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**UNITED STATES DEPARTMENT OF LABOR**

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BULLETIN OF THE UNITED STATES  
BUREAU OF LABOR STATISTICS

GIPE-PUNE-038592

WAGES AND HOURS OF LABOR SERIES

**WAGES AND HOURS OF LABOR  
IN THE PORTLAND CEMENT INDUSTRY  
1929**



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JANUARY, 1931

UNITED STATES  
GOVERNMENT PRINTING OFFICE  
WASHINGTON : 1931

For sale by the Superintendent of Documents, Washington, D. C. - - Price 15 cents

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R-22A1

X9(15): 951-952. 7377

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## APPENDIXES

### APPENDIX A.—DEFINITIONS OF OCCUPATIONS

#### QUARRY DEPARTMENT

[The definitions for each of the occupations in the industry as given here were formed from descriptions of the occupation as found in several representative mills and therefore do not necessarily apply in detail to all mills.]

*Drillers* use power drilling rigs to drill holes in the rock for placing dynamite to blast the rock down.

*Blasters* place dynamite in the holes made by the drillers, tamping the dynamite in and setting off the charges.

*Shovel engineers* operate power shovels, controlling the swing and movement of the boom, to load the rock into cars for transportation to the crusher.

*Shovel cranemen* control the operation of the "ram" or "dipper stick" and dump on large power shovels.

*Shovel firemen* fire and tend the boilers on the steam shovels.

*Locomotive engineers* operate locomotives, usually of the "dinky" type, to haul cars of rock from the quarry to the crusher or rock dump and empty cars back to the quarry.

*Locomotive firemen* fire the boilers on the larger types of locomotives that are used in some quarries to haul rock to the crusher. The "dinky" type is usually fired by the engineer.

*Laborers* do unskilled work in the quarry, such as cleaning out dirt, laying track, helping to move machine equipment, etc.

*Other employees* include all workers not included in the specified occupations, such as couplers, cablemen, brakemen, ropemen, switchmen, track foremen, etc.

#### RAW DEPARTMENT

*Unloaders, hand*, unload raw materials, using a hand shovel.

*Unloaders, mechanical*, unload coal, limestone, gypsum, or other raw materials by using a mechanical device.

*Crusher operators* tend the crushers that reduce the rock almost to a powder as it comes from the quarry.

*Elevator tenders* tend the elevators, usually of the bucket type, that elevate crushed rock from the crushers to the storage bins.

*Conveyor tenders* tend the conveyors, belts, or trams that convey the crushed rock from the crushers to storage bins. Conveyors are often used where the mill is removed some distance from the quarry, while an elevator may be used if the mill adjoins the quarry.

*Mixer tenders* tend to the mixing of the crushed shale and limestone before it is conveyed to the grinding machines.

*Dryer tenders* tend the apparatus used to dry rock, clay, etc., so that it can be properly mixed with other ingredients before burning.

*Dryer firemen* fire the drying apparatus used to dry rock, clay, etc.

*Grinder operators* tend the grinders that grind the mix, shale, and limestone.

*Raw finish mill operators* tend the mills that finish grinding the mixture of shale and limestone, making it ready for the burning process.

*Oilers* oil the bearings and grease the guide tracks on the grinding machines.

*Laborers* do unskilled work, such as sweeping and cleaning.

*Other employees* include all workers not included in the specified occupations, such as tube-mill helpers, dryer-tender helpers, shale punchers, weighers, helpers, transfer engineers, etc.

#### COAL MILL DEPARTMENT

*Laborers* do unskilled work such as shoveling coal, sweeping and cleaning in the coal mill.

*Elevator tenders* operate elevators, usually of the bucket type, conveying coal from the storage pile to the coal crusher or grinder.

*Conveyor tenders* tend conveyors where a conveyor instead of an elevator is used to move coal from the stock pile to the crushers or grinders.

*Dryer tenders* tend the apparatus that dries the pulverized coal before it is delivered to the kilns.

*Dryer firemen* fire and tend boilers that furnish heat for the coal dryers.

*Crusher operators* operate the crushers that crush coal into small sizes.

*Grinder operators* operate grinding machines that reduce coal to a powder for use as fuel in the kilns.

*Other employees* include all workers not included in the specified occupations, such as miller's helpers, coal-dump operators, carmen, etc.

#### SHOPS AND MISCELLANEOUS DEPARTMENTS

*Machinists* are skilled workmen that make and replace worn parts and repair any of the machinery used in the plant.

*Repairmen* make repairs to broken or defective mill and yard equipment, such as railroad cars and quarry machinery, which do not involve the machining of parts.

*Laborers* handle materials and do other unskilled work around the shop and yard.

*Other employees* include all workers not included in the specified occupations such as tanners, blacksmiths, welders, plumbers, riggers, belt makers, painters, carpenters, lumber-shed men, brick masons, etc.

#### CLINKER DEPARTMENT

*Burners, first*, are in charge of the kilns in which the raw materials are burned to make clinker.

*Burners, second*, assist the first burners and under their direction regulate the flow of fuel, the amount of the blast, etc., that controls the heat and the distance of the zone of intense heat from the lower end of the kilns.

*Cooler tenders* look after the apparatus used to cool the hot clinker.

*Mixers* tend the machines that are used to mix gypsum with the clinker in the proper proportions before the clinker is ground.

*Elevator tenders* tend the elevators that are used in the clinker department to take the clinker from the kilns to the seasoning pile.

