PART IV. MINE SAFETY

EMPLOYMENT AND ACCIDENTS IN THE MINERAL INDUSTRIES

By W. W. Adams

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A small increase in the number of employees and a slight reduction in the aggregate number of man-hours of employment in the mining and quarrying industry of the United States in 1935 compared with 1934 were shown by reports furnished to the United States Bureau of Mines by operating companies. Preliminary reports for 1936 indicate a further increase in the number of men employed during that year and in the number of man-hours worked.

These statements are based upon an examination of complete reports for 1935 from operators of anthracite and bituminous-coal mines; stone quarries and related plants, such as cement mills, limekilns, rock crushers, and finishing plants; on reports from representative mines producing gold, silver, copper, lead, zinc, or other mineral; and on preliminary returns from various classes of mines and quarries for 1936.

Although the mineral industry includes the milling and smelting of ores, the production of petroleum and natural gas, and the manufacture of coke, statistics now available for 1935 and 1936 only cover mining, quarrying, and the preparation of such rock products as cement, lime, crushed rock, and sawed and finished stone.

Within the field covered by these operations, 697,402 men were employed in 1934, the latest year for which final and complete figures are available. Complete reports for most of the industry and partial reports for certain groups of metal mines indicate that the number of men at work in 1935 was approximately 709,000. Reports for 1936 from a relatively small number of plants suggest that the working force during that year may have reached 756,000 men, but the accuracy of this figure cannot be accepted until returns have been received from a much larger number of companies than have thus far furnished their annual reports to the United States Bureau of Mines. The indication of 756,000 employees in 1936 is based upon

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the percentage of increase in employment shown by reports for that year compared with reports from indentical plants operating during 1935.

Coal mining is by far the largest branch of the mining industry in the United States, whether measured by the number of men employed, the number of man-hours of labor performed during a normal year, or the quantity and value of mineral produced; it is also largest when measured by the number of men killed or injured by accidents that occur while the men are at work. For this reason, most of the present review of employment and accidents during 1935 is devoted to coal mining, although quarrying, metal mining, and nonmetallic-mineral mining are discussed briefly to show the trends of employment and accidents during that year and to show similar trends through 1936 so far as revealed by preliminary returns from identical establishments that were active both in 1935 and 1936.

**Employment and fatal-accident record of the mining and quarrying industries in the United States, 1911-33**

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<tr>
<th>Year</th>
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<th>Man-days worked</th>
<th>Men killed</th>
<th>Fatality rate per thousand 300-day employees</th>
<th>Year</th>
<th>Men employed</th>
<th>Man-days worked</th>
<th>Men killed</th>
<th>Fatality rate per thousand 300-day employees</th>
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EMLOYMENT AND ACCIDENTS

BITUMINOUS-COAL MINES

Employment.—The total number of men employed in bituminous-coal mining has increased continuously since 1932, when the lowest level of the depression period was reached. In that year the number of workers employed was 406,380, a decrease of 19 percent compared with the working force employed in 1929. Additions to the mine pay rolls during the three succeeding years brought the number of workers employed in 1935 to within 8 percent of the predepression level. Scattering returns from a small number of companies indicate that the number of workers was increased further in 1936.

Outstanding coal-producing States in increasing employment since 1932 are Virginia and West Virginia in the East, Ohio and Michigan in the east north central area, and Missouri, Iowa, and South Dakota in the trans-Mississippi region. In all of these States employment in 1935 was greater than in 1929. On the other hand, employment in both Pennsylvania and Kentucky was still lagging behind the predepression level. Compared with 1929 a decrease of 6 percent is shown in the number of bituminous mine workers employed in Pennsylvania, and Kentucky shows a decrease of 11 percent.

