UNITED STATES DEPARTMENT OF LABOR
L. B. Schwellenbach, *Secretary*
BUREAU OF LABOR STATISTICS
Ewan Clague, *Commissioner*

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Injuries and Accident Causes in the Brewing Industry, 1944

Bulletin No. 884

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Washington 25, D. C. - Price 15 cents

Letter of Transmittal

UNITED STATES DEPARTMENT OF LABOR,
Bureau of Labor Statistics,
Washington, D. C., August 30, 1946.

The SECRETARY OF LABOR:

I have the honor to transmit herewith a report on the occurrence and causes of work injuries in the brewing industry.

This report was prepared in the Industrial Hazards Division by Frank S. McElroy and George R. McCormack as a part of the Bureau of Labor Statistics regular program of compiling industrial-injury information for use in accident prevention work. Frank C. Ball, W. A. Klenota, P. L. Schuler, E. J. Steinkellner, and Guy T. Yates, safety engineers in the industry, assisted greatly by suggesting specific methods of accident prevention drawn from their experience.

EWAN CLAGUE, *Commissioner.*

Hon. L. B. SCHWELLENBACH,
Secretary of Labor.

Bulletin No. 884 of the

United States Bureau of Labor Statistics

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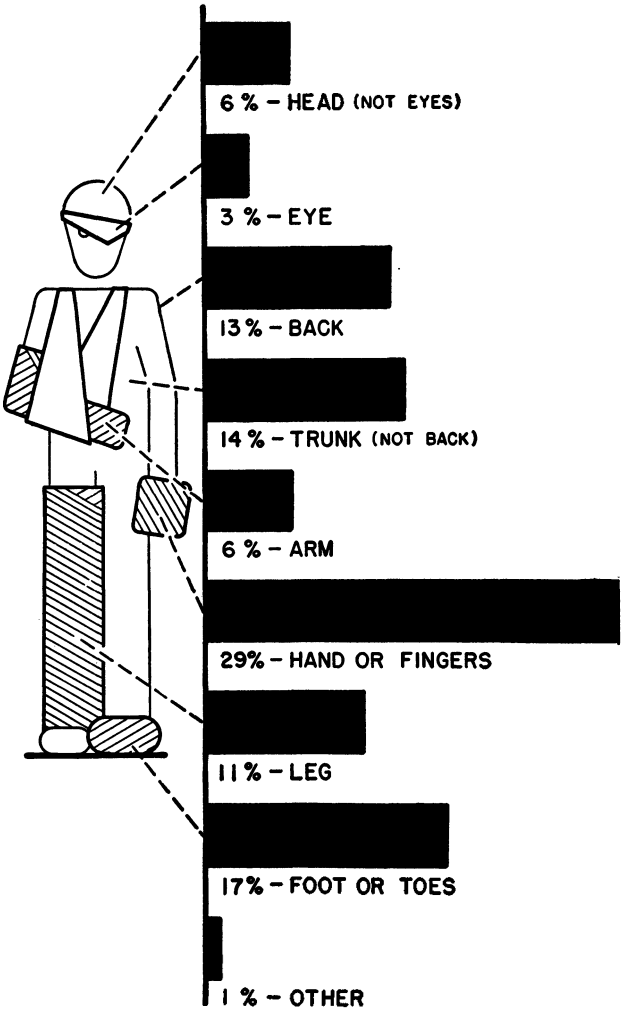
PART OF BODY AFFECTED BY DISABLING INJURIES IN BREWERIES

1944



UNITED STATES DEPARTMENT OF LABOR
BUREAU OF LABOR STATISTICS

Injuries and Accident Causes in the Brewing Industry, 1944

Summary

Industrial injury-frequency rates for breweries, as compiled by the Bureau of Labor Statistics, indicate that accidents constitute a major problem in this industry. In the year 1942, brewery workers experienced an average of 38.2 disabling injuries in the course of every million employee-hours worked, which was nearly double the average of 19.9 for all manufacturing activities. Similarly, in 1943, the average injury-frequency rate for the brewing industry was 35.3 as compared with an average rate of 20.0 for all manufacturing. In 1944 the divergence became even more pronounced, as the volume of recorded disabling injuries in the brewing industry climbed to an average of 46.2 per million employee-hours worked, whereas preliminary reports indicated a decline in the all-manufacturing average to about 18.8.

The significance of the 1944 frequency rate becomes more apparent when it is realized that it indicates the occurrence of about 1 disabling injury for every 10 workers in the brewing industry during the year. In actual numbers it is estimated that approximately 8,100 employees of breweries experienced such injuries during 1944. About 15 of these were fatal and approximately 660 resulted in some form of permanent physical impairment; the remainder, or about 7,425 cases, were temporary disabilities.

Without any allowance for the continuing loss in production and earning power arising from the deaths and permanent impairments, it is estimated that the actual employment losses resulting from the injuries experienced by brewery workers amounted to at least 162,000 man-days during 1944. On the basis of standard time charges for deaths and permanent impairments, it is estimated that the future economic loss accruing from the more serious injuries will eventually amount to at least 900,000 man-days. The total employment loss arising from the injuries which occurred in the course of brewery operations during 1944, therefore, will be equivalent to over 1,000,000 man-days of work.

Broad industry figures, such as the foregoing, amply demonstrate the existence of a safety problem in the brewery industry and, in a general way, serve to indicate the magnitude of that problem. The successful development of a safety program, however, requires much more detailed information as to where, how, and why the accidents occur. This survey was designed to supply some of those details.

In response to the Bureau's request, 321 breweries submitted summary reports showing for each of their operating departments the number of workers employed, the number of employee-hours worked, and the number and types of injuries experienced by their employees during 1944. From these data it was possible to make a number of comparisons which indicate more specifically where the major hazards of the industry are concentrated and thereby to point out the most effective line of approach to the achievement of greater safety.

On the basis of the 1944 record there is an apparent need for greater attention to safety in each of the major operating departments of the industry. The necessity for immediate attention is most apparent, however, in the delivery departments. The delivery departments had an average of 64.1 disabling injuries for every million employee-hours worked, the bottling departments had an average of 52.5, and the brewhouse departments had an average of 50.8. The most hazardous type of delivery work was that of handling draught beer. The workers in this particular operation had the extremely high average frequency rate of 93.1. Pasteurizing, with an average frequency rate of 59, was the most hazardous operation in the bottling department, and loading, with an average frequency rate of 76.6, was the most hazardous of the specific operations reported in the brewhouse departments.

Comparisons based upon the volume of employment in the reporting plants indicated that, on the average, breweries employing fewer than 100 workers and those employing over 500 workers had better safety records than the medium-size plants in which employment ranged from 100 to 500. It is noteworthy, however, that the proportion of serious injuries (that is, cases resulting in permanent impairments) was greater among the plants employing 1,000 or more workers than among those of any other size group. Generally speaking, this pattern corresponds with the conditions found in other industries, and reflects the greater attention devoted to safety by management in the smaller plants and the existence of safety departments in the larger plants.

The injury records of the participating breweries varied extensively. About 17 percent of the plants reported that none of their employees had experienced a disabling injury during the year. However, most of these plants were quite small and none had over 150 employees. In contrast there were 4 plants with injury-frequency rates of over 200. One brewery with an average employment of about 240 workers reported 169 disabling injuries, which gave it a frequency rate of 289.6.

Regional comparisons indicated that, in general, brewery operations were conducted most safely in the southeastern part of the country and that the relative volume of accidents was greatest in the northeastern area. Regional average frequency rates ranged from 31.4 in the East South Central to 67.9 in the New England region. In the areas which contain the greatest number of breweries the regional averages were 46.0 for the East North Central and 52.6 for the Middle Atlantic region. Among the 19 States for which separate average frequency rates were computed, Florida had the lowest (13.9) and Indiana had the highest (69.8). Both the highest and the lowest of the 16 city averages were for Pennsylvania cities; in

Wilkes-Barre the reporting breweries had an average frequency rate of 23.3, and those in Pittsburgh had an average of 128.0. Various factors enter into these regional, State, and city differences: State safety laws and the extent to which they are enforced, the general size of the plants in an area, and the general interest in safety as evidenced by the safety activities of local associations.

In addition to supplying summary reports for use in evaluating the magnitude and general aspects of the injury problem in brewing operations, 82 of the cooperating breweries also made their original accident records available for detailed analysis. This analysis was designed to determine how and why most brewery accidents occur and to indicate, wherever possible, the preventative measures which could help to eliminate such occurrences. These 82 plants were distributed among 15 States and, as a group, employed over 38,000 workers. Their combined injury-frequency rate was 53.3, which is somewhat higher than the industry average, but not sufficiently higher to indicate that their accident experience was other than typical of the industry. A total of 4,276 accident cases, each of which resulted in a disabling injury, were included in the major part of this analysis. Supplementary details relating to the occurrence of over 16,000 accidents which resulted in nondisabling injuries were also compiled for use in a portion of the analysis. The latter records, however, were all obtained in one plant and may not be entirely typical of the experience of other plants.

A representative of the Bureau of Labor Statistics visited each of these 82 cooperating breweries and, insofar as the data were available, transcribed from their records the following items regarding each accident: Place where the accident occurred; the occupation, age, experience, and sex of the injured worker; the nature of the injury and the part of body injured; the type of accident; the object or substance (agency) which caused the injury; and the unsafe condition and/or the unsafe act which led to the accident. These data were then analyzed according to the American Recommended Practice for Compiling Industrial Accident Causes, as approved by the American Standards Association.

In order of their numerical importance, the leading injury-producing agencies were found to be barrels and kegs, defective working surfaces, machines, cartons or boxes, and vehicles. Most common among the unsafe working conditions which led to accidents were defects in bottles, slippery floors, lack of proper lifting equipment, and inadequately guarded machines or conveyors. Inattention to footing and failure to maintain a proper grip on objects being lifted or carried were the most outstanding unsafe acts. Increased utilization of personal protective equipment such as safety shoes, gloves, goggles, and face shields would undoubtedly do much to reduce the volume of injuries. The record indicates, however, that the most effective accident prevention measures would include more effective guarding of machines and conveyors; better housekeeping to eliminate slipping and tripping hazards; increased use of mechanical devices in handling heavy materials; and more thorough inspection of materials and equipment, coupled with prompt repair or replacement of items which are found to be defective.

Departmental Injury Frequency Rates

The extent to which details were available concerning the experience of workers engaged in particular operations varied greatly among the reporting breweries. In many of the small plants there was very little departmentalization, and most employees whose time could not be broken down on the basis of specific operations were reported as general workers. Practically all of the plants, however, were able to report their experience in broad categories such as brewhouse work, bottling operations, and delivery operations. Such break-downs help to direct safety activities to the general divisions of the plants in which injuries are most common. Most suited for the development of an organized safety program, however, are those data which detail the experience of workers in specific activities within the broad operating divisions. About half of the reporting plants were able to furnish detailed records of the latter type.[1]

BREWHOUSE OPERATIONS

Brewhouse operations as a group had an average frequency rate of 50.8 disabling injuries for every million employee-hours worked. Although this average is very high in comparison with the frequency rates prevailing in most other manufacturing industries, it was lower than the averages for the bottling and delivery departments of the brewing industry. Temporary injuries in this division, as measured by the average amount of time lost, were generally more severe than those of the other major divisions. This was balanced, however, by the fact that there were proportionately fewer cases of permanent impairments reported in the brewhouse units than were reported in either the bottling or the delivery divisions.

The frequency rates of the individual departments of the brewhouse division were sharply divided into a "very high" rate group and a "high" rate group. The group with the more favorable average frequency rates was composed of the brewing, fermenting, and filtering departments, while the higher rate group included the racking, washing, and loading departments. It is significant that the operations in which injuries were less common were those in which the work involves comparatively little manual handling of heavy materials. The filtering departments' average frequency rate of 23.9 was the lowest in the group. The brewing and fermenting departments had nearly identical frequency rates, 32.4 and 32.8, respectively. All three of these rates were higher than the average injury-frequency rate for all manufacturing, but they were each substantially lower than the rates for the washing, racking, and loading departments.

Loading operations, which involve the intraplant transportation and storage of filled barrels and kegs, had an average frequency rate of 76.6—the highest for any of the brewhouse departments. In many of the loading departments much of the lifting and handling of the heavy barrels is performed manually, and as a result strains and sprains are relatively common. Permanent injuries, however, were

[1] See Appendix, table 1.

less common in these departments than in many of the other operating units.

Washing operations constituted the second most hazardous activity in the brewhouse division. In these units disabling injuries were reported to have occurred at the average rate of 58.3 per million employee-hours worked. In washing operations, empty barrels are usually placed by hand upon an automatic washing machine. On the machine, the barrels are mechanically rotated to place the bunghole in line with a water nozzle and are then lowered over the nozzle. Water is alternately sprayed into and drained out of the barrels several times, after which they are removed for inspection. If the coating of pitch on the interior of a barrel is found to be thin or broken, the barrel is placed on a second machine which operates similarly to the washer except that it sprays hot pitch into the barrel instead of water. The barrel is then rotated to insure that all inner surfaces are coated, and the excess pitch is drained out. The proportion of injuries resulting in permanent impairments was comparatively low in the washing departments. The average amount of time lost for each temporary disability, on the other hand, was very high.

In racking operations the empty barrel is placed, bunghole up, under the nozzle of the beer pump. The nozzle is lowered into the barrel and the beer is pumped in. When the barrel is full the bung is placed by hand and driven in with a hammer. Then the filled barrels are rolled from the rack to the loaders. The racking departments also had a very high frequency rate, their average being 51.8 disabling injuries per million employee-hours worked. The proportion of injuries resulting in permanent impairments was comparatively high, but the average time lost per case of temporary disability was identical with the industry average.

BOTTLING OPERATIONS

The average frequency rate for the departments comprising the bottling division was slightly higher than that of the brewhouse division, but was substantially lower than that of the delivery departments. As a group, the bottling departments had an average of 52.5 disabling injuries in every million employee-hours worked. One in every 14 of these injuries was a permanent impairment, as compared with averages of about 1 in 18 in the brewhouse group and about 1 in 8 in the delivery departments. Although there were 2 fatalities among the 1,031 disabling injuries reported for the brewhouse units, and 4 among the 1,172 injuries reported for the delivery departments, there were no deaths among the 2,423 disabling cases reported in the bottling departments. Temporary disabilities in the bottling departments, on the average, required 14 days for recovery. This time loss was identical with the corresponding average in the delivery departments, but was substantially lower than the average of 18 days of lost time per temporary disability in the brewhouse units.

Bottling operations, other than casing and loading, are generally highly mechanized and involve comparatively little physical exertion. Consequently, these operations are now largely performed by women.

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Empty bottles are loaded by hand into an automatic washing machine from which they pass onto a conveyor on which they generally remain until delivered to the casers. As they leave the washing machine they are given their first inspection by a worker who sits at the side of the conveyor and looks through each bottle as it passes. At this stage the inspection involves little hazard. At the later inspection points, however, there is continual danger that the filled bottles may explode and that the inspectors or other conveyor attendants may be struck by flying glass.

The conveyor carries the bottles from the washing machine successively to the filling machine, the capping machine, the pasteurizer, and the labeling machine, and then delivers them to the casers, who place them in cases or cartons. Casing is usually a manual operation, although a few breweries have installed machines to perform this function. The filled cases or cartons are then taken by the loaders to be stored or shipped out of the plant.

Bottle explosions are quite common at all stages of the bottling operations after the beer has been placed in the bottles. These explosions present a double hazard in that the flying glass may strike anyone in the vicinity, and the workers may receive hand cuts as they remove the broken glass from the machines, the conveyor, or the floor.

Inquiries addressed to a number of brewery safety engineers elicited various reasons for the occurrence of these explosions. The pressure used to speed the filling operations frequently is great enough to burst weak or defective bottles. In the pasteurizer the beer is heated and the gas contained in the liquid expands, thus increasing the internal pressure which may then burst the bottles. Most of the safety engineers were in agreement that the tendency for bottles to explode is increased when they are roughly handled. Worn machinery and conveyors add greatly to this hazard by causing the bottles to be bumped and shaken as they pass along the line. The safety engineers also agreed that the larger-size bottles are more likely to explode than are the bottles of standard size.

A few breweries have placed wire-mesh guards over the conveyor lines and have installed metal shields around the filling machines. At the inspection points the mesh guards are replaced by panels of shatter-proof glass. Most of the conveyor guards are constructed in sections which may be raised to permit the removal of rejected or broken bottles from the line. The use of such guards, however, is far from universal. Instead of guards, some breweries provide impact goggles for all bottling-department workers. These goggles prevent eye injuries, but do not eliminate other cuts caused by the broken glass.

At the present time very little beer is put in cans, because of the shortage of metal. It is pertinent to note, however, that from a safety point of view the use of cans has a distinct advantage in that it automatically eliminates all the hazards of bursting bottles.

Pasteurizing was the most hazardous operation in the bottling division. These units had an average of 59 disabling injuries for every million employee-hours worked. Casing operations, which had an average frequency rate of 55.1, were only slightly less hazardous. Loading operations in the bottling division had a frequency

rate of 47.9, which is high by most safety standards; nevertheless, it was much lower than the average of 76.6 for the brewhouse loading departments. Bottle washing (with the lowest frequency rate in the bottling division) and the filling and capping units had average frequency rates of 43.4 and 45.4, respectively.

In comparison with the average time loss for each temporary disability in the other divisions, the recovery time for temporary injuries in the bottling units was generally low. The proportion of injuries resulting in permanent impairments, however, was unusually high in some of the bottling operations, ranging as high as 20 percent in the filling and capping units.

DELIVERY OPERATIONS

In large measure the very high frequency rates of the delivery departments reflect the considerable volume of heavy manual work performed in these departments. The extremely high average frequency rate of 93.1 for the units delivering draught beer is seldom equaled in any of the operations of other industries. Similarly, the high proportion of serious injuries, represented by 2 deaths and 73 permanent impairments out of a total of 403 disabling injuries reported for this operation, is unusually high.

Although the units engaged in delivering bottle beer had a much better record than those handling draught beer, their experience nevertheless was considerably less favorable than that of most other industrial activities. This operation had an average of 56.5 disabling injuries per million employee-hours worked and, similarly, had a very high proportion of deaths and permanent impairments among the reported injuries.

MISCELLANEOUS OPERATIONS

Relatively few of the participating breweries reported any malting operations. The few reports received, however, showed an average frequency rate of 81.9, indicating a high degree of hazard in this operation. The maintenance departments had a fairly high average frequency rate of 41.0, and the garage units had a relatively high average of 32.9. The reporting power-plant units had an average frequency rate of 28.1, and the refrigeration units had an average rate of 22.0. The sales and the administrative and clerical units had average rates of 4.2 and 1.9, respectively, which are comparable with the experience of similar departments in other industries.

Regional, State, and City Injury-Frequency Rates

As brewery operations are largely standardized and follow much the same pattern regardless of the geographic location of the various plants, it is unlikely that the considerable variations in the average injury-frequency rates for different areas represent differences in inherent hazards. Primarily, the frequency-rate differences reflect variations in safety activities. Many factors contribute to these differences, and in particular instances it may be very difficult to specify which is the controlling factor. Differences in State safety requirements and in the degree to which the requirements are enforced have a very direct influence upon the frequency-rate levels in

different States. Similarly, safety activities, or the lack of such activities, on the part of trade associations or other organizations may have considerable effect upon the general accident record of an area. The average size of the plants in different areas and the availability or lack of experienced personnel are also factors which may influence the injury-frequency rate levels.

The 321 breweries participating in the survey were distributed among 35 States. As there were a number of States from which only one or two plants reported, representative State averages could be computed for only 19 States. The totals were combined, however, to provide averages for each of the nine geographic areas corresponding to the regions used in the tabulations of the United States Bureau of the Census.[2] In addition, it was possible to compute average frequency rates for 16 cities.[3]

The highest of the regional average frequency rates was that of the 10 breweries reporting from the New England States. These plants reported an average of 67.9 disabling injuries for every million employee-hours worked. As 8 of the 10 plants were located in Massachusetts this rate primarily reflects the experience of that State. The Massachusetts average frequency rate of 65.4 was exceeded only by the averages for Indiana and Colorado.

The East South Central region, with an average frequency rate of 31.4 based upon the experience of 6 plants, had the lowest of the regional averages. The Kentucky average of 37.4, computed from the reports of 4 of these breweries, was well below the national average. There were, however, 5 other States among the 19 for which averages were computed, which had lower rates.

In the Middle Atlantic region reports were received from 78 breweries. These plants had the high average frequency rate of 52.6, which was exceeded only by the average of the New England region. Within this region it was possible to compute separate averages for New Jersey, New York, and Pennsylvania. The New Jersey frequency rate of 27.6, based upon the records of 6 plants, was among the lowest of the State averages, and the Pennsylvania and New York averages (52.9 and 63.5, respectively), were among the highest. Separate city averages were computed for three cities in Pennsylvania and for two in New York. In Pennsylvania the 3 breweries reporting from Pittsburgh had an average frequency rate of 128.0, the highest of all the city averages. In the same State, three breweries in Wilkes-Barre had an average rate of 23.3, which was lower than the average for any other city. The Philadelphia average of 38.9, based upon the records of 8 plants, was somewhat better than the industry average. The 7 breweries reporting from New York City had a very high average, 70.2, which was exceeded only by the rates for Pittsburgh and Chicago. The Rochester (N. Y.) average, 40.0, covering the experience of 3 plants, was close to the median in the range of city rates.

The largest volume of reports received from any of the regions came from the East North Central States. The 136 reporting breweries in

[2] The regional groupings and the States included in each region are as follows: *New England.*—Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont. *Middle Atlantic.*—New Jersey, New York, and Pennsylvania. *East North Central.*—Illinois, Indiana, Michigan, Ohio, and Wisconsin. *West North Central.*—Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota. *South Atlantic.*—Delaware, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, and West Virginia. *East South Central.*—Alabama, Kentucky, Mississippi, and Tennessee. *West South Central.*—Arkansas, Louisiana, Oklahoma, and Texas. *Mountain.*—Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming. *Pacific.*—California, Oregon, and Washington.