*Conveyor tenders* attend the belts that bring seasoned clinker to the grinders, or take the ground clinker to the storage bins in the cement department.

*Clinker grinders* attend a battery of machines that grind the clinker mixed with gypsum. The material after grinding to the proper fineness is Portland cement.

*Oilers* oil or grease the various machines and conveyors in the department.

*Laborers* do unskilled work, such as cleaning up around the mills.

*Other employees* include all workers not included in the specified occupations, such as coal-tank tenders, clinker dumpmen, weighers, cranemen, screenmen, pumppmen, gypsum men, etc.

#### CEMENT DEPARTMENT

*Conveyor tenders* attend the conveyors that carry the cement from the silos or storage bins to the packing machines and the bagged cement from the packing machines to the warehouse or loading platform.

*Elevator tenders* attend elevators in the cement department of plants in which the cement or the bags have to be elevated rather than conveyed to a desired location.

*Packers (sackers)* place empty bags on the nozzle of the packing machines which automatically fill the bags through a flap in the bottom with 94 pounds of cement and drops them upon a conveyor that takes them to the loading platform or warehouse. These workers usually alternate with the workers that load cars.

*Sack tiers* tie the open ends of the sacks or close them with a wiring device before the sacks go to the packing machine.

*Loaders* carry bags of cement by hand to load a freight car higher than truck high, or load boats and other means of conveyance. When the loading is done by workers that alternate with the packers, they usually work on a piecework basis and in this report are included with packers.

*Laborers* clean cars, carry empty bags, and do other unskilled work in the cement department.

*Sack cleaners* operate devices, such as cleaning cylinders, etc., for cleaning cloth bags that have had cement in them and have been returned to be used again.

*Inspectors* examine used bags to determine whether they are fit for further use.

*Oilers* oil and grease the bearings and guide tracks in the department.

*Other employees* include all workers not included in the specified occupations such as cement-pump operators, car sealers, sack sorters and menders, etc.

#### POWER DEPARTMENT

*Firemen* fire and tend the boilers that furnish steam for power.

*Engineers* operate steam engines that furnish power for the operation of air compressors and of the different machines in the mill.

*Pumppmen* operate the pumps that furnish water for boilers and spray for the cooler.

*Oilers* oil bearings of the engines and other equipment in the power department.  
*Laborers* sweep and do other unskilled work in the power department.  
*Other employees* include all **workers** not included in the specified occupations for the department such as **switchboard men**, instrument watchers, motor tenders, turbine operators, tube blowers, lancers, etc.

#### APPENDIX B.—THE HISTORY OF PORTLAND CEMENT<sup>1</sup>

Although the Portland cement industry has now attained great importance, it is less than a century old and its period of rapid growth did not really begin until within the last 35 years. The industry is very young in comparison with the manufacture of iron.

Lime mortar for all structural work continued to be used until very near the close of the eighteenth century, when a new series of cementing materials was developed at almost the same time in England and in France. These were the natural cements that have been marketed from time to time down to the present.

About the year 1756 Smeaton, an English engineer, began a series of experiments on lime mortars. His purpose was to devise a lime suitable for marine construction in the Eddystone Lighthouse. It was not until 35 years had elapsed that any record of these experiments were published.

In 1796, in England and in France, a cement similar to our present-day natural or Rosendale cement was invented. Parker, an Englishman, called his patent "Roman cement." This cement consisted chiefly of using clay and limy matter, burned and powdered, which when mixed into a paste with water would harden under water as well as in the open.

When the building of the Erie Canal was begun it was planned to use lime as the mortar, and since great quantities of lime were to be used many quarries were opened along the line of the canal's construction. The stone, taken from a quarry opened in the town of Sullivan, Madison County, N. Y., failed to slake. On examination, Benjamin Wright and Canvass White, who were familiar with European cements, discovered that this lime was really a high-grade natural cement that required only grinding to prepare it for use. A number of tests were conducted, and it was used in the locks and walls of the middle section of the canal during the years 1818 and 1819. When the lime was pulverized and used by mixing two parts of lime and one part of sand it was discovered that the mixture set under water even better than in the open. This discovery led to a search of the country for similar material.

About six years later (1824) Joseph Aspdin, of Leeds, England, received a British patent for a cementing product, which he named "Portland cement." The name was due to a resemblance between the set cement and a well-known English building stone—the oolitic limestone of the Isle of Portland. In his patent, Aspdin stated that a definite amount of clay and limestone was to be used, and then went on to describe the method to be followed in amalgamating and calcining these two materials to make his "Portland" cement.

Portland cement differs from natural cements at the present time in the following particulars: (1) Natural cements are not made from carefully prepared and finely ground artificial mixtures but from natural rock. (2) Natural cements are burned at a lower temperature than Portland cements, the mass in the kiln never being heated high enough to even approach the fusing or clinkering point. (3) Natural cements, after burning and grinding are, as a rule, yellow to brown in color and light in weight, having a specific gravity of 2.7 to 3.1, whereas Portland cement is commonly blue to gray in color and heavier, its specific gravity ranging from 3 to 3.2. (4) Natural cements set more rapidly than Portland cement but do not attain so high a tensile strength. (5) Portland cement is a definite product, its percentages of lime, silica, alumina, and iron oxide varying only between narrow limits, whereas brands of natural cements differ greatly in composition.

The uniformity of quality last noted became assured for Portland cement as a result of the meeting of a committee in June, 1911, composed of government engineers in conference with representative consumers and the manufacturers, and a special committee of the national engineering societies. They laid down certain definite specifications for all Portland cement bought and used by the United States Government. President Taft approved these specifications April 30, 1912. As improvements are made, the specifications are accordingly changed from time to time.

