform, persons falling from stacked materials or, when riding is permitted, by persons falling from the platform. Many injuries to hands and feet occur when workers are loading materials onto or from the lifting platform.

The hazards of operating or assisting in the operation of cranes, derricks, or hoists stem from a number of causes, the most important of which are accidental contact between the crane load and the worker. In many cases loads fall on workers because of improper rigging of the load or failure of the cables or slings. Workers are often struck by a swinging load or the load is lowered on them. This type of accident frequently occurs to the riggers or hookers-on themselves, who may disregard or not know safe operating practices. Riggers are also injured by being caught between the load and the sling, this type of accident accounting for a large number of finger and hand injuries. Workers are also injured when crushed between the swinging cab or boom and the framework of the crane or other stationary object.

Many serious accidents are caused by overloading of the crane, thus causing the load to fall, or by failure of the crane itself, such as the tipping over of a hammerhead or pintle crane. Other hazards are created by moving machinery and electricity. Crane operators are frequently injured by being caught in the gears when oiling or adjusting the machine without disconnecting the power, and a number of crane operators are killed each year through accidental contact with unprotected high-tension power lines. Contact with electrical conductors feeding the bridge and trolley motors is another type of accident that occurs quite frequently, and many accidents occur because of

mechanical failure. But by far the largest number are due to the failure of the operator, or the person assisting the operator, to follow safe operating practices.

The hazards of operating high-lift trucks follow a different pattern from those of cranes. One of the most important hazards revolves around the driving of the lift truck. Improper or careless driving results in the truck striking other workers or other vehicles, many such accidents occurring when the truck is backing up. Standing on the fork of the truck is a practice that has caused many accidents, and should never be permitted. The excuse that riding is necessary to balance the load is not a valid one; the load should be balanced before the truck starts moving.

Injuries occur when material falls from the fork, usually because of improper loading, attempting to carry too large a load, stacking it too high, or sudden movements, or sudden stopping. Injuries also occur when the load is accidentally lowered upon the feet of a helper or when the load falls while being lowered and strikes the helper or fellow worker. A few accidents occur because of failure of the lift but by far the majority are due to failure to follow safe operating rules and to insufficient skill or error of judgment on the part of the operator.

Operators of hoisting apparatus and those assisting in the operation not only face the possibility of injury to themselves but also have grave responsibilities for the safety of others. An inexperienced or careless elevator operator may injure his passengers, and a careless crane operator's action may be the cause of injury to the crane hooker or to others in the shop who have no connection with the crane operation. Unless the crane hooker does his job correctly, the load may fall, injuring him or others in the shop. Large responsibility for safety to others is a burden which should not be placed on a 16- or 17-year-old boy or girl, particularly when an error of judgment or insufficient skill might result in killing or maiming a fellow worker.

## STATISTICS ON INJURIES CAUSED BY HOISTING APPARATUS

In interpreting the term "particularly hazardous" as used in the Fair Labor Standards Act of 1938, the Children's Bureau, following the suggestion of its Advisory Committee on Occupations Hazardous for Minors, adopted the policy that occupations particularly hazardous or detrimental to the health or well-being of workers in general are also particularly hazardous or detrimental to the health or well-being of minors under 18. Other occupations, not particularly hazardous or detrimental to the health or well-being of adults or experienced workers, may, however, have greater hazards for minors under 18, and for that reason also may be interpreted as being particularly hazardous for the employment of minors.

This section of the report is concerned with the evidence on hazard regardless of age that is available from injury statistics and pertains to the occupations of operating or assisting in the operation of hoisting apparatus. First, consideration is given to the number of injuries due to hoisting apparatus as a whole—that is, all except high-lift trucks—followed by more detailed analysis of the numbers of injuries due to each type separately: i. e., elevators, cranes, derricks, and hoists. Statistical evidence of the severity of injuries due to hoisting apparatus as a whole is presented next, followed by evidence of the severity of injuries due to specific types of hoisting apparatus. Statistical evidence on both the number and severity of injuries due to high-lift trucks concludes the presentation of statistical data on injuries. This information will be used in drawing conclusions on the degree of hazard involved.

The usual yardsticks for measuring the hazards of an industry or occupation—injury frequency and severity rates based on man-hours of exposure—are not available for evaluating the hazards of hoisting apparatus because no exposure data on an apparatus-hour or man-hour basis are available. Lacking such frequency and severity rates, other data must be used instead. Useful evidence of the frequency and severity of injuries due to hoisting apparatus is, however, obtainable by determining how many injuries are caused by the different kinds of apparatus and by comparing the severity of the injuries they cause with the severity of injuries in general.

Because Nation-wide statistics on injuries due to hoisting apparatus are not available, the statistical data presented in this part of the report on numbers of injuries regardless of age are chiefly for the States of Illinois, Ohio, and Wisconsin, whose figures represent the most complete and comprehensive statistical information available on these points. Some of the data presented include some non-power-operated equipment, but this constitutes so small a fraction of the total as not to alter any conclusions with respect to power-driven hoisting apparatus drawn from the statistics.

A subsequent section of the report discusses whether the hazards of operating or assisting in the operation of hoisting apparatus are greater for young persons than for adults. A discussion of the innate characteristics of young workers, together with available statistical evidence, is presented to show the susceptibility of minors to injury by hoisting apparatus.

### ***Number of injuries due to hoisting apparatus***

One indication of the hazardous nature of hoisting apparatus may be secured from information on the numbers of injuries caused by the use of such apparatus. In the 3-year period 1941–43, 3,928 compensable injuries caused by hoisting apparatus were reported to the

Illinois Department of Labor. These 3,928 injuries represented 2.6 percent of all compensable injuries reported during this 3-year period in Illinois. Of these injuries, 1,113 were due to elevators, 1,341 were caused by cranes and derricks, and 1,474 were due to other types of hoisting apparatus (table 1).

**Table 1.—ANALYSIS OF COMPENSABLE HOISTING-APPARATUS INJURIES REPORTED IN ILLINOIS, 1941-43**

Cause of injury	Number	Percent distribution
Total.....	152, 180	100.0
Hoisting apparatus.....	3, 928	2.6
Elevators.....	1, 113	.7
Cranes and derricks.....	1, 341	.9
Other.....	1, 474	1.0
All other causes.....	148, 252	97.4

Injuries due to hoisting apparatus cut across industry lines. The industry distribution of the 3,928 industrial injuries in Illinois due to hoisting apparatus illustrates this (table I, Appendix II). As would be expected, the largest number occurred in manufacturing industries (55.3 percent). Mining and quarrying, construction, wholesale and retail trade when combined accounted for nearly 31 percent of hoisting-apparatus injuries. Other nonmanufacturing industries likewise contributed their share of hoisting-apparatus injuries—finance, insurance, and real estate accounting for 2.4 percent. An industry distribution of injuries caused by elevators in Wisconsin also shows a wide range of industries involved (table II, Appendix II).

#### ***Number of injuries due to elevators***

Injuries due to elevators account for more than one in four among injuries due to hoisting apparatus of all kinds, according to Illinois experience, as shown by table 1 (above). Of the 3,928 hoisting-apparatus injuries in Illinois 1,113, or 28.3 percent, were caused by elevators.

The number of passenger elevators compared to the number of freight elevators is not known, but industrial injuries on freight elevators greatly outnumber those on passenger elevators, according to such information as is available. Statistics compiled from Wisconsin reports of compensable injuries illustrate this. Table 2, based on compensation cases settled in Wisconsin during the 3-year period 1941-43, shows 230 injuries caused by freight elevators as against 18 for passenger elevators. This large disparity in numbers of injuries indicates that the hazard of freight elevators is greater than that of passenger elevators, even in the absence of figures on the relative



numbers of each in use. That injuries should occur more frequently on freight elevators than on passenger elevators is to be expected, because freight elevators are not equipped with as elaborate safety devices as are passenger elevators. Also, passenger elevators are usually operated by an operator hired for that purpose, while freight elevators are often operated by anyone using the elevator. Since freight elevators are not intended for passenger transportation and are not equipped with all modern safety devices, there is even more reason why the operator should be a responsible, well-trained person and possess those characteristics that make a safe worker.

Table 2.—DISABILITY DISTRIBUTION OF ELEVATOR INJURIES COMPARED TO INJURIES FROM ALL OTHER CAUSES, WISCONSIN, 1941-43

Cause of injury	Disability distribution of compensated cases						
	Number				Percent		
	Total	Death and permanent total	Permanent partial	Temporary	Death and permanent total	Permanent partial	Temporary
Total.....	82,686	444	6,966	75,276	0.5	8.4	91.1
Elevators.....	248	8	33	207	3.2	13.3	83.5
Passenger.....	18	1	3	14	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )
Freight.....	230	7	30	193	3.0	13.1	83.9
All other causes.....	82,438	436	6,933	75,069	.5	8.4	91.1

<sup>1</sup> Percent not shown where base is less than 100.