[3] See Appendix, table 2.

this area had an average frequency rate of 46.0, which almost exactly matched the national average for the industry. Among the separate States comprising this region, Ohio had the lowest average frequency rate, 37.3. At the other extreme, Indiana had an average rate of 69.8, which was the highest State average computed. The rates of Michigan (42.4), Wisconsin (44.4), and Illinois (51.1) were all in the upper range of the State averages. Chicago had the highest city average in the region, 72.4, while Cleveland had the lowest, 33.4. Cincinnati and Columbus had average rates of 41.3 and 48.0, respectively; Milwaukee had an average rate of 47.2; and Detroit had a rate of 43.5.

The 25 breweries reporting from the West North Central States had an average injury-frequency rate of 39.2. These plants included 13 breweries in Minnesota for which the average rate was 35.6, and 9 breweries in Missouri, which had an average rate of 40.0. The 4 plants reporting from Minneapolis and St. Paul had an average frequency rate of 34.4, which was among the lowest of the city averages. The 4 breweries reporting from St. Louis had a slightly higher, but nevertheless better than average, rate of 38.9.

In the South Atlantic region the 11 reporting breweries had a relatively low average frequency rate of 33.6. The 4 Florida plants included in this group had an average rate of 13.9, which was the lowest among the entire group of State rates. The average frequency rate of 40.4 for the 3 breweries reporting from Maryland was relatively high in comparison with the Florida average, but was the median in the range of State rates.

In the West South Central region 10 breweries reported an average of 49.1 disabling injuries per million employee-hours worked. The 4 plants in Louisiana, all of which were in New Orleans, had an average rate of 51.4. The Texas average, based upon the experience of 5 plants, was 38.9.

For the Mountain States the regional average frequency rate, computed from the records of 18 breweries, was 48.1. Three of these plants (in Colorado) reported an average frequency rate of 67.1, which was the second highest State rate recorded.

Reports were received from 27 breweries in the Pacific region. As a group, these plants had an average frequency rate of 38.6, which ranked in the lower half of the regional averages. The 9 plants in the State of Washington, however, had a record substantially better than the regional average. The Washington rate (29.4) ranked third among the lowest of the State averages. In California the 14 reporting breweries had an average frequency rate of 40.3. The Los Angeles and San Francisco city averages of 37.2 and 37.4, respectively, were both in the lower half of the range of city rates.

Injury-Frequency Rate and Size of Plant

In many industries analysis of the accident experience of various plants has shown a direct correlation between the injury-frequency rates and the size of the plants as measured by employment. The most common findings have been that the small plants, in which the owners are in close contact with actual operations, and the large plants, which generally have safety engineers on their pay rolls, usually have the lowest average frequency rates. The medium-size plants, which are too large for intimate supervision by top management

and too small to have regularly established safety departments, commonly constitute the group which has the highest average frequency rate. In the brewery industry the same general pattern prevailed, although it did not appear to be so clear-cut as in some other industries.

Breweries employing from 100 to 499 workers had the highest general level of injury-frequency rates. For those with 100 to 249 employees the average rate was 51.3, while those with 250 to 499 employees had an average rate of 50.7. The group with the lowest average frequency rate (36.6) was composed of plants which employed from 25 to 49 employees. The plants with 50 to 99 employees and those with 500 to 999 employees, however, had only slightly higher averages, 37.7 and 38.7, respectively. The very small plants, with less than 25 employees, had an average frequency rate of 43.5, and the very large plants, with 1,000 or more employees, had an average of 48.3.[4]

Comparisons among the various size groups revealed another interesting relationship for which no positive explanation can be offered. The disability distribution indicated that, as the size of the plants increased, the proportion of permanent impairments also tended to increase. In none of the size groups composed of plants having fewer than 250 employees was the volume of permanent impairments greater than about 4.5 percent of the total volume of injuries reported. In the larger plants this proportion increased considerably, reaching 16 percent in the group made up of plants with over 1,000 employees. A possible explanation of this may be found in the fact that the larger plants frequently have medical service available on the premises, whereas most small plants must send their injured workers out of the plant for treatment. This means that some minor injuries must be counted as disabling [5] in the small plants, because the workers lose time in going outside for treatments, while identical injuries are not counted as disabling in the large plants because treatments can be obtained without the workers' taking time off. This circumstance would not affect the volume of permanent impairment cases, but would affect the volume of injuries counted as temporary disabilities, and thereby would affect the relationship between the permanent impairments and the total number of disabling injuries reported. A plant reporting a given volume of permanent impairments, therefore, might show either a high or low proportion of such cases, depending upon whether or not medical attention was available on the premises.

Kinds of Injuries Experienced

PLANT-WIDE EXPERIENCE

Inasmuch as the basic purpose of an accident prevention program is to prevent the occurrence of events which result in injuries, analysis of the injuries which have occurred can serve a definite purpose in setting the stage for the more pertinent analysis of accident causes. It also performs a direct "injury prevention" function by indicating the possibilities of utilizing personal protective equipment to supplement more specific accident prevention methods.

[4] See Appendix, tables 3 and 4.

[5] A disabling injury is one which results in death or permanent impairment, or causes the loss of time beyond the day of injury. Only disabling injuries are counted in computing the standard injury frequency rate

Personal protective equipment does not prevent accidents, but its use does reduce the probability of injury when accidents of certain types occur. Consideration of the need for personal protective equipment, therefore, is fundamental in any successful safety program.

In the course of this survey it was observed that workers in the bottling departments generally were very conscious of the eye hazards created by breaking bottles. As a result, the use of impact goggles by workers in these departments was quite common. Other types of personal protective equipment, however, were seldom seen in the breweries which were visited.

In the broad review of the types of injuries which were disabling, the most striking fact was the high proportions of strains, sprains, hernias, bruises, contusions, and concussions, which together constituted over 55 percent of the entire group of cases examined.[6] These are all types of injuries which are commonly associated with heavy work, particularly with the manual moving of heavy materials. In this connection it is pertinent to note that previous studies of this nature have been made in the foundry and longshore industries, both of which have a great deal of heavy manual work.[7] In the stevedoring industry, however, only 53 percent of the disabling injuries were in these categories; and in the foundry industry the proportion of such injuries was only about 40 percent. Of specific interest is the fact that hernia cases alone constituted 1.5 percent of the disabling injuries in breweries, but amounted to only 0.9 percent in stevedoring and 1.3 percent in foundry operations. The implication involved in these figures obviously is that further investigation should be made to determine why injuries of the types listed above outrank all others in the brewery industry.

Injuries to hands and fingers were more common among the brewery disabilities than were injuries to any other part of the body. These cases accounted for nearly 29 percent of the entire volume of disabilities. More than half of the hand and finger injuries were cuts or lacerations. Most of the others consisted of bruises, fractures, or sprains, which commonly occurred as a result of pinching, crushing, lifting, or striking-against types of accidents. No satisfactory type of personal protective equipment to guard hands and fingers from such injuries has been designed. On the other hand, cuts and lacerations arising from contact with sharp or rough materials frequently can be avoided through the use of gloves or other flexible hand coverings. It appears, therefore, that increased use of hand coverings in the brewing industry might effect a substantial reduction in the number of hand and finger injuries.

Injuries to legs, feet, and toes, as a group, accounted for nearly 28 percent of all the brewery disabilities. The most common leg injuries were bruises, sprains, cuts, and fractures. Leg sprains and fractures probably cannot be effectually minimized through the use of personal protective equipment. The use of aprons made of leather or other heavy material, however, is an effective means of avoiding leg cuts and bruises, particularly above the knee. The possibility of extending the use of such equipment, therefore, should be given consideration.

About 40 percent of the foot injuries were sprains or strains. It is improbable that any personal protective equipment could have

[6] See Appendix, tables 5 to 9.
[7] See Bureau of Labor Statistics Bull. No. 764: Injuries and Accident Causes in the Longshore Industry, 1942; and Bull. No. 805: Injuries and Accident Causes in the Foundry Industry, 1942.

prevented many of these injuries. Most of the other foot injuries and practically all of the toe injuries, however, consisted of bruises, cuts, punctures, or fractures. Many of these injuries undoubtedly would have been avoided if the injured workers had been wearing safety shoes.

The third major group of disabilities consisted of injuries to the trunk. This group included over 27 percent of the recorded cases. Approximately two-thirds of these were strains, sprains, or hernias, and about one-fourth were bruises. Personal protective equipment probably would not have prevented any appreciable number of these injuries. It is apparent, however, that measures should be taken to avoid overexertion and that the methods of moving materials in breweries should be given close scrutiny.

Head injuries accounted for about 9 percent of the disabilities. Somewhat more than a third of these cases were eye injuries. The rather general practice of wearing impact goggles in the bottling departments undoubtedly prevented the eye-injury total from being far higher. Wider use of such protective equipment in all operations involving eye hazards might have eliminated nearly all of the eye injuries which did occur. The use of face shields and hard hats wherever the danger of being struck by falling or flying material exists probably would have substantially reduced the volume of other head injuries.

To summarize, therefore, the over-all injury analysis indicates that a substantial volume of injuries could be avoided in the brewing industry through improved material-handling methods and by increasing the use of personal protective equipment, particularly gloves, goggles, safety shoes, leather aprons, face shields, and hard hats.

It was expected that the incidence of the various types of injuries would vary from one department to another and that the relative importance of the indicated protective measures would be different in the separate departments. To throw some light on this subject, therefore, the injuries were classified into the three major operating divisions of the industry and reexamined.

DEPARTMENTAL EXPERIENCE

Brewhouse Departments

Trunk injuries, accounting for nearly 35 percent of the brewhouse disabilities, were of primary importance in these departments. Strains and sprains resulting from incorrect lifting procedures were particularly common. About one-fourth of the trunk injuries, however, resulted from accidents in which employees fell, bumped into objects, or were struck by moving objects. From the injury prevention standpoint, therefore, the development of safe methods of moving heavy materials and a general improvement in housekeeping should be recognized as being of first importance in the brewhouse departments.

Next in numerical importance were the leg, foot, and toe injuries. As a group, these cases accounted for nearly 30 percent of the brewhouse disabilities. The leg injuries consisted primarily of bruises, sprains, and fractures. Many of these injuries resulted when workers were struck by barrels which were being rolled from the racking machine. The development of a safer procedure for moving the

barrels at this point would improve the injury record of many breweries.

Foot injuries in the brewhouse departments consisted primarily of bruises and sprains, while toe injuries were mainly fractures and bruises. Most commonly, foot and toe injuries were inflicted by dropped materials. It is apparent, therefore, that the use of safety shoes should be encouraged in the brewhouse departments.

Arm, hand, and finger injuries together were responsible for over one-fourth of the brewhouse disabilities. Within this group, over half the cases were finger injuries. The finger injuries were primarily cuts, fractures, or bruises, while the hand injuries were mainly cuts, sprains, or bruises. The cuts were largely the result of contact with imbedded metal or glass in kegs or with loose hoops on kegs or barrels. The bruises and fractures most often were the result of hands or fingers being pinched or crushed between barrels in piling operations. More general use of gloves when handling kegs or barrels undoubtedly would be effective in reducing the number of hand and finger cuts, but probably would not reduce the volume of bruises and fractures.

Injuries to the head accounted for about 9 percent of the brewhouse disabilities. Burns or scalds affecting the face or eyes were particularly important in this group, which indicated a need for increased use of goggles and face shields in operations involving the handling of hot liquids.

Bottling Departments

In the bottling departments, injuries to the upper extremities were by far the most common. Hand and finger injuries alone constituted about 40 percent of the disabilities in these departments. Most of these injuries consisted of cuts or lacerations resulting from contact with broken glass or the sharp edges of bottle caps.

Because of the large number of hand and finger cuts, extensive inquiries were made as to why hand coverings were not more widely used by workers in the bottling departments. Generally the responses to these inquiries indicated that the workers were not convinced of the need for hand coverings or that they found such equipment inconvenient. Canvas gloves were the most common hand coverings in use. However, objections to their use were raised on the ground that they are not durable. Leather gloves had been tried in some plants, but it was reported that they had been discarded because dampness led to mold on the leather, which in turn had produced a number of cases of dermatitis on the hands of the wearers. Metal gloves similar to those used in the slaughtering and meat-packing industry had been tried in one of the breweries which were visited. The workers there, however, objected to using them, claiming that the metal cut into their hands and fingers. In this connection it seems pertinent to note, however, that despite the widespread use of metal gloves in the slaughtering and meat-packing industry not one complaint of this nature was encountered in the course of the Bureau's study of injuries in that industry.

In view of this record there can be little doubt as to the desirability of increasing the use of hand coverings in the bottling departments. The selection of the particular type of hand covering to be used, however, obviously presents a problem which must be resolved in each plant.

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Injuries to legs, feet, and toes as a group accounted for about 21 percent of the disabilities in the bottling departments. Injuries which were limited to the toes were not very numerous. Nearly all of the toe injuries, however, could have been avoided if the injured persons had been wearing safety shoes. Safety shoes also might have prevented a considerable number of the disabilities designated as foot injuries. One in every three of the foot injuries was a sprain and one in every eight was a burn or scald inflicted by hot liquid. Safety shoes would not prevent injuries of these types. The fact that most of the foot sprains resulted from slips on loose material or slippery working surfaces, however, indicates that improved housekeeping in the bottling departments could effect a substantial reduction in the volume of foot injuries.

Leg injuries in the bottling departments consisted primarily of bruises, cuts, and sprains. Many of these were the results of slips or falls on wet or cluttered working surfaces. A considerable number of the leg cuts and bruises, however, came from forcible contacts with filled cases which the injured persons were handling. Leather aprons probably would have prevented some of these injuries.

As a group, trunk injuries represented over 19 percent of the bottling department disabilities. Back strains were particularly common among these cases. Most of the back strains resulted from improper lifting, such as lifting cases or cartons with the back bent, lifting while in a cramped or awkward position, or lifting heavy materials from heights beyond easy reach. Bruises were second in numerical importance among the trunk injuries. Accidents in which employees fell, bumped into objects, or were struck by moving objects were responsible for most of the bruises.

About 11 percent of the disabling injuries in the bottling departments were head injuries. A majority of these were cuts or lacerations, most of which were inflicted by flying glass from exploding bottles. Despite the rather general use of goggles to protect the eyes from flying glass, eye injuries constituted over 43 percent of the head-injury group. It appears, therefore, that the use of eye-protection devices could profitably be extended. Cuts on the face were very common—an indication that goggles alone do not furnish complete protection. Plastic face shields probably would be helpful in avoiding such injuries.

Delivery Departments

In the delivery departments, injuries to the trunk and injuries to the lower extremities each accounted for about one-third of the disabilities. In the trunk injury group nearly three-fourths of the cases were strains or sprains, with back sprains predominating. Most of these injuries were the results of lifting accidents.

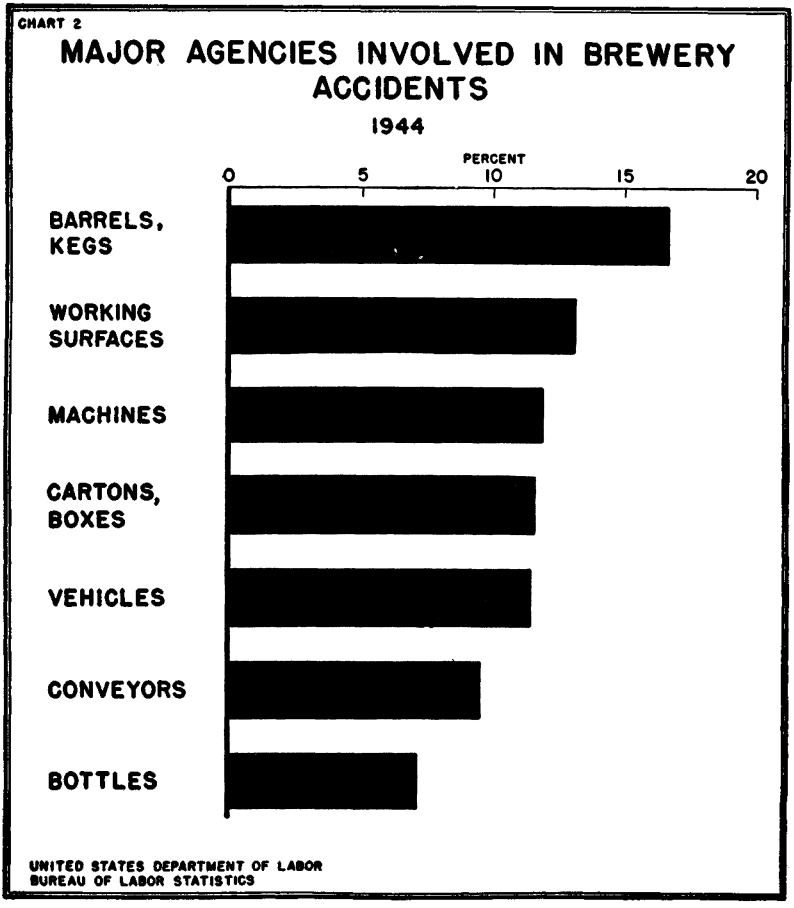
Strains and sprains were also common among the leg and foot injuries, but were not nearly so numerous as were bruises. Slips and falls were the sources of a large proportion of the sprains to legs and feet and similarly were responsible for many of the bruises. Most of the bruises to the lower extremities and practically all of the rather numerous fractures, however, were caused by dropped materials. Safety shoes or metal foot guards could have prevented many of these foot and toe injuries, and leather aprons probably would have been effective in eliminating some of the leg injuries.

Nearly a fourth of the delivery department disabilities consisted of injuries to hands or fingers. Many of these were cuts resulting from contact with rough or sharp materials. A substantial proportion, however, were fractures or bruises caused by hands or fingers being crushed under or between the cases or barrels which the workers were handling. Greater use of gloves would eliminate many of the hand or finger cuts. Improved material-handling procedures are necessary, however, to reduce the volume of bruises and fractures.

Head injuries were relatively less numerous in the delivery departments than in the other departments of the brewing industry. There were, however, a sufficient number of eye injuries to indicate that the use of goggles should be encouraged in some of the delivery department operations.

Agencies Involved in Accidents

The determination of the particular physical items which are most commonly involved in the occurrence of injuries constitutes a fundamental step in the development of a successful safety program. When these items are known it becomes possible to take direct action to learn why and how they contribute to the occurrence of injuries, and



then to take measures to overcome the accident-producing possibilities of these items. To permit the precise determination of these items, which are commonly termed "agencies," the American Recommended Practice for Compiling Industrial Accident Causes defines an agency as "the object or substance which is most closely associated with the injury, and which in general could have been properly guarded or corrected."

Analysis based upon this definition points directly to barrels or kegs, working surfaces, machines, cartons or boxes, and vehicles as the outstanding injury-producing agencies in the brewing industry.[8] Barrels and kegs were the indicated agencies in over 16 percent of the cases analyzed. In many of these instances, the accident grew out of faulty handling procedures rather than from defects in the barrels or kegs. Working surfaces, constituting the second most prominent agency group, were involved in 13 percent of the accidents. In this group, slippery or rough floors predominated although there were a substantial number of cases involving defective platforms, roadways, and other working surfaces.

Machines, other than elevators or conveyors, were involved in the occurrence of nearly 12 percent of the injuries. The importance of this group of cases, however, was enhanced by the fact that a relatively large proportion of the injuries associated with machines resulted in permanent disabilities. This was particularly true among the cases in which contact with the machine occurred at the "point of operation." The most striking fact about the accidents associated with machines, however, was that well over half of the injuries resulted from workers being struck by or cut by glass from bottles which burst while in the machines. Among the cases in which labeling machines were the designated agency over 75 percent of the accidents were of these types, and in the group involving pasteurizers the proportion was more than 80 percent. It is specifically indicated, therefore, that greater attention should be given to the provision of guards on these machines which will prevent broken glass from flying, and to the development of safer procedures for the removal of broken glass from the machines.

Conveyors and chutes were the designated agencies involved in nearly 10 percent of the accidents. In this group of cases, as in the group associated with other machines, the proportion of injuries which developed into permanent disabilities was particularly high. Most commonly, the injuries resulted from contact with the materials which were being carried upon the conveyors or chutes. There were, however, a substantial number of cases involving contact with belts, pulleys, gears, and other moving parts of conveyors—an indication that additional attention should be given to the guarding of this type of equipment, particularly at nip points.

Accidents in which vehicles were indicated as the agencies were responsible for over 11 percent of the disabling injuries. In the majority of these cases the vehicle involved was a delivery truck. There was, however, a substantial number of cases involving other types of vehicles, such as hand trucks, railroad cars, and horse-drawn wagons.

Cartons and boxes were the injury-producing agencies in another 11 percent of the accidents analyzed. In most instances these were

[8] See Appendix, table 10.

"struck by" accidents, in which the cartons or boxes either were dropped while being lifted or carried or fell from improperly built piles. There was, however, a substantial number of cases in which the injury resulted from the worker getting a part of his body caught and pinched or crushed between boxes or cartons in the course of piling or moving the materials. Sharp edges, splinters, and sharp wires on the boxes and cartons also produced many injuries.

Bottles were directly associated with about 7 percent of the injuries. These cases included many cuts from handling chipped bottles or from bottles which burst after they had been removed from the machines and conveyors. Bottles which burst while in the machines or on the conveyors were not designated as agencies, inasmuch as at that stage they were considered as being integrated with the machines and not as being independent units.

Among the other agencies of lesser prominence, but nevertheless of importance as producers of disabling injuries, were slippery or cluttered stairways, defective ladders, and defective tanks or vats. The defective stairways were responsible for about 3 percent of the disabilities, while the defective ladders, tanks, and vats together accounted for another 3 percent.