In recent years there has been a marked shortening of the coal miner's workday. Although the trend toward a shorter workday has been evident for many years, 1930 was the first year in which the mining companies were specifically requested to indicate on their reports to the Bureau of Mines the aggregate number of man-hours of work performed at their properties as given on the books of the companies. The returns for that year showed that many companies had not then begun to keep a record of man-hours worked; on the other hand, a large number of companies did keep such records, and they reported the actual book figure to the Bureau. Those that did not maintain man-hour records reported to the Bureau the average number of employees, the number of days on which coal was produced,
and the number of hours constituting a standard working day at the mines; with this information, the number of man-hours worked at these mines was calculated and added to the number of man-hours worked at the other mines where actual book records of man-hours worked were maintained. Complete figures for 1930, as thus reported and calculated, revealed that the bituminous-coal mining industry in the United States operated an average of 8.13 hours per day per man employed in 1930. By 1935 many more companies were maintaining records of man-hours actually worked, and the reports for that year for the entire industry showed an average of 7.03 hours worked per man-day. Incomplete reports for 1936 indicate a slight increase in the length of workday over 1935.

It should be made clear that the total number of employees and the number of hours constituting a workday do not in themselves show the volume of employment in the coal-mining industry. The volume of employment depends, further, on the number of days on which the mines were in operation. Whether a mine is active or idle on a given day is determined largely by the presence or absence of orders for coal on the company’s books; yet the working crew, in more or less normal numbers, must stand by and be available for work on any day of the year. In 1930, out of a possible working period of more than 300 days, the actual operating time of all bituminous-coal mines in the United States averaged only 187 days per man. In 1935 each employee averaged only 178 days of work, and even in 1929 the average employee had only 219 days of employment. This part-time employment, if spread over a year of 52 weeks, means that in 1930 the average period of employment was 29 hours per man per week; it was 25 hours in 1934 and 24 hours in 1935. In other words, the average coal miner averages about 3½ 7-hour days per week throughout the year.

The aggregate number of man-hours worked at coal mines rises and falls with the increase and decrease in the quantity of coal produced, except as the relation between the two sets of figures may be affected by the increasing productivity of labor due to increased mechanization and other improvements in methods of production. Upward trends in total production are accompanied by less-pronounced upward trends in man-hours worked. By contrast, when the trend of total production is downward, more-pronounced downward trends in the number of man-hours worked are observed. The tendency of total man-hours to lag behind total production when the trend is upward and to fall more rapidly when the trend is downward is chiefly due, as previously stated, to the increasing quantity of coal produced per man-hour of labor performed. Production of bituminous coal in the United States reached a maximum in 1918; this was also the year of maximum number of man-hours worked at the mines. Compared with 1918, there was a drop in 1935 of 36 percent in total production and 54 percent in the total number of man-hours worked. In 1918 production averaged 0.463 ton per man-hour worked; in 1935 the average was 0.644 ton, an increase of 39 percent.

Accidents.—Coal mining ranks as one of the most hazardous of the major industries of the United States. Nevertheless, the number of lives lost from accidents has been reduced greatly in recent years. The annual loss of life in bituminous mines during the past 3 years has averaged only about half of what it was 20 years ago. In 1935,
for example, only 968 men were killed compared with 1,683 in 1915; in 1934 there were 958 fatalities compared with 1,859 in 1914; and in 1933 the total was only 833 against 2,167 in 1913.

Although it is clear that fewer men are now being killed by accidents at the mines than formerly, this fact does not necessarily indicate that the present-day coal miner is a better life-insurance risk than was the miner of 20 years ago. To make the individual miner more acceptable to a life-insurance company, his per-capita accident experience must be reduced. Whether or not this has been accomplished is quite independent of the actual number of fatal accidents reported from year to year in the coal-mining industry as a whole. The number of fatal accidents must be considered in relation to the number of men employed and the number of hours the men work in the mines.

Physical conditions underground undoubtedly have been improved. Operators and miners are more safety-minded than they were 20 years ago. Mining machinery is used more extensively than ever before. Machine-loading of coal at the face has largely replaced loading by hand shovel in many mines. Haulage cars and tracks have been improved. There is no doubt that good housekeeping is practiced by more and more coal-mining companies.

These evidences of progress in a large number of mines make possible a larger production of coal by the average employee for each day or hour he spends at work. Under these conditions it is manifest that fewer men, or at least fewer man-hours, are required to produce a given quantity of coal. With the 1935 average productivity per man-hour the tonnage produced by the entire industry in the prosperous year 1929 could have been produced with 35,000 fewer men than were actually employed that year. Moreover, this could have been accomplished without any change in the working time of the 1929 employee. The production of coal during 1915 could have been made with 165,000 fewer men than were employed during that year, also without any change in the working time of the 1915 employee.