One of the striking things about elevator accidents is the fact that more persons whose regular job is not that of operating an elevator are injured than persons who are elevator operators by occupation. An analysis of occupations of workers injured by elevators in Wisconsin shows that of the 146 persons injured, 20 were classed as elevator operators, as against 126 classed in other occupations (table II, Appendix II). And since many more injuries occur on freight elevators than on passenger elevators (table 2), we can assume that most of the accidents causing injury to the 126 persons not classed as operators occurred on freight elevators and that the injured were operating the elevator (although not classed as operators), riding the elevator, or loading or unloading it. A further analysis of 244 injuries caused by elevators to minors under 18 years of age, occurring in Pennsylvania during the 4 years 1941-44, showed that more than half were due to either operating the elevator or riding on the elevator. In nearly all cases the elevator was a freight elevator. Of the 244 injuries, 73 were due to operating and 80 were caused by riding. The other 91 were due to a variety of causes, some of which were indirectly.

related to the elevator.<sup>5</sup> Pennsylvania is one of the States that has an 18-year age minimum for operating elevators. From this evidence, it is obvious that anyone who rides on a freight elevator, for whatever purpose, does so at considerable risk. The risk involved in merely riding on a freight elevator is recognized by the American Standard Safety Code for Elevators, Dumbwaiters, and Escalators, which defines a freight elevator as one on which only the operator and the persons necessary for loading and unloading are permitted to ride, the implication being that a freight elevator is not safe enough for passenger use. Similar provisions are carried in a number of State codes. All of this indicates recognition of the fact that any work which involves riding on a freight elevator carries with it a considerable hazard—a hazard to persons whether under or over 18 years of age.

No information is available as to the number of persons injured on portable elevators or tiering machines. Statistics on injuries due to portable elevators as distinguished from other types of hoisting apparatus are not available. But safety engineers are of the opinion that this type of apparatus offers considerable possibility for injury and that, considering the relatively small number used, a rather large number of injuries are caused by portable elevators.

The operator of an elevator, either passenger or freight, carries a great deal of responsibility for the protection of his passengers or of others who may be loading or unloading the elevator. The operator should be, therefore, a mature person, able to assume the responsibility that operating an elevator entails. To prevent injuries young workers should not be assigned to work which involves riding on a freight elevator.

#### *Number of injuries due to cranes, derricks, and hoists*

Cranes, derricks, and hoists constitute a class of equipment that, like elevators, accounts for a large number of injuries charged to hoisting apparatus. Of the 3,928 injuries due to hoisting apparatus in Illinois, 1,341, or 34.1 percent, were caused by cranes and derricks (table 1, page 10).

In Wisconsin 1,243 compensation cases involving injuries caused by cranes, derricks, and hoists were settled during the 3-year period 1941-43. Of these, 1,155 were reported as due to cranes and 88 due to derricks and hoists. These 1,243 injuries represented 1.5 percent of all compensated cases (82,686) settled in Wisconsin during this period (table 3).

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<sup>5</sup> From unpublished data supplied by the Pennsylvania Department of Labor and Industry, Harrisburg.

Table 3.—DISABILITY DISTRIBUTION OF INJURIES DUE TO CRANES, DERRICKS, AND HOISTS, COMPARED TO INJURIES FROM ALL OTHER CAUSES, WISCONSIN, 1941-43

Cause of Injury	Disability distribution of compensated cases						
	Number				Percent		
	Total	Death and permanent total	Permanent partial	Temporary	Death and permanent total	Permanent partial	Temporary
Total.....	82,686	444	6,966	75,276	0.5	8.4	91.1
Cranes.....	1,155	17	213	925	1.5	18.4	80.1
Derricks and hoists (selected types) <sup>1</sup> .....	88	1	20	67	1.2	22.7	76.1
All other causes.....	81,443	426	6,733	74,284	0.5	8.3	91.2

<sup>1</sup> Includes derricks, gin poles, air hoists, construction hoists, electric hoists.

Few data are available as to which type of crane, derrick, or hoist is the most dangerous. Very often reports of accidents as submitted to State labor departments or compensation commissions do not contain any information on specific type. What data are available underline the fact that injuries occur on all types of apparatus. The distribution by type of apparatus of the 1,155 crane and 88 derrick and hoist injuries in Wisconsin is as follows:

	<i>Number of injuries</i>
Cranes .....	1,155
Magnet .....	12
Traveling crane.....	354
Truck crane.....	28
Jib and pillar crane.....	3
Locomotive crane.....	1
Crane, not elsewhere classified.....	757
Derricks.....	32
Derricks .....	26
Gin poles.....	6
Hoists (selected types).....	56
Air hoist.....	28
Construction .....	5
Electric .....	28

Also, little information is available as to the hazards of cranes, derricks, and hoists because of size or capacity. It is the opinion of many safety experts, however, that small electric or air-operated hoists of low capacity such as one ton or less are much less dangerous to operate than larger hoists. They are used for light work and their operation is extremely simple.

As in the case of elevators, injuries caused by cranes are not restricted to operators but extend also to those who assist in the opera-

tion of the crane, such as hookers, riggers, followers, and the like, as well as others who may be working in the vicinity. In fact, on the basis of what information is available, many more crane hookers and riggers are injured than crane operators. In Wisconsin, for example, during the 3-year period 1941-43, 180 compensation cases were settled involving crane operators, while 363 cases involved crane hookers and riggers (table III, Appendix II).

A recent study of fatal injuries in shipyards by the Bureau of Labor Statistics of the United States Department of Labor throws further light on the extent to which cranes are involved in fatal injuries. This study is based on an analysis of 655 fatal injuries in shipyards during the 2-year period 1943-44 which were reported to that Bureau as a part of the Program of Safety and Industrial Health in Contract Shipyards, sponsored by the U. S. Maritime Commission and the U. S. Navy Department. Of these 655 fatal injuries, 15 occurred to crane operators or helpers, and 95 of the fatalities were to riggers or their helpers.<sup>6</sup>

Most of the fatalities to riggers and their helpers were closely associated with hazards arising directly from the operation of their craft. In analyzing these fatal injuries the report points out that falls from cranes or crane loads were responsible for 16 fatalities, 51 persons were killed when struck by moving crane loads, another 22 were killed when struck by moving parts of the cranes, 8 men were electrocuted while working on or standing near cranes, and 34 shipyard workers were killed when they were caught between cranes or crane loads and other objects. Cranes were involved in one way or another in at least 130 of the 655 fatal injuries.

### *Severity of injuries due to hoisting apparatus*

Injuries due to hoisting apparatus are often severe, the proportion resulting in death being extremely high. Of the 3,928 injuries due to hoisting apparatus reported in Illinois during 1941-43, 119 resulted in death. Thus, while hoisting apparatus was the cause of 2.6 per cent of all injuries reported over the 3-year period, it caused 7.5 per cent of all the fatal injuries (table 4).

Table 4.—NUMBER AND PERCENTAGE OF FATAL AND NONFATAL COMPENSABLE INJURIES CAUSED BY HOISTING APPARATUS,<sup>1</sup> ILLINOIS, 1941-43

Type of injury	All causes	Hoisting apparatus	
		Number	Percent
Total.....	152,180	3,028	2.0
Fatal.....	1,585	119	7.5
Nonfatal.....	150,595	3,809	2.5

<sup>1</sup> Chiefly elevators, cranes, and derricks.

<sup>6</sup> Bureau of Labor Statistics: Fatal Work Injuries in Shipyards, 1943 and 1944. Bulletin No. 839. U. S. Department of Labor, Washington, 1945.

### *Severity of injuries due to elevators*

Injuries caused by elevators in particular result in a disproportionately high percentage of fatal injuries, as well as those caused by hoisting apparatus generally. In fact, injuries caused by elevators result not only in a higher-than-average number of fatalities, but the number of serious injuries not resulting in death is also high. This is shown by the large proportion of permanent partial disabilities among elevator-caused injuries. This is verified by data from the State Industrial Commissions of Wisconsin and Ohio.

Table 2, mentioned previously, shows the disability distribution of elevator injuries in Wisconsin in compensation cases settled during the 3-year period 1941-43, and compares it with the disability distribution of injuries due to all other causes. Of 248 injuries caused by elevators, 8 resulted in death or permanent total disability, 33 in permanent partial disability, and 207 in temporary disability. Reduced to percentages, this means that for every 100 compensated injuries caused by elevators, 3.2 resulted in death or permanent total disability, and 13.3 caused permanent partial disability. For injuries due to all other industrial causes combined, the corresponding percentages are 0.5 and 8.4, respectively. In other words, the ratio of fatal and permanent total injuries to all injuries was more than 6 times as great for elevators as for all other causes combined. Similarly, the ratio of permanent partial injuries to all injuries was over half again as great for elevators as for all other industrial causes combined.