<sup>1</sup> Adapted from Willis, Henry Parker, and Byers, John R. B. *Portland cement prices*. New York, 1924.

The cement industry has made great strides in England and in Germany, but no real attempt was made to advance its manufacture in the United States until about 1872, when a plant was built at Kalamazoo, Mich. This project, from a commercial viewpoint, was a complete failure. In 1875, however, a true Portland cement was being made at a small plant located in western Pennsylvania, the raw materials being limestone and clay.

In the meantime, an entirely separate set of experiments laid the foundation of the great Portland cement industry in the Lehigh Valley district. Natural cement had long been manufactured in this region, and in the early seventies D. O. Saylor and his associates began selecting from the natural cement rock quarries the stone which would, on burning, yield Portland cement. The result was that a small quantity of Portland cement was produced in this district, but it really was a by-product of the natural cement industry. The Portland cement industry, having now gained a foothold in America, was soon to advance even beyond its European predecessors. This was almost entirely due to the improvements made from a technical point of view.

In the early part of the industry, the process used by practically all European manufacturers involved reducing the soft, natural, raw materials to powder or to a wet "slurry," mixing them to a paste with water; forming the mixture (after partial drying) into bricks or balls, charging these bricks (often by hand) in the vertical kiln in which they were burned, unloading the kiln by hand, and finally grinding the clinker in an ineffective and expensive way.

The early American mills attempted faithfully to follow this practice, but the producers in the Lehigh district quickly realized that with their hard, dry raw materials this wet European practice was too expensive. Also, the American experimenters realized that the relatively dear labor and cheap fuel of the United States, as contrasted with cheap labor and dear fuel of Europe, would necessitate changes in the technology of the industry if it were ever to be established on a firm commercial footing. Accepting the conditions they expended their greatest efforts in solving these problems. In order to meet conditions, the old stationary kilns and millstones were displaced by the rotary kilns and by the modern grinding machinery. The patents for the Ransome rotary kilns were taken out in Great Britain in 1885 and in the United States in 1886. The kilns now in use are the direct successors of the Ransome type.

It was at South Rondout, N. Y., in 1889, that a rotary kiln was first used in the United States. It was a large steel cylinder lined with fire brick and set at a slight inclination to the horizontal. The raw material was fed in at the upper end and traveled slowly downward by gravity as the kiln was revolved. The fuel was blown in at the lower end, and the burned clinker also fell out at this lower end. Petroleum was used as a fuel and for some years its use continued to be the current American practice. Another saving was made when it was found possible to charge the mixed and ground materials direct to the kiln without wetting. Thus, the two main types of present-day American practice were then in operation—(1) the dry process, used with limestone or cement rock, (2) the wet process, used with marl. Of the two, the dry process has proved far the more economical and at present is almost universally used.

The next step in the development of American Portland cement manufacturing methods began about 1895, when powdered coal was substituted for petroleum as fuel. Its use soon became standard practice throughout the United States, except at the few localities where petroleum and natural gas abounded. The use of coal brought about an economy in manufacturing costs because the industry was able to consume the fine coal, which at that time did not have any important use or market.

The latest complete report of the United States Geological Survey (1922) shows that of the 118 plants in operation, 90 burn coal in their kilns; 7 coal and crude oil; 1 coal and gas; 17 crude oil; 2 crude oil, coal and gas; and 1 natural gas.

The same report shows that the kilns varied in length as follows:

Length (feet)	Number of kilns
40 to 60.....	78
61 to 99.....	91
100 to 109.....	102
110.....	54
120.....	101
125.....	162
126 to 149.....	66
150 to 199.....	75
200 to 260.....	31



Thus the most recent improvement in the rotary kiln has been merely to increase its size and almost to center on coal as its fuel.

Parallel with the changes in type and capacity came the great changes in crushing and grinding machinery which have produced enormous tonnages of raw and finished material. The cracker crushers and millstones of the early industry have given place to larger and more economical reducers. This was due to the development of the gyratory crusher, the Griffin and Huntington mills, and the ball and tube mills. As these are still used in one stage or more, a description of their importance must be furnished as descriptive of present-day practice.

The raw materials used in the manufacture of Portland cement may be grouped as:

Cement materials proper, including limestone, marl, shells, cement rock, clay, shale, etc., which may be combined to form the actual cement mixture.

Fuels, including the coal, oil, or gas used to burn the cement plus the fuel usually required to furnish power for the plant.

Accelerators and retarders, including gypsum, lime, chloride, alkalies, fluorite, etc., which may be added to the cement or the cement mixture at different stages to accomplish certain purposes.

#### STAGES OF PRODUCTION

There are three distinct and separate operations from the preparation of the raw material to the finished product. The first process is mechanical and includes the assembling, preparing, grinding, and amalgamating of the raw material. The second process is chemical, during which the material prepared by the first process is calcined or roasted at a high temperature, bringing about chemical combination of the various ingredients. The third and final process is partly mechanical and partly chemical, in which the clinker resulting from the calcination, together with a small amount of retarding agent, is reduced to fine powder. The materials must be mixed in the exact proportions determined by tests, these proportions being changed as often as necessary to allow for any variation in the chemical composition of the raw materials.