With a reduction in the number of employees or man-hours as the productivity of labor increases, there must be a proportionate reduction in the number of accidents to hold the accident rate per employee or per man-hour to its former level. If the number of accidents is not thus proportionately reduced, the accident rate will rise; if accidents are reduced in greater proportion than men or man-hours, the accident rate will be lowered. From 1915 to 1935 the number of man-hours worked at the mines was reduced 40.8 percent, and the number of men killed was reduced 42.5 percent. Thus, efficiency in safety increased at a more rapid rate than did efficiency in the production of coal, and the fatality rate per million man-hours of employment was reduced from 1.722 to 1.673, a reduction of nearly 3 percent, although the average miner produced 42 percent more coal in an hour in 1935 than he did in 1915.

This point is often overlooked by those who are critical of the coal industry’s accident record, and it is equally overlooked by others who are inclined to claim for the industry more credit than it merits.

Could operating conditions in coal mines remain static, we might reasonably expect accident-prevention measures to produce a constant downward trend in the accident rate; but conditions change continually, and the inherent hazards of mining would take an
increasing toll of human life were it not for the safety measures the operators and miners observe in their work. As the per-capita hazards increase with the declining number of employees, safety measures also must increase. Under these conditions, it should be recognized that progress in safety is being made if the accident rate does not rise as fast as the per-capita hazards increase, and especially is this true if the accident rate is kept on its former level. It should be recognized that safety measures are doubly effective when the accident rate per man-hour worked shows a downward trend when the inherent hazards of mining per man employed are increasing.

ANTHRACITE MINES

Employment.—The anthracite mines covered by Bureau of Mines statistics of employment and accidents are situated entirely in the eastern part of the State of Pennsylvania. Data on the few anthracite mines elsewhere in the United States are included with the statistics for bituminous-coal mines. Employment at the anthracite mines in Pennsylvania declined in 1935 compared with 1934, both as to number of workers and man-hours of work performed. Moreover, the average period of employment per man was less than in 1934. Reports from the operating companies showed a total of 102,848 men employed and 154,096,381 man-hours worked in 1935, a reduction of 5 percent and 14 percent, respectively, compared with 1934. The average employee worked 187 days, or 19 days less than the year before. No specific information as to employment is available for 1936.

Accidents.—Reports for 1935 showed that 274 employees were killed and 18,046 were injured by accidents at the mines, breakers, and dredges. These figures indicate a fatality rate of 1.78 per million man-hours of employment compared with 1.50 for the previous year and a nonfatal lost-time injury rate of 117.11 compared with 117.68 for 1934. During the 6 years (1930–35) for which comparable figures are available, the lowest accident rate (113.74) for fatal and nonfatal injuries was that for 1933. Although the combined rate for 1935 was only a fraction less than in 1934 and although it did not compare favorably with the rate for 1933 it was more favorable than the rates for the 3 years preceding 1933.

IRON-ORE MINES

Employment.—A larger volume of work performed and a reduction in the number of men employed was shown for 1935 compared with 1934 by final and complete reports received by the Bureau of Mines from operating companies. The reduction in number of employees was 9 percent, but a 2-percent gain was reported in the aggregate number of man-hours worked during the year. The working time for all operating mines averaged 219 days or 1,758 hours per man compared with 195 days or 1,558 hours per man in the preceding year. An average of 8 hours per shift was reported for both years. Preliminary reports for 1936 indicate large gains in employment over 1935, both in the number of men working and the man-hours of labor performed. According to the returns thus far received, the increase in 1936 over 1935 was probably as much as 30 percent. Notwithstanding this evidence of further recovery from the recent depression, the industry
no longer seems to require the working force it employed 15 or 20 years ago. Maximum employment was reached in the war year, 1917, when the working force was more than 57,000 men and when more than 16 million man-days of labor were required to produce the tonnage of that year. Much of this labor doubtless was utilized to produce iron for purposes connected directly or indirectly with the World War. But even in 1920, more than 45,000 men were employed and more than 13 million man-days were worked. By 1935 the number of employees had been reduced to 14,000 and the number of man-days to approximately 3 million. Although this reduction in employment may be attributed, in part, to the absence of need for iron for war purposes, and partly to incomplete recovery from the depression, perhaps the chief reason for the industry’s present ability to operate with fewer men is the fact that methods of operation have been improved and, in consequence, each man-hour of labor is now more productive than formerly. Actual records of productivity per man-hour were not available until 1923, but since that year the output of iron ore in the United States per man-hour of labor performed has been tending upward. Other factors that contribute to a larger output per man-hour are the increasing proportion of total tonnage of ore now being obtained from open-pit mines compared with underground mines and the larger production of ore per man-hour made possible by using large power shovels in open-pit mining.