Ohio experience also shows that elevator injuries are more serious than the average. The percentage of fatal injuries among all reported lost-time injuries caused by elevators was 2.7 in 1943, while for injuries due to all other industrial causes the percentage was one-half as large—1.4. The number of permanent injuries per 100 lost-time injuries due to elevators (3.2) was about the same as that for all other agencies (3.6), but the average number of days lost per injury was higher for injuries due to elevators (204.6) than for injuries due to all other causes (125.8). (Table IV, Appendix II.)

No injury data are available showing separately the severity of injuries due to portable elevators. As previously pointed out, injuries from all hoisting apparatus, as well as injuries from elevators of all kinds, tend to be more severe than the average, and there is no reason to think that this does not apply to portable elevators.

### *Severity of injuries due to cranes, derricks, and hoists*

Cranes, derricks, and hoists constitute a class of hoisting apparatus which, like elevators, have established an unenviable record of causing many severe injuries. The extent to which injuries due to cranes,

derricks, and hoists exceed in severity injuries from other causes is shown in table 3, page 13, based on Wisconsin compensation records.

According to this table, death or permanent total disability resulted in 1.5 percent of all injuries caused by cranes, as compared to 0.5 percent of all injuries due to all other agencies combined—a proportion of 3 to 1. Permanent partial disability resulted in 18.4 percent of all injuries due to cranes, compared to 8.3 percent of all injuries due to all other causes.

Injuries due to derricks and hoists somewhat parallel injuries due to cranes in respect to their relatively severe character, according to the same table. Of each 100 injuries due to derricks and hoists, 1.2 resulted in death or permanent total disability, and 22.7 resulted in permanent partial disability. Comparing these figures with those in the preceding paragraph, it is seen that crane injuries resulted in about the same proportion of deaths and permanent total disability as injuries due to derricks and hoists, while derricks and hoists caused a somewhat larger proportion of permanent partial injuries than did cranes.

Dates available from other sources confirm these evidences that cranes, derricks, and hoists are the cause of many severe injuries. A report of the Industrial Commission of Ohio, based on lost-time industrial injuries reported during 1943, also indicates that the proportion of fatal and permanent injuries due to these types of hoisting apparatus are higher than those due to all other causes combined (table V, Appendix II). According to the Ohio experience, of each 100 injuries due to hoisting apparatus (mostly cranes, derricks, and hoists), 4.3 resulted in death and 11.7 in permanent injury. For injuries due to all other causes, 1.3 resulted fatally and 3.6 in permanent injury. The average number of days lost per case for hoisting-apparatus injuries was likewise high—335.3 days, compared to 124.2 days per case for injuries due to all other causes.

Shipyards are large users of cranes, and a study of injuries to shipyard workers by the Bureau of Labor Statistics of the U. S. Department of Labor throws further light on the severity of injuries due to cranes. Of each 100 injuries due to cranes in shipyards, 3.0 resulted in death or permanent total injury, and 7.9 caused permanent partial disability. When these figures are compared to similar figures for injuries from all other causes (0.4 and 3.2, respectively), it is apparent that crane injuries in shipyards are also relatively severe (table VI, Appendix II).

Navy Department experience somewhat parallels that of shipyards covered by the Bureau of Labor Statistics study. In the May 1945 issue of *Safety Review* in an article entitled "Are Cranes Killers?" the author points out that over 500 civil-service employees were injured in crane accidents during the previous year. Cranes were involved in

over 11 percent of all deaths in naval shore activities, and of every 31 lost-time accidents involving cranes, one was fatal. Eighteen employees were killed and 26 had arms, legs, hands, fingers, feet, or toes completely torn off. While it is true that in shipbuilding the exposure to cranes is very high, the accident results emphasize that cranes have earned their designation of "killers" by the severity of the injuries they cause.

For hookers or others assisting in the operation, as well as for operators, injuries due to cranes, derricks, and hoists are relatively severe. Data from Wisconsin for the 3-year period 1941-43 illustrate this. Of each 100 injuries in all occupations combined, 0.5 resulted in death or permanent total disability and 8.4 in permanent partial injuries. For crane operators the corresponding figures are 1.7 and 8.9. Crane hookers and riggers suffered almost as large a proportion of fatal and permanent total injuries (1.1 percent) and an even larger proportion of permanent partial injuries (16.8 percent) than did crane operators (table III, Appendix II).

### ***Number and severity of injuries due to high-lift trucks***

No statistical data are available from State accident records on injuries to workers operating high-lift trucks, or to those assisting in the operation. Evidence is, however, being accumulated from individual operators of high-lift truck fleets which indicates that such trucks are, in fact, the cause of a large number of injuries. One of the largest users of high-lift trucks, the Air Technical Service Command of the Army Air Forces, has made an intensive and continuing study of them as a part of its comprehensive safety program. The results of this study throw considerable light on the number and severity of injuries due to high-lift-truck accidents.

The first report of this study appeared in *Air Service Safety* for April 1944, and indicates an early recognition of the hazards of high-lift trucks, referred to by the Air Technical Service Command as fork-lift. The following excerpt shows not only that high-lift trucks cause a great many accidents but also that these accidents cause severe injuries:

**Fork Lifts.** The fork lift was involved in 115 accidents during the first 6 months of 1943, and was, therefore, one of the most dangerous vehicles in Air Service Command. The fork lift is a very versatile, labor-saving vehicle, but exposes the operator and surrounding employees to a variety of hazards. Two persons were killed, one lost a leg, and 21 suffered fractures in fork-lift accidents.

To operate the fork lift safely and efficiently, an experienced operator is required. Of the operators involved in the fork-lift accidents, 18 percent had been employed less than a month, 54 percent less than 3 months, and 79 percent less than 6 months.

In an 11-month period, July 1943 through May 1944, there were 230 high-lift-truck injuries to civilian personnel—10 percent of all injuries occurring in the Air Technical Service Command. And, again,

many high-lift-truck injuries were serious. Of these 230 injuries, one was a fatality, 5 were amputations, and 69 were fractures—all of which indicates that accidents due to such trucks have relatively serious results.<sup>7</sup>

An analysis of these accidents by cause was made to assist the Industrial Safety Branch in eliminating them. This analysis showed the accident causes as follows:

	<i>Percent distribution</i>
Standing on the fork.....	20
Driving without looking and/or workers in right of way.....	20
Unsafely balanced material on forks.....	12
Poor coordination between operator and assistant.....	7
Knob on steering wheel.....	7
Operating lift without authority.....	6
Material stacked too high on forks.....	4
Defective fork lifts.....	3
Unsafe cranking.....	3
Unsafely parked lifts.....	2
Unsafe operation in stacking or unstacking.....	1
All other causes.....	15

A further tabulation of injuries due to high-lift trucks was made by the Air Technical Service Command which throws more light on the accident hazards involved. In a 17-month period (January 1944 through May 1945) 252 civilian workers were injured by high-lift trucks. During this same time, a total of 3,851 disabling injuries occurred, the high-lift-truck injuries representing 7 percent of the total, a reduction from the 10 percent shown by the preceding study. A tabulation of these 252 injuries by type of accident is shown in table VII, Appendix II.

In the experience of the Air Technical Service Command, the types of accident causing the largest percentage of injuries are those usually associated with lack of judgment or coordination on the part of the operator ("caught between or struck by objects while loading and unloading" and "hit by moving fork lift"). This tabulation also shows that the operator carries a great deal of responsibility for the safety of those working with him or in the vicinity. Of the 252 civilian injuries cited above, 83 occurred to operators while 169 occurred to persons who were not operators. To protect himself and others about him, the operator of a high-lift truck must possess the characteristics of judgment, caution, and responsibility—characteristics seldom found in young persons. As a result of its investigation of injuries due to motor vehicles, including high-lift trucks, the Air Technical Service Command in a letter dated March 18, 1944, to com-

<sup>7</sup> Air Technical Service Command: *Air Service Safety*, August 1944. Washington. P. 16.



manders of all subordinate activities recommended, among other things, that no worker under 18 years of age should operate any motor vehicle.

Additional information on the hazards of high-lift trucks is contained in information collected by the Safety Branch, Office of Industrial Relations, Navy Department. The Navy is another of the largest users of high-lift trucks, referred to by them as fork trucks, and has made some studies of the causes of such truck accidents. Excerpts from a report on its accident experience with high-lift trucks follows:<sup>8</sup>

During 1944, more than 325 civilian employees of naval shore establishments were seriously injured by fork trucks alone. The data on these accidents submitted to the Safety Branch of the Navy Department indicate that practically every one of these accidents was due in some degree to human failures or errors in judgment. In some cases, mechanical safeguards would have prevented the injury.

The chart below indicates the relative frequency of accident happenings of each type.