Accident Types

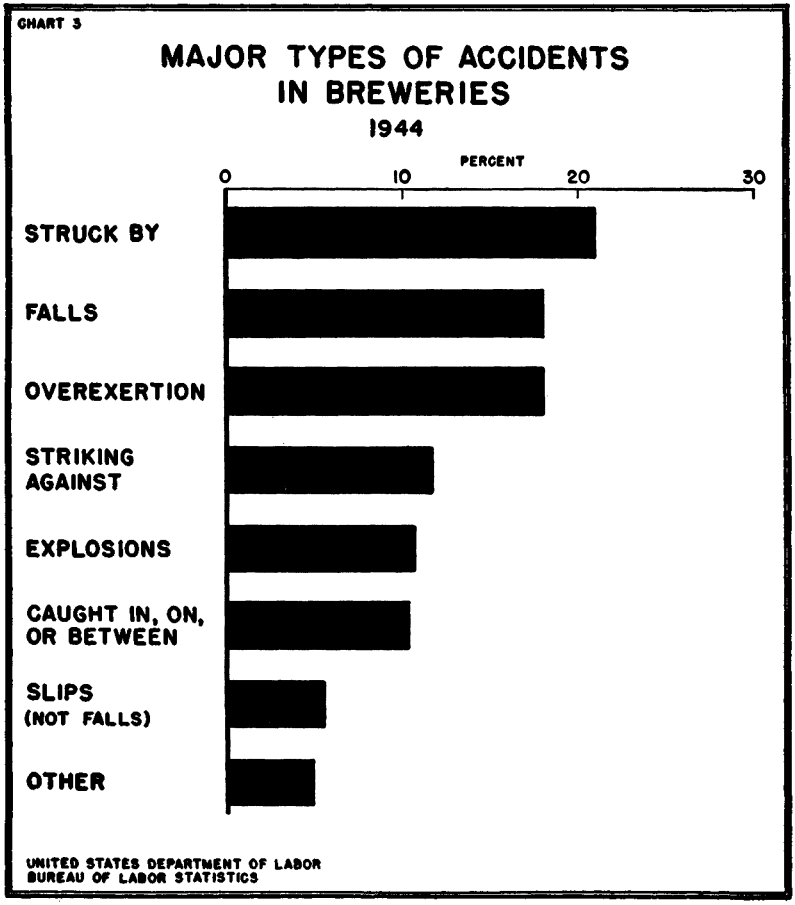
Most common among the accidents which resulted in disabling injuries were those in which the injured workers were struck by moving, falling, or flying objects.[9] This type of accident was responsible for 21 percent of the entire group of injuries for which details relating to the manner of their occurrence were available. From the accident prevention point of view, however, it is pertinent to note that there were wide variations in the relative importance of these accidents in the various departments. In the delivery departments "struck by" accidents were particularly outstanding, accounting for over 28 percent of the recorded disabilities. In the brewhouse departments they accounted for nearly 23 percent of the disabling injuries, but these cases were slightly outnumbered by the injuries resulting from overexertion. In the bottling departments, on the other hand, the "struck by" cases accounted for only 13 percent of the disabling injuries and were definitely outnumbered by the accidents of the explosion and "striking against" types. Generally speaking, the agencies most frequently involved in the "struck by" accidents were cases and kegs.

In the aggregate, accidents ascribed to overexertion were only slightly less important than were the "struck by" cases. It is noteworthy, however, that all but 1 of the 769 injuries resulting from accidents of this type were temporary in nature, whereas 5 percent of the injuries resulting from "struck by" accidents ended in death or permanent disability. Overexertion accidents also were of much greater importance in the delivery and brewhouse departments than in the bottling departments. In the brewhouse departments they accounted for over 23 percent of the disabling injuries, outnumbering the cases in any other accident-type category. In the delivery departments the overexertion accidents accounted for 24 percent of the disabilities, but were second in number to the "struck by" cases. In the bottling

[9] See Appendix, tables 11 and 12.

departments somewhat less than 12 percent of the disabling injuries resulted from overexertion, placing this category fourth among the more important accident types.

The volume of disabling injuries resulting from falls was practically identical with the number ascribed to overexertion. In this group of cases, the accidents in which the injured employee fell only to the



surface on which he was walking or standing outnumbered by 2 to 1 the instances in which the fall was to a lower level. As might be expected, however, the injuries resulting from falls to lower levels were generally more serious than those resulting from falls on the same level. In the brewhouse departments, falls were particularly common, accounting for over 23 percent of all the disabling injuries. In large measure the falls in the brewhouse departments were due to slippery floors and tripping hazards, such as hose lines extending across the working areas. In the delivery departments, falls were the source of about 18 percent of the disabling injuries. A substantial proportion of the falls experienced by the delivery department workers

occurred away from the employers' premises. However, many of these accidents consisted of falls on or from the employers' trucks. Falls at the shipping area of the plants commonly resulted from slippery surfaces, tripping hazards, unbridged openings between the docks and trucks, or from such unsafe practices as jumping from the dock or from trucks, or from climbing on unstable or irregular piles of materials. In the bottling department, falls were a somewhat less important source of injury than in either the brewhouse or the delivery department. Nevertheless, falls on the same level produced about 10 percent of the bottling department disabilities, and falls from one level to another accounted for over 3 percent more. Most of the falls in the bottling department resulted from slippery floors or from tripping hazards in the work areas.

Accidents in which the injured person bumped into or struck against objects or equipment accounted for over 11 percent of the entire group of disabling injuries. This type of accident was particularly common in the bottling departments, where it was responsible for nearly 16 percent of the injuries. In the brewhouse and delivery departments about 8 percent of the injuries resulted from "striking against" accidents. Cuts and lacerations from contact with broken bottles were the most common injuries resulting from these accidents in the bottling departments. In the brewhouse and delivery departments the objects most frequently bumped into were kegs, cartons, and cases.

Accidents involving explosions, nearly all of which were bottle explosions, produced about 10 percent of the disabling injuries. The great majority of these accidents occurred in the bottling departments, where they produced more injuries than were ascribed to any other type of accident. A high proportion, nearly 7 percent, of the injuries produced by explosions resulted in permanent disabilities, the most common of which was the loss of vision in one eye.

Accidents in which employees were caught in, on, or between objects or equipment also accounted for about 10 percent of the disabling injuries. Gears, pulleys, and belts were the agencies most commonly involved in these accidents, and the resulting injuries frequently were very severe. More than 13 percent of these injuries developed into permanent disabilities.

Accidents in which the injured workers slipped on wet, greasy, or irregular surfaces, but did not actually fall to the floor or ground, were responsible for over 5 percent of the disabling injuries. These accidents were most common in the brewhouse and delivery departments. As a rule, the resulting injuries were strains or sprains.

Accidents involving contact with extreme temperatures, which accounted for 3.5 percent of the entire group of disabling injuries, were rare in the delivery departments, but were the source of over 5 percent of the brewhouse injuries and of nearly 4 percent of the bottling department injuries. In most instances these accidents involved contact with hot liquids.

Accident Causes

Modern accident prevention is based upon two premises—first, that there is an identifiable cause for every accident; and second, that when an accident cause is known, it is generally possible to

eliminate or to counteract that particular cause as the probable source of future accidents of the same character. In many instances, it is true that a variety of circumstances contribute to the occurrence of an accident, and the line which accident prevention should take may seem confused because of the multiplicity of the possible courses of action. It is generally recognized, however, that every accident may be traced to the existence of some unsafe working condition, to the commission of an unsafe act by some individual, or to a combination of these accident-producing factors. In the analysis of individual accidents for the purpose of establishing an effective safety program, therefore, it is essential that particular attention be given to the identification of these elements in the chain of circumstances leading to the accidents. Concentration upon the elimination of the unsafe conditions and practices identified by such analysis, with emphasis upon the elimination of the elements which are found to have contributed to many accidents, will almost invariably result in improved safety records.

The correction of unsafe working conditions generally is entirely within the powers of management. The avoidance of unsafe acts, on the other hand, requires cooperation and understanding by both management and workers. Management must take the lead, however, by providing safety-minded supervision and by making sure that all workers are acquainted with the hazards of their operations and are familiar with the means of overcoming them.

UNSAFE WORKING CONDITIONS

Within individual plants the relative importance of the various types of unsafe conditions noted in the course of the survey varied widely. Similarly, the types of hazards prevailing in the various departments of individual plants differed greatly. The broad conclusions derived from the study, therefore, may not be taken as applying in their entirety to any particular plant or to any particular department. Nevertheless, the available evidence indicates that there are a number of simple precautionary measures which are frequently overlooked in brewery operations and that a substantial improvement in the industry's accident record could be achieved if these safety measures were established as fundamental parts of the safety program in every brewery. No safety program will be complete if it is based only upon these measures; but, on the other hand, it is apparent that no brewery safety program can be fully effective unless it stresses attention to the following: [10]

1. Machines and conveyors which carry bottles should be completely enclosed to eliminate the hazard of flying glass in the event of a bottle explosion.

2. The nip points on all power conveyors should be fully guarded and all conveyors should be equipped with rails or guides to prevent materials from falling from the conveyors.

3. The space under conveyors should be closed off so that employees cannot pass under them except at designated passageways. Where there is insufficient head room for passageways under conveyors, steps or stiles should be built to provide safe cross-overs.

[10] See Appendix, tables 13 and 14.

4. Adequate guards should be provided at the point of operation of all machines and over all gears, pulleys, belts, or other moving parts of machines.

5. All delivery trucks and trailers should be equipped with steps and hand holds to provide safe access to the body of the vehicles.

6. All bottles should be tested under pressure for strength before filling.

7. All barrels, cartons, and cases should be inspected for rough edges, projecting nails, and embedded pieces of glass or metal as well as for other defects.

8. All premises, equipment, and hand tools should be inspected frequently and immediately replaced or repaired if found to be defective.

9. Guard rails or hand rails should be installed on all platforms and stairways. Stiles over conveyors should have hand rails on each side.

10. All portable ladders should be equipped with ladder safety shoes. Substantially anchored permanent ladders should be provided wherever frequent access to particular elevations is necessary.

11. Guide rails or runways should be provided wherever it is customary to move barrels or kegs by rolling. These runways should slope slightly toward the destination of the barrels to prevent their rolling back.

12. Nonslip surfaces should be provided in all working areas and on all stairways and steps.

13. Personal protective equipment should be provided where needed and employees should be required to use such equipment.

14. Adequate provision should be made for the safe removal of broken glass from machines, conveyors, and floors; and employees should be thoroughly trained in the safe performance of this function.

15. Mechanical equipment should be used in the moving of filled barrels, kegs, and cases wherever possible both in the plant and in making deliveries. Where mechanical equipment cannot be used, limits should be set upon the weights to be handled by individuals and adequate assistance provided when overweight or awkward materials must be lifted.

16. Housekeeping conditions generally should be improved, with particular attention to the prompt removal of tripping and slipping hazards.

Hazardous Arrangements and Procedures

The importance of careful planning for all plant operations and of maintaining strict supervision throughout such operations as a means of avoiding accidents cannot be overemphasized. When agencies which are not inherently hazardous are arranged or regularly used so as to create hazards, the unsafe conditions and the resulting accidents must be ascribed to a failure on the part of management to exercise one of its proper functions.

More than 43 percent of the accidents which occurred because of an unsafe working condition were caused by hazardous arrangements or procedures in operations which normally can be carried on safely. Such hazards were particularly prominent in the brewhouse and delivery departments. The most common unsafe procedure was that of laying out material-handling operations without provision for the

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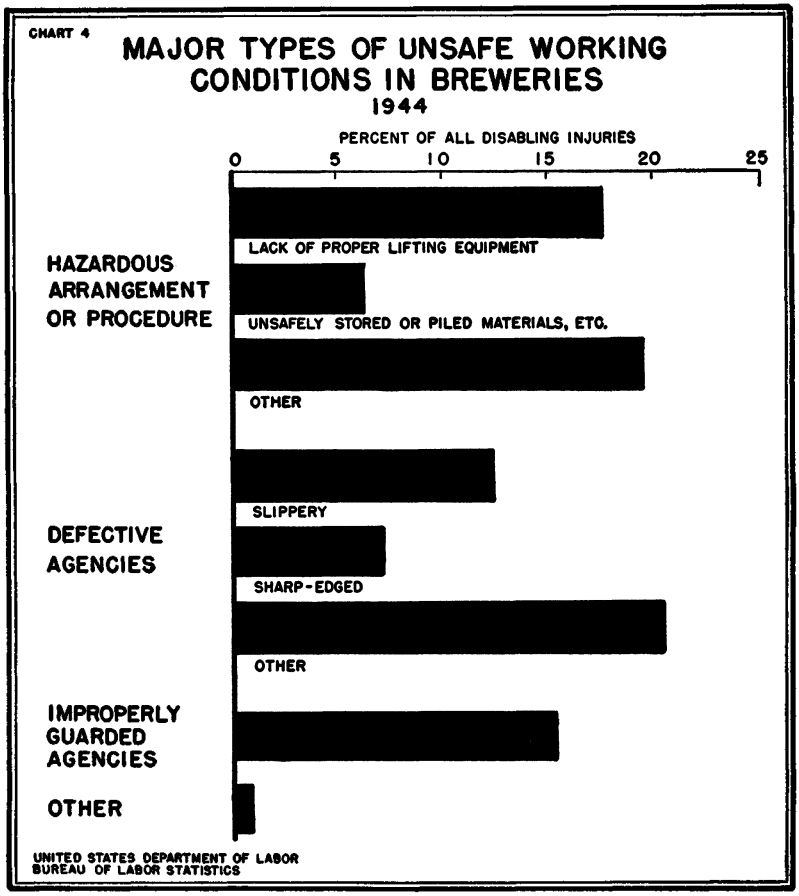


use of mechanical equipment or adequate assistance to insure safety in lifting.

Generally, brewery safety engineers agreed that the maximum weight which any worker should be expected or permitted to lift or to push up an incline without assistance should not exceed that of a filled quarter barrel or a single case of beer. The accident record, however, indicated a number of instances in which over-limit loads were being handled. Assignment of additional help when heavy materials are to be handled, however, cannot be considered an effective solution for this problem. In many of the reported cases of overlifting sufficient help had been provided, but workers had had no training in working as a team.

Basically it should be the duty of the immediate supervisor to see that proper safe procedures are followed in handling heavy materials. He should be held responsible for training the workers in those safe procedures and should be expected to observe such operations closely to insure that violations are quickly discovered and corrected.

Unsafely stored or piled kegs, barrels, cartons, or cases also contributed to a substantial volume of accidents in the delivery depart-

ments and, to a somewhat lesser volume, in the brewhouse and bottling departments. Unstable piling was the chief unsafe condition in this category. Generally, these conditions resulted from piling containers on irregular surfaces or from a failure to interlock properly the tiers in the piles. In some instances, it was reported that kegs were piled on their sides without sufficient blocking to keep the bottom tier from rolling. The lack of proper bracing to hold barrels or cases in trucks or freight cars also caused many injuries when gates or doors were opened for unloading. In numerous reported instances, workers were injured in reaching above their heads to place or remove materials at the top of piles, or fell when they attempted to climb up or down the vertical side of a pile. Strict limitations upon the height of hand lifts and the construction of stepped piles will do much to avoid such accidents.

Tripping and bumping hazards, created by misplaced material or debris in walkways or on working surfaces caused many accidents in each of the three departments (bottling, brewhouse, and delivery) but were most prominent in the bottling and brewhouse departments. Broken glass on the floor was the chief hazard of this type in the bottling departments. Most plants had rules that broken glass should be cleaned up promptly, but generally enforcement was rather lax. Dust pans and brooms should be used for this work and gloves should be worn when it is necessary to handle the broken material. In the operation of some machines, however, the use of gloves is a definite hazard; the gloves may easily become caught in the moving parts and pull the operator's hands into the machine. When the operators are required to clean up broken glass around their workplaces they must be trained to remove their gloves before returning to their machines.

The principal tripping hazards in the brewhouse departments were created by hose lines lying on the floor. In some sections the complete elimination of this hazard is probably impossible without extensive plant remodeling. In new units, however, there seems to be little reason why facilities cannot be incorporated which will eliminate practically all of these hazards. Existing plants can minimize the hose hazard by providing fenced or marked-off areas or lanes in which hose lines may be laid, particularly when not in actual use. Where hose lines must cross aisles or walkways, it is frequently possible to carry them overhead, or to place warning standards over them, thus eliminating some tripping. The use of white hose will also attract attention and thereby prevent some accidents.

A substantial number of falls were reported to have occurred because bottles or other materials were left on steps or in passages. Such poor housekeeping within a plant is inexcusable evidence of lax supervision. Delivery department records showed numerous cases of such falls on the premises of customers. Brewery management can exercise little control over unsafe conditions on the customer's premises, but delivery personnel can be specially trained to acquaint them with methods of overcoming hazards encountered outside the plant. Such training probably should include instructions not to carry or move any materials into a customer's premises until the route is thoroughly checked for tripping, bumping, or falling hazards. Any such hazards probably should be reported both to the customer and to the delivery superintendent. When extreme hazards or frequently

recurring hazards are encountered it would be advisable for a company representative to visit the customer and insist on improvements.

The number of accidents in which workers were struck by barrels rolling from the racking machines or experienced strains or sprains as a result of kicking barrels into motion indicates a need for completely revamped procedures. It was common for the racking-machine operator to start the filled barrels rolling by kicking them and to allow them to roll freely across the floor away from the machine. In some plants, the floor was constructed with a slight slope away from the racking machine; in others the floor was level. The freely rolling barrels frequently left their intended path and at times struck workers or machines. The employee engaged in moving the barrels from the floor to the conveyor or to the storage racks was constantly faced with the possibility of being struck by the freely rolling barrels. Many plants eliminated these hazards by installing a sloping track on which the barrels are rolled directly from the racking machine to the point of transfer to the conveyor or storage racks. Good safety practice should also bar the kicking of barrels into motion.

In the bottling departments many reported injuries resulted from employees striking their heads as they attempted to walk under conveyors. Some plants tried to minimize such bumping hazards by placing pads (sometimes discarded beer hose) over the corners and projections on the under side of conveyors. This procedure, however, cannot be recommended, except as a temporary expedient. All spaces under conveyors which do not have sufficient head room to be used as passageways by persons walking erect should be barricaded. When walkways are necessary to cross conveyors at points where head room is insufficient under the conveyors, steps or stiles should be provided.

The hazards connected with cleaning tanks are generally well known in the brewing industry, but the volume of injuries incurred in this operation indicates frequent neglect of the proper precautionary measures. Workers who must enter closed spaces where there is any possibility of toxic fumes or of oxygen deficiency should be furnished with air-line respirators and life lines. The door into any tank in which work is being done should be blocked open and posted with a prominent notice that employees are inside, and the valves on all pipes leading into the tank should be locked in closed position. Because of the great slipping hazards inside most tanks, particular attention must be given to the design and manner of using the necessary equipment. Ladders in use should be anchored at the top, if at all possible. In any event, all ladders should be equipped with effective nonslip ladder safety shoes. Generally, however, the preferable safety measure is to substitute scaffolds for ladders.

It is doubtful if any safety engineer, representative of management, machine operator, or maintenance man will question the fundamental safety rule that no cleaning, repairing, or adjusting of machinery or other moving equipment should be performed while it is in operation. Nevertheless, injuries resulting from violations of this rule were relatively frequent in the brewing industry. This indicates that many supervisors were permitting if not encouraging this procedure. Workers were frequently caught in moving parts while removing broken glass from machines or while cleaning beneath machines. Others were injured while repairing or adjusting machines

during regular production operations. Similarly, in numerous instances employees were injured in attempting to release materials which had jammed on conveyors without first stopping the conveyors. In other instances, workers who were repairing or adjusting stopped machines were injured when other persons started the machines. Thorough training in the safe methods of cleaning, adjusting, or repairing machines for all employees who work on or about machines and strict supervision to enforce the instructions are essential for the elimination of such accidents. Moreover, the control switch on every machine or power circuit should be constructed so that it may be padlocked in its open position, and repair men should be required to lock any machine or power circuit before starting work.

In the delivery departments there was a considerable volume of accidents in which workers fell while attempting to climb into or out of trucks which were not equipped with steps or footrests for use in entering or leaving the truck body. In several instances, side or end gates were utilized as ladders and the employees were thrown to the ground when the gate slipped. Although enforcement is difficult when employees are working away from the plant, management should see that delivery personnel are thoroughly instructed in safe procedures. Each driver should be responsible for the enforcement of safe procedures on the part of his helpers. Management should also see that every truck is equipped with steps and hand holds. Ropes used as hand holds should be inspected frequently and renewed at the first sign of wear or weakness.

Other unsafe practices which led to numerous accidents included the use of barrels or cases as platforms or in place of ladders, and allowing operations to extend into aisles or passageways. Safe ladders, platforms, or scaffolds should be made easily available for use when it is necessary for any one to work at levels beyond easy reach from the floor; the use of boxes or barrels for such purposes should be strictly prohibited. Frequently traveled aisles or passageways should be fenced insofar as practicable. If fencing is impracticable, the boundaries of the aisles should be marked with painted stripes and the area between the stripes should be kept clear at all times.

Defective Agencies

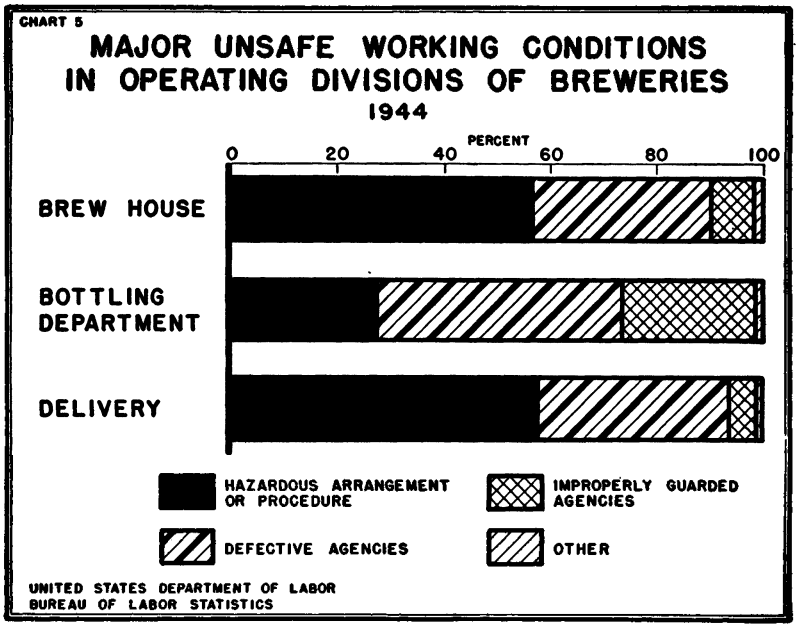
Unfortunately, the record indicates that in many breweries the safety and safety-inspection standards appear to be much below those applied to product quality. In the brewhouse, for instance, barrels are inspected for cleanliness and strength, yet numerous injuries resulted from contact with projecting metal or glass imbedded in the barrels. Similarly, in the bottling department the bottles passed through several inspections during the various operations, but many bottle explosions were ascribed to defective bottles by the plant safety engineers.