The crushing of the rock is accomplished by means of immense gyratory or roll crushers, which reduce the huge masses of quarried rock to small-size pieces ready for the pulverizing or grinding machines. Before going to these machines, however, the rock is passed through dryers. These dryers are horizontal steel cylinders, which revolve as the crushed rock passes slowly through them. A current of heated air flows through the cylinder, thus removing from the rock by evaporation moisture that would prevent efficient pulverization.

The powdering or pulverizing of the raw material is one of the most important steps in the manufacture of the cement. Decided advances have been made during the past few years in the grinding and pulverizing machines, and types found to be most advantageous in the Portland cement industry are quite novel. Nearly all grinding machines work on the principle of striking or pounding the material between a hammer in some form and a solid metal mass. The ball mill, for example, is a horizontal iron cylinder 6 to 8 feet in diameter, and 4 to 6 feet long, revolving about its axis 23 to 25 revolutions per minute. This mill is partly filled with steel balls and is lined with steel plates fastened inside the cylinder and arranged in steps. In rolling around, the balls fall from these steps on to the material (fed in at one end) until it passes small screens fastened to the outer side of the cylinder and revolving with it. The particles too coarse to pass the screens are returned to the grinding chamber through the openings under the stepped grinding plates. The output of a machine ranges from 15 to 24 barrels per hour.

Other types of grinding machines are the Huntington mill and the Griffin mill, which consist essentially of a steel ring or die, against the inside of which a heavy steel crushing roll mounted on a pendulum suspended by a universal joint is made to roll by centrifugal force. The pendulum is rotated by a pulley, and the grinding zone is between the steel outside stationary ring and the revolving pendulum. The principle of this mill is more clearly illustrated by the simple and crude illustration of a boy swinging around and around over his head a weight tied to the end of a string. If this weight or ball were made to travel about the inside of a steel cylinder there would be a grinding action between the cylinder and the revolving ball on the end of the string or pendulum shaft. That is what takes place in the Griffin mill but, of course, under more favorable conditions. The output of one of these mills is about eight barrels of raw material per hour.

While the mills described grind the rock quite fine—the particles averaging in size one-fiftieth of an inch—it is further pulverized in the tube mills. A tube mill is a long steel cylinder that makes about 25 revolutions a minute. The cylinder is lined with very hard material, either iron or a specially hard natural stone, and is partly filled with flint pebbles, which also are extremely hard. When the partly ground rock is fed into the revolving tube mill, these pebbles are constantly rolling over and falling on one another, and the rock, being relatively softer, is so broken by this grinding action that when it reaches the discharge end it is pulverized to extreme fineness.

The crushing of the raw material is followed by the mixing and proportioning, which is done by means of automatic weighing machines that weigh out just the right quantity of cement rock and the right quantity of limestone. These automatic weighing machines are under the direct control of the chemists in charge of the operation throughout the day and night, so that with this control the mixture never varies.

The next process is burning, where the pulverized raw material passes into a new chemical compound known as "cement clinker." This is accomplished by using rotary kilns. The rotary kiln as used to-day differs very slightly from the earlier model, and will produce from 500 to 3,000 barrels per day, according to size; and, as already stated, this alone has been largely instrumental in reducing the cost of manufacture to such an extent as to make Portland cement an economical building material.

The kiln consists of steel cylinders varying from 60 feet long and 5 feet in diameter to 260 feet long and 12 feet in diameter. Present practice favors the use of longer kilns. These immense machines are inclined at a pitch of about three-fourths of an inch per foot of length and are supported by roller bearings at several points along their length. The upper end of the kiln is connected with a stack, the draft to which is controlled by a damper. The raw material is fed into the upper end of the kiln and because of the kiln's inclined position and its slow rotation of about three-fourths revolution per minute about its axis, the material slowly moves toward the lower or discharge end. The fuel chiefly used is finely pulverized, highly volatile, bituminous coal. This coal is blown in at the discharge end of the kiln and instantly ignites and maintains an intense combustion zone 10 to 20 feet from the lower end of the kiln. The hot gases pass through the kiln to the stack and heat the raw material as it passes. On entering the kiln at the upper end, the raw material continues to gather heat until the hot zone is reached, when the chemical combination forming Portland cement clinker takes place. The clinker after it passes over the remaining length of the kiln drops out in the form of red-hot nodules varying from bird-shot size to perhaps a 2-foot size. This hot clinker is then conveyed to rotary or stationary coolers.

The clinker is then ground and pulverized into the Portland cement of commerce. The process of grinding and the machines used are practically the same as those used for the grinding and pulverizing of the raw material. The cement is usually deposited in bulk bins, each bin having a capacity of several thousand barrels. Samples of the cement are taken from these bins and complete tests are made for fineness, setting, soundness, strength, and chemical analysis. Having passed these tests satisfactorily, the cement is ready for packing and shipment.

The packing of Portland cement is an important item in preparing it for the market. Because of the immense quantities annually used, economical methods have been devised for packing the cement in bags, cloth, or paper or in barrels. These containers are being continually tested and improved in order to insure safe delivery on the job. The cement is delivered from the storage bins to the packing house by conveyors and feeds down through hoppers and automatic weighing machines. Thus the exact quantity required is placed in each bag. Cloth bags are not filled through the top, for this is tied shut while the bag is empty, the cement being introduced into the bag through a valve in the bottom. These bags must be of the best material, and are of such fineness as to be very costly. One of the latest developments in marketing Portland cement for large building operations is the shipping of it in bulk—loose, in a box freight car. This has worked well, with even less loss of cement through wetting than when shipped in cloth or paper bags.