PERCENTAGE DISTRIBUTION OF FORK-TRUCK-ACCIDENT CAUSES		Percent
Negligent operation.....	-----	39
Defective surroundings.....	-----	13
Defective fork trucks.....	-----	8
Unsafely balanced material.....	-----	8
Riding the forks or loads.....	-----	7
Operating without authority.....	-----	6
Poor driver-loader coordination.....	-----	3
Unsafe parking.....	-----	3
Material stacked too high.....	-----	3
Unsafe stacking or unstacking.....	-----	2
All other causes.....	-----	8

The severity of injuries due to fork trucks is further verified by the Navy Department's report, which comments on the seriousness of accidents as follows:

We've been talking at considerable length about these fork-truck accidents. But are they as serious as they sound, or are the safety engineers just preaching a sermon again? You can bet your life they are serious. And many sermons on this subject are needed! Do you realize that more than one out of every four lost-time accidents on fork trucks in naval shore establishments resulted in broken bones?

Here is the roll call:

Feet.....	-----	18
Trunk.....	-----	17
Legs.....	-----	15
Toes.....	-----	13
Arms.....	-----	12
Fingers.....	-----	8
Skull.....	-----	4
Hands.....	-----	3
Nose.....	-----	1

Grand total: 91 out of 334 lost-time injuries.

<sup>8</sup> Navy Department: *Safety Review*, March 1945. Washington. Pp. 22-25.

This report goes on to point out that an unsafe act caused or contributed to 95 percent of all lost-time fork-truck injuries and, as previously mentioned, practically all of the serious injuries were due to human failures or errors of judgment. More than half of the injuries reported occurred to fellow workers.

A further study of injuries due to fork trucks brought out the fact that during the calendar year 1944 and for the first 5 months of 1945, the operation of fork trucks accounted for approximately 3 percent of all lost-time injuries suffered by civilian employees in all naval shore establishments.<sup>9</sup>

The experiences of the Air Technical Service Command and the Navy Department with injuries by high-lift trucks to civilian personnel seem to be parallel. They point up the facts that such trucks are the cause of a considerable number of injuries, that injuries are likely to be relatively serious, that injuries involve not only the operator but also others working in the vicinity, and that many accidents are due to lack of skill and care on the part of the operator. All this indicates that the occupation of operating high-lift trucks is not suitable for young workers.

### INJURIES TO MINORS CAUSED BY HOISTING APPARATUS

In evaluating the dangers of work involving hoisting apparatus as applied to young workers, consideration should be given, not only to the hazard regardless of age of worker, but also to the question of whether the hazards of operating or assisting in the operation of hoisting apparatus are greater for young persons than they are for adults. The operation of all hoisting apparatus requires not only skill, but stability and judgment to a marked degree. To be safe, an elevator operator must have his mind on the job every minute. He cannot indulge in horse-play and he must be ready to meet all emergencies. In operating a crane, derrick, hoist, or lift truck, the operator must be able to estimate distance, to calculate the weight of his load, and to use sound judgment as the need arises.

The person assisting in the operation of hoisting equipment must also possess these characteristics. A crane hooker must know something about the capacity of cables and slings, how to secure them, and the proper way to signal the craneman. Stability, judgment, and coolness when an emergency occurs are important factors when working about hoisting apparatus, and these characteristics are usually lacking in young and inexperienced workers.

<sup>9</sup> Letter of July 20, 1945, to the Children's Bureau from the Safety Branch, Office of Industrial Relations, Navy Department.

What information is available shows that minors are frequently injured by accidents due to hoisting apparatus, particularly elevators. Of the 1,113 Illinois injuries on elevators shown in table 1 (page 10) 112 (10.1 percent) occurred to persons under 18 years of age.<sup>10</sup> That as many as 10 percent of those injured were minors under 18 suggests that these young workers are far more susceptible to injury than are adults.

Further evidence that minors are being injured by elevators when operating, or when riding, particularly in connection with loading or unloading, is available from other sources. In some States the operation of elevators by minors under certain ages is prohibited by State law or regulation, and if the minor is injured while illegally employed, the payment of extra compensation is required by law. Among the extra compensation cases of minors illegally employed that were settled in 1944 in Wisconsin, a State which prohibits minors under 18 from operating elevators, were those of 14 minors under 18 years of age who were injured by elevators. These cases are summarized in table VIII, Appendix II. This table further illustrates the fact that injuries due to elevators cover a wide range of occupations. Of the 14 minors injured, the occupation of only one was given as elevator operator. That many of the others were also operating is evidenced by the fact that treble compensation was awarded in 11 of the 14 cases. These injuries emphasize the fact that young and inexperienced workers should not have anything to do with operating elevators.

Although very little statistical information is available showing how many minors under 18 years have been injured by cranes, derricks, and hoists, there is evidence that a number of such injuries occur. Of 2,815 injuries caused by hoisting apparatus other than elevators in Illinois (table 1, p. 10), 30 occurred to workers under 18 years of age. This is not a large proportion of the total number of injuries due to such accidents; but it indicates that some minors under 18 years are employed in such a way as to be subject to the hazards of cranes, derricks, and hoists.

Likewise, little information is available as to the number of persons under 18 injured by high-lift trucks, but what meager data are available indicate that the total number may be considerable. An analysis of 250 sample cases of injury to civilians due to high-lift trucks in naval shore establishments shows clearly that minors under 18 years of age, both operators and nonoperators, who may or may not have been helpers, are being injured. The results of this sample survey are as follows:

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<sup>10</sup> Illinois Department of Labor: Annual reports on industrial accidents in Illinois, 1941-48. Chicago.

Table 5.—AGES OF CIVILIAN EMPLOYEES OF NAVAL SHORE ESTABLISHMENTS INJURED BY FORK TRUCKS, JANUARY 1, 1944—MAY 31, 1945

Age	Injuries to operators (percent distribution)	Injuries to nonoperators (percent distribution)
Total.....	100.0	100.0
Under 18 years.....	8.8	10.3
16 years.....	4.4	3.7
17 years.....	4.4	6.6
18 years and over.....	91.2	89.7

Compiled from an unpublished analysis of 250 lost-time injuries made by the Safety Branch, Office of Industrial Relations, Navy Department, Washington.

The fact that 8.8 percent of all operators and 10.3 percent of all nonoperators injured by fork trucks in naval shore establishments were less than 18 years of age indicates that the total number of minors injured by high-lift trucks in all industries would be considerable.

### EXISTING MINIMUM-AGE STANDARDS FOR OPERATING HOISTING APPARATUS

Recognition of the hazards of operating hoisting apparatus is reflected in the minimum-age standards now established under State law for their operation or recommended by recognized safety organizations for adoption by employers on a voluntary basis. A discussion of minimum ages prescribed for such work throws light on opinion as to the degree of hazard involved.

Legal minimum-age standards are established by State laws, the most important group of which are State child-labor laws and regulations thereunder. Some safety codes established under State laws and municipal ordinances relating to construction and operation of hoisting apparatus also contain certain legal requirements on age qualifications for operators. Safety codes of the American Standards Association covering primarily the construction of hoisting apparatus also contain rules for operation including provisions on age for operators. These codes are developed for adoption on a voluntary basis or as legal standards when approved by appropriate authorities.

A discussion of legal as well as recommended minimum-age standards as contained in State child-labor laws and in safety codes as applied to work in operating or assisting in the operation of elevators, cranes, derricks, hoists, and lift trucks follows.

#### *For operating elevators*

State laws and regulations in 35 States, the District of Columbia, and Puerto Rico provide a minimum age referring specifically to operating freight or passenger elevators. The District of Columbia,

Puerto Rico, and 14 States<sup>11</sup> have a minimum age of 18 years; 19 States<sup>12</sup> set 16 years; one State, Maine, sets 15 years, but provides for a minimum of 16 for operating elevators running 200 feet a minute as well as operating any elevator in any hotel, lodging house, or apartment house; and one other State, Kansas, sets a minimum age of 14 years.

The minimum age set in these jurisdictions for operating elevators is usually higher than the age established for general employment, the differential being 4 years in 6 States<sup>13</sup> and the District of Columbia, 3 years in 1 State, Michigan, and 2 years in 22 States<sup>14</sup> and Puerto Rico. In the remaining 6<sup>15</sup> of these 35 States which have established a minimum age for the operation of elevators, the age established for such work is the same as that set for general employment.

In only 13 States, Alaska, and Hawaii are there no minimum-age provisions referring specifically to the operating of elevators. In Hawaii and 4 of these States—California, Florida, South Dakota, Utah—however, prohibitions against the employment of minors as operators of power-driven machinery or in hazardous occupations may be interpreted to apply to elevator operators. Minors under 16 in Florida, Utah, and Hawaii are prohibited from operating power-driven machines, and, in California and South Dakota, from employment in any occupation dangerous or injurious to life, health, or morals. Except as the minimum age for general employment may apply in the remaining 9 States<sup>16</sup> there is no minimum age for elevator operation.

The minimum-age standards set specifically for operating elevators in the 35 States above are generally established under the State child-labor laws. In 3 of these 35 States, however, Arkansas, Massachusetts, and Nebraska, standards for operating elevators established by State elevator codes raise the standards established by the child-labor law. In Massachusetts and Nebraska the elevator codes provide an 18-year minimum age, while in Arkansas a 16-year minimum is established. In 4 other States—Michigan, Minnesota, Oklahoma, and Pennsylvania—elevator codes provide the same age as that established by or under the State child-labor law—16 in Minnesota and Oklahoma, and 18 in Michigan and Pennsylvania.