In the aggregate, 40 percent of all the accidents associated with any unsafe working condition were attributed to defects in materials and equipment. In the bottling departments the proportion was 46 percent; in the brewhouse it was 34 percent; and in the delivery department it was 36 percent.

Slippery or otherwise defective working surfaces were the most common of all unsafe working conditions. Wet floors caused many slips and falls, particularly in the brewhouse departments. This

hazard was generally recognized and most of the breweries which were visited were making an effort to overcome it. In one plant, large fans had been installed to speed the drying of the floors through evaporation. The most effective installation was nonslip flooring, several varieties of which are available commercially. Slippery stairways also caused a considerable number of injuries. Nonslip surfaces on the stair treads and stout hand rails on both sides should be considered as absolute minimum provisions for safety. Holes, bumps, and other irregularities in floors, roadways, and platforms were also responsible for a number of injury-producing accidents. Most of these conditions were the result of wear or gradual deterioration resulting from inadequate maintenance.

Defects in the vehicles or their parts were directly responsible for a third of all the accidents involving vehicles. Falls on or from slippery truck bodies were the most common accidents in this group. From the continual sliding of heavy materials over the metal surfaces of truck bodies, surfaces wear smooth and are slippery when wet. Therefore, it is advisable to install some form of corrugated or other nonslip truck flooring. Corrugated surfaces should also be provided and maintained in rough condition on all steps used for entrance into trucks. In a number of cases it was reported that ropes, which were being used as hand holds to assist employees in climbing into trucks, had broken and caused the workers to fall. Such ropes should be inspected regularly and should be replaced on discovery of the first sign of wear. During the period covered by the survey, many of the plant garages were understaffed because of the difficulty in finding competent automobile mechanics. For this reason, the trucks were frequently operated while in need of repairs and rather numerous accidents resulted from efforts to start motors by cranking when the starting units failed.



Most breweries inspect cartons and cases before putting them into service. However, substantial evidence existed that this inspection was not sufficiently thorough. A considerable number of injuries were caused by the bottoms dropping out of filled cases and some times more than one person was injured by flying glass from the bursting bottles. Sharp or splintered edges on the cases also produced many hand injuries. Similarly, loose or bent ends of wire or metal strapping on cartons and loose hoops on barrels or kegs frequently caused injuries.

Inadequate Guards

About 15 percent of the accidents arising from unsafe working conditions resulted from a lack of adequate guards on machines, elevators, conveyors, or other hazardous equipment. This proportion is relatively small in comparison with the volume of accidents resulting from hazardous arrangements or procedures or from defects. However, 1 in every 11 of the accidents caused by inadequate guards resulted in an injury involving death or some form of permanent impairment.

The need for guards was apparent in all three of the major plant departments, but the departmental record indicates that efforts to improve conditions should be emphasized particularly in the bottling departments. In such departments 1 in every 4 of the disabling injuries resulted from accidents which could be traced to the need for some form of a guard.

Specifically, adequate guards on machines and conveyors were needed to protect the workers from the hazard of being struck by flying glass from bottle explosions. Some breweries had partially solved this problem, but no instances of complete guarding were observed in the course of this survey. Guards were generally provided at the filling machines and many plants had installed shatterproof glass panels at the inspection points along bottle-conveyor lines. Only one plant had tried to guard an entire bottle-conveyor line, and the guard had been applied only to the conveyors carrying the larger-sized bottles. Fine mesh wire completely enclosed the conveyor line and was constructed in sections which could be opened to remove bottles or parts of bottles from the line. Shatterproof glass replaced the wire at the inspection points.

In many bottling departments impact goggles were provided for protection against eye injuries and some plants required all employees in the department to wear goggles. In most instances the plant safety engineers reported difficulty in convincing the workers of the necessity of wearing goggles at all times. Other plants had experimented with the use of face shields to protect the entire face from flying glass. Almost invariably resistance was encountered among the workers who objected to the shields on the grounds of weight and discomfort, particularly in warm weather. Nevertheless, in the absence of complete guarding on the machines and conveyors, all bottling department workers should wear goggles, thereby practically eliminating eye injuries (the most serious cases resulting from bottle explosions). As goggles do not afford face protection, face shields may be preferable to goggles. In the final analysis, effective permanent guards should be utilized to prevent fragments from flying into the air.

In addition, many conveyors in breweries were inadequately equipped with guards to prevent other types of accidents. Many

conveyors used for moving cases and cartons lacked side rails to keep materials from falling off the conveyor surface, and on many of the belt conveyors the ends of the rollers were exposed so that it was not uncommon for workers to catch their hands or fingers in the mechanisms. Similarly, in a number of instances workers' hands were pulled by the belt into the space between the last belt roller and the first of the free rollers at the end of belt lines. Under good safety practice the first free roller would be spaced 3 or 4 inches from the end of the belt to prevent the hand from being caught before it could be withdrawn. The first free roller should also be set in open slots from which it can be lifted rather than to have it fixed firmly in place. With this type of design a back pull on the hand or object which might become caught between the end of the belt and the free roller will cause the free roller to rise in the slots and thereby release the pinching pressure.

The lack of adequate guards on other types of machines, on elevators, elevated working surfaces, stairways, and ladders also resulted in numerous accidents. Those caused by unguarded gears, pulleys, and points-of-operation of machines, and unguarded elevators often resulted in very serious injuries. The number of injuries resulting from falls from low platforms often used in breweries indicates strongly the need for guard rails at the edge of all elevated working surfaces, regardless of their height. Similarly, the stiles or steps over conveyor lines which commonly are constructed with a hand rail on only one side should have substantial hand rails on both sides. The record also indicated that many of the ladders used in breweries were without ladder safety shoes which should be considered a minimum safety requirement for all straight ladders. In addition, if ladders are used repeatedly at the same location, facilities should be provided for anchoring them at the top, or permanently constructed fixed ladders should be erected.

UNSAFE ACTS

For the purpose of accident analysis an unsafe act is defined as "a violation of a commonly accepted safe procedure."[11] Literally this definition means that no personal action shall be designated as unsafe unless there was a reasonable and less-hazardous alternative procedure. There is, however, no implication that the alternative safe procedure must have been known to the person who acted in an unsafe manner, nor that his unsafe act was the result of a considered choice between the two alternative procedures. In many instances it is apparent that the individual knew the safe procedure and consciously decided not to follow it. Strict supervision coupled with disciplinary action is essential to eliminate unsafe acts of this category. In other instances circumstances indicate that the person who acted unsafely did so, not as a matter of choice, but simply because he did not know the alternative method. The first step toward the elimination of unsafe acts, therefore, consists of making sure that all workers are thoroughly instructed in the safe methods of performing their duties and that they are familiar with the hazards connected with deviations from those safe procedures. Insofar as possible the safe procedures should then be established as working rules. The second essential step is to exercise strict supervision to see that unsafe procedures are

[11] American Recommended Practice for Compiling Industrial Accident Causes, approved by the American Standards Association, August 1, 1941.

prohibited. It is of utmost importance, however, to realize that successful instruction in safe practices cannot be limited to an indoctrination program at the beginning of employment, but rather must be continued throughout employment and must include the "old timers" as well as the new employees.

Most of the brewery accidents which occurred because of the commission of an unsafe act were associated with (1) the assuming of an unsafe position or posture; and (2) the use of unsafe equipment or equipment in an unsafe manner. Analysis indicated that a program of instruction and enforcement for the elimination of accident-producing unsafe acts should emphasize proper methods for (1) lifting, carrying, and other handling of barrels, kegs, cases, and cartons; (2) piling of materials and equipment, particularly kegs and cases; and (3) the removal of broken glass from equipment and floors.[12]

Unsafe Position or Posture

More than half of the accidents resulting from unsafe acts were the direct outcome of the injured person's placing himself unnecessarily in an unsafe position or posture. Five of the six fatal accidents reported by the 82 breweries reporting were classified in this general group.

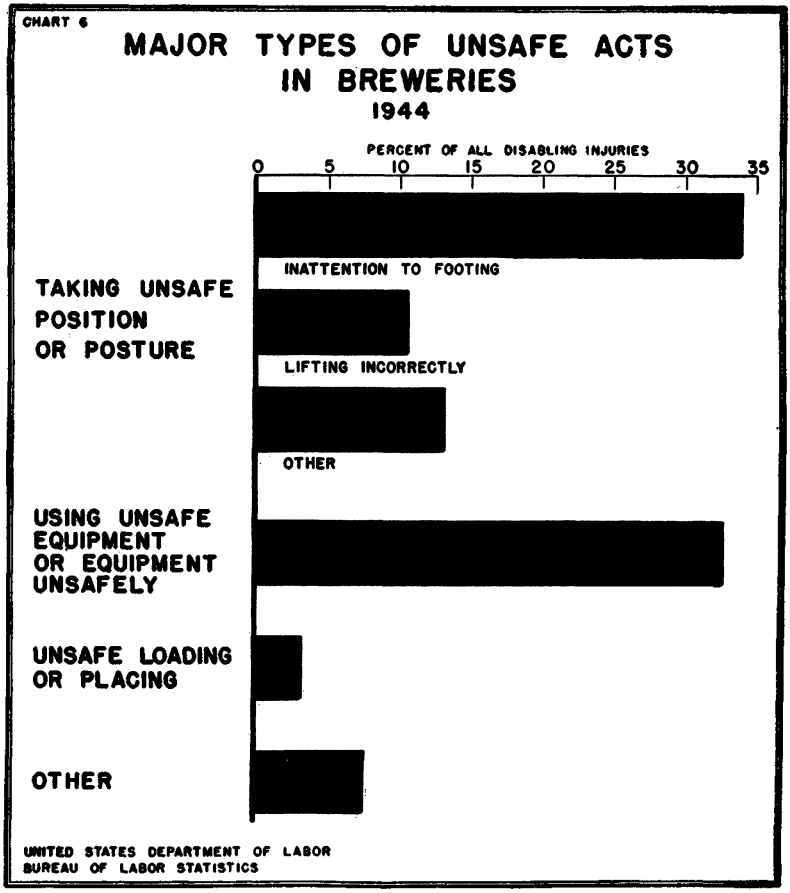
Most prominent among the specific actions designated as assuming an unsafe position or posture were inattention to footing; lifting unsafely; running or jumping; working, standing, or walking in the path of moving vehicles; climbing on boxes or barrels instead of using ladders; taking shortcuts instead of using the provided walkways, particularly in respect to crawling under or climbing over conveyors; and attempting to adjust or repair moving equipment.

Inattention to footing was a common source of injury in all brewery departments. In the delivery departments most of these instances occurred in the course of climbing into or out of trucks or freight cars. In the other departments accidents on stairways and ladders were frequently ascribed to inattention to footing.

Injuries resulting from manual lifting of heavy objects are a serious problem in breweries. Every such accident involves the lifting of excessive weight—that is, excessive under the existing circumstances for the individual involved. Variations in the strength and skill of different individuals make it difficult if not impossible to determine the safe maximum weight to be lifted by one person. However, a knowledge of and the strict application of proper lifting procedure—lifting with the legs instead of the back—will render safe the handling of greater weights than is safe by hit or miss procedures. In classifying the lifting accidents, an effort was made to exclude those cases in which individuals attempted to lift weights which obviously should have been handled mechanically or by a team. As far as possible, those included represent injuries which resulted from lifting weights ordinarily handled by individuals and normally considered to be within the lifting ability of most workers. These cases represented 10 percent of all accidents resulting from unsafe acts.

Most injured persons can report only that in lifting, pain was suddenly felt. Only rarely has a witness observed the operation with sufficient care to identify accurately the specific faulty procedure.

[12] See Appendix, tables 15 and 16.



It is well known, however, that strains, sprains, and hernias frequently result from lifting with the back muscles instead of the leg muscles; from lifting in cramped or awkward positions; or from lifting while standing on irregular or insecure surfaces. Most of the accidents in this group undoubtedly resulted from the lifter assuming one or the other of these unsafe lifting positions.

Use of Unsafe Equipment or Using Equipment Unsafely

Relatively few injuries resulted from the use of unsafe mechanical equipment or from the use of mechanical equipment unsafely. Over one-fourth of all the cases resulted from the unsafe act of gripping objects insecurely or taking hold of objects incorrectly. In most of these accidents heavy objects, such as barrels, kegs, cases, or cartons, slipped from the hands of workers and fell upon their feet. There were, however, numerous instances in which workers crushed their fingers while piling cases or kegs. In the bottling departments, numerous employees mashed their fingers when the cases which they were removing were struck by other cases moving upon the conveyors.

Insistence upon the general use of steel-toed safety shoes by all workers who handle heavy materials would materially lessen the volume of injuries resulting from improper handling methods. The elimination of such accidents, however, requires intensive instruction in the proper procedures and close supervision to insure their observance.

The unsafe act of picking up broken glass with bare hands instead of using brushes and dust pans, and the practice of attempting to remove broken bottles from conveyors or machines by hand instead of using the tools generally provided for this purpose, were responsible for many cut fingers in the bottling departments. The elimination of these unsafe acts is largely dependent upon the development of worker interest in safety and strict supervision to enforce rules prohibiting such practices.

Other Unsafe Acts

In the general category of unsafe arrangement or placement of materials and equipment, stacking materials in insecure piles was outstanding. The improper placement of equipment, however, was of nearly equal importance, as, for example, the placement and use of portable slides or chutes without seeing that they were securely anchored in place.

Other types of unsafe acts, which produced accidents in sufficient volume to indicate that they are fairly common in brewery operations, included operating equipment without authority; failing to shut off equipment when not in use; operating equipment at unsafe speeds; and failing to use proper safety equipment or proper clothing.

Nondisabling Injuries

Because many plants do not maintain records of nondisabling injuries, the customary procedure in evaluating the accident experience of a plant or an industry is to consider only the record of disabling injuries. It is true that the disabling injury cases represent the more serious segment of the accident problem, but it must be recognized that the prevention of accidents which result in nondisabling injuries is also an essential part of any successful safety program. In respect to total costs, including interruptions to production, it is frequently contended that nondisabling injuries are just as important as the more serious disabling injuries. Nearly every nondisabling injury involves some expense and results in the loss of some productive time even though the injured person does not leave the premises.

In a broad industry-wide study of accident causes, in which it is possible to include a large volume of cases drawn from the experience of many plants, it is possible to reach valid conclusions of general application based entirely upon consideration of disabling injuries. Analysis on the same basis within a single plant for the purpose of developing a safety program for that plant is often hampered, however, by the fact that the volume of disabling cases available for analysis is frequently too small to lead to accurate conclusions as to the prevailing unsafe conditions and unsafe acts which should be counteracted. In such instances it is very desirable to apply cause analysis to the nondisabling injury cases as well as to the disabling injury cases. The analysis of nondisabling injuries in many instances

will also produce collateral information regarding such questions as whether or not accident proneness, sex of workers, or the experience of workers have any bearing upon the occurrence of accidents. This collateral information, which may be of great value in a plant safety program, seldom can be drawn from an analysis of disabling injuries alone.

Studies made over a long period in a wide variety of plants have indicated that for manufacturing as a whole about 29 nondisabling injuries occur, on the average, for every disabling injury.[13] This generality has received wide acceptance as a basis for making broad comparisons. Its author, however, has pointed out that this ratio cannot be considered as representative of conditions in any specific industry and that it is to be expected that there will be wide variations in the experience of different industries and of different plants.

In the present survey an attempt was made to collect information concerning nondisabling injuries in order to provide some indication of the volume of such injuries in the brewing industry and, incidentally, to indicate how the volume of nondisabling injuries in this industry compares with the ratio generally accepted as normal for manufacturing as a whole. However, because of the scarcity of complete records relating to nondisabling injuries, and because of limitations as to the time which could be devoted to this work, such data were compiled for only one plant. The sample, therefore, is insufficient to support any generalization regarding the industry as a whole. The data, however, have a definite value in that they give some indication of the size of the nondisabling injury problem in brewing operations. It is also hoped that the conclusions reached in respect to this one plant will interest other plants in making similar studies of their nondisabling injury cases.

The brewery in which the nondisabling injury data were compiled was a large plant employing over 2,500 workers. In 1944 its injury frequency rate was 41.0. A professionally staffed first-aid room was maintained upon the premises, and every effort was made to have all injured employees report at once to the first-aid room regardless of how minor the injury might seem to be. A complete record of each case, including subsequent treatments, was maintained in the first-aid room.

In order to insure homogeneity in the data, so that all comparisons would be upon the same basis, some of the injury records were omitted from the tabulations. For this purpose the first step was to prepare from the personnel records a list of all workers who had been employed throughout the year 1944. All office workers were then eliminated from this list. The final list, containing the names of 2,210 full-year employees, was then checked against the first-aid records, and all injuries and treatments reported for these employees were tabulated.

In the course of the year these 2,210 workers experienced 16,336 injuries, of which only 109 were disabling. For this group, therefore, there was an average of 149 nondisabling injuries for every injury involving disability, a ratio much higher than the 29 to 1 ratio commonly considered typical for manufacturing as a whole.[14]

[13] Industrial Accident Prevention, by H. W. Heinrich. New York, McGraw-Hill Book Co., 1941.
[14] See Appendix, tables 17 to 19.

No record was kept of the amount of productive time lost because of the nondisabling injuries. There were, however, complete records as to the number of treatments given, from which it was possible to determine that each nondisabling injury required an average of 1.9 visits to the medical office. Allowing only a half hour for each treatment and disregarding the additional time lost by the many workers who were sent home for the rest of the day on which they were injured, the time lost during the year because of the nondisabling injuries amounted to at least 7 hours for every employee in the group.

Wide variations were apparent in the ratio of nondisabling to disabling injuries in the three major operating divisions of the plant. In the bottling department the ratio was 170 to 1; in the brewhouse it was 92 to 1; and in the delivery department it was 80 to 1.

Nearly three-fourths of the total volume of injuries were classified as cuts, lacerations, or punctures. In this group there were 451 nondisabling cases for every disabling injury. On the other hand, in the group of cases designated as bruises and contusions, which constituted nearly 15 percent of the entire group of injuries, there were only 54 nondisabling injuries for every disabling case.

Finger and hand injuries were very numerous, but the proportion of these cases resulting in lost time beyond the day of injury was low. Among the finger injuries, for example, there were 587 nondisabling cases for each disabling injury. Injuries to the lower extremities were much less common than were the hand and finger injuries, but the percentage of disabling injuries in these groups was considerably higher. One in every 25 injuries to legs, feet, or toes was disabling, and 1 in every 10 injuries to the trunk was disabling.

REPEAT INJURIES

In planning an accident prevention program for any plant it is very helpful to know not only where accidents are concentrated and what are the common accident causes, but also whether or not there are particular workers who need special training or reassignment for their own safety. In other words, it is desirable to determine whether or not there are individual workers who are more likely to be involved in accidents than are others who face identical hazards. This, of course, is specific information which must be collected in the plant where it is to be used. A knowledge of the existence of a considerable group of accident-prone workers in one plant, however, can be taken as an indication of the need for investigation along this line in other plants. With this in mind, an analysis was made to determine how many cases of repeat injuries were included in the experience of the 2,210 full-year employees whose records were discussed in the preceding section.

For the entire group the reported cases indicated an average of 7.4 injuries for each employee. However, the average number of cases varied rather widely among the various departments. In the bottling department the average was 10.3 injuries per employee, and in the delivery department the average number of cases was 9.5. The service and maintenance department had an average of 5.6 injuries per

employee, and the brewhouse group had an average of 4.4 cases per worker.[15]

The most striking fact immediately apparent from the break-down of the case records was that despite these high averages, there were a considerable number of individuals who worked the entire year without reporting a single injury. This group constituted over 30 percent of the 2,210 employees whose records were examined. No information was available regarding the specific work assignments of these uninjured employees. However, since the sample was restricted to the operating departments and excluded all office workers, it may be assumed that they were generally exposed to much the same hazards as were encountered by those who were injured. The obvious conclusion, therefore, is that there are some workers who successfully practice safety.

There was, however, strong evidence in the record indicating that accident proneness is a factor meriting serious consideration in the establishment of a program designed to reduce accidents. Over half (51 percent) of all the reported injuries were experienced by a group of workers who comprised only 11 percent of the employees. Even more striking was the fact that in the bottling department a small group of 13 workers, representing only 1.4 percent of the employment in the department, experienced 984, or 10.5 percent, of all the bottling department injuries. Each of these workers averaged more than one injury per week. Similarly, in the brewhouse division a small group of 10 employees, comprising only 2.8 percent of the brewhouse employment, experienced 407 injuries, representing over 25 percent of all brewhouse injuries. Two possible conclusions may be drawn from these facts, either (a) that some employees were working under special conditions involving extreme possibilities for injury without much provision being made for their protection, or (b) that these particular employees were either incapable or unwilling to observe the ordinary rules of safe procedure. Inasmuch as the brewery in which these observations were made employed a full-time safety engineer and generally tried to maintain safe conditions throughout the plant, the latter conclusion, i. e., that these employees were "accident prone," seems to have the greater validity. In the interest of safety for these workers, therefore, it would seem logical to analyze their particular injury experience with a view to reassigning them to work which would not present injury possibilities similar to those which they seemingly cannot avoid.

Great care must be exercised, however, in applying the information concerning "repeaters" which may be derived from an analysis of the medical office records. If the impression is given to the workers that these records may be used to their disadvantage, the net result will be that many employees will discontinue reporting seemingly minor injuries. This will undoubtedly result in a great increase in the volume of infections and will lead to disabilities, in many cases, which would remain in the minor category if they were given prompt medical attention.