## LIST OF BULLETINS OF THE BUREAU OF LABOR STATISTICS

*The following is a list of all bulletins of the Bureau of Labor Statistics published since July, 1912, except that in the case of bulletins giving the results of periodic surveys of the bureau only the latest bulletin on any one subject is here listed.*

*A complete list of the reports and bulletins issued prior to July, 1912, as well as the bulletins published since that date, will be furnished on application. Bulletins marked thus (\*) are out of print.*

### **Conciliation and Arbitration (including strikes and lockouts).**

- \*No. 124. Conciliation and arbitration in the building trades of Greater New York. [1913.]
- \*No. 133. Report of the industrial council of the British Board of Trade on its inquiry into industrial agreements. [1913.]
- No. 139. Michigan copper district strike. [1914.]
- \*No. 144. Industrial court of the cloak, suit, and skirt industry of New York City. [1914.]
- \*No. 145. Conciliation, arbitration, and sanitation in the dress and waist industry of New York City. [1914.]
- \*No. 191. Collective bargaining in the anthracite-coal industry. [1916.]
- \*No. 198. Collective agreements in the men's clothing industry. [1916.]
- No. 233. Operation of the industrial disputes investigation act of Canada. [1918.]
- No. 255. Joint industrial councils in Great Britain. [1919.]
- No. 283. History of the Shipbuilding Labor Adjustment Board, 1917 to 1919.
- No. 287. National War Labor Board: History of its formation, activities, etc. [1921.]
- \*No. 303. Use of Federal power in settlement of railway labor disputes. [1922.]
- No. 341. Trade agreement in the silk-ribbon industry of New York City. [1923.]
- No. 402. Collective bargaining by actors. [1926.]
- No. 468. Trade agreements, 1927.
- No. 481. Joint industrial control in the book and job printing industry. [1928.]

### **Cooperation.**

- No. 313. Consumers' cooperative societies in the United States in 1920.
- No. 314. Cooperative credit societies (credit unions) in America and in foreign countries. [1922.]
- No. 437. Cooperative movement in the United States in 1925 (other than agricultural).

### **Employment and Unemployment.**

- \*No. 109. Statistics of unemployment and the work of employment offices in the United States. [1913.]
- No. 172. Unemployment in New York City, N. Y. [1915.]
- \*No. 183. Regularity of employment in the women's ready-to-wear garment industries. [1915.]
- \*No. 195. Unemployment in the United States. [1916.]
- No. 196. Proceedings of the Employment Managers' Conference held at Minneapolis, Minn., January 19 and 20, 1916.
- \*No. 202. Proceedings of the conference of Employment Managers' Association of Boston, Mass., held May 10, 1916.
- No. 206. The British system of labor exchanges. [1916.]
- \*No. 227. Proceedings of the Employment Managers' Conference, Philadelphia, Pa., April 2 and 3, 1917.
- No. 235. Employment system of the Lake Carriers' Association. [1918.]
- \*No. 241. Public employment offices in the United States. [1918.]
- No. 247. Proceedings of Employment Managers' Conference, Rochester, N. Y., May 9-11, 1918.
- \*No. 310. Industrial unemployment: A statistical study of its extent and causes. [1922.]
- No. 409. Unemployment in Columbus, Ohio, 1921 to 1925.
- No. 520. Social and economic character of unemployment in Philadelphia, April, 1920.

### **Foreign Labor Laws.**

- \*No. 142. Administration of labor laws and factory inspection in certain European countries. [1914.]
- No. 494. Labor legislation of Uruguay. [1929.]
- No. 510. Labor legislation of Argentina. [1930.]

### **Housing.**

- \*No. 188. Government aid to home owning and housing of working people in foreign countries. [1914.]
- No. 263. Housing by employers in the United States. [1920.]
- No. 295. Building operations in representative cities in 1920.
- No. 524. Building permits in the principal cities of the United States in [1921 to] 1929.

### **Industrial Accidents and Hygiene.**

- \*No. 104. Lead poisoning in potteries, tile works, and porcelain enameled sanitary ware factories. [1912.]
- No. 120. Hygiene of painters' trade. [1913.]
- \*No. 127. Dangers to workers from dust and fumes, and methods of protection. [1913.]
- \*No. 141. Lead poisoning in the smelting and refining of lead. [1914.]
- \*No. 157. Industrial accident statistics. [1915.]
- \*No. 165. Lead poisoning in the manufacture of storage batteries. [1914.]
- \*No. 179. Industrial poisons used in the rubber industry. [1915.]
- \*No. 188. Report of British departmental committee on the danger in the use of lead in the painting of buildings. [1916.]
- \*No. 201. Report of the committee on statistics and compensation insurance cost of the International Association of Industrial Accident Boards and Commissions. [1916.]
- \*No. 209. Hygiene of the printing trades. [1917.]
- \*No. 219. Industrial poisons used or produced in the manufacture of explosives. [1917.]
- No. 221. Hours, fatigue, and health in British munition factories. [1917.]
- No. 230. Industrial efficiency and fatigue in British munition factories. [1917.]
- \*No. 231. Mortality from respiratory diseases in dusty trades (inorganic dusts). [1918.]
- \*No. 234. Safety movement in the iron and steel industry, 1907 to 1917.
- No. 236. Effects of the air hammer on the hands of stonecutters. [1918.]
- No. 249. Industrial health and efficiency. Final report of British Health of Munition Workers' Committee. [1919.]
- No. 251. Preventable death in the cotton-manufacturing industry. [1919.]
- No. 256. Accidents and accident prevention in machine building. [1919.]
- No. 267. Anthrax as an occupational disease. [1920.]
- No. 276. Standardization of industrial accident statistics. [1920.]
- No. 280. Industrial poisoning in making coal-tar dyes and dye intermediates. [1921.]
- \*No. 291. Carbon-monoxide poisoning. [1921.]
- No. 293. The problem of dust phthisis in the granite-stone industry. [1922.]
- No. 298. Causes and prevention of accidents in the iron and steel industry, 1910-1919.
- No. 306. Occupational hazards and diagnostic signs: A guide to impairments to be looked for in hazardous occupations. [1922.]
- No. 392. Survey of hygienic conditions in the printing trades. [1925.]
- No. 405. Phosphorus necrosis in the manufacture of fireworks and in the preparation of phosphorus. [1926.]
- No. 427. Health survey of the printing trades, 1922 to 1925.
- No. 428. Proceedings of the Industrial Accident Prevention Conference, held at Washington, D. C., July 14-16, 1926.
- No. 460. A new test for industrial lead poisoning. [1928.]
- No. 466. Settlement for accidents to American seamen. [1928.]
- No. 488. Deaths from lead poisoning, 1925-1927.
- No. 490. Statistics of industrial accidents in the United States to the end of 1927.
- No. 507. Causes of death by occupation. [1929.]