<sup>11</sup> Arizona, Indiana, Louisiana, Maryland, Massachusetts, Michigan, Nebraska, New Jersey, Ohio, Oregon, Pennsylvania, Rhode Island (passenger elevators only), Virginia, Wisconsin.

<sup>12</sup> Arkansas, Colorado, Connecticut (18, for operating elevators running 200 feet a minute), Delaware, Georgia, Illinois, Iowa, Kentucky, Minnesota, Missouri, Montana, Nevada, New Mexico, New York (18, for boys operating elevators running 200 feet a minute; 18, for girls operating any elevator), North Carolina, North Dakota, Oklahoma, Vermont, Washington (18, for girls).

<sup>13</sup> Arizona, Indiana, Maryland, Nebraska, Oregon, Virginia.

<sup>14</sup> Arkansas, Colorado, Delaware, Georgia, Illinois, Iowa, Kentucky, Louisiana, Massachusetts, Minnesota, Missouri, Nevada, New Jersey, New Mexico, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, Vermont, Washington, Wisconsin.

<sup>15</sup> Connecticut, Kansas, Maine, Montana, North Carolina, New York.

<sup>16</sup> Alabama, Idaho, Missouri, New Hampshire, South Carolina, Tennessee, Texas, West

The American Standard Safety Code for Elevators, Dumbwaiters, and Escalators, originally approved by the American Standards Association as an American Standard in 1925, is recognized as being a model for elevator construction and operation. This code has been adopted verbatim by a number of States and elsewhere State and municipal codes are based on it. One of its provisions on the qualifications and duties of operators is that the operator shall be not less than 18 years of age.

The National Recovery Administration, 1933-35, under which code authorities were required to submit to the Administrator lists of occupations which were deemed to be particularly hazardous for minors under specific ages and from which minors should be excluded, also recognized special hazards to young workers in elevator operation. Of the 166 codes which contained lists of occupations considered particularly hazardous, 140 established an 18-year minimum for operation of elevators.<sup>17</sup>

#### *For operating cranes, derricks, and hoists*

Minimum-age provisions referring expressly to operating hoisting machines, hoisting apparatus, or to hoisting engineers other than those in mines (apart from elevators) are found in only 13 States. The operation of cranes and derricks may be considered to be covered by the language of these laws and regulations. A minimum-age standard of 18 years is established in 10 States<sup>18</sup>; and 16 years in 3 States (Nevada, North Carolina, Vermont).

In addition to the 13 States that have provisions specifically referring to operating hoisting machines, 3 States,<sup>19</sup> D. C., and Hawaii have a 16-year minimum age for operating power-driven machinery, which may include operating hoisting machines, and 11 States<sup>20</sup> prohibit employment under 16 in any hazardous occupation, which may be interpreted to include elevator operation. In Puerto Rico and the remaining 21 States, there is no minimum age for operating hoists, cranes, or derricks except as such work may be prohibited by the age for general employment.

The American Standards Association has approved as an American Standard a Safety Code for Cranes, Derricks, and Hoists. This code, approved in 1943, contains detailed provisions for construction and operation of the equipment covered. Recognition of the im-

<sup>17</sup> Barkin, Solomon: Child-labor control under N. R. A., Office of National Recovery Administration, Washington, 1936. Pp. 61, 87-90.

<sup>18</sup> Arizona, Delaware, Indiana, Louisiana, Maryland, Massachusetts, New Jersey, Ohio, Pennsylvania (21-year minimum age for hoisting engineers in charge of hoisting or lowering persons in any mine or tunnel construction and work in compressed air), Wisconsin (except 16 for apprentices in connection with their training and under certain conditions; and except 16 for hoisting not more than 500 pounds if a hoistlug machine is an integral or auxiliary part of an individual lathe or milllug machine).

<sup>19</sup> Florida, Missouri, Utah.

<sup>20</sup> Arkansas, California, Iowa, Kansas, Kentucky, Minnesota, Missouri, Montana, New Mexico, North Dakota, South Dakota.

portance of age in the selection of the operator is contained in Rule 3002 (b) which states:

No person under 18 years of age shall operate an overhead crane, gantry crane, jib crane, pillar crane, or simple drum hoist. No person under 21 years of age shall operate a derrick, locomotive crane, crawler crane, or motor-truck crane.

As in the case of elevators, National Recovery Administration industry codes recognized the hazards of operating cranes, derricks, and hoists. In fact, cranes, derricks, and hoists were combined with elevators in adopting rules for establishing minimum ages for the employment of operators. The same 140 industries that adopted codes establishing an 18-year minimum age for elevator operators also set an 18-year minimum age for operating cranes, derricks, and hoists.

#### ***For operating high-lift trucks***

Since high-lift trucks are a comparatively recent development, little official recognition has been given to establishing an age limit for operators, and as far as can be ascertained, no States have as yet declared their operation as particularly hazardous or set a minimum age for their operation beyond the application of the minimum age for general employment.

Some of the largest users of high-lift trucks have voluntarily set an 18-year minimum age for operators based on their experience. For example, the Air Technical Service Command of the Army Air Forces following their comprehensive studies of the use of high-lift trucks, the findings of which are referred to in this report, recommended that no worker under 18 years of age be permitted to operate any motor vehicle including high-lift trucks.

The Children's Bureau has also recommended in the past that no minors under 18 years of age be permitted to operate high-lift trucks. This recommendation is contained in several of the advisory-standards leaflets available from the Child Labor and Youth Employment Branch under the general title "Which Jobs for Young Workers?" These advisory standards, which suggest jobs considered too hazardous for minors as well as those considered relatively safe in various occupations or industries, were developed with the assistance of technical advisers and representatives of employers and labor. They have met with universal acceptance and no protest has been received against this particular recommendation on high-lift trucks.

## CONCLUSIONS

The conclusions to be drawn from this report may be summarized as follows:

(1) Many minors under 18 years of age are being injured in operating or assisting in the operation of hoisting apparatus.

In Illinois alone, for example, 112, or 10.1 percent, of the total of 1,113 compensable elevator injuries reported during the 3-year period 1941-43, occurred to minors under 18 years of age. In the same State, during the year 1943 alone, 20 compensable injuries to workers under 18 years were reported that were caused by hoisting apparatus other than elevators.

High-lift trucks in naval shore establishments have caused a considerable number of injuries to minors under 18 years of age. According to a sample survey of injuries to civilians in these establishments, 8.8 percent of all operators, and 10.3 percent of all nonoperators injured by high-lift trucks were minors under 18 years of age.

(2) The number of industrial injuries caused by hoisting apparatus is substantial in comparison with industrial injuries in general.

Hoisting apparatus caused 3,928, or 2.6 percent, of all compensable injuries reported in Illinois during the 3-year period 1941-43. Of these 3,928 injuries, 1,113 were caused by elevators, 1,341 by cranes and derricks, and 1,474 by all other types of hoisting apparatus.

High-lift-truck accidents to civilians employed in establishments operated by the Air Technical Service Command, Army Air Forces, resulted in 252, or 7 percent, of all industrial injuries from all causes reported for these establishments during the 17-month period January 1944 through May 1945.

(3) Injuries due to hoisting apparatus are relatively severe. This is shown by the disproportionately high number of deaths and permanently disabling injuries.

Hoisting apparatus caused 7.5 percent of all fatal compensable injuries reported in Illinois during the 3-year period 1941-43, compared with 2.6 percent of all compensable injuries.

In Wisconsin, the ratio of deaths and permanent total disabilities was more than six times as great for elevators as for all other causes combined, according to compensation cases settled during the 3-year period 1941-43. And the ratio of permanent partial disabilities to all injuries was over half again as great for elevators as for all other causes combined. For cranes the ratio of death and permanent total disabilities was three times as great as for all other causes combined, and for permanent partial disabilities the ratio was more than twice as high. Injuries from derricks and hoists resulted in about the same proportion of deaths and permanent total disabilities as from cranes, but caused a somewhat higher proportion of permanent partial disabilities.

Of 115 injuries caused by high-lift-trucks during the first 6 months of 1943 in establishments operated by the Air Technical Service Command, Army Air Forces, 2 resulted in death and 1 in loss of a leg, and 21 involved fractures. This represents a high proportion of relatively serious injuries (20.9 percent).

(4) Injuries due to hoisting apparatus occur not only to the operators but also to those assisting in the operation of hoisting apparatus and to other employees.



Of 148 persons injured by elevators in Wisconsin whose compensation cases were settled during the 2-year period 1941-42, 20 were operators. Many of the others were injured while operating, although not classed as operators, or while riding. And in Pennsylvania more minors were injured while riding freight elevators than were injured while operating. More injuries occurred on freight than on passenger elevators.