To exemplify the extreme instances of repeat injuries, a few of the outstanding individual records are outlined below.

[15] See Appendix, table 20.

Bottling Department

The most outstanding individual record of repeat injuries in the entire plant was that of a bottling department worker for whom 108 injuries were listed. None of these injuries was disabling, but the medical record indicated that it was necessary for him to visit the first-aid room for treatment 258 times during the year. It is impossible to specify exactly how much time was consumed in these treatments, but with due allowance for the time required to get ready for a visit to the infirmary and to resume work after the visit, it seems reasonable to assume that each visit would probably involve about a half hour of employee time. On this basis, the 108 nondisabling, or so-called no-lost-time injuries, of this employee probably resulted in the loss of his productive efforts for 129 hours during the year. On a 40-hour-week basis, that is equivalent to over 3 weeks of lost time in a single year. Five of the injuries experienced by this employee were bruises, 1 was a burn, and 102 were cuts or lacerations. The cuts included 94 cuts on his hands and fingers, 4 cuts on his arms, and 4 cuts on his head. The particular propensity of this employee to experience cuts on his hands carries the specific implication either that his methods of handling broken glass should be revised or that he should be transferred to work which will not involve his coming into contact with broken glass.

A second bottling department worker, this one a woman, had 99 nondisabling injuries listed upon her record for the year. As a result of these injuries she received 235 treatments in the first-aid room. Allowing a half hour for each of these visits to the infirmary, it is estimated that the productive time lost because of her injuries also was equivalent to nearly three 40-hour weeks during the year, although she actually did not take any time off because of the injuries. The great majority of her injuries (73) consisted of cuts on her fingers, hands, or arms. In this brewery it was an established plant rule that all bottling department workers must wear face shields. The record of this particular employee, however, included 7 injuries consisting of foreign bodies becoming imbedded in her eyes, which appears to indicate that she did not always observe the accepted safety rules.

Ninety nondisabling injuries were listed during the year for a third bottling department worker, and the records of 5 other employees included from 70 to 90 injuries each. One of the 463 injuries experienced by these 6 workers was disabling. Approximately three-fourths of this group of injuries consisted of cuts on fingers or hands. Fifteen of the injuries were eye cases, despite the face-shield rule.

Brewhouse Department

In the brewhouse department the greatest number of injuries reported for any one employee was 58. All but one of these were hand or finger injuries, consisting of 53 cuts and 4 bruises. The one other injury was a strained back.

The second most extensive injury record in the brewhouse department was that of a female worker for whom 55 nondisabling injuries were listed. All but one of her injuries were cuts, primarily on her fingers, hands, and arms.

Four other brewhouse employees had betewen 40 and 50 injuries each during the year. Nearly all of the 174 injuries experienced by these workers were cuts. The record for one of the group, however, included 7 bruises and 4 instances of flying particles becoming imbedded in the eyes.

Other Departments

Four percent of the employees working in departments other than the bottling and brewhouse departments experienced 26 or more injuries each during the year. As a group, the injuries of these 39 employees represented 30 percent of all the injuries recorded in these departments. In contrast, one-third of the employees worked the full year without a single injury and 45 percent reported only 1 injury apiece.

Two of the employees in the repeater group had 74 injuries each. All of these were nondisabling injuries. One of the two workers, a woman working in the yard department, had 54 cuts, 10 bruises, and 5 sprains among the cases on her record. All but 2 of the cuts were on her arms, hands, or fingers. The second employee, also a woman, had 69 hand or finger cuts among her 74 injuries.

Another female yard employee reported 69 injuries, of which 67 were cuts, primarily on her arms, hands, and fingers. A male yard employee had a record of 71 injuries, among which were 52 cuts and 14 bruises.

In the maintenance department one employee was recorded as having been treated for 60 injuries during the year. His record listed 41 cuts, 15 bruises, and 2 strains. All of the cuts and 12 of the bruises affected his hands or fingers. A second maintenance worker had 50 injuries during the year, including 32 cuts, 12 bruises, and 4 burns.

One delivery department worker also reported 50 injuries during the year. His record included 44 cuts and 4 bruises. All but 3 of these were injuries to his fingers, hands, or arms. A somewhat higher volume of injuries (57) recorded for a malthouse employee included 51 hand and finger cuts, 2 bruises, 2 sprains, and 2 cases of flying particles lodging in the eyes.

WORK EXPERIENCE AND INJURIES

Experience on the job frequently is cited as a factor of importance in explaining the injury record of a group of workers, usually with the implication that workers who have had little experience are more likely to suffer injuries than are workers with long experience who have become familiar with the hazards of the operations in which they are engaged. Taken at face value this contention appears to be based upon sound logic. Too often, however, it is accepted without investigation merely because it seems logical, whereas actual analysis will indicate that this generality does not always hold true. A safety program designed to concentrate upon training the less experienced workers in safe procedures and leaving the "old timers" to carry on on their own because they are assumed to know all the angles, therefore, may fall short of full effectiveness. To illustrate this point the results of a comparison between the injury experience of 910

bottling department workers and their job experience is presented below.[16]

These 910 workers comprised all of the bottling department employees who had worked throughout the 12 months of 1944. It was impossible to determine the exact details concerning the experience that some of these workers may have had in other breweries, so the experience classifications had to be based upon the length of their employment in the plant where the study was made. The experience classifications, therefore, were established to represent the length of the employment of each worker in this plant as of the beginning of the period studied. The injuries tabulated included all cases which were reported to the first-aid room during the 12-month period, with no differentiation between disabling and nondisabling injuries. For the entire group of 910 workers there were records of 9,405 injuries, representing an average of 10.3 injuries per employee.

Among the various length-of-service classifications, the best injury record was that of the group composed of workers who had been employed in the plant for at least 2 years prior to the year of the study. These workers, comprising about 11 percent of the total employment, had only 8 percent of the injuries—averaging 7.3 injuries per person. Because of their seniority, however, this group of "old timers" included a number of workers who were performing supervisory or semisupervisory functions, which kept them from coming constantly into contact with the operating hazards faced by the nonsupervisory group. Their better-than-average record, therefore, should be interpreted in this light and should not be credited entirely to their greater skill in avoiding injuries as acquired through experience in the plant.

A striking degree of uniformity prevailed in the injury records of the workers who started the year with less than 2 years' experience to their credit. The group holding a year or more of service credit represented 28.2 percent of the total employment and accounted for 27.6 percent of the injuries—an average of 10 injuries per individual. Fully 60 percent of the workers in the department had had less than a year of service at the beginning of 1944. To secure greater detail in the comparisons, therefore, these workers were classified into smaller groups representing 3-month service intervals. The least experienced group, composed of workers with less than 3 months' seniority in the plant at the beginning of the period, represented 8.9 percent of the employment and suffered 9 percent of the injuries—averaging 10.3 injuries per individual. For the other groups the corresponding figures were: 3 to 6 months' experience, 16.5 percent of employment, 16.4 percent of the injuries, average 10.2 injuries per individual; 6 to 9 months' experience, employment 14.8 percent, injuries 14.4 percent, average 10.0 injuries; 9 to 12 months' experience, employment 20.2 percent, injuries 24.6 percent, average 12.5 injuries. The poorest injury record among all of the experience classifications, therefore, was that of the workers who started the year with from 9 to 12 months' experience to their credit. The difference, however, was small enough to have been due entirely to chance, and in view of the uniformity in the records of the other groups, it seems to have little significance.

[16] See Appendix, table 21.

The conclusion in this instance must be, therefore, that the more experienced employees in this plant were no less likely to be injured than were new employees, and that the safety training program should be directed with equal vigor to all workers regardless of their length of service.

SEX OF INJURED WORKERS

For the purpose of comparing the injury experience of men with that of women, the records of 904 full-year bottling department workers were tabulated in a break-down by sex. In this group there were 491 men and 413 women. Inasmuch as it was impossible to analyze the work assignments of each of these employees in order to establish exactly comparable groups on the basis of exposure to identical hazards, it was necessary to assume that because all worked in the same surroundings the hazards which they faced were generally about the same. In tabulating the recorded injuries, no distinction was made between disabling and nondisabling cases.

In general, the men had a better injury record than the women. The male employees experienced 4,398 injuries, or an average of 9 injuries each, while the female employees had 4,969 injuries, or an average of 12 injuries each. Over 32 percent of the men worked the entire year without reporting a single injury. Only 24 percent of the women were successful in avoiding all injuries during the period.

In respect to repeat injuries, the women also had a somewhat less favorable record that that of the men. Nearly 15 percent of the women were listed as having experienced 26 or more injuries each, as compared with 10 percent of the men. Similarly, a division of the employees at the level of 21 or more injuries each included 21 percent of the women but only 12 percent of the men. A further division at the level of 6 or more injuries each included 53 percent of the women and 47 percent of the men.

Typical Accidents and Suggestions for Their Prevention

To illustrate the general types of accident problems encountered in the brewing industry, brief descriptions of a number of actual accidents were collected. Typical examples of these were then studied to determine what specific procedures might be employed to prevent their recurrence. The intention was not to make all-inclusive recommendations, nor to attempt to propound authoritative safety rules. On the contrary, the purpose was merely to indicate that there is a simple approach to the prevention of practically every type of accident. Many safety engineers no doubt would attack the problems involved in these accidents from a different angle and would achieve equally good or possibly better results. The method of prevention, however, is of secondary importance so long as it accomplishes its purpose. It is of prime importance to emphasize that there is some practicable method of minimizing nearly every type of accident.

The selected accident descriptions, accompanied by suggestions [18] as to the preventive measures which might prevent their recurrence, are given on the following pages.

[18] Frank C. Ball, W. A. Klenota, P. L. Schuler, E. J. Steinkellner, and Guy T. Yates, safety engineers in the industry, assisted greatly in the preparation of these suggested preventive measures. In general, the suggestions presented in this section represent their collective thinking.

BREWHOUSE ACCIDENTS

1. Employee was carrying 100-pound bags of grain from the chute. He strained his back in the process. Lost 4 days.

In moving packages such as these, a hand truck should be used. If the distance between loading, unloading, and storage points is too short to warrant use of a hand truck, sections of a chute or gravity conveyer should be used; or additional help should be provided. In any event, employees should be given thorough training in the proper methods of lifting and close supervision should be exercised to see that safe procedures are employed.

2. Hot wort boiled from a brew kettle and burned an employee's leg and foot. Lost 8 days.

(a) *Temperature controls should be installed on the kettles to prevent the kettles from boiling over.*

(b) *Kettles should be provided with a cover equipped with sliding doors and a glass inspection opening. Doors should be constructed so that they may be operated from a safe distance.*

3. An employee was opening the bottom of a brew kettle. Hot wort running from the kettle splashed into his eye. Lost 15 days.

(a) *The valve at the base of the brew kettle should be fitted with a reach rod or a chain and sprocket so that it may be operated from a safe distance.*

(b) *A splash guard should be provided to protect the operator.*

(c) *When opening this valve the operator should wear a face shield, gloves, and boots.*

4. An employee was cleaning a fermenting tank. When a co-worker left the tank and closed the door, the employee was overcome by fumes. Lost 11 days.

When work is to be performed inside any tank where toxic fumes or an oxygen deficiency may be encountered, the following precautions should be taken:

(a) *Workers in the tank should be equipped with air-line respirators and life lines.*

(b) *A trained co-worker should be assigned to watch the air supply and the life lines. This employee should have no other duties to distract his attention and should be held strictly accountable for any neglect of his duty or for any departure from his post.*

(c) *All doors into the tank should be blocked open and posted with warning signs.*

5. An employee who was cleaning the inside of a fermenting tank fell from a scaffold and hurt his back. Lost 31 days.

Cleaning fermenting tanks is a frequently recurring routine operation for which safe equipment should be designed and provided. The scaffolds should be substantially constructed with a guard rail and should have a nonslip surface applied to the floor boards. Each time a scaffold is erected the foreman should inspect it before it is put into service.

6. Employee was standing on a ladder cleaning a settling tank. The ladder slipped and the employee fell 7 feet injuring his back. Lost 8 days.

(a) *Working from ladders is dangerous. Wherever possible, scaffolds or platforms should be used.*

(b) *All ladders should be equipped with safety shoes and, if possible, anchored or tied at the top.*

7. An employee, who was cleaning inside a tank, slipped and fell on the concave bottom of the tank. Lost 30 days.

(a) *Tanks should be thoroughly flushed out with water before employees are required to enter them.*

(b) *Boots with corrugated soles and heels should be worn by workers who are engaged in this work.*

(c) *Plank platforms are sometimes used inside such tanks in an effort to provide a level working surface. There is some question, however, whether plank platforms may not create additional hazards as great as those which they eliminate. If plank platforms are used it is essential (1) that the planks be wide, (2) that a nonslip surface be applied to the planks, and (3) that the planks be firmly fixed in place.*

(d) *Proper tools are essential in this work. For instance, both short-handled and long-handled brushes should be provided so that the employee may work without stretching or twisting his body.*

8. An employee was checking beer being pumped into tanks. He tripped over a hose on the floor and strained his back. Lost 24 days.

(a) *Hose should be kept out of passageways as much as possible. Where operations require frequent use of hose, parking areas for the lines should be marked on the floor at the sides of the aisles, and employees should be required to see that the hose lines are laid in those spaces.*

(b) *Lighting at the floor level should be adequate to make hose lines fully visible.*

(c) *All hose should be white to contrast with the color of the floor, so as to increase visibility.*

9. Employee was squaring off hops press. He slipped and fell on the wet floor and sustained a hernia. Lost 54 days.

Floors should be kept as dry as possible to prevent slips. Working areas should also have "anti-slip" surfaces; concrete floors should be rough-finished with carborundum particles or grit worked into the surface.

10. An employee was washing the pump-room floor with a caustic solution. The solution penetrated a hole in his boot and burned his toe. Lost 4 days.

(a) *Whenever possible the use of caustic soda should be eliminated.*

(b) *All safety equipment, such as boots, should be inspected before use. If worn or defective, they should be discarded.*

11. Employee was inspecting and repairing barrels. While he was driving a hoop with a hammer, a chip flew from the hammer and longed in his eye. Lost 8 days.

(a) *Evidently the head of this hammer had crystalized. To prevent accidents of this kind, all hand tools should be inspected regularly and replaced when worn or defective.*

(b) *Goggles should be worn by employees performing this type of work.*

12. An employee was moving full half-barrels in the racking room by kicking them. When his foot slipped, he felt a sharp pain in his hip. Lost 8 days.

(a) *The practice of moving barrels by kicking them should be prohibited. The racking room should be equipped with power conveyors to minimize the handling of barrels and kegs. Where power conveyors are not available, barrels should be rolled by hand or by use of keg pusher, and barrel runs should be installed.*

(b) *Floors should be kept as dry as possible to prevent slips. Working areas should also have "anti-slip" surfaces; concrete floors should be rough-finished with carborundum particles or grit worked into the surface.*

13. An employee in the keg-pitching department bumped his knee on the end of a skid which was used for the transfer of kegs. Lost 50 days.

(a) *Skids should have rounded and preferably padded ends to minimize injuries of this type.*

(b) *Skids, either permanent or portable, should not be placed haphazardly, but should be located so as to allow the maximum clearance possible and so as not to infringe on aisles.*

14. While trying to adjust the spray of hot pitch, an employee was burned when the pitch splashed on his arms. Lost 2 days.

(a) *The spray should not be adjusted while in operation.*

(b) *Asbestos gloves and other safety clothing should be worn by employees working near the spray.*

15. A racking-machine operator was struck by a barrel rolling from a co-worker's machine. Lost 5 days.

The area around racking machines should be designed so that, when the barrel is pushed from the racking machine, it will move by its own momentum away from adjacent machines and toward the storage space. Where possible, barrel runs from the racking machines to the storage space should be installed.

16. An employee who was removing barrels from a racking machine lacerated his hand on a piece of glass which was imbedded in the side of a barrel. Lost 11 days.

(a) *Close inspection of barrels is necessary to prevent this type of accident.*

(b) *Gloves or other palm protection should be provided for workers handling barrels or cases.*

17. Employee was stacking filled half-barrels two-high in the racking room. Strained hip muscles resulted in 11 days lost time.

Employees should not be required nor permitted to lift full half-barrels without assistance. Mechanical equipment should be used, or two workers who have been trained to lift together should be assigned to such work.

18. An employee was transferring empty barrels, which were piled three-high to a chute. As he attempted to remove the top one, it caught the barrel beneath it, pulling it from the pile. The falling barrel struck the employee's great toe. Lost 31 days.

(a) *Close supervision and proper instruction in job procedure are necessary to prevent accidents of this type. Two men should be used in removing the top tiers when barrels are piled more than two-high.*

(b) *All workers who handle heavy materials should wear safety shoes.*

19. An employee was pushing filled kegs through the door at the loading dock. A barrel which he had passed out rolled back against the barrel which he was handling, crushing his hand. As a result of fractured fingers, he lost 25 days.

(a) *No keg should ever be passed through the opening from the racking room until the dockman has signaled that he is ready to receive it.*

(b) *To prevent barrels from rolling back, either of the following suggestions may be adopted:*

(i) *A teeter-totter arrangement installed at the racking-room opening will permit only one keg to be passed to the dockman, while holding the next in check until the dockman is ready to receive it.*

(ii) *Barrel lines should be installed with a slight pitch. It is important in this instance, however, to design the line properly so that the speed of the barrels will not be excessive for handling on the dock.*

BOTTLING DEPARTMENT ACCIDENTS

20. Employee was adding caustic to the soaker. The solution boiled over and spilled on his back. As a result of the chemical burn, he lost 3 days.

(a) *Caustic may react violently when dumped into water. For this reason it should not be added directly to the liquid in the soaker but should be made into a solution in a separate tank and piped into the soaker. The valves for the control of this solution should be placed at a safe distance from the outlet.*

(b) *Proper protective clothing should be worn by all employees handling caustic.*

21. When a bottle exploded in the filling machine, a piece of glass struck employee in the eye. Lost 4 days.

A guard should be placed around the filling machine at the point where the bottles move. This will protect both the operator and any other person who may be near the machine from being struck by flying glass.

In the absence of an effective guard all persons who work near filling machines should be required to wear face shields or goggles.

22. Blisters formed on the hand of a female employee who was working at a filler. The doctor diagnosed the blisters as resulting from a yeast infection common to people whose hands are wet a great deal of the time. Lost 10 days.

(a) *Supervisors or plant nurses should frequently examine the hands of employees engaged in this and similar work to detect infection before it becomes serious. Employees who are susceptible to this infection should be placed on dry work.*

(b) *Rubber gloves or protective creams may be used to prevent this type of infection.*

23. The operator of a can filler injured his hand as he attempted to remove a can which had become wedged. Lost 49 days.

No adjustments, repairs, or removal of wedged material should be permitted on any machine until the power has been shut off and the machine has stopped. Supervisors should be required to enforce this rule strictly.

24. An employee scratched his finger on the crown of a bottle while placing bottles in the pasteurizer. The scratch became infected and the employee lost 7 days.

(a) *Modern plants have eliminated the handling of bottles at this point by installing mechanical equipment for placing bottles in the pasteurizer.*

(b) *Where bottles must be placed in the pasteurizer by hand, gloves should be worn.*

(c) *All injuries should be treated promptly at the first-aid room to prevent infections.*

25. A bottle exploded in the pasteurizer. When an employee attempted to remove the broken glass, he cut his finger. Lost 7 days.

(a) *A special tool or brush should be used to remove broken bottles from the pasteurizer.*

(b) *Proper gloves should be worn by all employees handling broken glass.*

26. A bottle coming from the pasteurizer tipped. As the attendant reached to straighten it the bottle exploded, lacerating his hand and causing a permanent impairment to one of his fingers.

(a) *This is the point in the bottling process where the hazard of bursting bottles is greatest. Conveyor equipment at the pasteurizer, therefore, should be inspected frequently and thoroughly, and should be maintained in good operating condition so that there will be no jerks to jar or tip the bottles during temperature changes.*

(b) *Goggles and gloves should be worn by all employees working at the pasteurizer.*

27. A female employee was inspecting bottles at the lights. A bottle exploded lacerating her hand. Permanent impairment of one finger.

(a) *All bottle conveyors between the pasteurizer and labeling machine should be covered with a heavy wire-mesh guard. To permit removal of broken glass from the conveyor, the guard should be made in sections and hinged at the top. At inspection light stations, a movable safety-glass panel will protect the inspector's eyes and face in case of an explosion.*

(b) *Employees removing bottles from the conveyors should wear light leather gloves and goggles or face shields as protection against explosions.*

28. When a female employee reached for a carton on the conveyor, she caught her hand between the rollers of the conveyor and the belt. Permanent impairment of hand.

(a) *Spaces between rollers should be closed with sheet-metal guards.*

(b) *Conveyors should have power-driven belts instead of power-driven rollers.*

29. Cartons on a belt conveyor jammed at a high point in the line. An employee piled cases 15-high and stood on the pile in order to release the jammed cartons. He lost his balance and fell to the floor. Lost 62 days.

Standing on cases is dangerous and should be prohibited. A substantial ladder equipped with safety shoes should have been used.

If there are points along an elevated conveyor line at which materials frequently stick, platforms with guard rails should be installed at those points.

30. Bottles had been placed upon the bottom three steps of a stile over a conveyor. An employee descending the steps fell and injured his chest when he attempted to step over the bottles. Lost 5 days.

This is a case of poor housekeeping and poor supervision. Supervisors should see that no material is placed on steps or stairways.

31. A female employee was transferring cases of beer from one conveyor to another. One case passed her and as she stretched to reach for it, she suffered a strain in the lower abdomen. Lost 11 days.

(a) *Wherever practicable, a stop should be installed on conveyors to prevent cases from traveling beyond easy reach of workers. Where stops are not available, employees should be provided with a hooked rod to draw back cases which have passed.*

(b) *Employees should be warned against overreaching and supervisors should enforce this rule.*

32. Employee was removing filled cases from the conveyor. When the cases became jammed, he jerked one to release it. As it came free, it struck him in the abdomen. Lost 3 days.

Job instruction and close supervision are necessary to prevent accidents of this kind. Conveyors should be stopped before any attempt is made to remove jammed cases.