Accidents.—The iron-ore-mining industry is outstanding among the metal-mining industries of the United States for its low death and injury rates from accidents. In 1935 the accident rate was 18.7 per million man-hours of employment, having been reduced from 20.8 for the previous year. In one respect the record was less favorable than in the preceding year, the fatality rate being 0.89 in 1935 against 0.66 in 1934. Thus, the improvement in 1935 was in the field of nonfatal injuries rather than accidents causing the death of the injured employees. Except for 1932, when the combined accident rate for fatal and nonfatal injuries was 17.0 per million man-hours of employment, the corresponding rate of 18.7 for 1935 was the lowest accident rate and therefore the best safety record that the industry has ever had. The remarkable extent to which accidents have been eliminated from iron-ore mining is indicated by the low accident rates that have prevailed in recent years. So successful have the mining companies been in preventing accidents to their employees that the accident rate for 1935 was 82 percent lower than it was for 1911, the first year for which figures are available. Preliminary reports from the operating companies indicate that the accident rate was higher in 1936 than in 1935, but even if final returns should bear out this apparent increase the rate for 1936 was lower than that for any year preceding 1932.

COPPER MINES

Employment.—Although complete reports for copper mines for 1935 are not yet available, partial returns from the operators indicate substantial gains over 1934 in the number of men working and man-hours worked. Further increases are indicated by preliminary reports from the producing companies for 1936. The improvement in employment was general, virtually all copper-mining districts sharing in the gains. The industry employed 8,084 men in 1934, and it is probable that this figure was increased to approximately 9,500 in 1935.
The total volume of labor performed in 1934 was reported as 14,726,617 man-hours, which apparently was increased to about 20,800,000 man-hours in 1935.

Accidents.—Complete statistics on accidents at copper mines are not yet available for 1935, but incomplete figures show a large increase in the accident rate over 1934. For each million man-hours of employment during 1934, reports from producing companies showed 46.2 accidents. This rate apparently increased to approximately 68 accidents per million man-hours in 1935, and preliminary reports for 1936 indicate a further increase.

LEAD AND ZINC MINES (MISSISSIPPI VALLEY STATES)

Employment.—Figures covering identical mines operating during 1934 and 1935 in Kansas, Missouri, and Oklahoma—the principal lead-zinc producing States of the Mississippi Valley—and covering mines that employ about half the total number of men in the entire region, showed a slight reduction in the number of employees in 1935 and a more material falling off in the number of man-days and man-hours worked. The decreases were in Kansas and Oklahoma. Mines in Missouri reported gains in employees, man-days, and man-hours, but these gains were not extensive enough to overcome a decline in employment in the region as a whole. In 1936, according to preliminary returns, the number of workers and the volume of employment increased, Kansas and Missouri sharing in the gains and Oklahoma reporting a further decline.

Accidents.—Although Oklahoma reported a loss in employment in 1935 it was the only one of the three important lead-zinc producing States in the Mississippi Valley to report a better safety record. The accident rate for Oklahoma was lowered to such an extent that increased rates in Kansas and Missouri were more than overcome, so that the group rate for the three States was lower in 1935 than in 1934. This favorable showing apparently did not continue in 1936, as partial returns indicate higher accident rates for each of the three States and, consequently, for the district as a whole.

GOLD, SILVER, AND MISCELLANEOUS METAL MINES

Employment.—Employment and accident data for this group of mines reflect chiefly the experience of mines that produced gold and silver, but the figures also cover lead and zinc mines operating in States other than those in the Mississippi Valley; the figures also include data for mines that produced minor metals, such as quicksilver, manganese, etc.