### **Industrial Relations and Labor Conditions.**

- No. 237. Industrial unrest in Great Britain. [1917.]
- No. 340. Chinese migrations, with special reference to labor conditions. [1923.]
- No. 349. Industrial relations in the West Coast lumber industry. [1923.]
- No. 361. Labor relations in the Fairmont (W. Va.) bituminous-coal field. [1924.]
- No. 380. Postwar labor conditions in Germany. [1925.]
- No. 383. Works council movement in Germany. [1925.]
- No. 384. Labor conditions in the shoe industry in Massachusetts, 1920-1924.
- No. 399. Labor relations in the lace and lace-curtain industries in the United States. [1925.]

### **Labor Laws of the United States (including decisions of courts relating to labor).**

- No. 211. Labor laws and their administration in the Pacific States. [1917.]
- No. 229. Wage-payment legislation in the United States. [1917.]
- No. 285. Minimum wage laws of the United States: Construction and operation. [1921.]
- No. 321. Labor laws that have been declared unconstitutional. [1922.]
- No. 322. Kansas Court of Industrial Relations. [1923.]
- No. 343. Laws providing for bureaus of labor statistics, etc. [1923.]
- No. 370. Labor laws of the United States, with decisions of courts relating thereto. [1925.]
- No. 408. Laws relating to payment of wages. [1926.]
- No. 486. Labor legislation of 1928.
- No. 517. Decisions of courts and opinions affecting labor, 1927-28.

**Proceedings of Annual Conventions of the Association of Governmental Labor Officials of the United States and Canada. (Name changed in 1928 to Association of Government Officials in Industry of the United States and Canada.)**

- No. 286. Seventh, Seattle, Wash., July 12-15, 1920.
- No. 307. Eighth, New Orleans, La., May 2-6, 1921.
- No. 323. Ninth, Harrisburg, Pa., May 22-26, 1922.
- \*No. 352. Tenth, Richmond, Va., May 1-4, 1923.
- \*No. 389. Eleventh, Chicago, Ill., May 19-23, 1924.
- \*No. 411. Twelfth, Salt Lake City, Utah, August 13-15, 1925.
- No. 429. Thirteenth, Columbus, Ohio, June 7-10, 1926.
- \*No. 455. Fourteenth, Paterson, N. J., May 31 to June 3, 1927. \*
- No. 480. Fifteenth, New Orleans, La., May 21-24, 1928.
- No. 508. Sixteenth, Toronto, Canada, June 4-7, 1929.

**Proceedings of Annual Meetings of the International Association of Industrial Accident Boards and Commissions.**

- No. 210. Third, Columbus, Ohio, April 25-28, 1916.
- No. 248. Fourth, Boston, Mass., August 21-25, 1917.
- No. 264. Fifth, Madison, Wis., September 24-27, 1918.
- \*No. 273. Sixth, Toronto, Canada, September 23-26, 1919.
- No. 281. Seventh, San Francisco, Calif., September 20-24, 1920.
- No. 304. Eighth, Chicago, Ill., September 19-23, 1921.
- No. 333. Ninth, Baltimore, Md., October 9-13, 1922.
- \*No. 359. Tenth, St. Paul, Minn., September 24-26, 1923.
- No. 385. Eleventh, Halifax, Nova Scotia, August 26-28, 1924.
- No. 395. Index to proceedings, 1914-1924.
- No. 406. Twelfth, Salt Lake City, Utah, August 17-20, 1925.
- No. 432. Thirteenth, Hartford, Conn., September 14-17, 1926.
- \*No. 456. Fourteenth, Atlanta, Ga., September 27-29, 1927.
- No. 485. Fifteenth, Paterson, N. J., September 11-14, 1928.
- No. 511. Sixteenth, Buffalo, N. Y., October 8-11, 1929.