33. An employee crawled under a conveyor. As she lifted her head, she struck it on a part of the conveyor. Lost 7 days.

Stiles should be provided for crossing conveyors and barricades installed to prevent employees from crawling under them.

34. As an employee walked under a conveyor, he struck his head against its edge. Lost 8 days.

Walkways should be placed only where there is adequate clearance. Where there is insufficient head room for passage under conveyors, stiles should be provided. Barricades should be installed to prevent workers from passing under conveyors at points other than regularly established passageways.

35. An employee standing near a conveyor placed his hand on the conveyor belt. A co-worker started the conveyor and the employee's hand was caught between the pulley of the line conveyor and a gravity conveyor. Lost 16 days.

(a) *Where gravity and power conveyors meet, a piece of metal extending from the power conveyor to the gravity conveyor will cover the danger point. If this is impractical, more clearance between the two conveyors will permit the employee to remove his hands. This can be done by removing the first roller next to the power belt or by placing the roller in slotted supports so that it can easily be pulled free.*

(b) *No powered equipment should be placed in operation without sufficient warning.*

36. An employee, working near an overhead conveyor, was injured when a filled carton dropped from the conveyor and struck him on the head. Lost 16 days.

All overhead conveyors should be guarded with side rails to prevent material from falling from the conveyors, or metal screens should be installed under the conveyors to catch falling material. Where this is not feasible, barriers should be installed to prevent employees entering the area under conveyors.

37. Employee was using a hoe to remove broken glass under a labeling machine. He had stopped the machine, but a co-worker turned on the switch. The hoe was caught by the bottle carrier and the employee was thrown to the floor. Lost 11 days.

Switches should be locked in an open position while powered equipment is being cleaned, adjusted, or repaired.

38. A female employee was cleaning a labeling machine with hot water. While removing labels from the machine, she put the nozzle of the hose in a bucket. The hose twisted and threw the nozzle from the bucket to the floor, spraying hot water on her foot. Lost 11 days.

(a) *The nozzle should have been equipped with an open-and-close control valve and the valve closed before she placed the hose in a bucket or on the floor.*

(b) *Rubber boots should be worn by employees engaged in this work.*

39. While working at a labeling machine, an employee stepped on a piece of glass. Lost 9 days.

(a) *Broken glass should be removed from the floor immediately after a bottle breaks or explodes.*

(b) *Employees should wear substantial footwear to prevent injuries of this kind.*

40. When an employee tried to tighten a nut under the bumper on a labeling machine, the prong on the machine came down and caught his finger, amputating it.

No repairs or adjustments on powered equipment should be undertaken without first shutting off the power and locking the control switch in an open position. This rule should be rigidly enforced.

41. As an employee was placing the cover on a case, a bottle exploded. Flying glass severed a tendon in the worker's wrist causing him to lose the use of his hand.

(a) *All casers should wear gloves with gauntlets, and goggles for protection against flying glass.*

(b) *Rough handling of cased bottles leads to many explosions. Supervisors should watch this operation closely to see that proper procedures are followed.*

(c) *Strength tests should be applied to all bottles before they are filled.*

42. An employee was closing cartons on a sealing machine. As he reached down to remove a piece of carton from under the machine, the arm of the sealing machine pulled his arm into the machine. Fractured hand.

(a) *All moving parts of machines should be guarded to prevent accidental contact with the moving parts.*

(b) *Supervisors should enforce the rule that no powered equipment be cleaned, oiled, or adjusted while it is in motion.*

43. While using a strapping machine to place metal bands around filled cartons, an employee was injured when the handle of the machine struck him as it was returning to its normal position. Lost 6 days.

Handles which return to position automatically should be guarded or so located that they cannot strike the operator.

44. An employee was gluing stamps on cases. The glue which was being used caused a rash on his hands. Lost 9 days.

(a) *A chemical analysis of the glue should first be made to determine whether any ingredients in the glue are injurious. If such an ingredient is found, the glue should be replaced by another kind.*

(b) *Skin lotions may be used by employees in this operation to prevent similar injuries.*

(c) *If employee is allergic to the glue, he should be transferred to other work.*

45. An employee stood on a box in order to reach a box of crowns at the top of a pile. The box on which he stood tipped, throwing him to the floor. Lost 10 days.

(a) *Suitable safe ladders, step stools, or platforms should be furnished for employees' use whenever it is necessary for them to work at an elevation. The use of boxes, cases, or other makeshift means to gain access to elevations should be prohibited.*

(b) *Slides, skids, or similar equipment should be used in removing cases from piles which are not within easy reach from the floor.*

46. Employee was stitching the bottom of a carton. A staple from the machine entered her finger. Lost 23 days.

Stitching machines should be so guarded that it is impossible for workers to reach into the danger zone.

47. Employee had to pass through an area where a co-worker was sorting cartons and throwing them on a pile several feet away. The employee was struck in the face by a carton. Lost 10 days.

This is an instance of poor supervision and poor planning of work procedures. Cartons should not be thrown across passageways without barricading the aisle.

48. While handling cases, an employee cut his hand on a metal band that bound one of the cases. Lost 5 days.

(a) *Adequate case inspection should have indicated this unsafe condition and it should have been corrected immediately.*

(b) *Workers handling cases should wear gloves.*

49. As employee picked up a case of filled pints, the bottom of the case loosened. Several bottles dropped out and exploded. The employee was struck on the face and leg by flying glass. Lost 10 days.

Proper inspection of empty cases at the point where they are placed on the filling line should have revealed the defect. It should then have been removed for repair.

50. When an employee lifted an empty case, he cut his finger on a rough edge. Lost 20 days.

(a) *Close inspection and repair of cases is necessary to prevent this type of accident.*

(b) *Gloves should be worn by employees handling cases.*

51. While placing a case of beer on a truck, an employee strained his back. Lost 3 days.

Close supervision and adequate instruction in lifting procedures are necessary to prevent injuries of this kind. Each employee should be impressed with the importance of lifting with a straight instead of a bent back.

52. While piling cases of beer 5-high, a female employee strained her back as she put the fifth case in place. Lost 20 days.

(a) *Men should be used in this work as it is too heavy for most women. All employees performing this type of work should be thoroughtly trained in lifting procedures.*

(b) *Wherever possible, mechanical equipment should be used in piling filled cases.*

53. An employee was piling cases 10-high. He fell from the top of the pile and injured his back. Lost 17 days.

Close supervision and adequate job instruction are necessary for the prevention of injuries in piling operations. Standing or working on cases piled 10-high is dangerous and should be avoided. To lessen the danger of falling over the sides of piles, the cases should be piled in bins or inside wooden frames which will hold the cases and also act as a guard against falls. Cases should also be piled stepwise and interlocked by turning alternate rows. For better footing while working on piles, employees should work from planks.

54. As an employee walked under a slide, a case fell from it and struck him in the eye. Lost 7 days.

Slides should be equipped with side rails to prevent material falling over the sides. If the slides are not guarded in this way, barriers should be placed to prevent employees entering the area beneath the slides.

SHIPPING AND DELIVERY DEPARTMENT ACCIDENTS

55. While loading filled half-barrels from the loading dock, a worker cut his finger on a sharp hoop. Lost 22 days.

(a) *Adequate barrel inspection should have indicated this unsafe condition and proper maintenance should have eliminated it.*

(b) *All employees handling barrels should wear heavy gloves.*

56. A truck was parked 10 inches from the loading platform. It had been raining and the metal edge of the truck was slippery. As an employee attempted to step to the truck, he slipped and caught his leg between the truck and the platform. Lost 7 days.

(a) *Trucks should be parked close to platforms to eliminate openings between the trucks and the platforms. If trucks cannot park adjacent to the loading areas without leaving a space between them and the area, the space should be spanned with portable platforms.*

(b) *Metal sections that are smooth and on which employees must step or stand should be replaced with corrugated sheet metal.*

57. As an employee jumped from a truck, he slipped and strained his knee. Lost 9 days.

Ladders or steps should be provided for access to and from all elevated platforms, trucks, and railroad cars.

58. A truck driver was using the side gate of his truck as a ladder to enter and leave the truck. The gate slipped as he was climbing on it and threw him to the ground. Lost 17 days.

(a) *All trucks should have permanent nonslip steps and handholds to permit safe access to the bed of the truck.*

(b) *When there are no steps on the truck, the driver should be provided with a short ladder so designed that it can be firmly hooked at the top. Truck gates should never be used as substitutes for ladders.*

59. When an employee attempted to roll a barrel of beer over a step at the entrance of a tavern, he wrenched his back. Lost 4 days.

Employees should not attempt to handle filled barrels by themselves. Sufficient help should always be provided. Where possible, a skid should be used in moving barrels.

60. An employee was carrying a full half-barrel of beer into a tavern. He missed his step and dropped the barrel on his feet. Lost 20 days.

(a) *No employee should be required to carry filled half-barrels single-handed. When filled kegs are moved horizontally they should be rolled. When moved down grade they should be lowered with a rope or skidded. Whenever it is necessary to carry filled kegs which are larger than one-quarter barrel, they should be handled by two men using barrel tongs. Small hand trucks can also be used to move filled kegs on even surfaces, but not to move them up or down steps.*

(b) *Employees handling filled or empty kegs should be required to wear safety shoes.*

61. An employee was using a hand truck to pull cases of quart bottles up a stairway. He strained the ligaments of his leg at the hip and as a result lost 29 days.

Loaded hand trucks should not be pulled up a stairway. If other facilities, such as elevators, were not available, the cases should have been carried one at a time.

62. While carrying two cases of beer, an employee stepped on a piece of wood and fell down a flight of stairs. Lost 58 days.

(a) *Before making any deliveries, the employee should have inspected the premises and removed any such hazards.*

(b) *Employee should carry only one case of beer at a time.*

63. Because of an approaching storm a truck driver attempted to place a tarpaulin over the load. He climbed to the top of the load by holding to a rope. The rope broke and he fell to the pavement. Lost 4 days.

The driver and his helper should have drawn the tarpaulin into place with ropes thereby eliminating the climbing on the load.

64. An employee was putting stakes in a trailer when a slide, which had been placed against a door, fell and hit his foot. Lost 5 days.

(a) *Slides or skids should always be laid in a horizontal position or hung on hangers when not in use. No material of any kind should be placed beside or against a door which might move.*

(b) *All workers in delivery departments should wear safety shoes. In this instance, safety shoes probably would have avoided or minimized the injury.*

65. Employee was unloading cases of empty bottles from a truck. One section of the slide which was being used for this work slipped off a pile of cases upon which it rested. Employee was struck by the falling slide. Lost 9 days.

Because these operations are usually a part of the regular routine, employers should furnish permanent equipment for these jobs which would eliminate makeshift set-ups. Skids should have sound supports, such as light metal A-frames. Cases, particularly cartons, should never be used as skid supports.

66. As an employee was leaving a freight car which he had been loading, he stepped on a beer case. When it overturned, he fell and struck his leg against the corner of the case. Lost 13 days.

Cases should never be used as substitutes for steps or ladders. Ladders equipped with safety shoes should be furnished and their use enforced on all jobs where the need for ladders exists.

67. While placing a bulkhead in a railroad car, an employee caught his finger between the car and the bulkhead. Permanent injury to the finger.

Thorough training and close supervision are necessary for the prevention of accidents of this type. Bulkheads are frequently heavy as well as unwieldy, and employees should not be required to put them in place without assistance.

68. Employee struck his back when he stooped to walk under a case conveyor which was being used to load a railroad car. Lost 38 days.

The space under portable conveyors should be closed off and employees prohibited from attempting to go under such equipment.

MAINTENANCE DEPARTMENT ACCIDENTS

69. An employee, not an electrician, was working on an electric fuse box. A flash resulting from a short circuit, burned his face. Lost 41 days.

(a) *Only qualified electricians should be permitted to work or make repairs on electrical equipment.*

(b) *Before work is begun on any electrical installation, the circuit should be opened and the switch locked in the open position.*

70. A machinist was putting a link in the conveyor between the labeler and packer. A second employee started the conveyor line, which caught the machinist's hands and resulted in amputation of a thumb and two fingers.

Before repair work is started on any machine or mechanical equipment, the starting switch should be locked in an open position to prevent starting of the equipment. If the switch cannot be locked, the fuse should be pulled or the motor disconnected. Warning signs, which are sometimes attached to the switch instead of locking it open, give inadequate protection as they may be knocked off or disregarded.

71. Employee attempted to remove excess grease from the gear case of the main drive on a soaker without stopping the machine. The guard on the gear case had been removed. The employee had a finger amputated when it was caught in the gears.

(a) *Supervisors should enforce the rule that all guards must be in place before starting or using machinery.*

(b) *No powered equipment should be repaired, cleaned, or adjusted while it is in operation.*

72. While painting pipes near the ceiling in the brewhouse, an employee collapsed as a result of heat exhaustion. Lost 5 days.

(a) *Painting should be done during nonoperating periods of the brewhouse. When it is necessary to paint during the brewing operation, forced ventilation should be provided.*

(b) *Salt tablets should be provided for employees working in over-heated areas.*

73. A painter was washing mold from walls with a chemical compound. When a fellow worker handed him a beer can filled with the chemical, the employee drank it thinking it was beer. Lost 1 day.

(a) *Chemicals should never be put in beer cans; proper cans labeled to show the nature of the contents should be used.*

(b) *Plant rules should prohibit the consumption of beer on the premises except at specified times and places. If this rule had been in effect the employee would not have thought that the can contained beer.*

74. An employee was using a scaffold to paint the walls in the bottle shop. He fell 15 feet from the scaffold to the concrete floor, fracturing his skull. Lost 85 days.

All scaffolds should be equipped with guardrails and toeboards. Construction of scaffolds should be in accordance with a safe standard, and both the installation and use of scaffolds should be under the close supervision of a responsible employee.

MISCELLANEOUS ACCIDENTS

75. An employee was using a rope to pull a hand truck. The rope broke and the truck pinned another employee against the wall, injuring his arm. Lost 6 days.

Hand trucks are never under complete control when they are being pulled with ropes. For this reason the use of ropes should be prohibited.

All hand trucks should have handles by which they can be pushed and their movements controlled. Truckers should be required to push trucks rather than to pull them.

76. While walking backward and pulling a 4-wheeled truck, an employee was caught between the truck and a post. Lost 69 days.

(a) *Hand trucks should be pushed not pulled.*

(b) *Workers should never walk backward.*

77. A warehouse employee was pushing a 4-wheeled truck. He stepped to the side of the truck to open a door. As he did so, his trouser cuff caught on the truck and one of the wheels of the truck passed over his foot. Lost 4 days.

(a) *Supervisors should forbid employees to wear loose, worn, or torn clothing. Work clothes should not have cuffs.*

(b) *Employees who are handling materials should wear steel-toed safety shoes.*

78. While making his regular inspection, a guard lifted the elevator gate, stepped into the shaft, and fell 6 feet. As a result of a fractured leg, the employee was disabled 6 months.

All openings into elevator shafts should be equipped with gates (a) *interlocked with the controls so that the elevator will not operate when any gate is open and* (b) *interlocked with the car so that no door can be opened without a special key unless the car is stopped at its level.*

79. Employee was using a hand truck to wheel a can of alkali solution. The truck struck a rough place on the platform causing the solution to splash and strike employee's eye. Loss of eye.

(a) *Covered containers should be used for transporting alkali solutions.*

(b) *All workers handling this material should be required to wear goggles, gloves, and other protective clothing.*

(c) *Under an adequate program of plant inspection and repair, the platform would not have been allowed to remain in poor condition.*

80. An employee was shoveling alkali. Some of the alkali fell into his shoes, causing a chemical burn. Lost 22 days.

All employees handling dangerous chemicals should be provided with proper wearing apparel, such as goggles, rubber gloves, rubber aprons, and proper footwear.

Appendix.—Statistical Tables

TABLE 1.—*Industrial Injury Rates for 321 Breweries, 1944, Classified by Department and Extent of Disability*

Department [1]	Number of units reporting	Number of employees	Employee-hours worked (thousands)	Number of disabling injuries				Total days lost	Injury rates [3]		Average days lost per temporary total disability
				Total	Resulting in—				Frequency	Severity	
					Death or permanent total disability [2]	Permanent partial disability	Temporary total disability				
Total	[4] 321	54,759	124,305	5,745	(1) 11	468	5,266	735,486	46.2	5.9	15
Malting	18	311	720	59	0	2	57	1,259	81.9	1.7	12
Brewhouse	1,017	8,826	20,278	1,031	2	55	974	99,996	50.8	4.9	18
Filtering	129	431	1,004	24	0	1	23	4,240	23.9	4.2	10
Brewing, including mashing	171	1,106	2,590	84	0	7	77	10,485	32.4	4.0	19
Fermenting	160	870	2,044	67	0	0	67	1,119	32.8	.5	17
Racking	162	786	1,758	91	0	6	85	5,494	51.8	3.1	15
Washing	149	868	1,973	115	1	3	111	13,374	58.3	6.8	23
Loading	106	516	1,175	90	1	3	86	8,551	76.6	7.3	16
Other	13	174	409	18	0	3	15	1,471	44.0	3.6	25
Bottling department	908	20,068	46,114	2,423	0	173	2,250	228,722	52.5	5.0	14
Washing	153	1,305	3,109	135	0	6	129	6,030	43.4	1.9	10
Filling and capping	152	880	2,070	94	0	19	75	13,482	45.4	6.5	14
Pasteurizing	144	768	1,812	107	0	6	101	9,681	59.0	5.3	12
Casing	146	1,440	3,412	188	0	16	172	21,398	55.1	6.3	12
Loading	150	1,970	4,720	226	0	20	206	31,175	47.9	6.6	16
Other	29	606	1,406	83	0	7	76	7,093	59.0	5.0	10
Delivery	375	7,862	18,291	1,172	4	154	1,014	232,273	64.1	12.7	14
Draught	110	1,882	4,328	403	2	73	328	98,120	93.1	22.7	16
Bottle	107	2,399	5,613	317	2	39	276	80,187	56.5	14.3	14
Service and maintenance	1,220	14,665	32,232	686	(1) 4	73	609	149,208	21.3	4.6	19
Administrative and clerical	278	5,877	12,443	24	1	1	22	6,619	1.9	.5	15
Garage	122	484	1,093	36	0	8	28	18,116	32.9	16.6	29
Plant maintenance	219	2,691	6,176	253	1	26	226	51,849	41.0	8.4	24
Power	182	1,404	3,137	88	1	3	84	12,362	28.1	3.9	21
Refrigeration	110	512	1,183	26	0	0	26	338	22.0	.3	13
Sales	217	1,894	4,001	17	0	1	16	4,378	4.2	1.1	24
Other	92	1,803	4,199	242	(1) 1	34	207	55,546	57.6	13.2	13

[1] Totals include figures not shown separately because of insufficient data.
[2] Figures in parentheses indicate the number of permanent total disability cases included.
[3] The frequency rate is the average number of disabling injuries for each million employee-hours worked. The severity rate is the average number of days lost for each thousand employee-hours worked.
[4] Number of breweries reporting.

TABLE 2.—*Industrial Injury Rates for 321 Breweries, 1944, Classified by Geographic Area, State, and City, and by Extent of Disability*

Geographic area, State, and city [1]	Number of establishments	Number of employees	Employee-hours worked (thousands)	Number of disabling injuries				Total days lost	Injury rates [3]		Average days lost per temporary total disability
				Total	Resulting in—				Frequency	Severity	
					Death or permanent total disability [2]	Permanent partial disability	Temporary total disability				
United States: Total	321	54,759	124,305	5,745	(1) 11	468	5,266	735,486	46.2	5.9	15
New England: Total	10	1,470	3,226	219	1	2	216	11,943	67.9	3.7	25
Massachusetts	8	1,004	2,294	150	0	2	148	2,796	65.4	1.2	15
Middle Atlantic: Total	78	14,380	32,763	1,724	(1) 6	328	1,390	481,486	52.6	14.7	14
New Jersey	6	2,621	6,519	180	0	109	71	150,195	27.6	23.0	13
New York	22	6,464	14,728	935	(1) 4	212	719	308,817	63.5	21.0	15
Brooklyn–New York	7	4,124	9,343	656	3	172	481	260,206	70.2	27.8	16
Rochester	3	519	1,314	52	(1) 1	0	51	6,951	40.0	5.3	19
Pennsylvania	50	5,295	11,517	609	2	7	600	22,474	52.9	2.0	14
Philadelphia	8	1,194	2,696	105	1	0	104	7,533	38.9	2.8	15
Pittsburgh	3	863	1,867	239	1	1	237	9,181	128.0	4.9	12
Wilkes-Barre	3	608	1,244	29	0	1	28	878	23.3	.7	21
East North Central: Total	136	20,638	47,626	2,191	3	61	2,127	124,703	46.0	2.6	14
Illinois	26	2,859	6,738	344	0	18	326	27,932	51.1	4.1	9
Chicago	13	1,412	3,302	239	0	6	233	10,095	72.4	3.1	7
Indiana	11	1,908	4,326	302	0	1	301	3,543	69.8	.8	11
Michigan	19	2,639	6,294	267	0	2	265	5,038	42.4	.8	16
Detroit	8	2,181	5,215	227	0	1	226	3,965	43.5	.8	16
Ohio	26	3,862	9,149	341	3	5	333	36,773	37.3	4.0	21
Cincinnati	3	1,156	2,733	113	1	0	112	7,875	41.3	2.9	17
Cleveland	4	1,232	3,023	101	0	3	98	10,589	33.4	3.5	24
Columbus	4	424	958	46	0	0	46	947	48.0	1.0	21
Wisconsin	54	9,370	21,119	937	0	35	902	51,417	44.4	2.4	13
Milwaukee	8	7,292	16,216	766	0	32	734	45,245	47.2	2.8	13
West North Central: Total	25	7,940	17,584	689	0	36	653	56,277	39.2	3.2	17
Minnesota	13	1,917	4,124	147	0	3	144	8,966	35.6	2.2	20
Minneapolis–St. Paul	4	1,596	3,403	117	0	1	116	4,144	34.4	1.2	20
Missouri	9	5,678	12,696	508	0	33	475	46,922	40.0	3.7	16
St. Louis	4	5,135	11,510	448	0	30	418	44,843	38.9	3.9	17

South Atlantic: Total	11	1,448	3,395	114	0	5	109	10,712	33.6	3.2	18
Florida	4	444	1,079	15	0	1	14	498	13.9	.5	14
Maryland	3	737	1,807	73	0	4	69	9,939	40.4	5.5	22
East South Central: Total	6	1,388	3,089	97	0	3	94	7,503	31.4	2.4	16
Kentucky	4	1,051	2,221	83	0	2	81	4,819	37.4	2.2	15
West South Central: Total	10	2,112	4,519	222	0	17	205	16,443	49.1	3.6	16
Louisiana	4	1,022	2,371	122	0	4	118	3,130	51.4	1.3	16
New Orleans	4	1,022	2,371	122	0	4	118	3,130	51.4	1.3	16
Texas	5	1,041	2,030	79	0	13	66	13,266	38.9	6.5	20
Mountain: Total	18	1,015	2,265	109	1	2	106	11,729	43.1	5.2	13
Colorado	3	521	1,162	78	1	1	76	7,017	67.1	6.0	9
Pacific: Total	27	4,368	9,839	380	0	14	366	14,690	38.6	1.5	18
California	14	3,034	7,143	288	0	12	276	12,955	40.3	1.8	20
Los Angeles	3	492	1,130	42	0	6	36	4,207	37.2	3.7	11
San Francisco	5	1,996	4,789	179	0	2	177	5,348	37.4	1.1	25
Washington	9	1,051	2,105	62	0	2	60	1,473	29.4	.7	15

[1] Totals include figures not shown separately because of insufficient data.
[2] Figures in parentheses indicate the number of permanent total disability cases included.
[3] The frequency rate is the average number of disabling injuries for each million employee-hours worked. The severity rate is the average number of days lost for each thousand employee-hours worked.