Complete figures for this and several other classes of metal mines are not yet available for 1935, owing to the loss of one-third of the Bureau of Mines personnel several years ago and the inability of the small available force to complete the tabulation of returns from mining companies in time for inclusion of the figures in this publication. Such reports as have been tabulated cover approximately 34 percent of all men who work in this class of mines. These reports show increases in the number of employees, man-days, and man-hours for 1935. The increase in number of employees, according to these incomplete figures, was approximately 14 percent, and the gain in number of man-hours worked was about 20 percent.
Accidents.—The accident rate for mines producing gold, silver, and the other metals included in this group was 99.2 per million man-hours of employment in 1934. According to available returns, the rate for 1935 was lower than this, perhaps by as much as 6 percent, which would indicate that the rate will be about 93.3 per million man-hours worked in 1935. Early returns for 1936 indicate an increase over the accident rate for 1935.

NONMETALLIC-MINERAL MINES

Employment.—Included in this group are mines that produce gypsum, phosphate rock, sulphur, or any nonmetallic mineral except coal, sand, gravel, or clay. Nonmetallic-mineral mines, as thus defined, reported a total of 8,339 men employed during 1935 compared with 8,234 men in the previous year. The total working time for all employees equaled 16,168,307 man-hours, an increase of a little more than 6 percent over 1934. The average employee was at work 1,939 hours during the year, which compares favorably with the previous year's average of 1,844. No data are available for 1936 for mines included in this group.

Accidents.—The mining of other nonmetallic minerals is usually attended by fewer accidents in proportion to the volume of employment than is the mining of coal, and, with the exception of iron mining, the record for the nonmetallic group is also usually more favorable than that of metal mines. The accident rate for mines in the nonmetallic group was 50.7 per million man-hours of employment in 1935, a reduction from the rate of 52.3 for the year 1934. Reports have not yet been compiled to reveal the rate for 1936.

CEMENT

Employment.—A slight reduction in the number of employees engaged in quarrying and an equally slight increase in the number of men working at the cement mills were reported by the operating companies for 1935. The reduction and increase extended to the number of man-hours worked at the quarries and mills, respectively, a net increase being reported for the industry as a whole. The returns for both quarries and mills showed 24,416 men employed and 39,243,018 man-hours worked, the average working time per employee being 227 days (1,607 man-hours). A further increase in the number of workers and a very material increase in the number of man-hours worked were shown for 1936 by reports that, though not covering all companies, reflect conditions in more than 80 percent of the industry based on the number of men employed.

Accidents.—The cement industry ranks as the leader in safety among the various stone-quarrying industries of the United States. For a number of years the accident rate for cement mills and quarries has been low, much lower than for any other important branch of the quarrying industry. The rate for 1934, which represented 12.6 lost-time accidents per million man-hours of employment, was lowered to 9.5 in 1935, a reduction of more than 24 percent. Unfortunately, the accident rate increased in 1936, according to incomplete returns for that year, the reports indicating an increase large enough to raise the rate for the year back approximately to that for 1934.
LIMESTONE

Employment.—The number of men employed at quarries that produce limestone for purposes other than the manufacture of cement was 30,973 in 1935. This number is not strictly comparable with the number (24,119) reported for 1934 because many small operations were canvassed for 1935 that were not canvassed in the preceding year. Statistics for identical plants that were active during both years indicate that the number of employees was slightly less in 1935 than in 1934 and that there was also a small reduction in the number of man-hours of labor performed. The entire canvass for 1935 showed a total of 45,197,391 man-hours worked, an average of 1,459 hours per employee. A slight reduction in the length of the workday was reported, from 8.1 hours per day in 1934 to 7.8 hours per day in 1935, based upon reports for identical plants. A few reports showed more employment in 1936, both in total number of employees and total number of man-hours worked, over the record of the identical establishments for 1935.

Accidents.—Progress was reported in preventing accidents in 1935 compared with 1934, both as to all establishments canvassed for those 2 years and as to identical establishments active in 1934 and 1935. The accident rate was reduced from 57.3 fatal and nonfatal lost-time-injuries per million man-hours of employment in 1934 to 53.9 per million hours in 1935, with preliminary reports for 1936 indicating a further slight improvement over the 1935 record.