**Proceedings of Annual Meetings of the International Association of Public Employment Services.**

- No. 192. First, Chicago, December 19 and 20, 1913; second, Indianapolis, September 24 and 25, 1914; third, Detroit, July 1 and 2, 1915.
- No. 220. Fourth, Buffalo, N. Y., July 20 and 21, 1916.
- No. 311. Ninth, Buffalo, N. Y., September 7-9, 1921.
- No. 337. Tenth, Washington, D. C., September 11-13, 1922.
- No. 355. Eleventh, Toronto, Canada, September 4-7, 1923.
- No. 400. Twelfth, Chicago, Ill., May 19-23, 1924.
- No. 414. Thirteenth, Rochester, N. Y., September 15-17, 1925.
- No. 478. Fifteenth, Detroit, Mich., October 25-28, 1927.
- No. 501. Sixteenth, Cleveland, Ohio, September 18-21, 1928.

**Productivity of Labor.**

- No. 356. Productivity costs in the common-brick industry. [1924.]
- No. 360. Time and labor costs in manufacturing 100 pairs of shoes, 1923.
- No. 407. Labor costs of production and wages and hours of labor in the paper boxboard industry. [1926.]
- No. 412. Wages, hours, and productivity in the pottery industry, 1925.
- No. 441. Productivity of labor in the glass industry. [1927.]
- No. 474. Productivity of labor in merchant blast furnaces. [1928.]
- No. 475. Productivity of labor in newspaper printing. [1929.]

**Retail Prices and Cost of Living.**

- \*No. 121. Sugar prices, from refiner to consumer. [1913.]
- \*No. 130. Wheat and flour prices, from farmer to consumer. [1913.]
- \*No. 164. Butter prices, from producer to consumer. [1914.]
- No. 170. Foreign food prices as affected by the war. [1915.]
- No. 357. Cost of living in the United States. [1924.]
- No. 369. The use of cost-of-living figures in wage adjustments. [1925.]
- No. 495. Retail prices, 1899 to 1928.

**Safety Codes.**

- \*No. 331. Code of lighting: Factories, mills, and other work places.
- No. 336. Safety code for the protection of industrial workers in foundries.
- No. 350. Specifications of laboratory tests for approval of electric headlighting devices for motor vehicles.
- \*No. 351. Safety code for the construction, care, and use of ladders.
- No. 375. Safety code for laundry machinery and operations.
- No. 378. Safety code for woodworking plants.
- No. 382. Code for lighting school buildings.

### **Safety Codes—Continued.**

- No. 410. Safety code for paper and pulp mills.
- No. 430. Safety code for power presses and foot and hand presses.
- No. 433. Safety codes for the prevention of dust explosions.
- No. 436. Safety code for the use, care, and protection of abrasive wheels
- No. 447. Safety code for rubber mills and calenders.
- No. 451. Safety code for forging and hot-metal stamping.
- No. 463. Safety code for mechanical power-transmission apparatus—first revision.
- No. 509. Textile safety code.
- No. 512. Code for identification of gas mask canisters.
- No. 519. Safety code for woodworking plants, as revised, 1930.

### **Vocational and Workers' Education.**

- \*No. 159. Short-unit courses for wage earners, and a factory school experiment. [1915.]
- \*No. 162. Vocational education survey of Richmond, Va. [1915.]
- \*No. 199. Vocational education survey of Minneapolis, Minn. [1917.]
- No. 271. Adult working-class education in Great Britain and the United States. [1920.]
- No. 459. Apprenticeship in building construction. [1923.]

### **Wages and Hours of Labor.**

- \*No. 146. Wages and regularity of employment and standardization of piece rates in the dress and waist industry of New York City. [1914.]
- \*No. 147. Wages and regularity of employment in the cloak, suit, and skirt industry. [1914.]
- No. 161. Wages and hours of labor in the clothing and cigar industries, 1911 to 1913.
- No. 163. Wages and hours of labor in the building and repairing of steam railroad cars, 1907 to 1913.
- \*No. 190. Wages and hours of labor in the cotton, woolen, and silk industries, 1907 to 1914.
- No. 204. Street-railway employment in the United States. [1917.]
- No. 225. Wages and hours of labor in the lumber, millwork, and furniture industries, 1915.
- No. 265. Industrial survey in selected industries in the United States, 1919.
- No. 297. Wages and hours of labor in the petroleum industry, 1920.
- No. 356. Productivity costs in the common-brick industry. [1924.]
- No. 358. Wages and hours of labor in the automobile-tire industry, 1923.
- No. 360. Time and labor costs in manufacturing 100 pairs of shoes, 1923.
- No. 365. Wages and hours of labor in the paper and pulp industry, 1923.
- No. 394. Wages and hours of labor in metalliferous mines, 1924.
- No. 407. Labor costs of production and wages and hours of labor in the paper boxboard industry. [1926.]
- No. 412. Wages, hours, and productivity in the pottery industry, 1925.
- No. 416. Hours and earnings in anthracite and bituminous coal mining, 1922 and 1924.
- No. 472. Wages and hours of labor in the slaughtering and meat-packing industry, 1927.
- No. 476. Union scales of wages and hours of labor, 1927. [Supplement to Bulletin 457.]
- No. 484. Wages and hours of labor of common street laborers, 1928.
- No. 487. Wages and hours of labor in woolen and worsted goods manufacturing, 1910 to 1928.
- No. 492. Wages and hours of labor in cotton-goods manufacturing, 1910 to 1928.
- No. 497. Wages and hours of labor in the lumber industry in the United States, 1928.
- No. 498. Wages and hours of labor in the boot and shoe industry, 1910 to 1928.
- No. 499. History of wages in the United States from colonial times to 1928.
- No. 502. Wages and hours of labor in the motor-vehicle industry, 1928.
- No. 503. Wages and hours of labor in the men's clothing industry, 1911 to 1928.
- No. 504. Wages and hours of labor in the hosiery and underwear industries, 1907 to 1928.
- No. 513. Wages and hours of labor in the iron and steel industry, 1929.
- No. 514. Pennsylvania Railroad wage data. From Report of Joint Fact Finding Committee in wage negotiations in 1927.
- No. 515. Union scales of wages, May 15, 1929.
- No. 516. Hours and earnings in bituminous coal mining, 1929.
- No. 522. Wages and hours of labor in foundries and machine shops, 1929.
- No. 523. Wages and earnings in the manufacture of airplanes and aircraft engines, 1929. (In press.)