Wisconsin compensation statistics for the 3-year period 1941-43 show 363 injuries to crane hookers and riggers, compared with 180 injuries to crane operators.

(5) The hazards of operating or assisting in the operation of hoisting apparatus tend to be greater for young persons than for more mature persons because young persons usually lack the characteristics of caution and judgment needed to operate hoisting apparatus safely.

(6) The hazard to minors of operating hoisting apparatus is recognized by minimum-age standards for the employment of young workers imposed by State laws, and in nationally recommended safety codes.

Fourteen States, the District of Columbia, and Puerto Rico have an 18-year age minimum for the operation of elevators under their child-labor laws or elevator codes. In 28 States, the District of Columbia, and Puerto Rico, the minimum age for operating elevators is higher than the minimum age for general employment. The American Standard Safety Code for Elevators, Dumbwaiters, and Escalators provides an 18-year minimum for elevator operators.

Ten States have an 18-year minimum age for the operation of hoisting apparatus. Two additional States have a minimum age of 18 years or higher for operating hoisting equipment under their construction codes. The American Standard Safety Code for Cranes, Derricks, and Hoists specifies that the operator shall be not less than 18 years old and for some types of cranes, 21 years.

Some employers, including the Air Technical Service Command, Army Air Forces, have voluntarily adopted an 18-year age minimum for high-lift truck operators.

(7) On the basis of these facts, substantiated by the opinion of safety experts, it is concluded that occupations involved in the operation of power-driven hoisting apparatus involve a high degree of accident risk and should be considered as particularly hazardous for the employment of minors under 18 years of age. This conclusion applies to the operation of all classes of power-driven hoisting apparatus including elevators, cranes, derricks, hoists, and high-lift trucks, except the operation of small capacity hoists. It also applies to work which involves riding on a freight elevator and to assisting in the operation of a crane, derrick, or hoist.

## APPENDIX I. DEFINITIONS OF CRANES, DERRICKS, AND HOISTS

The principal types of cranes, derricks, and hoists are those defined by the American Standard Safety Code for Cranes, Derricks, and Hoists. This report of investigation covers all these types as well as other and similar types not defined in the code.

The principal types of apparatus covered by the American Standard Safety Code for Cranes, Derricks, and Hoists are defined as follows:

### *Types of cranes*

*Cantilever gantry crane.*—A gantry crane in which the bridge girders or trusses are extended transversely beyond the crane runway on one or both sides. Its runway may be either on the ground or elevated.

*Crawler crane.*—A crane of the locomotive-crane type mounted on a tractor frame instead of on a railroad car, using tractor or caterpillar belts, or treads, for locomotion in any direction.

*Gantry crane.*—A crane similar to an overhead traveling crane, except that the bridge for carrying the trolley or trolleys is rigidly supported on two or more movable legs running on fixed rails or other runway.

*Hammerhead crane.*—A rotating counterbalanced cantilever equipped with one or more trolleys and supported by a pivot or turntable on a traveling or fixed tower.

*Ingot-pouring crane.*—An overhead traveling crane used for pouring molten metal into ingot molds.

*Jib crane.*—A fixed crane consisting of a vertical member supported at top and bottom, from which extends a horizontal revolving arm carrying a trolley.

*Locomotive crane.*—A crane consisting of a self-propelled car operating on a railroad track, upon which is mounted a rotating body supporting the power-operated mechanism together with a boom capable of being raised or lowered at its head (outer end), from which end is led a wire rope for raising and lowering a load.

*Motor-tractor crane.*—See crawler crane.

*Motor-truck crane.*—A crane of the locomotive-crane type mounted on a motor-truck frame or rubber-tired chassis.

*Overhead traveling crane.*—A crane on a pair of parallel elevated runways, adapted to lift and lower a load and carry it horizontally parallel to, or at right angles to, the runways, or both; and consisting of one or more trolleys operating on the top or bottom of a bridge, which in turn consists of one or more girders or trusses mounted on trucks operating on the elevated runways, with its operation limited to the area between the runways.

*Pillar crane.*—A fixed crane consisting of a vertical member held in position at the base to resist overturning moment, with constant-radius revolving boom supported at the outer end by a tension member.

*Pillar jib crane.*—A fixed crane consisting of a vertical member held at the base, with horizontal revolving arm carrying a trolley.

*Pintle crane.*—A crane similar to a hammerhead crane, but without a trolley, and which supports the load at the outer end of the cantilever arm.

*Portal crane.*—A gantry crane without trolley motion, which has a boom attached to a revolving crane mounted on a gantry, with the boom capable of being raised or lowered at its head (outer end). Portal cranes may be fixed or mobile.

*Semi-gantry crane.*—A gantry crane with one end of the bridge rigidly supported on one or more movable legs, running on a fixed rail or runway, the other end of the bridge being supported by a truck running on an elevated rail or runway.

*Semi-portal crane.*—A portal crane mounted on a semi-gantry frame instead of a gantry frame.

*Storage bridge crane.*—A gantry crane of long span usually used for bulk storage of material, with the bridge girders or trusses rigidly or nonrigidly supported on one or more legs. It may have one or more fixed or hinged cantilever ends.

*Tower crane.*—A portal crane, with or without an opening between the legs of its supporting structure, adapted to hoist and swing loads over high obstructions and mounted upon a fixed or mobile towerlike gantry. The revolving crane may be supported on the tower by a revolving mast or by a turntable.

*Tractor (caterpillar) crane.*—See crawler crane.

*Traveling jib crane.*—See walking jib crane.

*Walking jib crane.*—A jib crane with the vertical member running on a track, its upper end guided by a parallel overhead track.

*Wall crane.*—A crane having a jib with or without a trolley and supported from a side wall or line of columns of a building so as to swing through a half circle only. Wall cranes are usually of the traveling type, in which case they operate on a runway attached to the side wall or columns.

### **Types of derricks.**

*A-frame derrick.*—A derrick in which the boom is hinged from a cross member between the bottom ends of two upright members spread apart at the lower ends and united at the top, the upper end of the boom being secured to the upper junction of the side members, and the side members braced or guyed from the junction point.

*Breast derrick.*—A derrick without a boom, the mast consisting of two side members spread further apart at the base than at the top, tied together at top and bottom by rigid members, the top held from tipping by guys, and the load raised and lowered by ropes through a sheave or block secured to the top cross-piece.

*Chicago boom derrick.*—A boom which is attached to a structure, an outside upright member of the structure serving as the mast, and the boom being stepped in a fixed socket clamped to the upright. The derrick is completed with load fall line and boom fall line.

*Gin-pole derrick.*—A derrick consisting only of a mast, with guys from its top so arranged as to permit leaning the mast in any direction, the load being raised or lowered by ropes leading through sheaves or blocks at the top of the mast.

*Guy derrick.*—A fixed derrick consisting of a mast capable of being rotated, supported in a vertical position by three or more guys, and a boom whose bottom end is hinged or pivoted to move in a vertical plane, with lines between the head of the mast and the head of the boom for raising and lowering the boom, and lines from the head of the boom for raising and lowering the load.

*Stiff-leg derrick.*—A derrick similar to a guy derrick except that the mast is supported or held in place by two or more stiff members capable of resisting either tensile or compressive forces. Sills are generally provided to connect the lower ends of the two stiff legs to the foot of the mast.

### **Types of hoists**

*Base-mounted electric hoist.*—A hoist similar to an overhead electric hoist, except that it has a base or feet and may be mounted overhead, on a vertical plane, or in any position for which it is designed.

*Clevis suspension hoist.*—A hoist whose upper suspension member is a clevis.

*Hook suspension hoist.*—A hoist whose upper suspension member is a hook.

*Monorail hoist.*—A trolley suspension hoist whose trolley is suspended from a single rail.

*Overhead electric hoist.*—A motor-driven hoist having one or more drums or sheaves for rope or chain, and supported overhead. It may be fixed or traveling.

*Simple drum hoist.*—A hoist with one or more drums controlled by manually operated clutches, brakes or ratchet and pawl on drum, and control levers, which is operated by hand or by power.

*NOTE.*—This type of hoist is known to the trade as a contractor's hoist and is usually a portable unit.

*Double-drum hoist.*—A simple drum hoist having two independent hoisting drums.

*Single-drum hoist.*—A simple drum hoist having only one hoisting drum.

*Single-fixed-drum hoist.*—A single-drum hoist with the drum geared directly to the power unit instead of by means of friction clutches.

*Triple-drum hoist.*—A simple drum hoist having three independent hoisting drums.

*Trolley suspension hoist.*—A hoist whose upper suspension member is a trolley, for the purpose of running the hoist below a suitable runway. It may be either floor- or cage-operated.