MARBLE

Employment.—With approximately the same number of men working as in the preceding year, companies engaged in the operation of marble quarries and finishing plants reported a substantial gain in the number of man-hours worked in 1935. The average number of men employed was 2,441 compared with 2,488 in 1934, but the volume of employment, as measured by the number of man-hours of labor performed during the year, increased from 3,508,983 in 1934 to 4,016,819 in 1935, a gain of 14 percent. The average employee worked 1,646 hours during the year, a gain of 236 hours over the average number of hours worked in the preceding year. The average length of working day, weighted for all plants and for all men, was 7.8 hours, a slight increase over the average of 7.5 hours per day in 1934. Information available for 1936 and covering about two-thirds of the men employed in the marble industry shows an increase in employment in 1936 over 1935.

Accidents.—One fatal accident and 176 nonfatal lost-time injuries occurred among the employees at marble quarries and plants during 1935. These figures indicate an accident rate of 44.1 per million man-hours of employment compared with a rate of 43.3 for the preceding year. Preliminary reports for 1936 present a material reduction in the accident rate for that year.

SANDSTONE

Employment.—Reports from companies engaged in the production of sandstone during 1935 showed an average working force of 2,739 men and a total of 3,688,135 man-hours of labor performed. As these figures cover some companies that had not previously been
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included in the Bureau's annual employment canvasses they are not entirely comparable with similar figures for 1934. Reports from identical companies for both years showed approximately the same number of employees in 1935 as in the previous year, but they also showed an increase of 8 percent in the total number of man-hours worked. The identical companies reporting this increase in man-hours worked represented about half of the industry. Complete reports from all companies operating during 1935 showed an average period of employment of 167 days or 1,347 hours per man and an average daily shift of 8.1 hours.

Accidents.—The accident rate for the sandstone industry remained virtually unchanged in 1935, whether measured by reports from identical companies or by comparing the complete canvass for 1935 with the somewhat less complete canvass for 1934. Complete returns for 1935 showed that 243 men had been injured by nonfatal accidents. The accident rate for the year was 65.9 per million man-hours of employment compared with 64 for 1934. Information for 1936 is still too meager to indicate the accident rate for that year.

GRANITE

Employment.—Granite quarries and finishing plants reported a reduction in the number of employees and in the number of man-hours worked in 1935 compared with 1934. That these losses were recovered in 1936, however, is indicated by preliminary reports for that year which represent something less than one-fifth of the industry. As far as may be judged from these early reports, the gain over 1935 was about 20 percent in number of men employed and approximately 27 percent in number of man-hours worked. Final statistics for 1935 showed 6,877 employees and 10,555,416 man-hours of work performed compared with 7,807 men and 11,000,155 man-hours in 1934. The aggregate working time for all plants in 1935 averaged 1,535 hours per man employed. The weighted average length of workday was 7.6 hours. These figures represent more hours of work per man for the year and a slightly longer workday, as the reports for 1934 showed 1,409 hours per man and an average workday of 7.3 hours.

Accidents.—The industry's safety record improved in 1935, according to final reports from the operating companies, which revealed a rate of 54.6 per million man-hours worked in 1935, as against 71.9 in 1934. A further slight reduction in the accident rate is shown by partial returns for 1936.

TRAP ROCK

Employment.—Reports from operators of trap-rock quarries for 1935 showed a total of 3,496 men employed and 4,235,223 man-hours of labor performed. These figures represent a large increase both in number of employees and in man-hours worked over the corresponding statistics for 1934. However, as the canvass of the industry was more complete in 1935 than in the preceding year, the larger number of reporting companies for 1935 must be responsible for some of the increase. That the industry distinctly improved in 1935 is shown by the reports from operating companies, which revealed a much larger quantity of stone produced during 1935 than in the preceding year. Although the output of building stone declined in 1935, a very marked
increase occurred in the quantity of rubble produced.\(^1\) The reports from operating companies for 1935, which, as stated, are more complete than those of the previous year, showed an average working time of 154 days, or 1,211 hours of employment, per man.

**Accidents.**—Accidents at trap-rock quarries were reduced to a marked degree in 1935, as shown by a substantial lowering of the accident rate per million man-hours of employment. For the industry as a whole the rate was 53.6, a reduction of 34 percent from the previous year's rate of 81.1. This improvement corresponds with that shown by reports from identical establishments for the 2 years, which showed a rate of 66.7 for 1934 and 42.1 for 1935.