### **Welfare Work.**

- \*No. 123. Employers' welfare work. [1913.]
- No. 222. Welfare work in British munitions factories. [1917.]
- \*No. 250. Welfare work for employees in industrial establishments in the United States. [1919.]
- No. 458. Health and recreation activities in industrial establishments, 1926.

### **Wholesale Prices.**

- No. 284. Index numbers of wholesale prices in the United States and foreign countries. [1921.]
- No. 453. Revised index numbers of wholesale prices, 1923 to July, 1927.
- No. 521. Wholesale prices, 1929.

### **Women and Children in Industry.**

- No. 116. Hours, earnings, and duration of employment of wage-earning women in selected industries in the District of Columbia. [1913.]
- \*No. 117. Prohibition of night work of young persons. [1913.]
- \*No. 118. Ten-hour maximum working-day for women and young persons. [1913.]
- No. 119. Working hours of women in the pea canneries of Wisconsin. [1913.]
- \*No. 122. Employment of women in power laundries in Milwaukee. [1913.]
- \*No. 160. Hours, earnings, and conditions of labor of women in Indiana mercantile establishments and garment factories. [1914.]
- \*No. 167. Minimum-wage legislation in the United States and foreign countries. [1915.]
- \*No. 175. Summary of the report on conditions of woman and child wage earners in the United States. [1915.]
- \*No. 176. Effect of minimum-wage determinations in Oregon. [1915.]
- \*No. 180. The boot and shoe industry in Massachusetts as a vocation for women. [1915.]
- \*No. 182. Unemployment among women in department and other retail stores of Boston, Mass. [1916.]
- No. 193. Dressmaking as a trade for women in Massachusetts. [1916.]
- No. 215. Industrial experience of trade-school girls in Massachusetts. [1917.]
- \*No. 217. Effect of workmen's compensation laws in diminishing the necessity of industrial employment of women and children. [1918.]
- \*No. 223. Employment of women and juveniles in Great Britain during the war. [1917.]
- No. 253. Women in the lead industries. [1919.]

### **Workmen's Insurance and Compensation (including laws relating thereto).**

- \*No. 101. Care of tuberculous wage earners in Germany. [1912.]
- \*No. 102. British national insurance act, 1911.
- No. 103. Sickness and accident insurance law in Switzerland. [1912.]
- No. 107. Law relating to insurance of salaried employees in Germany. [1913.]
- \*No. 155. Compensation for accidents to employees of the United States. [1914.]
- \*No. 212. Proceedings of the conference of social insurance called by the International Association of Industrial Accident Boards and Commissions, Washington, D. C., December 5-9, 1916.
- \*No. 243. Workmen's compensation legislation in the United States and foreign countries, 1917 and 1918.
- No. 301. Comparison of workmen's compensation insurance and administration. [1922.]
- No. 312. National health insurance in Great Britain, 1911 to 1921.
- No. 379. Comparison of workmen's compensation laws of the United States as of January 1, 1925.
- No. 477. Public-service retirement systems, United States and Europe. [1929.]
- No. 496. Workmen's compensation legislation of the United States and Canada as of January, 1929. (With text of legislation enacted in 1927 and 1928.)
- No. 529. Workmen's compensation legislation of the Latin American countries.

### **Miscellaneous series.**

- \*No. 174. Subject index of the publications of the United States Bureau of Labor Statistics up to May 1, 1915.
- No. 208. Profit sharing in the United States. [1916.]
- No. 242. Food situation in central Europe. 1917.
- No. 254. International labor legislation and the society of nations. [1919.]
- No. 268. Historical survey of international action affecting labor. [1920.]
- No. 282. Mutual relief associations among Government employees in Washington, D. C. [1921.]
- No. 319. The Bureau of Labor Statistics: Its history, activities, and organization. [1922.]
- No. 326. Methods of procuring and computing statistical information of the Bureau of Labor Statistics. [1923.]
- No. 342. International Seamen's Union of America: A study of its history and problems. [1923.]
- No. 346. Humanity in government. [1923.]
- No. 372. Convict labor in 1923.
- No. 386. Cost of American almshouses. [1925.]
- No. 398. Growth of legal-aid work in the United States. [1926.]
- No. 401. Family allowances in foreign countries. [1926.]
- No. 461. Labor organization in Chile. [1928.]
- No. 462. Park recreation areas in the United States. [1928.]
- No. 465. Beneficial activities of American trade-unions. [1928.]
- No. 479. Activities and functions of a State department of labor. [1928.]
- No. 483. Conditions in the shoe industry in Haverhill, Mass., 1928.
- No. 489. Care of aged persons in United States. [1929.]
- No. 491. Handbook of labor statistics, 1929 edition.
- No. 505. Directory of homes for the aged in the United States. [1929.]
- No. 506. Handbook of American trade-unions: 1929 edition.
- No. 518. Personnel research agencies, 1930 edition.

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