## APPENDIX II. INDUSTRIAL INJURY STATISTICS

**Table I.—FATAL AND NONFATAL INDUSTRIAL INJURIES CAUSED BY HOISTING APPARATUS,<sup>1</sup> BY INDUSTRY; ILLINOIS**

[Based on compensable injuries reported during the 3-year period 1941-43]

Industry	All injuries		Fatal		Nonfatal	
	Number	Percent distribution	Number	Percent distribution	Number	Percent distribution
Total.....	3,928	100.0	119	100.0	3,809	100.0
Agriculture, forestry, fishing.....	11	0.3	.....	.....	11	0.3
Mining and quarrying.....	396	10.1	16	13.4	380	10.0
Construction.....	440	11.2	16	13.4	424	11.1
Manufacturing.....	2,173	55.3	44	37.0	2,129	55.9
Trade.....	371	9.5	13	10.9	358	9.4
Wholesale.....	146	3.7	8	6.7	138	3.6
Retail.....	225	5.8	5	4.2	220	5.8
Finance, insurance, real estate.....	95	2.4	10	8.4	85	2.2
Transportation, communication, public utilities.....	213	5.4	6	5.1	207	5.4
Service industries.....	220	5.8	14	11.8	216	5.7

<sup>1</sup> Chiefly elevators, cranes, and derricks.

Compiled from annual reports on industrial accidents of the Illinois Department of Labor, Chicago.

**Table II.—INDUSTRY AND OCCUPATION OF EMPLOYEES INJURED IN ACCIDENTS CAUSED BY PASSENGER AND FREIGHT ELEVATORS; WISCONSIN**

[Based on compensable-injury cases settled in 1941 and 1942]

Industry and occupation	Number of cases	Industry and occupation	Number of cases
Total.....	140	Manufacturing—Continued	
Mining.....	2	Maintenance man.....	1
Millwright.....	1	Millwright.....	3
Minor.....	1	Oiler, machine.....	1
Construction-special trade contractors.....	5	Operator, elevator (freight).....	9
Laborer.....	2	Operator, sewing machine.....	1
Painter, house.....	1	Operator, other or unspecified.....	1
Truck driver.....	1	Painter, house.....	1
Watchman.....	1	Shake-out man.....	1
Manufacturing.....	66	Toggler.....	7
Assembler.....	2	Trucker, hand.....	1
Bottler.....	1	Watchman.....	1
Cheese maker.....	1	Transportation, communication, and other public utilities.....	12
Clerk, file.....	2	Driver, truck.....	5
Clerk, shipping.....	3	Laborer, yard.....	1
Clerk, stock.....	2	Laborer, not elsewhere classified.....	2
Driver, truck.....	1	Mechanic, automobile.....	1
Driver, factory truck.....	2	Mover, furniture.....	1
Filter, pipe.....	2	Operator, elevator.....	1
Foreman.....	1	Warehouseman.....	1
Inspector.....	1	Wholesale and retail trade.....	45
Janitor.....	2	Carver, wood.....	1
Laborer, factory.....	9	Clerk, stock.....	5
Laborer, foundry.....	1	Driver, truck.....	5
Laborer, not elsewhere classified.....	9	Elevator man (construction).....	1
		Furrier.....	1

<sup>1</sup> Of these 146 injuries, 20 were to elevator operators, of whom 5 operated passenger elevators, 11 operated freight elevators, and 4 operated other types of elevators.

Table II.—INDUSTRY AND OCCUPATION OF EMPLOYEES INJURED IN ACCIDENTS CAUSED BY PASSENGER AND FREIGHT ELEVATORS; WISCONSIN—Continued

[Based on compensable-injury cases settled in 1941 and 1942]

Industry and occupation	Number of cases	Industry and occupation	Number of cases
Wholesale and retail trade—Con.		All other industries.....	16
Laborer, construction.....	2	Charwoman.....	1
Laborer, factory.....	2	Janitor.....	2
Laborer, yard.....	2	Manager, building.....	1
Laborer, not elsewhere classified.....	7	Operator, elevator.....	7
Maltster.....	1	Porter.....	2
Mechanic, automobile.....	1	Waitress.....	2
Mechanic, not elsewhere classified.....	1	Other or unspecified.....	1
Operator, elevator.....	3		
Salesman.....	6		
Waitress.....	1		
Warehouseman.....	5		
Watchman.....	1		

Compiled from Statistical Release No. 3123, issued November 20, 1943, by the Industrial Commission of Wisconsin, Madison.

Table III.—COMPARISON OF DISABILITY DISTRIBUTION RATES OF CRANE OPERATORS, CRANE HOOKERS AND RIGGERS, OPERATORS OF DERRICKS AND HOISTS, AND OPERATORS OF PASSENGER AND FREIGHT ELEVATORS, WITH SIMILAR RATES FOR ALL OTHER OCCUPATIONS; WISCONSIN

[Based on compensable-injury cases settled during the 3-year period 1941-43]

Occupation	Disability distribution of compensated cases						
	Number			Percent			
	Total	Death and permanent total	Permanent partial	Temporary	Death and permanent total	Permanent partial	Temporary
Total.....	82,686	444	6,966	75,276	0.5	8.4	91.1
Crane operators <sup>1</sup> .....	180	3	16	161	1.7	8.9	89.4
Crane hookers and riggers.....	303	4	61	298	1.1	16.8	82.1
Derrick and hoist operators.....	44	1	6	37	(?)	(?)	(?)
Elevator operators.....	106	.....	5	101	.....	4.7	95.3
Freight elevators.....	77	.....	5	72	.....	(?)	(?)
Passenger elevators.....	29	.....	.....	29	.....	(?)	(?)
All other occupations.....	81,993	436	6,878	74,679	0.5	8.4	91.1

<sup>1</sup> Includes all types of cranes.

<sup>2</sup> Percent not shown where base is less than 100.

Compiled from statistical releases of the Industrial Commission of Wisconsin, Madison.

Table IV.—DISABILITY DISTRIBUTION AND AVERAGE NUMBER OF DAYS LOST PER INJURY FOR ELEVATOR INJURIES, COMPARED TO ALL OTHER CAUSES; OHIO<sup>1</sup>

[Based on lost-time industrial injuries reported during 1943]

Cause of injury	Number of injuries				Disability distribution per 100 injuries			Days lost	
	Total	Fatal	Permanent	Temporary	Fatal	Permanent	Temporary	Total number	Average number per injury
Total.....	73,987	1,006	2,706	70,275	1.4	3.6	95.0	9,340,601	126.2
Elevators <sup>1</sup> .....	407	11	13	383	2.7	3.2	94.1	83,205	204.0
All other causes <sup>1</sup> .....	73,580	995	2,693	69,892	1.4	3.6	95.0	9,257,336	125.8

<sup>1</sup> This table excludes injuries in mining industry.

Compiled from the 1943 Annual Statistical Report, Division of Safety and Hygiene, Industrial Commission of Ohio, Columbus.

**Table V.—DISABILITY DISTRIBUTION AND AVERAGE NUMBER OF DAYS LOST PER INJURY FOR INJURIES CAUSED BY HOISTING APPARATUS, COMPARED TO ALL OTHER CAUSES; OHIO**

[Based on lost-time industrial injuries reported during 1943]

Cause of injury	Number of injuries				Disability distribution per 100 injuries			Days lost	
	Total	Fatal	Perma- nent	Tempo- rary	Fatal	Perma- nent	Tempo- rary	Total num- ber	Average num- ber per injury
Total.....	73,987	1,006	2,706	70,275	1.4	3.6	95.0	9,340,601	126.2
Hoisting apparatus <sup>1</sup> .....	725	31	85	609	4.3	11.7	84.0	243,057	335.3
All other causes <sup>2</sup> .....	73,262	975	2,621	69,666	1.3	3.6	95.1	9,097,544	124.2

<sup>1</sup> Injuries due to elevators, and to hoists in mining industry, are not included in this table.

<sup>2</sup> Excludes all injuries in mining industry.

Compiled from 1943 Annual Statistical Report, Division of Safety and Hygiene, Industrial Commission of Ohio, Columbus.

**Table VI.—DISABILITY DISTRIBUTION AND AVERAGE NUMBER OF DAYS LOST PER TEMPORARY TOTAL INJURY IN CRANE ACCIDENTS, COMPARED TO ALL OTHER CAUSES, 1941**

[Based on experience of 11 shipyards, 1941]

Cause of injury	Disability distribution							Average days lost per temporary total injury
	Number of injuries				Percent distribution			
	Total	Death and permanent total	Permanent partial	Temporary total	Death and permanent total	Permanent partial	Temporary total	
Total.....	3,066	15	102	2,949	0.5	3.3	96.2	17
Cranes.....	101	3	8	90	3.0	7.9	89.1	30
All other causes.....	2,965	12	94	2,859	0.4	3.2	96.4	( <sup>1</sup> )

<sup>1</sup> Not reported.

Compiled from Bulletin No. 722 of the Bureau of Labor Statistics, U. S. Department of Labor, Washington.