**SLATE**

**Employment.**—Reports from operators of slate quarries for 1935 revealed a total working force of 2,063 men and a volume of employment equal to 3,097,339 man-hours of labor. These figures indicate that the average employee worked 1,501 hours during the year. The plants were in operation for an average of 184 days per man, the average working shift being 8.2 hours. As the Bureau of Mines canvass of the slate industry was more complete in 1935 than in 1934, statistics for 1935 are not entirely comparable with those for the previous year. Identical establishments operated during both years showed substantial gains in number of men working and in number of man-days and man-hours of labor performed in 1935. Even larger increases in number of employees, man-days, and man-hours over the record for 1934 are indicated by complete returns for 1935 due to the increase in number of establishments that reported for 1935.

**Accidents.**—The accident rate for slate quarries was higher in 1935 than in 1934. This fact is revealed by reports covering identical plants that were active during both years; the reports show a rate of 58.0 per million man-hours worked in 1934 and 62.8 per million man-hours in 1935. The entire canvass for 1935 revealed an accident rate of 54.9 compared with 58.1, as given by the somewhat less complete canvass for the preceding year.

**CONCLUSION**

The mining and quarrying industries of the United States apparently have achieved efficiency of operation that no longer demands so large a number of workers as were employed heretofore. Complete statistics for the industry, beginning with 1911, show a total of 1,005,281 men employed.\(^1\) The number reached a maximum in 1923, when 1,078,270 employees were reported to the Bureau of Mines by the operating companies. Only 637,777 workers were employed in 1932, the lowest number. An upward trend brought the number of employees to 697,402 in 1934, the latest year for which complete data are available. As stated previously, this figure was increased further in 1935 and 1936, according to reports for 1935 from nearly all operating companies and according to preliminary returns for 1936.

Maximum employment, as indicated by the number of man-days of labor performed, a standard of measurement used in the absence of a long-time record of man-hours worked, was reached in 1917 during

the World War, when operating companies reported 269,482,848 man-
days. This number declined to a minimum of 100,954,646 man-days
in 1932, when the number of workers was also lowest. Employment
increased to 131,771,709 man-days in 1934, and was increased further
in the 2 years following, according to reports now available but not
complete for the entire industry.

The death rate from accidents has been reduced 30 percent since
1911, and it was lower in 1934 than ever before. Likewise, the non-
fatal-injury rate was lower in 1934 than at any time since 1930, the
earliest year covered by reports of injuries for all branches of mining
and quarrying.

If the most favorable fatality rate (that reported for 1934) had
prevailed during all years since 1911, nearly 13,000 lives would have
been saved during that period. The actual number of fatalities during
the 24-year period 1911 to 1934 was 65,188. This number would have
been 52,337 if the rate for 1934 had prevailed.

What the long-time trend of employment and accidents in the
mineral industries may prove to be is perhaps impossible to forecast
because of the impossibility of determining the effects of varying
trends of technological improvements in methods of mining, of operat-
ing mines with leaner ore bodies and thinner seams of coal, of the
character of labor force that future working conditions may attract
to the mines, of substitution of mineral products with changing prices,
and of unpredictable markets for mineral commodities. There can
be little doubt, however, that the next decade or so will witness only
moderate increases in the number of men employed, with relatively
larger increases in total man-hours worked to meet unusual demands
for larger quantities of mineral products. Small increases in the
demand for minerals may be met by the increasing productivity of
labor per man-hour worked.

In the realm of safety, fewer accidents may be expected in propor-
tion to the number of men employed. Recognition of the hazards
involved in mining has spread to large sections of the industry, not
only among the masses of workers but among supervisory officials
and owners of mines. Although the value of mechanical safeguards
is not to be discounted, accident prevention is largely a matter of
safety education of mining officials and their employees. The progress
the mining industry has made during the past few years in lowering
the death and injury rate from accidents should be credited more to
safety education than to any other single factor. As long as safety
education is continued without interruption, a downward trend in the
industry's accident rate may be expected. The greatest danger that
can threaten the safety movement in mining is the false idea that the
movement may proceed temporarily under its own momentum when
funds are low and profits small or nonexistent.