TABLE 3.—*Industrial Injury Rates for 321 Breweries, 1944, Classified by Size of Establishment and Extent of Disability*

Size of establishment	Number of establishments	Number of employees	Employee-hours worked (thousands)	Number of disabling injuries				Total days lost	Injury rates [2]		Average days lost per temporary total disability
				Total	Resulting in—				Frequency	Severity	
					Death or permanent total disability [1]	Permanent partial disability	Temporary total disability				
Total	321	54,759	124,305	5,745	(1) 11	468	5,266	735,486	46.2	5.9	15
Under 25 employees	47	737	1,678	73	0	3	70	7,149	43.5	4.3	15
25 to 49 employees	80	2,951	6,562	240	0	7	233	9,939	36.6	1.5	16
50 to 99 employees	75	5,561	12,401	468	3	15	450	38,687	37.7	3.1	14
100 to 249 employees	65	9,914	22,803	1,170	(1) 4	20	1,146	54,903	51.3	2.4	14
250 to 499 employees	35	12,785	28,224	1,431	1	109	1,321	160,143	50.7	5.7	17
500 to 999 employees	12	7,974	18,679	722	1	50	671	99,580	38.7	5.3	18
1,000 employees and over	7	14,837	33,958	1,641	2	264	1,375	365,085	48.3	10.8	14

[1] Figures in parentheses indicate the number of permanent total disabilities included.
[2] The frequency rate is the average number of disabling injuries for each million employee-hours worked. The severity rate is the average number of days lost for each thousand employee-hours worked.

TABLE 4.—*Distribution of Industrial Injury-Frequency Rates of 321 Breweries, 1944, Classified by Size of Establishment*

Size of establishment	Total number of establishments	Number of establishments with frequency rates of—											
		0	1 to 9	10 to 19	20 to 29	30 to 39	40 to 49	50 to 59	60 to 69	70 to 79	80 to 89	90 to 99	100 and over
Total	321	55	11	33	41	46	37	31	15	21	5	6	20
Under 25 employees	47	22			5	1	3	4	3	1			8
25 to 49 employees	80	17	1	16	8	10	6	7	4	4	1	4	2
50 to 99 employees	75	11	10	7	9	12	8	7	2	3	1	1	4
100 to 249 employees	65	5		9	8	11	8	8	3	6	2	1	4
250 to 499 employees	35			1	5	8	8	4	2	4	1		2
500 to 999 employees	12				5	2	3	1		1			
1,000 employees and over	7				1	2	1		1	2			

TABLE 5.—*Disabling Injuries in 82 Breweries, 1944, Classified by Nature of Injury and Extent of Disability*

Nature of injury	Number of disabling injuries					Average number of days lost per temporary total disability
	Total		Resulting in—			
	Number	Percent [1]	Death	Permanent partial disability	Temporary total disability	
Total	4,276	100.0	6	162	4,108	17
Amputations	37	.9	----	37	----	----
Bruises, contusions, concussions	1,154	27.1	----	8	1,146	13
Without infection	1,111	26.1	----	7	1,104	13
With infection	43	1.0	----	1	42	18
Burns, scalds	145	3.4	----	2	143	15
Without infection	130	3.0	----	2	128	15
With infection	15	.4	----	----	15	15
Cuts, lacerations, punctures	1,123	26.4	1	62	1,060	12
Without infection	952	22.4	----	56	896	12
With infection	171	4.0	1	6	164	14
Dislocations	19	.4	----	----	19	24
Foreign bodies in eyes	57	1.3	----	----	57	9
Without infection	46	1.0	----	----	46	7
With infection	11	.3	----	----	11	18
Fractures	454	10.7	2	50	402	35
Without infection	453	10.7	2	50	401	35
With infection	1	[2]	----	----	1	----
Hernia	63	1.5	1	----	62	48
Industrial diseases	20	.5	----	----	20	47
Strains, sprains (except hernia)	1,161	27.3	----	2	1,159	16
Without infection	1,160	27.3	----	2	1,158	16
With infection	1	[2]	----	----	1	----
Other	22	.5	1	1	20	14
Unclassified—insufficient data	21	----	1	----	20	12

[1] Percentage of cases for which nature of injury is known. [2] Less than 0.05.

TABLE 6.—*Disabling Injuries in 82 Breweries, 1944, Classified by Part of Body Injured and Extent of Disability*

Part of body injured	Number of disabling injuries					Average number of days lost per temporary total disability
	Total		Resulting in—			
	Number	Percent [1]	Death	Permanent partial disability	Temporary total disability	
Total	4,276	100.0	6	162	4,108	17
Head	379	8.9	1	26	352	13
Eye(s)	147	3.4	----	14	133	11
Brain or skull	105	2.5	1	1	103	14
Other	127	3.0	----	11	116	16
Trunk	1,158	27.2	2	1	1,155	20
Chest (lungs), ribs, etc	210	4.9	1	----	209	17
Back	553	13.0	----	----	553	18
Abdomen	125	2.9	1	----	123	30
Hip(s) or pelvis	68	1.6	----	----	68	29
Shoulder	131	3.1	----	1	130	18
Other	71	1.7	----	----	72	16
Upper extremities	1,493	35.1	----	110	1,383	15
Arm(s)	262	6.2	----	3	259	17
Hand (s) (including wrist)	550	12.9	----	19	531	14
Finger(s) and/or thumb(s)	681	16.0	----	88	593	14
Lower extremities	1,182	27.8	1	25	1,156	17
Leg(s)	471	11.1	----	6	465	20
Foot or feet (including ankle)	517	12.1	1	4	512	16
Toe(s)	194	4.6	----	15	179	13
General	43	1.0	1	----	42	18
Unclassified—insufficient data	21	----	1	----	20	14

[1] Percentage of cases for which part of body injured is known.

TABLE 7.—*Disabling Injuries in 82 Breweries, 1944, Classified by Department, Part of Body Injured, and Nature of Injury*

Department and part of body injured	Total number of disabling injuries	Nature of injury											
		Amputations	Bruises, contusions, and concussions	Burns and scalds	Cuts, lacerations, and punctures	Dislocations	Foreign bodies in eyes	Fractures	Hernia	Industrial diseases	Strains and sprains	Other	Unclassified—insufficient data
All departments: Total	4,276	37	1,154	145	1,123	19	57	454	63	20	1,161	22	21
Head	379		105	47	151		57	8		1	5	5	
Eye(s)	147		16	29	44		57					1	
Brain or skull	105		54	1	47			3					
Other	127		35	17	60			5		1	5	4	
Trunk	1,158		271	11	17	14		78	63	1	695	5	3
Chest (lungs), ribs, etc	210		104	4	6	1		64			27	3	1
Back	553		71	1	1	2		4		1	472		1
Abdomen	125		16		3				63		42	1	
Hip(s) or pelvis	68		25	3	3			6			30		1
Shoulder	131		37	1	4	11		4			73	1	
Other	71		18	2							51		
Upper extremities	1,493	34	269	30	811	2		185		15	144		3
Arm(s)	262		75	10	104	1		28		1	42		1
Hand(s) (including wrist)	550		90	15	293			52		10	89		1
Finger(s) and/or thumb(s)	681	34	104	5	414	1		105		4	13		1
Lower extremities	1,182	3	489	50	139	3		183		1	308	2	4
Leg(s)	471		235	14	74	1		43		1	100	1	2
Foot or feet (including ankle)	517		176	35	50	1		45			208	1	1
Toe(s)	194	3	78	1	15	1		95					1
General	43		19	6	3					2		9	4
Unclassified—insufficient data	21		1	1	2						9	1	7
Brewhouse: Total	752	4	211	49	94	6	9	110	13		250	2	4
Head	67		22	20	12		9	4					
Eye(s)	26		3	13	1		9						
Brain or skull	18		10	1	6			1					
Other	23		9	6	5			3					

Trunk	261		54	2	2	3		20	13		165		2
Chest (lungs), ribs, etc	52		23	1	2			17			8		1
Back	106		14								92		
Abdomen	25								13		12		
Hip(s) or pelvis	18		5					2			10		1
Shoulder	32		9	1		3		1			18		
Other	28		3								25		
Upper extremities	195	4	47	10	63	2		43			24		2
Arm(s)	38		13	2	8	1		8			5		1
Hand(s) (including wrist)	57		10	5	20			7			15		
Finger(s) and/or thumb(s)	100	4	24	3	35	1		28			4		1
Lower extremities	222		86	16	17	1		43			59		
Leg(s)	84		36	4	8	1		10			25		
Foot or feet (including ankle)	91		34	11	7			5			34		
Toe(s)	47		16	1	2			28					
General	5		2	1								2	
Unclassified—insufficient data	2										2		
Bottling department: Total	1,655	15	363	60	750	4	22	94	21	13	297	7	9
Head	178		38	16	96		22	1		1	2	2	
Eye(s)	77		10	13	32		22						
Brain or skull	48		19		29								
Other	53		9	3	35			1		1	2	2	
Trunk	317		93	4	11	3		22	21		159	3	1
Chest (lungs), ribs, etc	61		33	1	3			17			6	1	
Back	133		23	1				1			107		1
Abdomen	49		12		3				21		12	1	
Hip(s) or pelvis	21		6	1	2			3			9		
Shoulder	37		11		3	3		1			18	1	
Other	16		8	1							7		
Upper extremities	800	14	100	11	569			41		11	53		1
Arm(s)	144		29	6	87			7		1	14		
Hand(s) (including wrist)	320		44	4	216			15		7	33		1
Finger(s) and/or thumb(s)	336	14	27	1	266			19		3	6		
Lower extremities	347	1	130	27	71	1		30		1	82	1	3
Leg(s)	162		78	8	36			10		1	28		1
Foot or feet (including ankle)	155		39	19	31			10			54	1	1
Toe(s)	30	1	13		4	1		10					1
General	8		2	2	1							1	2
Unclassified—insufficient data	5				2						1		2

TABLE 7.—*Disabling Injuries in 82 Breweries, 1944, Classified by Department, Part of Body Injured, and Nature of Injury*—Continued

Department and part of body injured	Total number of disabling injuries	Nature of injury											
		Amputations	Bruises, contusions, and concussions	Burns and scalds	Cuts, lacerations, and punctures	Dislocations	Foreign bodies in eyes	Fractures	Hernia	Industrial diseases	Strains and sprains	Other	Unclassified—insufficient data
Delivery department: Total	1,364	9	432	4	206	8	9	180	19	4	483	6	4
Head	69		26	1	29		9	2				2	
Eye(s)	20		3	1	7		9						
Brain or skull	21		12		8			1					
Other	28		11		14			1				2	
Trunk	448		89	1	3	7		23	19	1	304	1	
Chest (lungs), ribs, etc	66		34		1	1		20			9	1	
Back	251		25		1	2		1		1	221		
Abdomen	40		3						19		18		
Hip(s) or pelvis	19		7	1				1			10		
Shoulder	52		14		1	4		1			32		
Other	20		6								14		
Upper extremities	366	7	94	1	133			79		1	51		
Arm(s)	59		25		8			8			18		
Hand(s) (including wrist)	120		26	1	39			22		1	31		
Finger(s) and/or thumb(s)	187	7	43		86			49			2		
Lower extremities	451	2	208	1	39	1		76			123		1
Leg(s)	159		86		25			10			37		1
Foot or feet (including ankle)	197		82	1	6	1		21			86		
Toe(s)	95	2	40		8			45					
General	21		14		2					2		3	
Unclassified—insufficient data	9		1								5		3
Other departments: Total	505	9	148	32	73	1	17	70	10	3	131	7	4
Head	65		19	10	14		17	1			3	1	
Eye(s)	24			2	4		17					1	
Brain or skull	18		13		4			1					
Other	23		6	8	6						3		
Trunk	132		35	4	1	1		13	10		67	1	
Chest (lungs), ribs, etc	31		14	2				10			4	1	
Back	63		9					2			52		
Abdomen	11		1						10				
Hip(s)	10		7	1	1						1		
Shoulder	10		3			1		1			5		
Other	7		1	1							5		

Upper extremities	132	9	28	8	46			22		3	16		
Arm(s)	21		8	2	1			5			5		
Hand(s) (including wrist)	53		10	5	18			8		2	10		
Finger(s) and/or thumb(s)	58	9	10	1	27			9		1	1		
Lower extremities	162		65	6	12			34			44	1	
Leg(s)	66		35	2	5			13			10	1	
Foot or feet (including ankle)	74		21	4	6			9			34		
Toe(s)	22		9		1			12					
General	9		1	3								3	2
Unclassified—insufficient data	5			1							1	1	2

TABLE 8.—*Disabling Injuries in 82 Breweries, 1944, Classified by Part of Body Injured and Department*

Part of body injured	Brewhouse		Bottling department		Delivery	
	Number of disabling injuries		Number of disabling injuries		Number of disabling injuries	
	Number	Percent [1]	Number	Percent [1]	Number	Percent [1]
Total	752	100.0	1,655	100.0	1,364	100.0
Head	67	8.9	178	10.8	69	5.1
Eye(s)	26	3.4	77	4.7	20	1.5
Brain or skull	18	2.4	48	2.9	21	1.5
Other	23	3.1	53	3.2	28	2.1
Trunk	261	34.8	317	19.2	448	33.1
Chest (lungs), ribs, etc	52	6.9	61	3.7	66	4.9
Back	106	14.2	133	8.0	251	18.5
Abdomen	25	3.3	49	3.0	40	3.0
Hip(s) or pelvis	18	2.4	21	1.3	19	1.4
Shoulder	32	4.3	37	2.2	52	3.8
Other	28	3.7	16	1.0	20	1.5
Upper extremities	195	26.0	800	48.5	366	27.0
Arm(s)	38	5.1	144	8.7	59	4.4
Hand(s) (including wrist)	57	7.6	320	19.4	120	8.9
Finger(s) and/or thumb(s)	100	13.3	336	20.4	187	13.7
Lower extremities	222	29.6	347	21.0	451	33.3
Leg(s)	84	11.2	162	9.8	159	11.7
Foot or feet (including ankle)	91	12.1	155	9.4	197	14.6
Toe(s)	47	6.3	30	1.8	95	7.0
General	5	.7	8	.5	21	1.5
Unclassified—insufficient data	2		5		9	

[1] Percentage of cases for which part of body injured is known.

TABLE 9.—*Disabling Injuries in 82 Breweries, 1944, Classified by Nature of Injury and Department*

Nature of injury	Brewhouse		Bottling department		Delivery	
	Number of disabling injuries		Number of disabling injuries		Number of disabling injuries	
	Number	Percent [1]	Number	Percent [1]	Number	Percent [1]
Total	752	100.0	1,655	100.0	1,364	100.0
Without infection	720	95.7	1,534	92.7	1,303	95.5
With infection	32	4.3	121	7.3	61	4.5
Amputations	4	.5	15	.9	9	.7
Bruises, contusions, concussions	211	28.2	363	22.0	432	31.8
Without infection	202	27.0	348	21.1	417	30.7
With infection	9	1.2	15	.9	15	1.1
Burns, scalds	49	6.6	60	3.6	4	.3
Without infection	42	5.7	54	3.2	4	.3
With infection	7	.9	6	.4		
Cuts, lacerations, punctures	94	12.6	750	45.8	206	15.1
Without infection	79	10.6	655	40.0	162	11.9
With infection	15	2.0	95	5.8	44	3.2
Dislocations	6	.8	4	.2	8	.6
Foreign bodies in eyes	9	1.2	22	1.3	9	.7
Without infection	8	1.1	18	1.1	8	.6
With infection	1	.1	4	.2	1	.1
Fractures	110	14.7	94	5.7	180	13.2
Hernia	13	1.7	21	1.3	19	1.4
Industrial diseases			13	.8	4	.3
Strains, sprains	250	33.4	297	18.0	483	35.5
Other	2	.3	7	.4	6	.4
Unclassified—insufficient data	4		9		4	

[1] Percentage of cases for which nature of injury is known.

TABLE 10.—*Disabling Injuries in 82 Breweries, 1944, Classified by Agency and Part and by Extent of Disability*

Agency and part	Number of disabling injuries					Average number of days lost per temporary total disability
	Total		Resulting in—			
	Number	Percent [1]	Death	Permanent partial disability	Temporary total disability	
Total	4,276	100.0	6	162	4,108	17
Machines	491	11.9	----	34	457	14
Labeling machines	110	2.7	----	9	101	10
Bottles in machines	86	2.1	----	6	80	9
Other parts	24	.6	----	3	21	15
Pasteurizers	132	3.2	----	9	123	12
Bottles in machines	106	2.6	----	7	99	12
Other parts	26	.6	----	2	24	14
Other machines	249	6.0	----	16	233	16
Bed or frame	12	.3	----	1	11	32
Gears, pulleys, etc	25	.6	----	5	20	15
Point-of-operation	18	.4	----	3	15	15
Bottles in machines	75	1.8	----	3	72	8
Other parts	119	2.9	----	4	115	19
Elevators	26	.6	1	1	24	31
Conveyors and chutes	392	9.5	----	25	367	15
Belts, pulleys, gears, etc	47	1.1	----	8	39	21
Load	89	2.2	----	3	86	13
Bottles on conveyors	19	.5	----	----	19	12
Other parts	237	5.7	----	14	223	14
Vehicles	472	11.4	2	27	443	18
Motor	326	7.9	1	21	304	19
Frame	112	2.7	----	4	108	18
Load	117	2.8	1	8	108	15
Other parts	97	2.4	----	9	88	25
Hand trucks	50	1.2	1	----	49	14
Other vehicles	96	2.3	----	6	90	18
Frame	37	.9	----	2	35	22
Load	25	.6	----	3	22	12
Other parts	34	.8	----	1	33	17
Hand tools	99	2.4	----	5	94	13
Chemicals	73	1.8	----	2	71	11
Working surfaces	540	13.1	1	5	534	18
Floors	293	7.1	----	3	290	17
Platforms	81	2.0	----	1	80	21
Roadways	68	1.6	----	1	67	19
Other working surfaces	98	2.4	1	----	97	21
Miscellaneous agencies	2,034	49.3	2	63	1,969	17
Bales, bags	50	1.2	----	1	49	19
Barrels, kegs	688	16.7	----	28	660	19
Bottles	292	7.1	----	17	275	12
Cartons, boxes	481	11.6	1	5	475	16
Ladders	68	1.6	----	3	65	24
Stairways	118	2.9	----	3	115	17
Tanks, vats	52	1.3	----	1	51	27
Other	285	6.9	1	5	279	14
Unclassified—insufficient data	149	----	----	----	149	25

[1] Percentage of cases for which agency is known.

TABLE 11.—*Disabling Injuries in 82 Breweries, 1944, Classified by Accident Type and Extent of Disability*

Accident type	Number of disabling injuries					Average number of days lost per temporary total disability
	Total		Resulting in—			
	Number	Percent [1]	Death	Permanent partial disability	Temporary total disability	
Total	4,276	100.0	6	162	4,108	17
Striking against	488	11.6		10	478	13
Struck by	890	21.0	2	45	843	16
Caught in, on, or between	430	10.2	1	58	371	17
Falls—						
On same level	509	12.1		11	498	19
To lower level	252	6.0	1	6	245	26
Slips (not falls)	232	5.5	1		231	16
Contact with temperature extremes	148	3.5		2	146	14
Explosions	446	10.6		29	417	11
Overexertion	769	18.1	1		768	18
Other accident types	58	1.4		1	57	18
Unclassified—insufficient data	54				54	28

[1] Percentage of cases for which accident type is known.

TABLE 12.—*Disabling Injuries in 82 Breweries, 1944, Classified by Accident Type and Department*

Accident type	Brewhouse: number of disabling injuries		Bottling department: number of disabling injuries		Delivery: number of disabling injuries	
	Number	Percent [1]	Number	Percent [1]	Number	Percent [1]
Total	752	100.0	1,655	100.0	1,364	100.0
Striking against	64	8.6	254	15.6	112	8.3
Struck by	169	22.7	212	13.0	384	28.4
Caught in, on, or between	69	9.3	183	11.2	143	10.5
Falls—						
On same level	125	16.8	161	9.9	148	10.9
To lower level	49	6.6	57	3.5	101	7.4
Slips (not falls)	43	5.8	64	3.9	94	6.9
Contact with temperature extremes	42	5.6	63	3.9	8	.6
Explosions	1	.1	416	25.7	24	1.8
Overexertion	174	23.4	192	11.8	327	24.1
Other accident types	8	1.1	25	1.5	15	1.1
Unclassified—insufficient data	8		28		8	

[1] Percentage of cases for which accident type is known.