## THE OPERATION OF HOISTING APPARATUS

Table VII.—FORK-LIFT INJURIES TO CIVILIAN EMPLOYEES OF AIR TECHNICAL SERVICE COMMAND

*[Based on injuries reported during the 17-month period January 1944-May 1945]*

Type of accident	Total				Operator Injured		Others injured	
	Both sexes		Male	Female	Male	Female	Male	Female
	Number	Percent distribution						
Total.....	252	100.0	215	37	63	20	152	17
Material falling from lift.....	25	9.9	21	4	4	3	17	1
Operator confused in gear shift.....	3	1.2	2	1			2	1
Caught between or struck by objects while loading or unloading.....	44	17.5	36	8	6	1	30	7
Driving over material or depressions.....	12	4.7	7	5	4	5	3	
Hit by moving fork lift.....	31	12.3	25	6	2		25	6
Collision with other vehicle.....	13	5.2	11	2	6	2	5	
Lift boom failing to clear doorway.....	2	.8	2		2			
Unattended lift rolled down incline.....	4	1.6	4		3		1	
Loading or unloading lift, improperly stacked material fell.....	8	3.2	8		2		6	
Riding or standing on forks.....	26	10.3	25	1			25	1
Material falling from lift due to overloading.....	20	7.9	17	3	15	3	2	
Improper loading arrangement.....	12	4.7	12		1		11	
Injured while getting on or off lift.....	4	1.6	4		4			
Using lift instead of other proper equipment.....	2	.8	2		2			
Person falling from lift.....	1	.4	1				1	
Caught between objects struck by lift.....	2	.8	2				2	
Struck against objects while loading.....	2	.8	2				2	
Injured while repairing or adjusting lift.....	11	4.4	11		1		10	
Unsafe operating position.....	2	.8	2		2			
Improper operation (view obstructed, failing to turn off motor, etc.).....	21	8.3	17	4	8	4	9	
Walking without looking, ran into lift.....	1	.4	1				1	
Lift ran off ramp, overturned, etc.....	4	1.6	3	1	3	1		
Improper parking.....	1	.4		1				1
Operating defective lifts.....	1	.4		1		1		

Compiled from unpublished table prepared by Air Technical Service Command.



**Table VIII.—DOUBLE AND TREBLE LIABILITY CASES OF ILLEGALLY EMPLOYED MINORS INJURED BY ELEVATORS, AMONG COMPENSABLE CASES SETTLED IN 1944; WISCONSIN**

Industry	Occupation	Age	Sex	Cause	Injury	Disability <sup>1</sup>	Penalty <sup>2</sup>	Compensation paid	
								Normal	Increase
Canning.....	Factory laborer.....	16	M	Caught by platform.....	Amputated great and lesser toes.	PP	T	\$611.49	\$1,222.98
Bakery.....	Wrapper operator.....	17	M	Caught in gate.....	Cut hand.....	T	T	7.47	19.19
Leather garments.....	Packer.....	16	M	Caught by platform.....	Fractured toes.....	T	T	54.11	108.22
Printing and lithographing.....	Sorter.....	17	F	do.....	Fractured foot.....	PP	T	376.25	752.50
Hardware.....	Stock clerk.....	16	M	do.....	Broken large and 2d toe.....	T	T	74.86	149.72
Heavy machinery.....	Packer.....	15	M	Caught in gates.....	Fractured great toe.....	T	T	40.32	80.64
Renting refrigerator cars.....	Laborer.....	16	M	Fell down hoistway.....	Bruised side.....	T	D	10.08	18.72
Wholesale dry goods.....	Sweeper.....	15	M	Caught by platform.....	Bruised toe.....	T	T		5.96
Wholesale liquor and food.....	Laborer.....	14	M	do.....	Bruised foot.....	T	T	103.74	207.48
Variety store.....	Stock clerk.....	16	M	do.....	Fractured toe.....	T	T	72.52	145.04
Variety store.....	do.....	17	M	Struck by load on elevator.	Bruised back.....	T	D	2.10	9.16
General store.....	Salesman, inside.....	17	M	Caught by platform.....	Bruised legs.....	T	D	37.70	37.70
Hotel.....	Elevator operator.....	17	M	Fell down hoistway.....	Fractured ankle.....	T	T	165.76	331.52
University.....	Janitor.....	17	M	Caught by platform.....	Cut foot.....	T	T	30.33	60.66

<sup>1</sup> PP=permanent partial disability; T=temporary disability.

<sup>2</sup> D=double compensation; T=treble compensation.

Compiled from Statistical Release No. 3159 Issued by the Industrial Commission of Wisconsin, Madison.

# APPENDIX III. HAZARDOUS-OCCUPATIONS ORDER NO. 7

JULY 11, 1946.

(Code of Federal Regulations, Title 29, Chapter IV)

## Section 422.7. Occupations involved in the operation of power-driven hoisting apparatus

(a) *Finding and Declaration of Fact.* By virtue of and pursuant to the authority conferred by section 3 (1) of the Fair Labor Standards Act of 1938<sup>1</sup> and pursuant to the regulation prescribing the Procedure Governing Determinations of Hazardous Occupations;<sup>2</sup> an investigation having been conducted with respect to the hazards for minors between 16 and 18 years of age in employment in occupations involved in the operation of power-driven hoisting apparatus and a report of the investigation having been submitted to the Chief of the Children's Bureau; a finding and order relating to the employment of minors between 16 and 18 years of age in the said occupations having been proposed for final adoption by the Chief of the Children's Bureau upon the basis of the said report of investigation; a public hearing having been held with respect to the said proposed finding and order; all statements submitted in connection with the said hearing having been carefully considered and minor changes having been made in the proposed finding and order as a result of suggestions made at the hearing; and sufficient reason appearing therefore,

NOW, THEREFORE, I, Katharine F. Lenroot, Chief of the Children's Bureau of the United States Department of Labor, hereby find and declare that the following occupations involved in the operation of power-driven hoisting apparatus are particularly hazardous for minors between 16 and 18 years of age:

- (1) Work of operating an elevator, crane, derrick, hoist, or high-lift truck, except operating an unattended automatic operation passenger elevator or an electric or air-operated hoist not exceeding one ton capacity.
  - (2) Work which involves riding on a freight elevator. (Where employees are customarily transported to their work place at the beginning and end of scheduled work periods in a freight elevator operated by an assigned operator, such riding shall not be considered as work within the intent of this paragraph.)
  - (3) Work of assisting in the operation of a crane, derrick, or hoist performed by crane hookers, crane chasers, hookers-on, riggers, rigger helpers, and like occupations.
- (b) *Definitions.* As used in this order:
- (1) The term "elevator" shall mean any power-driven hoisting or lowering mechanism equipped with a car or platform which moves in guides in a substantially vertical direction. The term shall include both passenger and freight elevators (including portable elevators or tiering machines), but shall not include dumbwaiters.
  - (2) The term "crane" shall mean a power-driven machine for lifting and lowering a load and moving it horizontally, in which the hoisting mechanism is an integral part of the machine. The term shall include all types of cranes, such as cantilever gantry, crawler, gantry, hammerhead, ingot-pouring, jib, locomotive, motor-truck, overhead traveling, pillar, jib, pintle, portal, semigantry, semiportal, storage bridge, tower, walking jib, and wall cranes.
  - (3) The term "derrick" shall mean a power-driven apparatus consisting of a mast or equivalent members held at the top by guys or braces, with or without a boom, for use with a hoisting mechanism or operating ropes. The term shall include all types of derricks, such as A-frame, breast, Chicago boom, gin-pole, guy, and stiff-leg derricks.

<sup>1</sup> Act of June 25, 1938, C. 676, 52 Stat. 1060, U. S. Code, Title 29, Sec. 201.

<sup>2</sup> Issued November 3, 1938, pursuant to authority conferred by section 3 (1) of the Fair Labor Standards Act of 1938, published in The Federal Register, Vol. 3, p. 2640, Nov. 5, 1938, Procedure Governing Determinations of Hazardous Occupations.

- (4) The term "hoist" shall mean a power-driven apparatus for raising or lowering a load by the application of a pulling force that does not include a car or platform running in guides. The term shall include all types of hoists, such as base-mounted electric, clevis suspension, hook suspension, monorail, overhead electric, simple drum, and trolley suspension hoists.
- (5) The term "high-lift truck" shall mean a power-driven industrial type of truck used for lateral transportation that is equipped with a power-operated lifting device usually in the form of a fork or platform capable of tiering loaded pallets or skids one above the other. Instead of a fork or platform, the lifting device may consist of a ram, scoop, shovel, crane, revolving fork, or other attachments for handling specific loads. The term shall mean and include high-lift trucks known under such names as fork lifts, fork trucks, fork-lift trucks, tiering trucks, or stacking trucks, but shall not mean low-lift trucks or low-lift platform trucks that are designed for the transportation of but not the tiering of material.
- (c) This order shall not justify noncompliance with any Federal or State law or municipal ordinance establishing a higher standard than the standard established herein.
- (d) This order shall become effective on September 1, 1946 and shall be in force and effect until amended or repealed by order hereafter made and published by the Chief of the Children's Bureau.

KATHERINE F. LENROOT,  
*Chief of the Children's Bureau.*