TABLE 13.—*Disabling Injuries in 82 Breweries, 1944, Classified by Agency and Part and by Unsafe Working Condition*

Agency and part	Total number of disabling injuries	Unsafe working condition												
			Defects of agencies				Hazardous arrangement or procedure							
		Improperly guarded agencies	Total	Sharp-edged	Slippery	Other	Total	Unsafely stored or piled tools, materials, etc.	Unsafe planning or layout of traffic or process operations	Lack of proper lifting equipment	Lack of clear walkways or working surfaces	Other	Other unsafe working conditions	No unsafe condition	Unclassified—insufficient data
Total	4,276	460	1,200	216	373	611	1,303	191	73	525	92	422	24	23	1,266
Machines	491	244	140	62	17	61	32	1	3	7		21	1	1	73
Labeling machines	110	80	22	11	3	8	1					1			7
Bottles in machines	86	71	15	9		6									
Other parts	24	9	7	2	3	2	1					1			7
Pasteurizers	132	78	37	20		17	4			1		3			13
Bottles in machines	106	71	30	16		14									5
Other parts	26	7	7	4		3	4			1		3			8
Other machines	249	86	81	31	14	36	27	1	3	6		17	1	1	53
Bed or frame	12		5	1	3	1	2					2		1	4
Gears, pulleys, etc	25	12	2			2	3					3			8
Point-of-operation	18	15											1		2
Bottles in machines	75	32	40	22		18									3
Other parts	119	27	34	8	11	15	22	1	3	6		12			36
Elevators	26	11	3		1	2	2					2		1	9
Conveyors and chutes	392	86	28	1	2	25	177	4	24		7	142		2	99
Belts, pulleys, gears, etc	47	25	2			2	10					10			10
Load	89	18	11			11	36		16			20			24
Bottles on conveyors	19	11	5	1		4	2					2			1
Other parts	237	32	10		2	8	129	4	8		7	110		2	64
Vehicles	472	20	121	9	37	75	169	45	9	65	3	47		4	158
Motor	326	15	77	4	27	46	114	40	3	45		26		2	118
Frame	112	12	33		18	15	12		1	1		10		2	53
Load	117		5	2	1	2	90	40	1	44		5			22
Other parts	97	3	39	2	8	29	12		1			11			43
Hand trucks	50	2	6		1	5	24		1	10	3	10		2	16
Other vehicles	96	3	38	5	9	24	31	5	5	10		11			24
Frame	37	3	19	1	8	10	4		1			3			11
Load	25		3		1	2	18	5	2	7		4			4
Other parts	34		16	4		12	9		2	3		4			9

TABLE 13.—*Disabling Injuries in 82 Breweries, 1944, Classified by Agency and Part and by Unsafe Working Condition*—Continued

Agency and part	Total number of disabling injuries	Unsafe working condition												
		Improperly guarded agencies	Defects of agencies				Hazardous arrangement or procedure						Other unsafe working conditions	No unsafe condition	Unclassified—insufficient data
			Total	Sharp-edged	Slippery	Other	Total	Unsafely stored or piled tools, materials, etc.	Unsafe planning or lay-out of traffic or process operations	Lack of proper lifting equipment	Lack of clear walkways or working surfaces	Other			
Hand tools	99	---	15	---	---	15	14	1	---	3	---	10	1	3	66
Chemicals	73	2	4	---	---	4	16	1	---	---	---	15	10,	1	40
Working surfaces	540	42	315	6	232	77	111	4	5	1	69	32	---	1	71
Floors	293	5	185	5	151	29	70	2	---	---	58	10	---	1	32
Platforms	81	22	30	1	16	13	17	---	5	1	4	7	---	---	12
Roadways	68	1	53	---	37	16	2	---	---	---	1	1	---	---	12
Other working surfaces	98	14	47	---	28	19	22	2	---	---	6	14	---	---	15
Miscellaneous agencies	2,034	43	550	127	82	341	763	134	32	441	12	144	11	9	658
Bales, bags	50	---	1	---	---	1	39	7	---	28	---	4	---	---	10
Barrels, kegs	688	---	33	16	2	15	518	78	9	398	---	33	---	2	135
Bottles	292	---	265	43	2	220	2	---	---	---	---	2	1	1	23
Cartons, boxes	481	---	97	52	7	38	110	38	17	1	3	51	---	4	270
Ladders	68	23	5	---	1	4	6	1	---	---	3	2	---	---	34
Stairways	118	4	65	3	41	21	18	---	2	---	4	12	2	---	29
Tanks, vats	52	1	29	3	22	4	11	---	1	2	---	8	2	---	9
Other	285	15	55	10	7	38	59	10	3	12	2	32	6	2	148
Unclassified—insufficient data	149	12	24	11	2	11	19	1	---	8	1	9	1	1	92

TABLE 14.—*Disabling Injuries in 82 Breweries, 1944, Classified by Unsafe Working Condition and Department*

Unsafe working condition	Brewhouse: number of disabling injuries		Bottling department: number of disabling injuries		Delivery: number of disabling injuries	
	Number	Percent [1]	Number	Percent [1]	Number	Percent [1]
Total	752	100.0	1,655	100.0	1,364	100.0
Improperly guarded agencies	47	8.8	314	25.9	57	5.9
Defects of agencies	180	33.5	557	45.9	344	35.8
Slippery	116	21.6	81	6.7	117	12.2
Sharp-edged	14	2.6	143	11.7	48	5.0
Other	50	9.3	333	27.5	179	18.6
Hazardous arrangement or procedure	304	56.6	333	27.5	555	57.9
Unsafely stored or piled tools, materials, etc	33	6.1	27	2.2	116	12.1
Unsafe planning or lay-out of traffic or process operations	14	2.6	39	3.2	17	1.8
Lack of proper lifting equipment or lack of sufficient help in lifting operations	172	32.0	16	1.3	310	32.3
Lack of clear walkways or working surfaces	18	3.4	44	3.6	15	1.6
Other	67	12.5	207	17.2	97	10.1
Other unsafe working conditions	6	1.1	9	.7	4	.4
No unsafe working conditions	2	----------	9	----------	3	----------
Unclassified—insufficient data	213	----------	433	----------	401	----------

[1] Percentage of cases in which an unsafe working condition was known to exist.

TABLE 15.—*Disabling Injuries in 82 Breweries, 1944, Classified by Unsafe Act and Extent of Disability*

Unsafe act	Number of disabling injuries					Average number of days lost per temporary total disability
	Total		Resulting in—			
	Number	Percent [1]	Death	Permanent partial disability	Temporary total disability	
Total	4,276	100.0	6	162	4,108	17
Operating without authority; failure to secure or warn	63	2.2	----------	6	57	25
Operating or working at unsafe speed	57	2.0	----------	6	51	22
Using unsafe equipment, hands instead of equipment, or equipment unsafely	922	32.5	1	68	853	15
Using hands or feet instead of hand tools	31	1.1	----------	2	29	12
Gripping objects insecurely; taking wrong hold of objects	758	26.7	1	57	700	14
Other	133	4.7	----------	9	124	18
Unsafe loading, placing, etc	86	3.0	----------	2	84	18
Arranging or placing objects or materials unsafely	78	2.7	----------	1	77	20
Other	8	.3	----------	1	7	6
Failure to use proper safety equipment, or proper clothing	56	2.0	----------	5	51	9
Goggles	33	1.2	----------	5	28	5
Other	23	.8	----------	----------	23	14
Taking unsafe position or posture	1,625	57.2	5	27	1,593	18
Inattention to footing	962	33.8	2	20	940	18
Lifting incorrectly, or lifting too heavy loads	296	10.4	----------	----------	296	18
Running or jumping	36	1.3	----------	1	35	16
Other	331	11.7	3	6	322	16
Other unsafe acts	31	1.1	----------	5	26	22
No unsafe act	157	----------	----------	6	151	12
Unclassified—insufficient data	1,279	----------	----------	37	1,242	17

[1] Percentage of cases in which an unsafe act was known to have been committed.

TABLE 16.—*Disabling Injuries in 82 Breweries, 1944, Classified by Unsafe Act and Department*

Unsafe act	Brewhouse		Bottling department		Delivery	
	Number of disabling injuries		Number of disabling injuries		Number of disabling injuries	
	Number	Percent [1]	Number	Percent [1]	Number	Percent [1]
Total	752	100.0	1,655	100.0	1,364	100.0
Operating without authority; failure to secure or warn	13	2.5	16	1.6	25	2.6
Operating or working at unsafe speed	6	1.1	17	1.7	29	3.0
Using unsafe equipment, hands instead of equipment, or equipment unsafely	168	32.1	322	31.9	331	34.7
Using hands or feet instead of hand tools	4	.8	25	2.5	----------	----------
Gripping objects insecurely; taking wrong hold of objects	146	27.9	251	24.8	292	30.6
Other	18	3.4	46	4.6	39	4.1
Unsafe loading, placing, etc	19	3.6	24	2.4	37	3.9
Arranging or placing objects or materials unsafely	18	3.4	20	2.0	34	3.6
Other	1	.2	4	.4	3	.3
Failure to use proper safety equipment, or proper clothing	11	2.1	34	3.4	3	.3
Goggles	6	1.1	18	1.8	1	.1
Other	5	1.0	16	1.6	2	.2
Taking unsafe position or posture	303	58.0	579	57.2	528	55.3
Inattention to footing	205	39.2	307	30.2	316	33.1
Lifting incorrectly, or lifting too heavy loads	36	6.9	115	11.4	119	12.5
Running or jumping	----------	----------	13	1.3	19	2.0
Other	62	11.9	144	14.3	74	7.7
Other unsafe acts	3	.6	18	1.8	2	.2
No unsafe act	----------	----------	150	----------	2	----------
Unclassified—insufficient data	229	----------	495	----------	407	----------

[1] Percentage of cases in which an unsafe act was known to have been committed.

TABLE 17.—*All Industrial Injuries Experienced by Workers Employed for the Full Year 1944 in One Large Brewery, Classified by Department*

Department	Number of employees	Number of injuries			Average number of non-disabling injuries per disabling injury	Average number of injuries per employee	Average number of treatments per non-disabling injury
		Total	Non-disabling	Disabling			
Total	2,210	16,336	16,227	109	149	7.4	1.9
Brewhouse	358	1,582	1,565	17	92	4.4	1.9
Bottling department	910	9,405	9,350	55	170	10.3	1.9
Delivery	17	162	160	2	80	9.5	1.9
Service and maintenance	180	1,010	998	12	83	5.6	1.9
Other	416	2,178	2,155	23	94	5.2	1.9
Unclassified—insufficient data	329	1,999	1,999	----------	----------	6.1	2.0

TABLE 18.—*All Industrial Injuries Experienced by Workers Employed for the Full Year 1944 in One Large Brewery, Classified by Department and Part of Body Injured*

Department and part of body injured	Number of injuries				Average number of nondisabling injuries per disabling injury	Average number of treatments per nondisabling injury
	Total		Nondisabling	Disabling		
	Number	Percent [1]				
All departments: Total	16,336	100.0	16,227	109	149	1.9
Head	1,776	10.9	1,769	7	253	1.5
Eye(s)	1,097	6.8	1,095	2	548	1.2
Brain or skull	200	1.2	197	3	66	1.9
Other	479	2.9	477	2	239	1.9
Trunk	333	2.0	301	32	9	1.9
Chest (lungs), ribs, etc	36	.2	32	4	8	1.6
Back	153	.8	135	18	8	2.1
Abdomen	16	.1	11	5	2	1.2
Hip(s) or pelvis	25	.2	23	2	12	2.3
Shoulder	77	.5	74	3	25	2.0
Other	26	.2	26			1.2
Upper extremities	13,402	82.4	13,362	40	334	1.9
Arm(s)	950	5.8	945	5	189	1.8
Hand(s) (including wrist)	2,456	15.1	2,438	18	135	2.1
Finger(s) and/or thumb(s)	9,996	61.5	9,979	17	587	1.9
Lower extremities	762	4.7	732	30	24	2.5
Leg(s)	496	3.1	484	12	40	2.7
Foot or feet (including ankle)	210	1.3	197	13	15	2.0
Toe(s)	56	.3	51	5	10	2.4
General	8	[2]	8			5.5
Unclassified—insufficient data	55		55			1.2
Bottling department: Total	9,405	100.0	9,350	55	170	1.9
Head	879	9.4	876	3	292	1.5
Eye(s)	468	5.0	467	1	467	1.3
Brain or skull	113	1.2	112	1	112	1.7
Other	298	3.2	297	1	297	1.7
Trunk	166	1.8	151	15	10	1.8
Chest (lungs), ribs, etc	15	.2	15			1.7
Back	83	.9	75	8	9	2.0
Abdomen	10	.1	6	4	2	1.2
Hip(s) or pelvis	11	.1	9	2	5	2.6
Shoulder	33	.4	32	1	32	1.6
Other	14	.1	14			1.2
Upper extremities	7,929	84.4	7,903	26	304	1.9
Arm(s)	601	6.4	598	3	199	1.8
Hand(s) (including wrist)	1,362	14.5	1,349	13	104	2.0
Finger(s) and/or thumb(s)	5,966	63.5	5,956	10	596	1.9
Lower extremities	399	4.3	388	11	35	2.2
Leg(s)	272	2.9	266	6	44	2.3
Foot or feet (including ankle)	100	1.1	97	3	32	2.0
Toe(s)	27	.3	25	2	13	1.9
General	6	.1	6			6.7
Unclassified—insufficient data	26		26			1.3
All departments except bottling: Total	6,931	100.0	6,877	54	127	1.9
Head	897	13.0	893	4	223	1.5
Eye(s)	629	9.1	628	1	628	1.2
Brain or skull	87	1.3	85	2	43	2.1
Other	181	2.6	180	1	180	2.0
Trunk	167	2.4	150	17	9	2.1
Chest (lungs), ribs, etc	21	.3	17	4	4	1.4
Back	70	1.0	60	10	6	2.3
Abdomen	6	.1	5	1	5	1.2
Hip(s) or pelvis	14	.2	14			2.1
Shoulder	44	.6	42	2	21	2.3
Other	12	.2	12			1.2
Upper extremities	5,473	79.3	5,459	14	390	1.9
Arm(s)	349	5.1	347	2	174	2.0
Hand(s) (including wrist)	1,094	15.9	1,089	5	218	2.1
Finger(s) and/or thumb(s)	4,030	58.3	4,023	7	575	1.9
Lower extremities	363	5.3	344	19	18	2.8
Leg(s)	224	3.3	218	6	36	3.1
Foot or feet (including ankle)	110	1.6	100	10	10	2.0
Toe(s)	29	.4	26	3	9	2.8
General	2	[2]	2			2.0
Unclassified—insufficient data	29		29			1.1

[1] Percentage of cases for which part of body injured is known.
[2] Less than 0.05.

TABLE 19.—*All Industrial Injuries Experienced by Workers Employed for the Full Year 1944 in One Large Brewery, Classified by Department and Nature of Injury*

Department and nature of injury	Number of injuries				Average number of nondisabling injuries per disabling injury	Average number of treatments per nondisabling injury
	Total		Nondisabling	Disabling		
	Number	Percent [1]				
All departments: Total	16,336	100.0	16,227	109	149	1.9
Without infection	16,252	99.5	16,146	106	152	1.9
With infection	84	.5	81	3	27	4.0
Amputations	4	[2]		4		
Bruises, contusions, concussions	2,325	14.6	2,283	42	54	2.0
Without infection	2,323	14.6	2,281	42	54	2.0
With infection	2	[2]	2			1.5
Burns, scalds	388	2.4	385	3	128	3.2
Cuts, lacerations, punctures	11,739	73.5	11,713	26	451	1.9
Without infection	11,662	73.0	11,639	23	506	1.8
With infection	77	.5	74	3	25	4.2
Foreign bodies in eyes	909	5.7	909			1.1
Without infection	904	5.7	904			1.1
With infection	5	[2]	5			2.0
Fractures	8	.1	3	5	1	3.0
Industrial diseases	92	.6	92			3.1
Strains, sprains	495	3.1	466	29	16	2.1
Other	5	[2]	5			1.4
Unclassified—insufficient data	371		371			1.8
Bottling department: Total	9,405	100.0	9,350	55	170	1.9
Without infection	9,367	99.6	9,315	52	179	1.9
With infection	38	.4	35	3	12	3.4
Amputations	2	[2]		2		
Bruises, contusions, concussions	1,168	12.7	1,152	16	72	2.0
Burns, scalds	178	1.9	176	2	88	2.5
Cuts, lacerations, punctures	7,184	78.0	7,166	18	398	1.9
Without infection	7,148	77.6	7,133	15	476	1.9
With infection	36	.4	33	3	11	3.5
Foreign bodies in eyes	376	4.1	376			1.1
Without infection	374	4.1	374			1.1
With infection	2	[2]	2			2.0
Fractures	1	[2]		1		
Industrial diseases	48	.5	48			2.6
Strains, sprains	260	2.8	244	16	15	2.2
Other	3	[2]	3			1.7
Unclassified—insufficient data	185		185			1.9
All departments except bottling: Total	6,931	100.0	6,877	54	127	1.9
Without infection	6,885	99.3	6,831	54	127	1.9
With infection	46	.7	46			4.4
Amputations	2	[2]		2		
Bruises, contusions, concussions	1,157	17.2	1,131	26	44	2.1
Without infection	1,155	17.2	1,129	26	43	2.1
With infection	2	[2]	2			1.5
Burns, scalds	210	3.1	209	1	209	3.8
Cuts, lacerations, punctures	4,555	67.5	4,547	8	568	1.9
Without infection	4,514	66.9	4,506	8	563	1.8
With infection	41	.6	41			4.7
Foreign bodies in eyes	533	7.9	533			1.1
Without infection	530	7.9	530			1.1
With infection	3	[2]	3			2.0
Fractures	7	.1	3	4	1	3.0
Industrial diseases	44	.7	44			3.6
Strains, sprains	235	3.5	222	13	17	2.1
Other	2	[2]	2			1.0
Unclassified—insufficient data	186		186			1.6

[1] Percentage of cases for which nature of injury is known.
[2] Less than 0.05.

TABLE 20.—*All Industrial Injuries Experienced by Workers Employed for the Full Year 1944 in One Large Brewery, Classified by Department and Number of Injuries Per Employee*

Department and specified number of injuries	Number of employees who had specified number of injuries			Total number of injuries experienced		
	Number	Cumulative number	Cumulative percent	Number	Cumulative number	Cumulative percent
Brewhouse: Total	358		100.0	1,582		100.0
26 injuries and over	10	10	2.8	407	407	25.7
21 to 25 injuries	6	16	4.5	137	544	34.4
16 to 20 injuries	8	24	6.7	140	684	43.2
11 to 15 injuries	14	38	10.6	171	855	54.0
6 to 10 injuries	46	84	23.5	336	1,191	75.3
5 injuries	19	103	28.8	95	1,286	81.3
4 injuries	26	129	36.0	104	1,390	87.9
3 injuries	26	155	43.3	78	1,468	92.8
2 injuries	27	182	50.8	54	1,522	96.2
1 injury	60	242	67.6	60	1,582	100.0
No injuries	116	358	100.0	0	1,582	100.0
Bottling department: Total	910		100.0	9,405		100.0
56 injuries and over	13	13	1.4	984	984	10.5
51 to 55 injuries	5	18	2.0	265	1,249	13.3
46 to 50 injuries	9	27	3.0	421	1,670	17.8
41 to 45 injuries	13	40	4.4	565	2,235	23.8
36 to 40 injuries	18	58	6.4	680	2,915	31.0
31 to 35 injuries	20	78	8.6	663	3,578	38.0
26 to 30 injuries	31	109	12.0	881	4,459	47.4
21 to 25 injuries	41	150	16.5	940	5,399	57.4
16 to 20 injuries	61	211	23.2	1,084	6,483	68.9
11 to 15 injuries	99	310	34.1	1,257	7,740	82.3
6 to 10 injuries	142	452	49.7	1,115	8,855	94.2
5 injuries	32	484	53.2	160	9,015	95.9
4 injuries	39	523	57.5	156	9,171	97.5
3 injuries	37	560	61.5	111	9,282	98.7
2 injuries	35	595	65.4	70	9,352	99.4
1 injury	53	648	71.2	53	9,405	100.0
No injuries	262	910	100.0	0	9,405	100.0
Other departments: Total	942		100.0	5,349		100.0
26 injuries and over	39	39	4.1	1,611	1,611	30.1
21 to 25 injuries	19	58	6.2	424	2,035	38.0
16 to 20 injuries	34	92	9.8	607	2,642	49.4
11 to 15 injuries	72	164	17.4	915	3,557	66.5
6 to 10 injuries	114	278	29.5	883	4,440	83.0
5 injuries	42	320	34.0	210	4,650	86.9
4 injuries	56	376	39.9	224	4,874	91.1
3 injuries	67	443	47.0	201	5,075	94.9
2 injuries	79	522	55.4	158	5,233	97.8
1 injury	116	638	67.7	116	5,349	100.0
No injuries	304	942	100.0	0	5,349	100.0

TABLE 21.—*All Industrial Injuries Experienced by Workers Employed for the Full Year 1944 in the Bottling Department of One Large Brewery, Classified by Department and Number of Injuries Per Employee*

Experience to Jan. 1, 1944	Number of employees		Number of injuries		Average number of injuries per employee
	Number	Percent [1]	Number	Percent [1]	
Total	910	100.0	9,405	100.0	10.3
Less than 3 months	81	8.9	836	9.0	10.3
3 and less than 6 months	150	16.5	1,530	16.4	10.2
6 and less than 9 months	134	14.8	1,341	14.4	10.0
9 and less than 12 months	183	20.2	2,291	24.6	12.5
1 and less than 2 years	256	28.2	2,572	27.6	10.0
2 years and over	103	11.4	749	8.0	7.3
Unclassified—insufficient data	3		86		28.7

[1] Percentage of cases in which experience of injured is known.

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